ArcticNet

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ANNUAL SCIENTIFIC MEETING

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RÉUNION SCIENTIFIQUE ANNUELLE

ABSTRACTS

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Allard, Michel (1) (presenter), G. Attatahak (2), L. Adjun(2), L. Papatsie(3), M.-A. Ducharme(4), S. Coulombe(5), S.Bilodeau (1) and S.Gagnon(1)

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(3) Nunavut Parks & Special Places, Department of Environment, Government of Nunavut, Iqaluit, NU.
(4) ArcticNet, Québec city
(5) Polar Knowledge Canada, Cambridge Bay, NU

This project started in summer 2017 under the joint initiative of the Nunavut Parks & Special Places Service of the Department of Environment of Government of Nunavut and the Administration of Kugluk Territorial Park in the community of Kugluktuk. The park is a valued heritage area and is an important part of the wider resource region of the community. As the ATV trails to and within the park are experiencing significant damage due to disturbance of the vegetation cover, formation of mud puddles, multiple landslides and intense gully erosion, a study was launched to obtain a better understanding of how permafrost conditions, climate warming and landslides are involved in their degradation. This new knowledge is also intended to help find alternate routes and locally design technical solutions to mitigate the impacts of the trails on the tundra, even considering the potential impact of permafrost thawing due to climate change. Permafrost scientists from Centre d'études nordiques and Polar Knowledge Canada, with students, were invited to apply their scientific expertise and provide some training to participants. The technologies they use are: interpretation of satellite imagery, high-precision air photography with drones, surficial geology mapping and GIS applications, ground penetrating radar surveys, drilling and core permafrost extraction, and installation of thermistor cables to initiate a long term ground temperature and climate change monitoring program. The fieldwork takes about two weeks every summer and is carried out with youth from the community and park staff being trained in the use of the research tools and developing skills in permafrost sampling, thermistor cable installation and datalogger programming. The field work is overseen by an elder and offers an opportunity for young adults to taste their interest in environmental studies for a potential career. The project also includes other activities: one day initiation courses in basic permafrost science at the occasion of winter or fall meetings in conjunction with meetings of the Community Joint Park Management Committee, public radio shows, an "initiation to permafrost" in children summer camps in the park and open community encounters at the occasion of "Park Day" in summer. Solutions adopted by the community and the park administration to solve the issue of the trails are: construction of a locally designed summer road on a minimal embankment to the park entrance by the hamlet and construction of a slightly raised boardwalk trail for ATVs over the tundra in the park. Both those designs are inspired by local knowhow and are considered scientifically sound. Community members shall have the control on monitoring permafrost temperatures and overseeing the performance of the trails in the future.

OBSERVER ENGAGEMENT UNDER CAFF'S ARCTIC MIGRATORY BIRDS INITIATIVE: LEVERAGING THE ARCTIC COUNCIL TO ENGAGE NON-ARCTIC STATES

AMBI Steering Group: Syroechkovskiy, E. (1), Lanctot, R. (2), Auran, J-A. (3), Ekker, M. (3), Black, A. (4), Crockford, N. (5), Mundkur, T. (6), Barry, T. (7), Price, C. (7) (Presenter) , Marissink, M. (8)

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The Arctic Migratory Birds Initiative (AMBI), is a project of the Conservation of Arctic Flora and Fauna (CAFF), the biodiversity working group of the Arctic Council. AMBI is designed to improve the conservation status and secure the long-term sustainability of rapidly declining Arctic-breeding migratory bird populations, many of which are threatened from habitat alteration and illegal killing on their staging and wintering grounds. With the growing threat of climate change impacts on the breeding potentially exacerbating existing threats, a flyway-wide approach is needed to effectively conserve species in decline. Recently, AMBI brought together experts from across the globe to develop a new phase of work (2019-2023) that builds on the successes of the past five years (2015-2019). Flyway work plans in the Americas, Circumpolar, African-Eurasian and East Asian-Australasian Flyways were developed in partnership with Arctic and non-Arctic States to address priority conservation actions for priority species, where actions are designed to bring added value to ongoing conservation programs, or to address issues that are currently underrepresented. This presentation will describe the collaborative effort under this project to engage Arctic Council Observer States in Europe and Asia to develop complementary mechanisms, projects and actions to address flyway-level threats to migratory bird species in decline.

PRIMARY PRODUCTION IN THE EAST SIBERIAN SEA AS DEDUCED FROM HYDROGRAPHY

Anderson, Leif G. (1) (Presenter) and A. Ulfsbo (1)

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The East Siberian Sea (ESS) is likely the least studied shelf seas of the Arctic Ocean even if it comprises a substantial biogeochemical activity. One reason is that the ESS was largely ice covered in summer up until a decade ago, a fact that now has changed with a warming Arctic. Waters of three different sources determines the hydrography: river runoff and water from both the Atlantic and Pacific Oceans. This fact makes the western and eastern parts form two different domains. The eastern part has generally higher nutrient concentrations as governed by the Pacific source, but there is a distinct excess of phosphate relative to nitrate. Consequently the latter restricts primary production even if it can be quite substantial. In this contribution we use data from the International Siberian Shelf Study in 2008 to assess the magnitude of primary production in the eastern domain of the ESS. In a 300 km section from land towards the interior the conditions were typical of the time of investigation, early September. In the warmer and less saline surface water, phosphate was still present but lower than in the deeper waters, while nitrate was depleted. Carbon dioxide under-saturation and oxygen supersaturation coincided with the low nutrient concentrations. However, the oxygen showed a distinct maximum at about 20 m depth while the carbon dioxide partial pressure was quite constant in the upper 20-30 m. A correlation of phosphate with Apparent Oxygen Utilization (AOU) gave a slope significantly different from the classical Redfield-Ketchum-Richards (RKR) ratio, indicating that several water masses where present. One obvious addition is freshwater from both river runoff and sea ice melt, which produced the low salinity surface water of ~10 m thickness. This in turn hampers the gas exchange and thus maintains the oxygen supersaturated subsurface water. Using oxygen profiles together with a hypothesized seasonal evolution we compute the new primary production of the region to 15-20 gC/m2. If this is taken as the annual production it is somewhat higher than that computed from the C-deficit which gave a new production of 10 C/m2/y (Anderson et al., Biogeosciences, 2011). Multiplying the computed new primary production with the area of the Eastern ESS (500 000 km2) we get a production of 7.5-10/1012 gC, which compares well with previous estimates, 10-15/1012 gC (Vetrov and Romankevich, Carbon cycle in the Russian Arctic seas, Berlin, Springer Verlag, 331 p., 2004).

THE DEVELOPMENT OF A COMMUNITY-BASED MONITORING PROGRAM TO MONITOR CHANGING ANIMAL DISTRIBUTIONS, SHIPPING, ICE COVER AND OCEAN TEMPERATURE AND SALINITY IN THE CANADIAN ARCTIC

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With the changing climate amplified in the Arctic, there is a need to monitor and manage important traditional and ecological components in the environment. Marine mammals and fishes are important not only to the Arctic ecosystem but also for subsistence of the Inuit. Moreover, as industrial use of the Arctic increases with the expansion of the open-water summer season, there is an urgent need to monitor the effects of underwater noise from resource exploration and commercial shipping on marine mammals. This presentation will provide the initial design of a program to couple science and traditional and local knowledge into a community based environmental monitoring program with the aim of collecting long-term data on marine mammal distribution and habitat utilization, shipping, ice cover and ocean temperature and salinity profiles, vital for understanding the impact of climate change on Arctic ecosystems.

INVESTIGATING THE PERFORMANCE OF A ROLLER FOOTGEAR IN THE NUNAVUT OFFSHORE SHRIMP FISHERY. CAN INNOVATION HELP REDUCE SEABED IMPACT?

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Northern shrimp (Pandalus borealis) located off the east coast of Nunavut (Arctic Canada) is currently harvested by factory freezer vessels using bottom trawls. This fishery is a major contribution to the territory's economy. However, bottom trawling is not without its ecological impact. In this fishery, bottom trawls use roller rockhopper footgear, which is known to roll in the bosom section, where the rockhoppers axis are perpendicular to the towing direction. Quarter and wing sections are know to roll to a lesser extent, increasing seabed impact and species mortality. In this study, we evaluated the performance in terms of time to complete a rotation (TCR) of a bosom and quarter-wing roller rockhopper footgear sections in hard, mixed and soft seabed using self-recording cameras. Our results showed that the footgear sections are rotating at extremely low rates, between 23.57 and 1587.63 seconds in TCR, when compared to the estimated optimal footgear rotation (1.28 seconds). Results predicted a statistically significant 184% increase in TCR as we move from the bosom to the quarter-wing section ($p = 0.035$). TCR in hard seabed ranged from 23.57 seconds in the bosom to 43.38 seconds in the quarter-wing section, while mixed (from 169.02 to 311.06 seconds) and soft (from 862.64 to 1587.63 seconds) seabed types produced significantly longer TCR ($p < 0.0001$). This study provides evidence that the roller footgear currently in use by industry is not rotating at the rates expected. New footgear prototypes are currently under development with sea trials planned for the summer of 2020.

QIKITAIT: A COMMUNITY-DRIVEN APPROACH TO CREATING A PROTECTED AND CONSERVED AREA FOR THE BELCHER ISLANDS ARCHIPELAGO

Arragutainaq, Lucassie (1, 2), Appaqaq, Mick (2), Kudluarok, Johnny (2), Heath, Joel (2)

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The Belcher Island archipelago in the heart of Hudson Bay is a complex, unique and sensitive region that has been long recognized as a priority for stewardship and conservation. The unique habitats and geography of the archipelago act as a terrestrial refuge and migratory corridor for wildlife in summer, and the extensive land fast sea ice platform that forms around them in winter provides a unique vantage point for the larger Hudson Bay ecosystem. From this vantage point, the Inuit of Sanikiluaq are the sentinels and stewards of the region, with a rich history of mobilizing Inuit knowledge, effective co-management, and developing community-driven research and monitoring programs. The wildlife they steward and rely on includes a unique relationship with the non-migratory sub-species of the Common Eider (Somateria melissima sedentaria) which remains on the islands year-round and is a key indicator species for large-scale ecosystem change. Sanikiluaq has long desired a community-driven unique approach to protecting and

conserving the Belcher Islands archipelago and is currently moving forward with a vision that seeks a unique made-in-Sanikiluaq perspective that integrates to both marine and terrestrial protection and whole of government approach. "Qikiqtait" - the traditional name for the archipelago and proposed name for the protected area will support the unique habitats and wildlife that rely on the islands, support a local conservation economy and will be inclusive of terrestrial and marine habitats managed through Inuit-led research and stewardship programs, governance models, and management plan for the region. We will present the work to-date and future work planned to explore the feasibility of various scenarios for a protected and conserved area for the Belcher Islands. This region is part of the Nunavut Settlement Area (NSA) and we are working in partnership with the Qikiqtani Inuit Association (QIA), which is the Designated Inuit Organization.

IMPROVEMENT OF INDOOR AIR QUALITY IN NUNAVIK DWELLINGS: IMPACTS OF IMPROVED VENTILATION AND PREVENTATIVE MAINTENANCE ON INDOOR AIR QUALITY IN NORTHERN AND REMOTE HOMES

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Homes with inadequate ventilation and indoor air quality (IAQ) are particularly common in northern and remote communities. Previous studies have observed that the indoor air in these homes can have elevated concentrations of CO2, environmental tobacco smoke, and elevated relative humidity (RH) leading to mold issues. These conditions can cause various health problems, such as compromised respiratory health, for the occupants and in particular in children with developing respiratory systems. The objectives of this study were to measure the effectiveness of targeted preventative maintenance of existing heating and ventilation systems at improving ventilation, and IAQ parameters. This study enrolled 55 homes over the winter and spring of 2017-18 in Kuujjuaq, Québec, Canada. The cohort was further stratified into homes with a heat-recovery ventilator (HRV; n=17), an energy recovery ventilator (ERV; n=24), or with a forced-air furnace (n=15).Various IAQ and ventilation parameters were measured through field sampling both before and after the intervention. Following the intervention (optimization of mechanical and heating systems) we observed large reductions in the geometric mean concentrations for a number of health relevant IAQ parameters in the different cohorts. We observed statistically significant mean reductions of -52.4% for CO, -19.7% for CO2, -2.7% for RH and no significant change was observed for temperature. The measured air exchange rate increased by +231% for the HRV sub-group and +38% for the ERV sub-group while there was no statistically significant change for the sub-group with the forced air furnace. VOCs changes after the intervention in homes without a ventilation system are in accordance with expected seasonal variations. Despites these variations, the intervention greatly contributed to decrease mean concentrations for a majority of VOCs in homes equipped with ERV or HRV systems. Aldehydes, aliphatic and aromatic hydrocarbons and some terpenes and ester compounds showed significant decreases following the intervention. High levels of propylene glycol were reported in many homes equipped with ERV systems even after the intervention. These levels are likely to be related to leaks in the hydronic preheating system. Some VOCs, RH and CO2 showed correlation with ventilation intensity (R2= 0.66, 0.61 and 0.51 respectively). This study demonstrated that targeted preventative maintenance and optimization of ventilation systems can significantly improve ventilation rates and IAQ as a result.

EXPEDITION CHURCHILL: A GATEWAY TO ARCTIC RESEARCH - AN INNOVATIVE PARTNERSHIPS IN SCIENCE COMMUNICATION AND EDUCATION.

Barber, Lucette (1)

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Expedition Churchill: A Gateway to Arctic Research is an award-winning innovative and interactive public education and outreach campaign to share the world-leading Arctic climate change research done in the Churchill and Hudson Bay region by University of Manitoba (UM) scientists and collaborators. The campaign launched on Nov. 30, 2018 includes a multi-media e-book app, website, a series of interactive kiosks located at various public locations across Manitoba, and an education plan in the works with the Frontier School division and Duke of Marlborough High School in Churchill Manitoba. A unique feature of this project is the use of the VIA Rail passenger train that travels between Winnipeg and Churchill, and across Canada, as a platform to communicate and promote awareness. The project was led and developed by the UM in partnership with VIA Rail, The Town of Churchill, the Churchill Northern Studies Centre, Assiniboine Park, Zoo and Travel Manitoba. This presentation will focus on the collaborative approach to scientific outreach.

UPCOMING OPPORTUNITIES FOR CANADA-UK COLLABORATION WITH THE NRC

Barker, Anne

National Research Council of Canada, Ottawa, Ontario, K1A 0R6

Canada and the UK have a number of complimentary areas of engineering and technological expertise to support Arctic research and development, in collaboration with Inuit, First Nations and Métis co-developers. Some examples include expertise in coastal resiliency assessments and methodologies, marine safety, renewable energy technologies and remote sensing. Recently, the National Research Council of Canada's (NRC) and the UK's Offshore Renewable Energy Catapult held a number of workshops in Canada and the UK and have signed an MOU to investigate collaborative areas of opportunity pertaining to marine renewable energy. Other conversations have examined methods for evaluating winter road viability, and life-saving appliances for use in Arctic shipping scenarios. NRC is in the process of developing a new Arctic and Northern Challenge program, and is carrying out co-ordinated engagement with rights holders, stakeholders and potential research partners. As one part of this research program, collaborative research will be carried out with UK research partners. This presentation will outline the format of NRC's Challenge Programs and their execution, opportunities for collaboration with the UK that will fall under that program and provide information on how northern research communities and Industry can get involved in setting the research agenda and executing the research.

ENGINEERING INFRASTRUCTURE - PERMAFROST'S CHALLENGES FOR RESILIENT DESIGN

Barker, Anne

National Research Council of Canada

With rapidly changing permafrost conditions throughout Canada's Arctic, resilient engineering design is increasing important in order to be able to enable design lifetimes that can weather climate variations. This discussion will present an overview of the engineering challenges due to deteriorating permafrost that are increasingly surfacing across Canada, their impacts on design criteria, the role of scientific data collection and monitoring in supporting resilient engineering, and the applied research tools and technologies that can support both mitigation of existing and adaptation of new infrastructure in a changing Arctic climate.

TEMPORALLY REOCCURRING MOVEMENT MOTIFS OF GREENLAND HALIBUT IN A DEEP-WATER COASTAL REGION AND THEIR IMPLICATIONS FOR FISHERIES MANAGEMENT

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The development of small-scale fisheries is anticipated to bring much needed economic development to Inuit in the Canadian Arctic. In communities near deep water channels, access to Greenland halibut (Reinhardtius hippoglossoides), a commercially valuable flatfish species, provides a viable opportunity to fish with longlines through the ice during winter months. However, Greenland halibut are a long-lived species with a complex population structure that encompasses the entirety of the North Atlantic and Arctic Ocean. In addition, recent research has demonstrated halibut exhibit yearly migrations and highly localized site fidelity to coastal habitats along Baffin Island, Nunavut. As these coastal sites are the locations for several developing

fisheries, understanding the fine-scale movements of Greenland halibut will inform local management to limit overharvesting of unique phenotypes. Through the use of acoustic telemetry, ~400 Greenland halibut were tagged over eight years along the coastal region of Scott Inlet, a proposed community fishing ground near Clyde River. An array of bottom-monitors was deployed in a grid design to provide detailed movement information on halibut while present in the study area. Greenland halibut leave Scott Inlet each year in a highly timed migration, therefore the movements of each individual was separated into year groups encompassing the time during which fish were present within the coastal area. Network analysis was then conducted for each individual and a network similarity analysis run to determine if individual fish perform the same movements each year, while concurrently examining intraspecific segregation in habitat use. Given Greenland halibut philopatry to coastal sites, there is potential for intraspecific competition to drive spatial resource partitioning, resulting in relatively restricted individual home-ranges at this spatio-temporal scale. Variation in individual movements may also be a result of unique behaviours that drive some fish to be highly mobile, while others are predominantly sedentary. Commercial fishing often unintentionally targets more bold and mobile individuals, while a highly concentrated fishing operation can also impact the local phenotypic diversity and result in reduced population fitness. Results from this research will assist in directing fisheries to reduce their impact on local biodiversity, maintaining population integrity and therefore conferring resilience for the maintenance of future fishery stocks.

FROM MANDATE TO METHOD: BRINGING INUIT KNOWLEDGE INTO WILDLIFE MANAGEMENT UNDER A CO-MANAGEMENT SYSTEM

Basterfield, Mark (Presenter), Kaitlin Breton-Honeyman, Frankie Jean-Gagnon, Tommy Palliser

Nunavik Marine Region Wildlife Board

Co-management institutions under modern land claim agreements have a fundamental role in facilitating meaningful Indigenous engagement in wildlife management policy. While co-management, by nature, is generally equally inclusive of both Indigenous organizations and settler governments, in most cases co-management boards have inherited prior established management systems which are largely colonial in nature. The inclusion of Inuit local and traditional knowledge (IK) in decision-making is a fundamental step towards an adaptive co-management process, as is the inclusion of local perspectives on management issues. Accessing, analyzing, and integrating these forms of knowledge in a co-management system is an evolving concept and can be both an opportunity and a challenge for decision makers, especially considering the previous establishment of steadfast colonial systems. Addressing these challenges frequently requires innovative wildlife management techniques. Since its establishment in 2008, the Nunavik Marine Region Wildlife Board (NMRWB) has faced many such opportunities and challenges, and is continually working to adapt techniques for meaningful integration of IK in fulfilling its mandate. This presentation will focus on the following four examples: (1) The inclusion of IK in Polar Bear management decisions; (2) Setting NMRWB activity and research priorities; (3) The development of the Natsiq - ringed seal monitoring and education program; (4) Combining IK and genetic science to create novel beluga management techniques. These examples illustrate how the NMRWB has developed various techniques to value, utilize and integrate Nunavik Inuit knowledge into wildlife management to realize the objectives of the Nunavik Inuit Land Claims Agreement. Importantly, the NMRWB views the meaningful inclusion of IK as integral in not only ensuring continuing healthy wildlife populations and subsistence hunting, but also for developing wildlife management systems which represent the people who are affected by them. Achieving this level of integration and representation is essential to establishing successful and long-term wildlife management systems.

THE STORY OF THE BEAUFORT COAST - DEVELOPED THROUGH SHARED COMMUNICATION

Bates, Jennifer (1), D. Whalen (1), J. Malanowski (2)

(1) Natural Resources Canada, Geological Survey of Canada - Atlantic, Dartmouth, Nova Scotia, B2Y 4A2 2. TukTV, Tuktoyaktuk, Northwest Territories, X0E 1C0

Natural Resources Canada (NRCan) - Geological Survey of Canada (GSC) researchers are leaders and trusted sources for geoscience information in Canada. In Canada's far North, GSC researchers are collaborating with local Indigenous communities on coastal dynamics research. The Western Canadian Arctic (Beaufort Sea) is one of the fastest changing landmasses in the world and many communities are at risk. Together, scientists and local people are exchanging knowledge and scientific information to better understand and eventually predict the impacts of climate driven changes like erosion, storm

surge flooding that is happening more and more near Arctic coastal communities, coastal infrastructure and marine habitats. At NRCan we are proud of the long standing relationship that has been foster through the years between the Inuvialuit people who live on the Beaufort coast and the monitoring of coastal geoscience. NRCan has several projects looking at coastal dynamics in the region. We believe that knowledge sharing and the communication of science go hand in hand when working in this region. The informal communication of science and ideas that comes with working together has proven to be invaluable to better understand the long-term coastal changes and impacts across the region. A simple unscripted conversation between scientists and community members is able to bring a whole new level of understanding to the research. We believe it is in these conversations that foster the best results for all people involved. We wanted to create a short video documentary that highlights this aspect of the research partnership, shared communication in real time, while in the field, working alongside, travelling together, and learning together. The presentation will feature this video created by TukTV during the summer field campaign of 2019. The project will highlight the coastal geoscience work taking place in and around the community, highlight the importance of this research to the local residents and highlight the communication of coastal and climate change knowledge that is being shared between the scientists and local knowledge holders.

COMMUNITY-BASED MONITORING AND RESEARCH IMPLEMENTED AND LED BY NORTHERNERS IN THE GWICH'IN SETTLEMENT AREA, NWT: THE DIVII (DALL'S SHEEP) RESEARCH PROJECT

Bélanger, Édouard (1) (Presenter), Community member (2) - The community member will be selected in October during a community tour, Community Youth (2) - The youth will be selected in October during a community tour

(1) Gwich'in Renewable Resources Board, Inuvik, NT, X0E 0T0
(2) Ehdiitat Renewable Resources Council, Aklavik, NT, X0E 0A0

"I would like to see our sheep protected. Whatever species live in the Delta, like ducks, the caribou, the moose, the bear, they stay with us all year round, they don't go south." -Alfred Francis, Gwich'in Ecological Knowledge Project Interview, 1996, Gwich'in Words About the Land Community-based monitoring or research has become increasingly popular amongst northern communities and scientists in the past few years. This approach can have several benefits across multiple spheres: it increases the roles of communities in knowledge gathering, empowers communities, helps build strong relationship between communities and scientists, and improves the exchange of knowledge (i.e. traditional, local, and scientific). Ultimately, a deeper understanding of the North is gained to the benefit of Northern residents and scientists. The Gwich'in Renewable Resources Board (GRRB) is the main instrument of wildlife, fish and forest management in the Gwich'in Settlement Area (GSA), Northwest Territories. To achieve its mandate, the GRRB develops, implements and delivers community-based monitoring programs in collaboration with communities, management partners and researchers in the region and abroad. Two years ago, the GRRB implemented a new community-based monitoring project, the Divii (Dall's Sheep) Research Project, to respond to a population decline and community concerns. Here, we describe how we are developing a novel approach using remote cameras and local knowledge to monitor the animals.

A TOOL TO FACILITATE AGRI-RISK MANAGEMENT IN NUNAVIK

Benoit, Liane (1) (Presenter)

Arctic Risk Management Network(ARMNet)(Canada), Wakefield, Quebec, J0X 3G0

The desire to increase food security and sovereignty in the Inuit territory of Nunavik (Northern Quebec) through the development of local agriculture requires careful consideration and management of the myriad risk factors associated with Arctic food production. The objective of the Nunavik Agri-food Project was to provide northern agricultural entrepreneurs in the Nunavik region with a comprehensive tool to guide their planning and help identify the full range of risks to be considered prior to investment. Divided into Environmental, Production and Administrative Risks, the tool allows the user to select those most relevant to their proposed operation, offers a range of potential mitigation strategies and resources, and builds a customized report to serve as a road map to the risk management of their operation going forward. Once completed, the exercise helps illustrate the viability of their agricultural plan, encourages greater environmental stewardship and protection, and maximizes the likelihood of success.

LIGHT POLLUTION FROM A SHIP AND THE NEED FOR AUTONOMOUS PLATFORMS

Berge, Jørgen (1,2,3)(presenter), M. Geoffroy (4), M. Daase (1), F. Cottier (5,1), P. Priou (4,1), J. H. Cohen (6), G. Johnsen (3,2), D. McKee (7), I. Kostakis (7), P. E. Renaud (8,2), D. Vogedes (1), P. Anderson (5), K. S. Last (5), S. Gauthier (9)

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(9) Fisheries and Oceans Canada, Institute of Ocean Sciences, Sidney, BC, V8L 4B2, Canada † These authors contributed equally to this work

At any given moment, half of the Earth's surface is in darkness. While darkness prevails, biological processes regulated by the sun have generally been assumed to cease. Yet, darkness is also the preferred 'habitat' of most marine organisms. Here we explore the potential effects of artificial light on organisms that remain active in one of the last undisturbed and pristine dark habitats on the planet - the Arctic Polar Night. Effects include a disruption of diel vertical migration in the upper water column, tuned to either lunar and solar illumination, as well as a change in swimming behaviour on mesopelagic fish and zooplankton caused by normal working-light from a ship. These results suggest that extreme caution must be taken when conducting scientific surveys or stock assessments in the Arctic Polar Night in particular, but potentially also in darkness in general, and that there is a need to implement autonomous sampling platforms without light pollution more routinely when working in an dark environment.

FROM ICE TO OCEAN: UNDERSTANDING THE IMPACTS OF MELTING GLACIERS ON MARINE BIOGEOCHEMISTRY IN JONES SOUND

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When glaciers melt, they contribute significant quantities of water and ice, sediments and dissolved chemicals to the ocean. Recent efforts in Greenland and Antarctica show that both the delivery of materials to the marine environment, as well as local changes to ocean circulation induced by the input of freshwater, have the potential to profoundly impact marine biogeochemical processes such as as primary and secondary production. Yet, extensive knowledge gaps remain about the chemical composition of glacial meltwater runoff at the ice-ocean interface, the spatial extent of its influence within coastal environs, and the mechanisms by which glaciers affect surface marine microbial communities. Nowhere are these knowledge gaps more prominent than in the Canadian Arctic Archipelago (CAA) - a region where the role of glacial meltwater in marine biogeochemical cycles remains poorly characterized - despite the fact that it is a hotspot for glacial retreat and meltwater runoff to the ocean. Here, we conduct a regional comparative study of the nearshore coastal zone of glaciated and non-glaciated fjords and of multiple glaciers of varying type (land-terminating, tidewater) and size, draining large ice caps. Our study site in Jones Sound, NU is home to the Inuit hamlet of Grise Fiord. Traditional knowledge from this community indicates that the termini of tidewater glaciers in this region are rich in wildlife, providing habitual hunting grounds for its citizens. Guided by this information, in July-Aug 2019 we combined shipboard measurements, acquired aboard the research yacht Vagabond, of temperature, salinity, turbidity, and chlorophyll fluorescence with bottle samples characterizing oxygen, sediment, carbon, nutrient, metal, and molecular characterization of microbial community composition and activity to elucidate how these properties evolve with distance from the shore. Results from this study further our

understanding of glacier-ocean impacts in the CAA and beyond.

ASSESSMENT OF PERMAFROST CONDITIONS FOR PLANNING THE CONSTRUCTION OF THE KUGLUK TERRITORIAL PARK ACCESS ROAD, KUGLUKTUK, NUNAVUT

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Located along the Coppermine River, the Kugluk Territorial Park is a highly valued heritage area for the community of Kuglutuk that provides access to landmarks and inland resources. The ATV trails to and within the park are experiencing significant damage due disturbance of the vegetation cover, formation of mud puddles, multiple landslides and intense gully erosion. Those degradation processes are likely enhanced by warming permafrost temperatures, melting of ice wedges and increasing active layer thickness. Alterations and rerouting of some of the trails are needed annually to keep them usable. The Government of Nunavut's Parks and Special Places (NP&SP) and community leaders are working on building a suitable long-term access route to access the park area. A collaborative project involving the Government of Nunavut's Parks Division, the community of Kugluktuk, the Government of Nunavut Climate Change Secretariat (CCS), Centre d'études Nordiques (CEN) of Université Laval and Polar Knowledge Canada is evaluating geomorphological processes and changes of permafrost conditions to help meet this goal. This research project has two key objectives : 1) map permafrost conditions and measure ground temperature regime to support the community and the park's administration in designing locally an access road to the park and a tundra-safe ATV boardwalk trail in the park area, 2) train locals, with a elders-youths knowledge transfer in basic permafrost science and climate change issues. To access the Park, a summer gravel road is being built by the community on a very low embankment with the intent to increase bearing capacity for light vehicles without catching drifting snow alongside the road. Within the Park, a boardwalk trail resting on adjustable wood blocks and elevated only several centimeters above the tundra was locally designed to allow the circulation of ATVs with minimal disturbance. The applied multi-technique research methodology includes high resolution mapping of surficial geology and permafrost features through interpretation of air photos, high resolution satellite imagery, and making a very high DEM by combining drone photography and GNSS surveys. Over 20 km of linear ground penetrating radar surveys were conducted along the new proposed roads to and within the park. Intact permafrost samples were extracted down to 5 m. Three permafrost monitoring stations were installed to record ground temperature. Observations and results indicate that the dominant issue for permafrost stability and challenge for the road/trails construction is the presence of a very dense network of ice wedges throughout most of the majority of the area, most of them detectable in the field and on high-resolution images by furrows and ground polygonal patterns. However, a large number of ice wedges have no surface signature and can be detected and located only with the GPR. The project combines standard science work with knowledge sharing, training of youth and creative technical designs inspired by traditional knowledge.

DOCUMENTING INUIT KNOWLEDGE OF COASTAL OCEANOGRAPHIC FEATURES IN NUNATSIAVUT

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Climate change is having profound effects not only in arctic and subarctic communities, but also in the environment in general, and particularly in the ocean (i.e. changing sea ice thickness and timing, increasing water temperatures, and changing species distributions). This is evident in the Nunatsiavut region - where oceanographic research may be used in support of decision making and planning for future change. The land claims agreement has provisions to include Inuit knowledge in decision making, and new waves of marine research are looking to engage it alongside western science. Currently, oceanographic data derived from Inuit knowledge in Nunatsiavut is

limited. Incorporating Inuit knowledge is challenging because methods of documenting and mobilizing this knowledge are mostly shaped by western scientific paradigms, generating ontological tensions. This research explores the question: when recording Labrador Inuit knowledge of oceanographic features, what practices of documentation can be used to facilitate knowledge mobilization that respects the original ontological context? Through participatory mapping and semi-structured interviews in the Nunatsiavut communities of Rigolet and Hopedale, this question is addressed through two parallel approaches. First, through documenting Labrador Inuit knowledge of oceanographic features, this work identifies oceanographic trends and changes that Nunatsiavut communities are experiencing. Second, documenting such knowledge provides a case study to identify practices that marine researchers can incorporate when documenting Labrador Inuit ocean-knowledge. In addition to including narratives and using mobility networks as the starting point for data collection, this research reveals the importance of incorporating temporality with oceanographic spatial data. Further, this process makes evident the importance of maintaining interconnected data as a means of context keeping when documenting Inuit knowledge of oceanographic features.

FOXES (VULPES SPP.) AND LYNX (LYNX CANADENSIS) ARE GOOD INTERMEDIATE HOSTS FOR TOXOPLASMA GONDII IN NORTHERN CANADA

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In changing northern ecosystems, understanding the mechanisms of zoonotic pathogen transmission, including the coccidian parasite Toxoplasma gondii, is essential to protect vulnerable animal and human populations that live in these regions. As sentinel species, foxes and lynx give us a better idea of T. gondii distribution and help us understand how it persists in this ecosystem. Our research will generate baseline data on T. gondii amongst foxes and lynx across northern Canada, and help understanding trophic relationships between carnivores and their prey species. Red (Vulpes vulpes) and Arctic fox (Vulpes lagopus) (n=582), and lynx (Lynx canadensis) (n=162) carcasses were collected by local trappers and collaborators from Labrador, northern Québec, northern Manitoba, Nunavut, Northwest Territories, and Yukon during the winters of 2016-2019. We identified DNA from various coccidian species shed in lynx feces using real-time PCR and melting curve analysis, as lynx being the proposed definitive host of T. gondii in subarctic regions. We did not detect T. gondii in feces so far. Toxoplasma gondii genetic material was detected using magnetic capture PCR on brain and heart of all species. An indirect fluorescent antibody test and an enzyme-linked immunosorbent assay were also performed on heart fluid to detect evidence of previous exposure to the pathogen (antibodies). Finally, we are reconstituting the diet of Nunavik foxes for a year by measuring stable isotopes ratios of C and N in hair and muscle samples in order to link prey with status of infection. Thus far, the overall tissue prevalence is 21% (n=52/253, 95% CI:16-26) in foxes and 25% (n=15/60, 95% CI:16-37) in lynx, compared to a seroprevalence of 37% (n=46/126, 95% CI:29-45) and 35% (n=21/60, 95% CI:24-48) respectively. We found a difference in the tissue prevalence of T. gondii in foxes analyzed to date from eastern and western Nunavik: 8% (n=9/107; 95% CI:4-14) compared to 52% (n=12/23; 95% CI:33-71) respectively. Isotopic analyses to reconstitute the diet of foxes across these two ranges are currently underway and may help elucidate regional differences in T. gondii tissue prevalence. This study sheds new light on the current status of T. gondii in wildlife in northern Canada, informing future risk assessments and predictive models to determine the potential human and animal health risks associated to T. gondii infection.

USING SEABIRDS TO ESTIMATE THE DEPOSITION OF MICROPLASTICS TO THE ENVIRONMENT SURROUNDING BREEDING COLONIES

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The presence and persistence of microplastics in the environment is becoming increasingly recognized, however, there remain gaps in understanding the distribution and various drivers of microplastics within different environmental systems. Seabirds have been identified as a possible biovector of plastic pollution in the marine environment, however, the role of animals as vectors for microplastic pollution has yet to be fully examined. We examined two species of seabirds known to ingest plastics (Northern fulmars [Fulmarus glacialis] and thick-billed murres [Uria lomvia]) as potential significant vectors for the transport of microplastics in and around breeding colonies. With the guidance of local Inuit hunters from Qikiqtarjuaq, Nunavut, biotic and environmental samples were collected in August 2018 from a bird colony in the Qaqulluit National Wildlife Area, Nunavut. Through the use of bird population surveys and the quantification of microplastics found in the intestines of sampled seabirds from the same colony, we are able to estimate how many microplastics are likely being deposited into the environment surrounding the bird colony. This data will help examine whether migratory seabirds are contributing to the concentration of microplastics in the coastal environment.

MULTI-DECADAL CHANGE IN FURBEARER DENSITIES AND HABITAT USE IN THE MACKENZIE DELTA, NORTHWEST TERRITORIES

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As the Arctic's climate is changing, so is the composition of its wildlife community. Determining how Arctic wildlife populations will respond to changing weather and a changing biophysical environment is frequently complicated by a lack of baseline data with which to compare contemporaneous community dynamics. The Canadian Wildlife Service's Fur Resource Study Area was an active research site between 1962 and 1970 generating baseline density and habitat use data for furbearers in the Mackenzie Delta region of the Northwest Territories. Since this baseline research, local Inuvialuit and Gwich'in trappers have reported changes in their furbearer communities, namely an increase in beaver (Castor canadensis) densities, a northern range expansion of river otters (Lontra canadensis), and a decline in muskrat (Ondatra zibethicus) densities. Based on these reports, the Dzan-Kivgaluk Research Project was initiated to document declining muskrat densities and identify their potential drivers. Environment and Climate Change Canada, the Gwich'in Renewable Resources Board, and the Inuvialuit Game Council are cooperating to characterize temporal change in muskrat densities, habitat use, and community dynamics in the Mackenzie Delta. This community-based wildlife monitoring project combines reports of traditional knowledge holders with jointly conducted aerial counts and live capture surveys to compare muskrat densities and habitat use with those documented between 1962 and 1970 in the Fur Resource Study Area. Similarly, we characterized temporal change in beaver density and habitat use through the reports of traditional knowledge holders and beaver lodge surveys. Comparisons of traditional knowledge reports, cooperative

aerial and field surveys, and baseline data have been complimentary; muskrat densities appear to have declined in many regions of the Mackenzie Delta and could be associated with reduced overwinter survival. Similarly beaver densities have markedly increased in surveyed regions, and have seen a shift in habitat use over the past 50 years. Compiling multi-decadal records of wildlife community dynamics with the traditional knowledge of local trappers can support traditional food security by clarifying how a changing Arctic is affecting the availability of harvested wildlife species.

FOOD-WEB STRUCTURE OF BENTHIC SOFT-BOTTOM COMMUNITIES EXPOSED TO A FRESHWATER INPUT GRADIENT IN A HIGH-ARCTIC FJORD (YOUNG SOUND, GREENLAND)

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Climate change induces a strong warming of air and surface seawater temperatures in the Arctic, at least two time higher than the global average. Among Arctic ecosystems, Arctic fjords appear to be one of the most sensitive habitats to these ongoing environmental changes notably due to their high exposition to terrestrial inputs of freshwater, sediment and terrestrial organic matter. Although numerous studies have highlighted the impact of these physical constraints on species distributions, their impacts on food web structures remain largely unknown. Here, we present results from a study conducted in a high arctic fjord (Young Sound, Greenland) characterized by a long sea-ice cover (i.e. 9 months/year) and strong seasonal freshwater inputs. Spatial variability of benthic food-webs and community structure were studied along an inner/outer fjord gradient (i.e. reflecting a freshwater inputs exposition gradient) during both winter and summer. Isotopic values (δ13C and δ15N) and weight of benthic species were combined to determine the key species and main pathways involved in the carbon flow through the community. In parallel, several isotopic indices (e.g. isotopic functional richness and evenness indices) and community metrics (species and functional traits' diversity) were also compute in order to describe benthic community and food-web structures. Our results will aim to discuss: (1) to what extent freshwater inputs may impact the specific and functional diversity of benthic communities and (2) how these variations in the benthic communities are reflected in the benthic food-web structure.

INUVIALUIT SETTLEMENT REGION - COMMUNITY BASED MONITORING PROGRAM

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Despite the extensive research and monitoring in the Inuvialuit Settlement Region (ISR), Inuvialuit or "the real people" whom are the intrinsic stewards of this area, have not historically been equal and meaningful participants in the research and monitoring of their backyards. Inuvialuit and co-management bodies have specific land and wildlife management responsibilities under the Inuvialuit Final Agreement (IFA); therefore, regional authorities have been conscientious users of data and information collected by academics and government researchers. However, this dynamic positioned Inuvialuit as reactive to external research activities with consultation often coming too late, after the project/program has already been determined and researchers are simply looking for a stamp of approval or letter of support. The relationships described above are not upholding the 3 guiding principles of the IFA: to preserve Inuvialuit cultural identity and values within a changing northern society; to enable Inuvialuit to be equal and meaningful participants in the northern and national economy and society; and, to protect and preserve the Arctic wildlife, environment and biological productivity. Therefore, over time and as internal Inuvialuit capacity increased, regional authorities determined that one way to encourage equal and meaningful Inuvialuit participation in research and monitoring efforts was to develop the Inuvialuit Settlement Region - Community Based Monitoring Program (ISR-CBMP). The concept for ISR-CBMP was first tabled in 2010, when representatives from Inuvialuit Game Council and Fisheries Joint Management

Committee articulated the need for an Inuvialuit hub that could coordinate stakeholders to reduce research fatigue, further Inuvialuit research priorities, and ensure equal participation of Inuvialuit within community-based monitoring activities. It took six years to gather community input, garner financial support, and coordinate Inuvialuit stakeholders to launch ISR-CBMP in January 2016. Initial ISR-CBMP activity was limited by financial constraints and thus it was determined to focus on meeting immediate harvest data needs by delivering a long-term bird, fish and mammal harvest data collection program in the form of the Inuvialuit Harvest Study. This program enabled ISR-CBMP to organically build capacity overtime through the steady implementation of the Inuvialuit Harvest Study in all six communities through partnerships with local Hunters and Trappers Committee. Working out all the moving parts of region-wide program delivery through the Inuvialuit Harvest Study over two years, ensured that ISR-CBMP grew with communities and became a reliable, efficient and manageable vehicle to deliver additional activities. 2016-2018 were important years to build a strong ISR-CBMP foundation, which was further tested by the delivery of various components of multiple Inuvialuit-led projects that contributed to the Beaufort Regional Strategic Environmental Assessment. During that time, ISR-CBMP was working to acquire funding to support additional monitoring programs and to diversify the skills of local technicians and monitors. Finally, nearing the end of 2019, ISR-CBMP has grown into the role it was envisioned to have nearly 9 years prior. In conclusion, ISR-CBMP is an example of how programs designed to address Northern issues need to develop from locally identified need, while both encouraging and maturing with local capacity.

PREVALENCE OF ANTIBODIES AGAINST CALIFORNIA SEROGROUP VIRUSES IN BARREN-GROUND AND BOREAL CARIBOU, RANGIFER TARANDUS, FROM THE CANADIAN ARCTIC

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Due to rising annual temperatures, vector-borne pathogens have become a growing public health concern in northern Canada. California (CAL) serogroup viruses (Jamestown Canyon virus and Snowshoe hare virus) are mosquito-borne viruses of zoonotic importance, and cervids have been suggested as reservoirs for Jamestown Canyon virus in temperate regions of Canada. Recently, 27% of human participants in Alaska were seropositive for exposure to CAL serotype bunyaviruses. The objective of this study was to determine if barren-ground and boreal caribou in Canada have been exposed to CAL serogroup viruses based on detection of antibodies in caribou from the Northwest Territories, Nunavut, and Nunavik. Antibodies were detected with a competitive ELISA in 70% of caribou from the Northwest Territories (n=50; 95% CI [0.56,0.81]) and 2.4% of caribou from Nunavik (n=42; [0.00,0.12]) using serum collected from collaring activities, as well as whole blood collected with Nobuto strips from hunter-harvest activities. A plaque reduction neutralization test will be performed on positive samples, and Jamestown Canyon virus exposure is expected to be the primary virus identified in caribou. The regional differences observed in this study compel further investigation but may also be due to differences in sample collection, handling, and storage. This study provides supporting evidence that caribou are infected with CAL serogroup viruses, and indicates the need for further studies to determine if caribou play an important role in the ecology of these viruses and if there are effects on caribou health and reproduction following infection.

UNITED STATES APPROACH TO COMMERCIAL VESSEL REGULATION UNDER THE POLAR CODE. BRIEF HISTORICAL BACKGROUND AND DEVELOPMENT OF THE US APPROACH AND CURRENT STATUS WITH PROGNOSIS FOR DEVELOPMENTS AND DIRECTION IN THE NEAR FUTURE

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The author has been practicing maritime law in the United States for over 30 years, with experience in representing commercial operators in regulatory matters. He has been involved with Polar developments for much of the last decade, serving on the CMI's Polar Shipping Int'l Working Group and its Antarctica Subcommittee, chairing the the US MLA's Int'l Organizations, Conventions and Standards Committee and, in 2017-19, teaching maritime and transportation law at the Universitat zu Koeln and Universitat Hamburg. The author is currently working on his PhD studying vessel regulation under the Polar Code at Dalhousie University. The proposed presentation will be based upon an article on the US position on Arctic regulation he recently published in the Journal of Int'l Maritime Law. The author has had extensive contacts with the US Coast Guard legal office and the IMO through his professional work and academic research. The presentation (which is understood to last about 15 minutes) will briefly review the development of the US position and direction in Polar regulation of commercial vessels, and will address current "hot topics" and a prognosis of what to expect in the near future, given from the perspective of the private commercial shipping world (which the presenter has represented for many years).

A CASE STUDY ON COLLABORATIVE QUALITATIVE ANALYSIS AND ANTI-COLONIAL METHODS IN THE IMAPPIVUT MARINE PLANNING INITIATIVE

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The positionality of researchers relative to the community being researched has ethical, methodological and analytical implications. Anti-colonial methodologies reframe inquiry such that Indigenous ways of knowing are rooted at the center of research. Putting these methodologies into practice, however, remains challenging. Case studies are an important way to examine the process of engaging in anti-colonial research. The Nunatsiavut Government's Imappivut ("Our Oceans") marine planning initiative collected data in each of the five coastal communities and Upper Lake Melville that will contribute to marine spatial planning and research in the Labrador Inuit Settlement Area. The analysis of the Imappivut data provided an opportunity for a case study that explores anti-colonial and collaborative methodologies by first centering Inuit knowledge as the catalyst for inquiry, and then by facilitating the integration of essential information and ways of knowing into the analysis and interpretation of the data. In order to achieve its goal of integrating Inuit and Western ways of knowing on this project, the NG partnered with Dalhousie University to engage one Inuit researcher from Nunatsiavut and a graduate student to co-develop a qualitative analysis method, including a protocol to code, analyze, interpret, and communicate the qualitative interview data and subsequent results to inform NG marine planning and a community-based scientific agenda for the region. The university student travelled to Nain, Nunatsiavut for two months so that the two researchers could work together in the region to complete the analysis. Our experience suggests that the process of analysis was highly affected by the collaboration, and in particular, offered opportunities for iterative processes between coders that would not have been available through single-coder analysis. We used a Grounded Theory approach to analyze the data, which allowed us to use the Inuit Knowledge that was present in the interviews as the starting place for inquiry. First, we inventoried the 42 interviews which allowed us to develop an understanding of the knowledge, perspectives and narratives present in the data in a holistic sense. Then we asked: "How can the information captured in the inventory inform future research and planning?" Our experience of collaborative, cross-cultural analysis has yielded insightful lessons on the value of collaborative research to inform deeper and more meaningful decision-making. We use examples from our research on the Imappivut project to reflect on how our cross-cultural partnership enhanced our analysis, as well as the ethical, practical and methodological barriers we faced as a result of our partnership. Our work provides a case study that can highlight valuable lessons learned about the process for future research in contexts defined by multiple ways

of knowing and inform methods that support Inuit self-determination in research.

MULTIPLE GEO-HAZARDS AT CHAPMAN LAKE, KM 116, DEMPSTER HIGHWAY, YT: IS PERMAFROST LEAKING?

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The landscape of the JMRFN lands, located in the Dehcho region, NWT, is changing. Driven by permafrost thaw, these changes have been observed by the community, and have and will have considerable impacts on country food. Continuing the collaborative project initiated in 2011, our research team have integrated traditional, local and scientific knowledge to produce maps showing the vulnerability of traditional use areas near Jean Marie River to permafrost thaw in a newly extended area of about 2000 km2. Our geological survey and mapping results suggests that approximately 52% of the study area encompasses grounds having a medium to high vulnerability to permafrost thaw. This permafrost is warm and close to degradation, with several areas already experiencing severe degradation processes. The resulting landscape changes affect the wildlife habitat and wildlife behavior. The impact assessment on food security shows that changes have and will have considerable impacts on country food, as an average of 33.4% of sites, indicating the presence of animals used for food, overlap with areas vulnerable to permafrost. JMRF's diet is composed of 75% country food which triggers great concerns in terms of food security. In addition to extending the vulnerability assessment, our study has focused on the habitat of the woodland caribou; a species that might be particularly affected by permafrost thaw in the Dehcho region. The caribou is very important in JRMFN's culture and potential loss of caribou habitat in relation to permafrost degradation was evaluated by overlapping the permafrost vulnerability by a map of the Index of Habitat Quality developed for this study. GPS collar data also were used to refine the analysis. In the future the quantity of animals and plants that The JMRFN currently uses for food by the community are likely to be reduced as the degradation of permafrost continues to change their habitat. The issue is aggravated by the increase in frequency of forest fires during the past years, which contributed to the loss of wildlife habitat, as well as devastated permafrost areas that now are more likely to degrade in an accelerated manner. To adapt to the situation, solutions may consist in hunting, trapping and gathering in different areas, eating news species that come to JMRFN traditional lands, growing a community garden annually to have vegetables at their disposal, and build a root cellar to preserve our produce and some country food in good condition. The vulnerability hazard map resulting from this project was tailored to the needs of the JMRFN community, is culturally oriented and, when overlain with spatial traditional land use information, brings a new, integrated perspective regarding climate change impacts on the JMRFN. Finally, JMRFN vulnerability hazard map has been integrated into the Permafrost and Hazard Atlas jointly developed by Laval University and Yukon College, which aim to make easily accessible Permafrost and Hazard Maps developed in Nunavik, Québec, Northwest Territories, and Yukon. https://yukoncollege.maps.arcgis.com/apps/MapSeries/index.html?appid=e034cb44769d430baf88f434bd1e0aa7 Our project piloted an innovative approach to mapping aimed at identifying and quantifying the impacts of permafrost degradation from a broader and more holistic viewpoint that combines western science and traditional and local knowledge.

NUTRITIVE QUALITIES OF MARINE MICROALGAE IN NUNAVIK

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In the Arctic Ocean, microalgae generally are the principle source of primary production, which then transfers to the pelagic food web, the benthos and the sediments. Algae are also the only organisms able to synthesize essential compounds such as omega-3 fatty acids and carotenoid pigments. Due to the rapid pace of environmental change in the coastal Arctic, physico-chemical water parameters are changing, including temperature, pH, salinity and nutrient availability. These changes are expected to affect microalgal production and the quality of the organic matter available for consumers,

potentially affecting the entire wood web and modifying the nutritional qualities of the local marine foods harvested by Inuit. As part of Sentinel North's BriGHT program, the goal of this project is to explore environmental determinants of the composition of marine particulate organic matter in Nunavik, Canada. Results show strong spatial gradients in physico-chemical water properties across the three coastal regions of Nunavik: relatively fresh, warm and low-pH conditions are found in the Hudson Bay region, whereas colder, saltier and high-pH conditions are found in the Hudson Strait and Ungava Bay regions. Nutrients are generally depleted from the surface in all regions, but increase rapidly with depth. Hudson Bay shows the highest chlorophyll a biomass, particularly in the subsurface chlorophyll maximum (SCM). Omega-3 fatty acids (EPA and DHA) do no show any clear regional or depth-related pattern, whereas carotenoids are generally much more abundant at the SCM. When combining data from two years, carotenoids and fatty acids seem to be most affected by water temperature and pH.

MAJOR QUATERNARY DEPOSITIONAL ELEMENTS AND MORPHO-SEDIMENTARY FEATURES IN WESTERN BAFFIN BAY

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The surficial geology of the western Baffin Bay shelf and slope was mapped, focusing on the major depositional elements of the region. Features were delineated using available geophysical data including 3.5 kHz sub-bottom profiles, seismic reflection profiles, and multibeam bathymetry. Sediment cores and Ocean Drilling Program site 645 provided ground truth for the study. Since the Quaternary, glaciers and glaciomarine sedimentation have significantly affected the surficial geology of the Baffin Bay region. The most prominent features on the continental shelf are 11 u-shaped transverse troughs that, in some cases, incise more than 800 m into the adjacent banks. Trough mouth fans (TMFs) developed at the shelf break of transverse troughs. These sedimentary fans mantle most of the continental slope in the study area and are composed of stacked, lenticular glaciogenic debris flows interbedded with turbidites and hemipelagites. Conventional mass transport deposits are comparatively rare and are mostly located on the continental slope south of Clyde River to Davis Strait, and along the steep flanks of transverse troughs. There is also relatively little evidence of submarine channels. A 200 km-long by 15 km-wide submarine terrace is located in ~1200 m water depth seaward of Clyde River. Extensive diapiric structures are located in the subsurface, down slope from the terrace, and are likely due to loading by TMFs upslope. The regional scale map will provide useful context for future studies in Baffin Bay.

PIKIALASORSUAQ IN PARTNERSHIP WITH THE CANADA EXCELLENCE RESEARCH CHAIR (CERC) AT THE UNIVERSITY OF MANITOBA

Candlish, Lauren M (1) (Presenter), E. Worden(1), D. Dahl-Jensen(1) and D.G. Barber(1)

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The North Water (NOW) Polynya, located in northern Baffin Bay between Canada's Ellesmere Island and Greenland, is the largest polynya in the Arctic and is home to a large and diverse biological ecosystem. It is heavily influenced by regional glacier, oceanic and atmospheric conditions, as well as the sea ice exported from the Arctic Ocean. In recent decades, there have been large changes in the polyna's physical, biological, and chemical processes. These changes have also identified significant knowledge gaps. With continual monitoring of the region, these knowledge gaps can be narrowed and we can develop effective models to predict how the region will respond to further changes in the Arctic system. The University of Manitoba has partnered with Oceans North and the Inuit Circumpolar Council, to help implement recommendations from the Pikialasorsuaq Commission for international and regional management and conservation of the North Water Polynya. Through our Canada Excellence Research Chair (CERC), our group will integrate new research to integrate the scientific background with Inuit knowledge on the functioning of the polynya, thereby helping to inform monitoring or management decisions for the Pikialasorsuaq region. In this presentation we will discuss our partnerships and how we will move forward to facilitate a monitoring network across Baffin Bay.

EXPLORING THE KNOWLEDGE-SHARING NETWORKS FOR WEATHER, WATER AND ICE INFORMATION IN IQALUIT, NUNAVUT

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The coincidental occurrence of climate-change-driven unpredictable environmental conditions and a reduction in the intergenerational transfer of knowledge and skills, due to various socio-economic changes, challenges the ability of Inuit to travel safely on land, water and ice. These challenges have led to a significant increase in search and rescue incidents in the past decade. One of the ways community members have been responding is to seek out and use diverse weather, water, ice and climate (WWIC) information and services, in support of safe travel. However, to date, there has been no systematic effort to document and assess the uses or needs of WWIC information and services in Nunavut. As the capital city, and largest community, of Nunavut, Iqaluit has numerous active full-time, as well as part-time hunters. As the regional centre for government (federal and territorial), Inuit organizations and health services, Iqaluit also draws Inuit from communities across Nunavut for temporary and long-term residency. Many newcomers arrive with limited knowledge of the local environment, including the largest tides in Nunavut, challenging topography, and a complex sea-ice regime, all of which increase travel risk for Inuit harvesters throughout the year. As part of a larger ArcticNet-funded project to understand Inuit community WWIC uses and needs, this presentation will share my proposed Master's research. My work will focus specifically on Iqaluit, in particular the formal and informal knowledge-sharing networks. I will outline how I will use results from a community survey and plans to facilitate follow-up interviews. Understanding how Iqaluit's knowledge sharing networks function is important to improve the circulation and assessment of relevant environmental information for safe travel decisions.

THE TRAJECTORY OF PERMAFROST ENVIRONMENTS IN NORTHWESTERN CANADA'S DISCONTINUOUS PERMAFROST ZONE

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Arctic and subarctic regions are undergoing rapid and accelerating climate warming and experiencing widespread permafrost thaw as a result. Canada's discontinuous permafrost zone is among the most vulnerable regions on Earth as it undergoes a significant transformation associated with rapid climate change and the resultant impacts of permafrost thaw. Permafrost thaw is one of the most dramatic manifestations of climate warming yet the rate, pattern and stages of land cover change are not well understood, and as such, the land and water resources across the circumpolar region have an uncertain future. This is particularly important in Canada's discontinuous permafrost zone, where permafrost is effectively isolated to areas of high peatland coverage, where substantial changes to landcover and regional hydrology have been well described. While permafrost is able to be preserved by the insulating properties of peat in these environments, the permafrost is still typically at or very near to melting point temperatures. As such, rapid climate warming over recent decades has significantly decreased the area underlain by permafrost and has catalyzed dramatic landscape transition from forest to wetland in these peatland areas. These permafrost thaw-induced landscape transformations indicate the region is particularly sensitive to warming temperatures and will continue to respond to climatic changes and landscape disturbances. While these changes are known to significantly affect the hydrological mechanisms governing the storage and routing of water across the landscape, predicting these responses across the discontinuous permafrost zone is challenging due to the remoteness and size of the region, spatial and temporal heterogeneity, limited data availability, and incomplete monitoring networks. This study explores the future trajectory of these transitioning landscapes by proposing a space-for-time substitution spanning the approximately 600 kilometer latitudinal gradient and 300,000 square-kilometer areal

extent of northwestern Canada's discontinuous permafrost zone. This space-for-time approach is an appropriate method of studying these environments given the parallels between the climatic gradient observed across this latitudinal span and the climatic linkages associated with landscape transitions in these environments. In order to determine the future trajectory of these environments, the current patterning of permafrost and forest distribution is established before a conceptual model of peatland transition following permafrost thaw is presented. The proposed conceptual model is designed to represent local changes over time and regional changes across space.

PROJECT CO-DEVELOPMENT ADDRESSING COMMUNITY CONCERNS OVER REINTRODUCED MUSKOX HABITAT USE

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Following extirpation in the 1860's, muskox were reintroduced to the Alaskan North Slope in the 1960's. Over the following decades, groups of muskox emigrated and established breeding groups eastward into the Yukon's North Slope and the Richardson Mountains of the Northwest Territories. This reintroduction has been cause for concern from local communities, who suspect muskox may be modifying caribou behavior and migration patterns and impacting community members' ability to harvest caribou. The Wildlife Management Advisory Council North Slope, in collaboration with Yukon and Northwest Territories Government, Parks Canada, the Aklavik Hunters and Trappers Committee, the Ehdiitat Renewable Resources Council, and the Gwich'in Renewable Resources Board has developed muskox research and management plans to guide future actions and management decisions. This process involved the participation of McGill researchers and was initiated through a series of community meetings and interviews with local organizations to allow for knowledge exchange at the research design stage. The habitat use project stemming from the research plan addresses community concerns regarding the reintroduced muskox population and assesses potential for competition between the two ungulates. Through this project, data from 24 satellite collar deployed across muskox groups have been used for habitat selection analysis through resource selection functions. Muskox herbivory impacts were evaluated by sampling sites across a gradient of muskox densities to quantify changes in vegetation. Here, we discuss the process of research co-development and its relevance in co-managed wildlife species, muskox habitat selection and impact results, and management challenges associated with a reintroduced species.

LESSONS LEARNED THROUGH RESEARCH PARTNERSHIP AND CAPACITY ENHANCEMENT IN INUIT NUNANGAT

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Conducting research and enhancing community research capacity through a partnered approach in Inuit Nunangat presents learning opportunities and challenges for southern-based, non-Inuit researchers and community members alike. The Arctic Corridors and Northern Voices project involved participatory mapping workshops in and with 14 Inuvialuit, Nunavut, and Nunavik communities (http://www.arcticcorridors.ca). This multi-community study focused on participatory mapping and understanding Inuit and Northern perspectives about the impact and potential management options for increased marine shipping and transportation in the region. Our research approach prioritized partnerships with local organizations, and training and hiring youth cultural liaisons as workshop co-facilitators. For our diverse team of Inuit, Northern (i.e non-Inuit living in Inuit Nunangat), and southern-based non-Inuit researchers, our efforts to engage in partnered research formed a critical component of the research and learning experience. In this presentation, we

will share our methodological reflections and the lessons we learned about what collaborative partnered research means in practice. Our aim in doing so is to further the ever-increasing dialogue and efforts around knowledge co-production and Inuit self-determination in research. Key conclusions of this reflective exercise include the importance of: 1) facilitating research that is relevant to local interests and needs; 2) partnering with local organizations; 3) involving youth as cultural liaisons; 4) co-developing and refining research tools; 5) ensuring results validation and sharing exercises are conducted; and 6) being open to forming friendships and research relationships.

INTEGRATION OF SOLAR ENERGY AND DIESEL WASTE HEAT RECOVERY FOR DISTRICT HEATING IN BEAVER CREEK, YUKON

Eric Labrecque and Quinn Cavanagh(Presenter)

Northern Energy Innovation, Yukon College

The community of Beaver Creek, Yukon is pursuing two avenues to reduce their diesel consumption for electricity by 60%. The first is focused on the feasibility of a solar photovoltaic (PV) plant and a community-scale battery energy storage system (BESS). The second is focused on a district heating system (DHS) which would harness waste heat from the community's diesel generators to offset their heating fuel consumption. To meet their diesel reduction targets, the community has proposed a 1.5MW solar PV plant with a 4 MWh battery. This will reduce both annual diesel consumption and generator operating hours (thereby maximizing "diesel-off time"). This system is expected to allow the community to be 100% solar powered from April to September and reduce their annual diesel consumption by 55%. The proposed waste heat district heating system considered at total of ten community- and territorial-owned buildings in Beaver Creek. To be considered, buildings had to be sufficiently close together and to the diesel plant and whose heating load were significant . Without the PV/BESS system, the district heat system would be able to satisfy the majority of the identified buildings' annual heating load. Both projects would require most of their initial capital costs to be covered by grants in order to be at least marginally feasible. The proposed solar PV and battery system would produce excess solar energy at times during the summer. Pairing the solar/battery system with a district heating system would allow this excess solar energy to be harnessed by the district heating system, much like it would otherwise be harnessing waste heat from the diesel plant. The proposed solar PV and battery project would also reduce the amount of waste heat available from the diesel generators. A diesel boiler has been proposed for times when there is insufficient waste heat from the diesel generators and no excess solar generation available. Through this project, the Yukon College's Northern Energy Innovation research group, led by Dr. Michael Ross, is seeking to optimize the integration of solar energy, battery storage, and district heating into a remote northern community. We will create a district heat system model in MATLAB's Simscape modelling environment that can integrate seamlessly with our existing Power System Impact Study (PSIS) models. The PSIS models have been used in multiple communities across the Canadian Arctic to study the impact of intermittent renewable energy on remote grids from a community-specific perspective. However, PSIS models have yet to incorporate the thermal needs of northern communities to date. This presentation will outline the importance of and approach to incorporating thermal modelling for Beaver Creek's district heat system and solar PV / battery project. Technical aspects of our integrated electric-thermal modelling will be described and the incorporation of social concerns into the project and modelling approach will discussed as well. Our discussion of social concerns will include the impact of "diesel-off" time on the community, which has implications on human health and well-being. Social considerations that influenced the district heating project's building selection process included the impact of building ownership models on the community's diesel reduction efforts. While results of our modelling are not yet available, preliminary results are expected to be ready in time for the conference.

SHRUB CANOPY INDUCES A DECLINE IN LICHEN ABUNDANCE AND DIVERSITY IN NUNAVIK (QUÉBEC, CANADA)

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Lichens are an important component of biodiversity in northern ecosystems and are involved in diverse ecological processes. They contribute to nutrient availability through nitrogen fixation, are a substantial part of caribou winter diet and influence global climate by increasing land surface albedo. Over the last decades, increased primary productivity in northern ecosystems,

mainly associated with the expansion of shrub species, has led to a decline of lichen-dominated areas. We evaluated the impacts of shrubs on lichens by comparing lichen communities in the open environment and underneath dwarf birch (Betula glandulosa) canopy in Nunavik, Canada. Our results showed a decrease in abundance, richness and evenness, and a shift in community assemblage between open areas and understory. These changes were mainly induced by the presence of a shrub canopy rather than by its characteristics, as shrub height and canopy closure had little effect. Richness and evenness dropped from shrub edge to shrub center, suggesting that that the intensity of the decline was positively correlated to the time spent under the shrub canopy. Important changes in lichen communities are therefore expected to occur with further shrub expansion and may have substantial unfavorable implications for global climate and ecosystem functioning.

A PROBABILISTIC ICEBERG CLIMATOLOGY OF EASTERN CANADA BASED ON OBSERVATIONS

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Current iceberg climatologies along the east coast of Canada rely on observed counts of icebergs sighted by various sources (flights, ships, platforms, etc). As a result, iceberg climatology is often reported as a frequency measure, which omits information about the monitoring frequency (i.e. how often an area was monitored before an iceberg was observed). Spatial-temporal distributions of sightings may bias iceberg counts in the climatology towards areas that are monitored more frequently. In this study, we consider the spatial and temporal distribution of areas monitored, in combination with the number of icebergs sighted, to derive an spatial-temporal probabilistic iceberg climatology. The dataset used to create the iceberg climatology can also be used as an iceberg validation dataset for automated detection in remote sensing. The probabilistic iceberg climatology will allow for (a) a risk assessment of when and where icebergs are more likely to be encountered, and (b) may contribute to statistical assessment of changes in iceberg distributions over time.

THERMAL CONTRACTION CRACK POLYGONS IN NUNAVIK: INVESTIGATION OF POLYGONAL PATTERN DEVELOPMENT

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Despite abundant research on permafrost in Nunavik, on ice-wedge polygons and on ground thermal cracking, no study has yet been done concerning the spatial distribution of active frost cracking and of thermal contraction crack polygons. To fill this knowledge gap, this study evaluates the spatial distribution of actively cracking polygons under the current climate conditions across the different bioclimatic zones of Nunavik. The study also assesses the importance of cold Holocene climate episodes for the formation of polygonal networks over the territory. Thousands of geo-referenced aerial photographs (80 737) and Esri satellite map bases (264,504.14 km^2) were analyzed to develop a thorough inventory of Nunavik's tundra polygons. A total of 4,567 polygonal networks were inventoried. For each identified site, the arrangement (e. g. open, closed or unorganized networks), intersections (angles), cracking orders (primary, secondary and tertiary cracks), type of bulge and rims (flat, high-centred, low-centred), the affected surficial geological materials and the vegetation cover were noted and registered in a database. Mapping of the results and modelling of cracking conditions indicated that currently, active polygonal networks are only present beyond 60°N, in the herbaceous tundra, principally in organic soils, on raised beaches, and on sandy organic-covered fluvial terraces. In addition, the statistical analyses carried out on our sampled population showed that there is a strong dependence between the types of surficial deposits and the different angles forming the polygonal networks. Orthogonal polygons (90° intersection angles) dominate on flat terrains where the thermo-mechanical stresses are spatially homogeneous and a tendency for hexagonal polygons (120° intersection angles) exists where uneven local topography generates non- homogeneous heat flows and uneven thermo-mechanical stresses in the ground, thus forcing a less regular cracking pattern.

POLAR CODE IMPLEMENTATION IN THE ARCTIC 5 STATES: IS THE AMSA RECOMMENDATION ON LEGISLATIVE HARMONIZATION BEING ACHIEVED?

Chircop, Aldo

Dalhousie University and Ocean Frontier Institute, Halifax, Nova Scotia, B3H4R2,

In 2009 the Arctic Marine Shipping Assessment Report of the Arctic Council encouraged member States to work through the IMO in the development of international standards for Arctic shipping and to explore harmonization of laws and implementation within their respective jurisdictions. Within this group of States, the Arctic 5 had core interests to protect because of coastal frontage on the Central Arctic Ocean. In 2014/15 the IMO adopted the Polar Code after a lengthy development process that included numerous contributions from the Arctic 5 States. All five States have taken steps to implement the Code, and while they appear to have largely embraced the new standards, Canada, Denmark (Greenland) , Norway and the Russian Federation appear to have employed modifications for different reasons. The presentation discusses these practices and provides observations on the extent to which Arctic 5 States embraced international rules while protecting national interests and local concerns, and the consequences for international navigation.

INTER-ANNUAL VARIATION IN DIET ESTIMATES OF EASTERN BEAUFORT SEA BELUGA WHALES: INSIGHTS ON CLIMATE CHANGE EFFECTS THROUGH A COMMUNITY-BASED MONITORING PROJECT

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As a top predator with an Arctic circumpolar distribution, beluga whales (Delphinapterus leucas) are an indicator species for the effects of climate change in the Arctic. The eastern Beaufort Sea beluga whale population, one of Canada's largest, has experienced a twenty-year decline in inferred growth rates of individuals, which is hypothesized to have resulted from changes in prey availability. As part of the beluga health community-based monitoring program, a partnership between community members and Fisheries and Oceans Canada, we collected tissue samples from traditional subsistence harvests of beluga whales at hunting camps across the Inuvialuit Settlement Region. Using the blubber and liver tissues collected from the harvests, we analyzed fatty acid signatures and stable isotope ratios to examine inter-annual variation (between 2011 and 2014) of 14 potential prey species in 178 beluga whales. Diet estimates using quantitative fatty acid signature analysis in R identified Arctic cod (Boreogadus saida) as the dominant prey, but indicated beluga whales also consume capelin (Mallotus villosus), Canadian eelpout (Lycodes polaris), Greenland halibut (Reinhardtius hippoglossoides), kelp snailfish (Liparis tunicatus), and decapods (Argis dentata, Eualus gaimardii gaimardii, and Sclerocrangon ferox). Diet estimates varied among years and the interaction of sex and size-class, with large males consuming the highest proportions of Arctic cod and females consuming the most capelin. Dietary proportions of Arctic cod decreased from 2011 to 2014, coinciding with an increase in capelin in the diet of whales. Beluga consumed the highest proportions of capelin and the lowest proportions of cod in 2014, the same year in which body condition was lowest in all whales. Therefore, switching to a capelin diet may result in declines in beluga condition, and, in turn, this may affect females and small males since they consume the highest proportions of capelin. Understanding inter-annual variations in beluga diet in response to changes in prey availability, quality and quantity, and longer-term nutrition condition implications for beluga of shifting from an Arctic cod to a capelin-dominated diet, should be a priority for monitoring the health and resilience of beluga populations.

"I WASN'T HOMELESS UNTIL I MOVED BACK HOME TO GREENLAND": HOUSING POLICY AND THE PRODUCTION OF HOMELESSNESS IN NUUK, GREENLAND

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In the summer of 2018, cranes cluttered the skyline in Nuuk, Greenland as the city entered into another construction season in its aggressive municipal expansion plans. That same summer, however, a cluster of shipping containers were deposited next to the garbage dump, and transformed into lower-cost housing. These units were intended to address in some small way what housing advocates in the community describe as a dramatic increase in the number of Greenlanders living without housing in the city of Nuuk. Since the early 2000s, the number of people staying at the municipal shelter, accessing support programs, and registering as homeless in the community has grown. Yet despite the relatively recent visibility of this phenomenon, homelessness itself has not appeared out of thin air. As we argue in this paper, the emergence of homelessness in Greenland is part and parcel of a trajectory of welfare colonialism, centralization/ resettlement, and contemporary urbanization without housing/homelessness strategy. The intergenerational effects of colonialism also have profound implications for the social health needs of Greenlanders, and these needs intersect with rural-urban geographies and housing policy in significant ways. One of the effects of welfare colonialism is the replacement of family and community as supports with state institutions, institutions that are increasingly concentrated in regional centres. Thus, the geographies of institutionalization and social welfare play key roles in the reproduction of homelessness-both within Greenland through rural-urban mobility, but also between Greenland and Denmark along persistent colonial lines. Therefore, in order to understand the causal factors behind acute homelessness in Nuuk, or in Greenland generally, we need to understand the historical and contemporary context of welfare colonialism and urbanization, and the effects that both have had on housing and housing policy. In this presentation, we trace the trajectory of contemporary visible homelessness in Nuuk, Greenland, by positioning this emerging social phenomenon within the context of welfare colonialism and shifting housing policy in Greenland. Welfare colonialism, we argue, helps us to understand the dynamics of centralization, resettlement and urbanization in Greenland, and how these forms and processes frame the production of homelessness within the capital city of Nuuk today. Moreover, we can better understand the constraints within which the Greenlandic Self-Government governs the housing landscape today, and the implications this has for low-income and marginalized Greenlanders. The absence of policy directed at housing inclusion for those who are without employment or education is a serious gap, with profound implications for Greenlanders experiencing homelessness. The result is the total lack of social policy directed towards social inclusion and homelessness, and instead piecemeal efforts to contain a rapidly expanding problem. Through our research, we find that homelessness is currently being managed in the city of Nuuk through a collection of unintegrated supports, several of which rely on charitable funding from outside Greenland, and general community tolerance towards squatters. We also attend to the ways in which homeless geographies themselves reveal important relationships between rural and urban Greenland.

LISTENING TO THE CLOCKS OF CIRCUMPOLAR BIRDS USING AUTONOMOUS RECORDERS AND DEEP LEARNING

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As polar regions are vulnerable to climatic perturbations, there is concern that some arctic bird populations could decline if they cannot adjust their phenology appropriately - i.e the timing of activities such as migration or breeding. However, due to their remoteness, the cost and logistics involved, few studies describe how climatic variation impacts the phenology of arctic birds. Moreover, these studies are usually restricted spatially to a few sites simultaneously. Recent advances in acoustic technology now allow us to deploy small and cheap automatic devices that can be easily deployed around the world. This allows us to record sounds at a large spatial scale and collect lots of data in a way that is cheaper, more precise, more objective and more replicable. In the summer of 2018, we deployed 56 acoustic recorders from Alaska to Sweden along latitudinal and longitudinal gradients. In total, over 200 days of recordings were gathered. Using a deep learning detector, we extracted the biophonic events that occurred to obtain an acoustic image of each site. The results show that seasonal variations of acoustic activity can be detected over the summer and between sites. By linking them to environmental variations, we will see if geographical patterns in the phenology of arctic bird communities can be detected. We believe this method could provide us with a reliable, cheaper, and easier way to monitor arctic environments and will allow us to further our understanding on how bird species can react to climatic variations.

1. EVALUATING UAV-SFM BY RTK DIRECT GEOREFERENCING WITH OBLIQUE IMAGES FOR QUANTIFYING RAPID ARCTIC COASTAL

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Arctic coasts have been shown to exhibit some of the highest rates of erosion in the world. Above average warming in the Arctic is leading to increasing permafrost temperatures and a reduction of sea ice cover which are expected to contribute to increasing rates of Arctic coastal retreat. The presence of excess ice in permafrost can lead to rapid morphological change along Arctic coasts in the form of retrogressive thaw slumps and block failures. Traditional erosion studies along Arctic coasts have used satellite imagery (>1m resolution) over longer time scales (>10 years) which are unable to capture unique processes like retrogressive thaw slumps and block failure that occur rapidly. UAV-SfM offers a flexible form of high spatial and temporal resolution data collection that has been successfully implemented for a variety of geomorphological applications including along lower latitude coasts. Typically, ground control points (GCP) are distributed throughout a field site and measured with RTK-GNSS before a UAV survey to ensure accurate georeferencing of the resulting products. However, retrogressive thaw slumps and block failure areas present issues of accessibility and safety which limit the ability to appropriately distribute GCP. RTK Direct Georeferencing (DG) provides a possible alternative to GCP but has been shown to be unreliable in the vertical dimension of 3D models. However, incorporating oblique images has been shown to enhance UAV-SfM 3D model accuracy in high relief landscapes but has not yet been tested when RTK DG is used. This project demonstrates the utility of UAV-SfM for studying rapid coastal retreat in the Arctic by assessing the 3D model accuracy georeferenced by RTK DG compared to GCP georeferencing with oblique images being incorporated. 33 ground targets where distributed and measured with RTK GNSS at Crumbling Point, NWT with 6 being used as GCP to georeferenced the model during initial processing with the remaining 27 being used as independent check points which forms the basis of this analysis. The results of this study suggest that by incorporating oblique images with RTK DG improves the vertical accuracy of the resulting 3D models and meets ASPRS Accuracy Standards for Digital Geospatial Data. This study has demonstrated an alternative UAV-SfM data collection method that provides comparable, if not improved, accuracies to accepted data collection methods in the literature. This is particularly important in the context of Arctic coastal field work which is expensive, challenging, and potentially dangerous, however, the results demonstrate applicability across disciplines. This study enables opportunities for local scale Arctic coastal monitoring as well as Arctic coastal process based studies which are especially pertinent because of the impacts of climate change in the Arctic and the potential subsequent wider implications.

BEAR-HUMAN CONFLICT AS AN ORGANIZING FOCUS FOR COMMUNITY-BASED WILDLIFE MONITORING

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Adaptive co-management systems have been hypothesized to self-organize in response to a sufficiently-compelling interest. Here we describe how community concern about conflicts between both polar bears and grizzly bears has emerged as an organizing focus for an evolving community-oriented research initiative, the Arctic Bears Project. The project originally began in 2011 to gain insight into polar bear-human interactions in Wapusk National Park, Manitoba, and demonstrated the viability of remote cameras to monitor polar bear activity and ecology in the subarctic. By 2018 the project expanded to include active partnerships in Churchill (MB), Arviat (NU), and Ulukhaktok (NT) where community members are deploying remote cameras themselves to monitor polar and grizzly bear activity at sites of interest; often where bear-human conflicts are anticipated. While it is too early to report on project findings it is possible to identify factors which may have contributed to formation of these partnerships, including pre-existing relationships, social media connectivity, grizzly bear establishment in new habitat, and - tragically - local crises involving bears. These factors suggest hypotheses about partnership formation that can be examined throughout the project's implementation, and the potential to gain insights that could ultimately strengthen the outcomes of this and similar projects elsewhere.

COMMUNITY-LED APPROACHES TO SUICIDE PREVENTION AND MENTAL WELLNESS IN NORTHERN CANADA: DEVELOPING A POSITION STATEMENT WITH THE CANADIAN SOCIETY FOR CIRCUMPOLAR HEALTH

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Suicide is a complex and persistent public health problem that requires a comprehensive approach to prevention. The World Health Organization has called on member states to develop comprehensive suicide prevention strategies to reduce the incidence and impact of suicide globally. In many circumpolar nations including Canada, suicide disproportionately impacts Indigenous communities. This has made prevention an urgent health issue across the North. Over the last thirty years, many communities have developed creative approaches to suicide prevention that integrate Indigenous knowledge and practices with clinical and public health interventions. These local innovations often address overlapping priorities including food security, intergenerational relationships, and mental health. Yet, they also face challenges in terms of sustainability, human resources, evaluation, and scale. The Canadian Society for Circumpolar Health has developed a draft position paper on suicide prevention. This is an effort to synthesize evidence and propose recommendations for governments, communities, and health authorities to improve mental wellness and resilience, and advance a collaborative approach to reduce the incidence of suicide. Although we acknowledge the importance of policy-level interventions and mainstream mental health care, our position statement aims to encourage investment in community-led and place-based interventions and services, especially those that build on local strengths and assets. This paper serves as a collective statement of the CSCH regarding the historical context, incidence, and significance of suicide in northern regions in Canada. The purpose of this presentation is to introduce the draft paper, discuss highlights, and seek feedback for further development.

ARCTIC AMBIENT NOISE MEASUREMENTS FROM A REAL TIME OBSERVATORY

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The Barrow Straight Real Time Observatory (BSRTO) is a cabled underwater monitoring station operated by Fisheries and Oceans Canada, located in the Tallurutiup Imanga National Marine Conservation Area. In addition to measuring a range of ocean and ice properties, an integrated hydrophone records for 1 minute every 2 hours and transmits a spectrogram in near real-time to the Bedford Institute of Oceanography. These spectrograms are used to identify trends in the ambient noise at BSRTO and relate them to their natural or anthropogenic sources, including: marine mammals, ice, wind, temperature, ships, etc. Here we present the contributions of wind and ice-generated noise to the ambient levels. We also present an overview of the ambient noise level distributions and how they change with frequency and season as well as how these levels and trends compare with measurements reported in the literature. The correlations between ambient noise and wind speed do not exhibit the expected relationships during open water periods and correlations between ambient noise and ice draft are mostly weak. In addition, correlations between temperature and ambient noise during periods of full ice cover are investigated.

RECENT CHANGES IN GLACIER MASS BALANCE, TERMINUS RETREAT PATTERNS AND ICEBERG CALVING ON THE CANADIAN SIDE OF THE PIKIALASORSUAQ

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The Canadian Arctic contains over 300 marine-terminating glaciers, with many of them flowing into the Pikialasorsuaq (North Water Polynya). They provide a key source of icebergs for this region, and an important source of freshwater runoff. These glaciers have been undergoing rapid changes recently, including retreat of their termini, increases in surface melt, and changes in ice motion. Based on a combination of satellite remote sensing, field measurements and modelling, we assess the factors controlling these changes and how they have been evolving in a warming climate. For example, >94% of tidewater glaciers retreated between 1958 and 2015, with a region-wide trend of gradual retreat before ~2000, followed by a fivefold increase in retreat rates up to 2015. Significant correlations with surface melt indicate that increased atmospheric temperature has been the primary driver of this acceleration in glacier frontal retreat. The release of vast quantities of freshwater from melting glaciers could have important implications for ocean stratification, circulation, sea ice formation, and marine ecology in the Pikialasorsuaq. In addition, recent increases in the velocity of some tidewater-terminating glaciers bordering the Pikialasorsuaq suggest that the circulation of warm Atlantic layer ocean water may also be locally important to glaciers that terminate in deep fjords, such as Trinity Glacier in Talbot Inlet, indicating an important link between ocean processes in the Pikialasorsuaq and the dynamics of surrounding glaciers.

SPATIAL AND TEMPORAL DISTRIBUTION OF POLYCYCLIC AROMATIC HYDROCARBONS IN SEDIMENTS FROM THE CANADIAN ARCTIC ARCHIPELAGO

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The Arctic is the region of the planet where the seafloor topography and composition are the least studied and understood. Indeed, the vast majority of the channels within the Canadian Arctic Archipelago (CAA), as well as the adjoining continental shelf and slopes, are characterized by a substantial knowledge gap of the seafloor sediment composition and associated contaminants. Therefore, a wider spatial coverage of sedimentary records across the marine CAA is essential to provide fundamental baseline information on the physical and geochemical sediment properties and also to forecast future dispersion of possible pollutants. In this context, a total of 115 surface sediment samples and 8 push-cores were subsampled from box cores collected over a large area covering the Canadian Beaufort Sea to the Baffin Bay. Sampling was performed during the 2016, 2017, 2018 and 2019 ArcticNet expeditions aboard the CCGS Amundsen to characterize the modern spatial distribution patterns and the temporal trends of polycyclic aromatic hydrocarbons (PAHs) within the CAA. The chronology of push-cores was established using 210Pb measurements (Letaïef, 2018). In order to document the depositional history of PAHs during the last century, only the top 10 cm of the push-cores were analyzed. Extractions were performed using a one-step accelerated solvent extraction and clean-up, followed by gas chromatography coupled to a mass spectrometer analysis. The sum concentrations of 23 PAHs in surface sediments ranged from 6 ng/g (dry weight basis) in the North Baffin Bay to 437 ng/g in the Canadian Beaufort Shelf, with a mean value of 67 ng/g. PAHs source characterization was investigated through diagnostic ratios: fluoranthene over the sum of fluoranthene and pyrene and benzo(a)anthracene over the sum of benzo(a)anthracene and chrysene. These tend to point a profile with mainly petrogenic sources (i.e., igneous rock-derived, petroleum or crude oil spill) for the majority of the stations. Some of them have a mixed profile with petrogenic sources and pyrogenic sources (i.e, incomplete combustion of either fossil fuel or biomass) that could indicate an anthropogenic input. As a first interpretation of the results, by considering previous studies in the Canadian Arctic, the inputs of PAHs to the surface sediments in CAA were relatively stable during the last years, but their sources are likely shifting from petrogenic to pyrogenic sources. This shift could be related to climate changes that modify the global atmospheric transport of PAHs, as recently suggested to explain the shift in the sources of PAHs associated with atmospheric particulates sampled at Alert (Yu et al., 2019). Taken as a whole, our study will provide a baseline of PAHs levels in surface sediments within the CAA before maritime transport increases in this area (notably within the North West Passage) as well as a better understanding on the sources and depositional history of PAHs in this Arctic region.

DEVELOPMENT OF THERMOKARST LAKES IN ARCTIC LANDSCAPES UNDERLAIN BY BURIED GLACIER ICE

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Buried glacier ice is widespread in formerly glaciated permafrost regions, but the extent and volume of ice not yet disturbed remain unknown. The broad distribution and the substantial amount of ground ice in glacier-derived permafrost makes it highly vulnerable to disturbances, such as thermokarst. Here, we investigated the influence of buried glacier ice on the inception and evolution of Arctic tundra lakes on Bylot Island, Nunavut. We studied a lake-rich area using dated lake-sediment cores, detailed bathymetric data and observations of buried glacier ice exposures. Seventeen of the forty-one studied lakes stand out by their notably larger depths (5 to 12 m), and in some cases, the presence of multiple sub-basins. Our results suggest that these deep lakes were primarily kettle holes that resulted from the melting of buried stagnant blocks of glacier ice. This interpretation is supported by the presence of exposures of glacier ice revealed by small lakeside slumps. These lakes now evolve as "classic" thermokarst lakes that expand in area and volume as a result of the melting of ice wedges and intrasedimental ground ice in the surrounding material and the underlying glaciofluvial and till material. It is expected that the deepening of talik and the enlargement of arctic lakes in response to global warming will reach undisturbed buried glacier ice, which in turn will significantly alter lake bathymetry, drive shifts in aquatic ecosystems, and release carbon and mercury preserved in the frozen ground of arctic lowlands.

BIOLOGICAL DIVERSITY OF A HIGH ARCTIC SEABED HYDROCARBON SEEP AT SCOTT INLET, BAFFIN BAY

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Characterising the Arctic marine microbiome is an important objective towards establishing baseline data in the face of rapid climate change, and is critical for enabling environmental monitoring following pollution events such as an oil spill. Seabed hydrocarbon seeps present a natural laboratory for investigating responses of marine ecosystems to petroleum input. A geologic fault near Scott Inlet, Baffin Bay, is the site of a hydrocarbon seep previously identified by the Geological Survey of Canada. This site was visited for in situ observations and sampling by the CCGS Amundsen and RV Nuliajuk in August 2018. Visual observation of an active gas seep near Scott Inlet was recorded using the Amundsen's Super Mohawk II remotely operated vehicle (ROV) and confirmed by methane and hydrocarbon analysis in the water column above the seep. Surface oil slicks sampled nearby contained biomarkers similar to those reported for oil seeps off western Greenland. Video surveys using the ROV at the seabed seep site revealed microbial mats morphologically resembling sulfide-oxidizing Beggiatoa, and many shrimp (Eualus belcheri) associated with the mats. Sulfide-oxidizing microbial mats are indicative of a microbial ecosystem where hydrocarbon biodegradation is coupled to sulfate reduction in anoxic layers, producing sulfide that is subsequently oxidized aerobically in

overlying surficial sediment or bottom water. 16S rRNA gene amplicon sequencing of the seafloor material near the bubbling seep revealed putative methane-oxidizing Methyloprofundus, sulfate-reducing Desulfobulbaceae (SEEP-SRB4 group) commonly associated with anaerobic methane-oxidizing Archaea in seep ecosystems, and sulfide-oxidizing Sulfurovum. At Scott Inlet, many members of these clades are uniquely found in the seafloor sediment at the seep epicentre but not at sites 1 km and 5 km away that were sampled similarly, suggesting the seep itself hosts methanotrophic communities. Bacterial consortia in the water column above the seep, at its centre and up to 5 km away, are very different from those in the sediment. Metabolic genes diagnostic for aerobic methanotrophs (pmoA) were detected in the bottom water above the seep epicentre and at sites 1 km and 5 km away. All of these libraries prominently feature the Deep sea-3 clade within the bacterial family Methylococcaceae. Members of this clade are thought to be adapted to low methane concentrations and may be facultative methanotrophs. Whereas this pmoA-based observation was common among all water samples, 16S rRNA gene amplicon sequencing revealed that waters overlying the geologic fault (running SW to NE) are more similar to each other than to the water column microbial communities off-axis of the fault (1 and 5 km away in NW and SE directions). This implies seepage along the fault, consistent with video observation of white mats along this SW-NE axis. The detection of bacterial clades associated to hydrocarbon degradation and methane oxidation points to the importance of the seep at Scott Inlet as a habitat for cold-adapted marine microbial communities that oxidize methane preventing its atmospheric release.

MOBILITY OF NUTRIENT AND POTENTIALLY TOXIC TRACE METALS IN A CHANGING ARCTIC OCEAN

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The effects of climate change are being felt first and most strongly in the Arctic. Recent research studies show that warmer temperatures are melting sea ice, permafrost and glaciers, releasing metal and radioactive elements to Arctic coastal waters. Ice free conditions allow storms to mix and mobilize both nutrients and contaminants from coastal waters and sediments on the continental shelves and transport them offshore. Continued warming of the Arctic will also allow for more economic development, shipping and natural resource extraction that are likely to increase the amount and mobility of nutrients and contaminants alike. Because Northern people rely in part on the ocean for food, changes in the productivity of the marine environment and the potential movement of contaminants into the Arctic food web could increase the exposure of human consumers of marine living resources to unwanted toxins. Here we highlight the behavior of essential (Fe, Zn) and potentially toxic (Cd, Cu) trace metals as they are mobilized and transported from dynamic Arctic coastal shelves to deep waters. Metal concentrations are mapped along the pathway whereby high nutrient, low oxygen Pacific origin waters are transported through the Canadian Arctic Archipelago and eventually enter the Labrador Sea and North Atlantic. We highlight the utility of using multiple geochemical tracers to examine sources and sinks of metals of concern and the need to assess the impact of ongoing climate change and human activities in Canada's Arctic coastal waters.

SYSTEMATIC LITERATURE REVIEW OF FACILITATORS AND BARRIERS RELATED TO FOOD (IN)SECURITY STATUS IN INUIT NUNANGAT: PRELIMINARY RESULTS

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Food insecurity is an urgent public health issue shown to contribute to many negative health outcomes including heart disease, diabetes, obesity, depression and suicidal ideation. Some of the highest reported rates of food insecurity in Canada are experienced in the North, including Inuit Nunangat. Many large-scale and longstanding interventions have been implemented in Inuit Nunangat to address food insecurity, such as the Nutrition North Subsidy program and various hunter support programs. Despite these, and many other interventions, the most recent reports of food insecurity estimate that more than 50% of Inuit in Inuit Nunangat experienced food insecurity in 2012. Research projects and food insecurity interventions around the world often focus on one factor related to food insecurity thought to be critical, rather than considering multiple factors present in the system

simultaneously. There is a long history of this approach leading to unintended consequences or ineffective action. One such example is the approach taken in an effort to protect declining fish stocks in Kiribati. As fishing and coconut harvesting were the two main sources of income on the island, coconut harvesting was incentivized to alleviate some of the pressure on the declining fish stocks. However, this strategy ended up increasing incomes, which allowed coconut harvesters to purchase better fishing equipment and afforded them more leisure time to fish, which ultimately contributed to a further decline in fish stocks. As evidenced in this and other examples of complex issues, in retrospect, it often becomes clear that more effective impact may be achieved if interventions were designed with a better understanding of the complexity of the system of factors that influence the issue. To begin exploring the system of factors that influence food (in)security status among Inuit in Inuit Nunangat, we conducted a systematic literature review, following PRISMA guidelines. We searched seven databases for white literature using keywords and subject headings that represented the concepts "food (in)security" and "Inuit Nunangat". After removing duplicates, two reviewers independently followed a two-step screening process. All titles and abstracts were screened for studies that analyzed a relationship between at least one barrier or facilitator and at least one element of food (in)security among Inuit in a community or region within Inuit Nunangat. Data were then systematically extracted and analyzed thematically to identify a list of facilitators and barriers reported to be associated with food (in)security status of Inuit in Inuit Nunangat. This systematic literature review is the basis of a Master's research project to statistically explore how multiple factors related to food insecurity status interact and how these interactions are related to the food (in) security status of individuals in Nunavik. The results of this project are expected to support a more comprehensive and inclusive consideration and development of new interventions to address food insecurity in the region.

USING SAILDRONE-MOUNTED ECHOSOUNDER TO STUDY ZOOPLANKTON DISTRIBUTION PATTERNS: POTENTIALS AND LIMITATIONS

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The Lofoten-Vesterålen shelf-slope-oceanic ecosystems is a highly productive system of great ecological and commercial value. Zooplankton and fish aggregate in this area, and along-shelf currents transport zooplankton and spawning products of important fish species into nursing areas in the Barents Sea. The copepod Calanus finmarchicus is a key species in this ecosystem. It can form large aggregations in the upper water layers but the extent and temporal development of these patches is poorly documented. Traditional ship-based sampling is limited in its spatial and temporal coverage, restricting our understanding of the variability in vertical and horizontal distribution patterns, and surface near aggregations may escape notice as they fall within the blind zone of hull-mounted echosounders. The development of autonomous subsurface and surface vehicles with compact and energy efficient acoustic sensors has provided a new set of tools enabling acoustic surveys on time and geographical scale exceeding traditional research vessel-based surveys. Here we will discuss the potential and limitations of this technology based on an acoustic survey conducted with a saildrone equipped with a Mini Wideband transceiver (Kongsberg's WBT Mini®). The saildrone was deployed on the shelf west of Lofoten and Vesterålen (Norwegian Sea, 66-69oN) from March to September 2018. The survey revealed a consistent presence of a sound scattering layer in the upper 50 m centred between 15-30 m in the 333 khz range. In situ sampling using plankton nets and a video plankton recorder (VPR) confirmed high abundance of C. finmarchicus in these layers. The centre of mass was located shallower during night than during day indicating short-scale diel vertical migrations (DVM) that went unnoticed using traditional sampling methods. The survey also revealed limitations in resolving near surface layers as bubble entrainment hampers the interpretation of near surface backscattering layers, particular in high seas. Overall, acoustic surveys using autonomous surface vehicles can reliably record large amount of data over large time and geographical scales. However, payload restrictions can limit the possibilities to record other relevant environmental parameters simultaneously. Data processing and interpretation is time consuming and advances in machine learning technologies are needed to cope with these large datasets in an efficient way. Furthermore, the necessity of obtaining ground truthing

data on relevant spatial and temporal scales and a well thought-through study design should be taken into account when planning future studies.

AUTONOMOUS SURFACE AND UNDERWATER VEHICLES REVEAL NEW DISCOVERIES IN THE ARCTIC OCEAN

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The overall aim of the GLIDER project is to demonstrate an innovative, flexible and cost-efficient offshore monitoring and data management approach. GLIDER consists in the deployment of 3 ocean autonomous and mobile platforms, a diving Sea glider (Kongsberg), and two surface vehicles, a Sailbuoy (Offshore Sensing) and a Wave Glider (Maritime Robotics), fitted with a well proven suite of sensors to collect chemical, physical and biological data of the ocean space. The vehicles are piloted from your computer, and collected data received in real-time via satellite. The aim is to increase the sampling of high quality marine environmental data and provide more flexible sampling schemes. These state-of-the-art platforms can move in space, provide long-term and real-time monitoring, and in addition reduce costs and CO2 emission compared to other traditional measurement concepts. A data management e-platform has been developed along with scientists and consultants to ensure a high integration of the collected data. The e-platform will allow to manage the data from storage approach, to visualization tools, and finally to allow interpretation and use for different end users (oil and gas, fisheries, aquaculture, mining, authorities etc.). We have successfully deployed the three vehicles fitted with sensors from March to September 2018 in the Lofoten - Vesterålen area along the Norwegian coast above the Arctic circle (67°16'48"N 14°24'00"E) with the objective to get a better understanding of the ecosystem during the spawning period of the Atlantic cod. The data collected revealed that the autonomous vehicles provide scientific information of a completely undisturbed ecosystem unlike what is collected from traditional research vessel from which instruments are deployed. The survey provided significant gain on the understanding on the dynamic and timing of biological events over large spatial and temporal scale. Furthermore, we have successfully assimilated data in real time into oceanographic and meteorological models in order to improve the forecast. Currently, data are being analyzed to understand the ecosystem from the primary production to zooplankton, fish larvae, adult fish and sea mammals. Analysis will offer i) baseline data on a large spatial scale ii) professional solutions to industry operating in the marine environment iii) scientific data for improving knowledge in ecosystem functioning and structure and iv) input data into existing models (oceanography, weather and ecology).

RESPONSE OF MICROALGAL COMMUNITIES TO A SEASONAL FRESHWATER GRADIENT IN SOUTHWESTERN HUDSON BAY, CANADA

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Riverine input to the marine system can modify the surrounding hydrography and chemistry, and subsequently shape the marine ecosystems in coastal regions. Freshwater can have indirect effects on biological communities by influencing sea ice thermodynamic and dynamic processes, nutrient transport, turbidity and direct effects by osmotic and physiological impacts. Increased discharge from regulated rivers in winter arrives in Hudson Bay during the annual ice algal spring bloom and is expected to have a direct effect on its production. In this study, we investigate the role of regulated rivers on the bottom ice algal communities and phytoplankton production along two spatial gradients from the estuary to the marine system in southwestern Hudson Bay, Canada during the winter-spring transition in 2017 and spring-summer in 2018, respectively. Water column structure, nutrient concentrations, algal chlorophyll a biomass, production, and species composition within the sea ice and water column were used to examine ice algal and phytoplankton communities along the salinity gradients. Preliminary results indicate that salinity significantly influenced ice algal biomass where the horizontal distribution of ice algae was positively associated with the salinity of the underlying water column. Furthermore, the gradient in surface-water salinity influenced the structure of the ice and thus suitability of habitat for bottom communities in addition to osmotic and physiological effects. Phytoplankton production followed a similar pattern as ice algal biomass, increasing productivity as well as shifts in composition with increasing salinity along the transect away from the estuary. These observations suggest the presence of the freshwater river plume played

a significant role in controlling microalgal communities in coastal southwestern Hudson Bay.

GREENLAND HALIBUT (REINHARDITUS HIPPOGLOSSOIDES) MOVEMENT PATTERNS IN OFFSHORE BAFFIN BAY, NUNAVUT

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The Greenland halibut (Reinharditus hippoglossoides) is a predatory flatfish found in North Atlantic and Arctic marine ecosystems and is a key resource for commercial fishing industries. In the Eastern Canadian Arctic, Greenland halibut prefer deep water (600-1400 m) and occur in inshore and offshore environments. Research in deep-water inshore environments suggests that Greenland halibut exhibit strong depth fidelity, undertake seasonal movements related to timing of ice cover, and that certain individuals show site philopatry, displaying a timed exit and return on an annual basis. However, little is known about Greenland halibut behaviour in the offshore. Here, we present the first analysis of long term movement patterns of Greenland halibut in offshore Baffin Bay waters (n = 3 years) using a telemetric approach. A network of acoustic receivers (n = 135; VEMCO) was deployed around inshore-offshore Baffin Bay (689 000 km2). From 2016-2018, Greenland halibut (n = 396) were caught on long lines, tagged with internal transmitters and released at five specific locations on deep water banks around Baffin Bay, including the Disko Fan Marine Refuge. Offshore receivers detected a total of 293 unique individuals (79% of tagged individuals). Using these detection data, a suite of movement metrics (direction, linearity, travel speed, residency, and visitation rates) was calculated. Movement patterns were summarized across all offshore receivers and then within a concentrated design of receivers inside the Disko Fan Marine Refuge. Spatial modeling was used for path reconstruction, habitat preference, and trajectory simulation; the latter testing the observed movement patterns against a random walk model. Results of this work have implications for fisheries management for inshore and offshore management areas, contributing to more accurate stock assessments and informing quota allocation.

PARTICIPATORY CLIMATE MODELLING IN THE ARCTIC: BENEFITS, CHALLENGES AND THE ENGAGEMENT OF DIVERSE FORMS OF KNOWLEDGE

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Participatory modelling (PM) is a collaborative, multi-actor learning process. It is designed to make sense of systems that involve considerable uncertainty and complex interactions with multiple rightsholder groups, through creating shared representations of reality. PM processes are said to foster social learning, shared commitment, successful policy implementation, and low conflict levels in decision-making. There is increasing use of PM processes in climate change research, as well as in collective decision-making processes for environmental management and policy. The use of PM in the Arctic is particularly pertinent due to ongoing and rapid socio-environmental change. In this context, PM can prioritise collective decision-making and co-production of knowledge. The research approaches that are used in Arctic science can both contribute to international policy and influence global research trends. The growing emphasis on Indigenous knowledge has created a paradigm shift in Arctic research, with calls for rightsholder involvement increasing, and mechanisms put in place to ensure their inclusion. However, reports suggest that meaningful engagement remains limited and heterogeneous, and that participation in modelling research is often quite nominal. Drawing insights from a literature review of the use of participatory climate modelling around the globe, this presentation identifies and evaluates how PM has been used in climate change research in the Arctic. We define and describe the benefits of PM, how PM processes can and are being used in climate change research, contrast this with published best-practice guidance for PM, and discuss the use and challenges of PM in Arctic contexts. We also look at how, and to what extent, PM processes are engaging and utilizing diverse forms of knowledge.

INFUSING LOCAL KNOWLEDGE INTO LOW-IMPACT SHIPPING POLICY: AN ADAPTATION TO INCREASED SHIPPING ACTIVITY AND CLIMATE CHANGE IN ARCTIC CANADA

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Ship traffic has nearly tripled in the Canadian Arctic over the past decade and additional growth is expected as climate change continues to increase navigability in the region. In response, the Canadian Government is developing Low Impact Shipping Corridors as an adaptation strategy that supports safety and sustainability under rapidly changing environmental conditions. The corridors are specified voluntary maritime routes where services and infrastructure investments are prioritized. While a large amount of data from different sources were used to establish the location of the corridors, important local and traditional knowledge from Arctic communities has yet to be considered in much detail. The Arctic Corridors and Northern Voices (ACNV) project was established in response to this fundamental gap in knowledge. The purpose of this paper is to outline perspectives and recommendations for the corridors from 13 Canadian Inuit communities across Inuit Nunangat (Inuit homeland) that were involved in the ACNV project through a series of participatory community mapping exercises. A summary of the recommendations for the corridors that emerged from communities is presented, including spatial representations for: 1) preferred corridors, 2) areas to avoid, 3) restrictions by season, 4) modification of vessel operation and 5) areas where charting is needed. The findings of the study further reiterate the vital need for meaningful inclusion of northern voices and science alongside fed

IMPACT OF THE VENTILATION SYSTEM ON BACTERIAL BIOAEROSOLS IN DWELLINGS IN NUNAVIK

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Ventilation is an important parameter in optimization of indoor air quality in dwellings. In the northern buildings, ventilation is an important concern because the new buildings are more insulated to reduce the energy consumption reducing the natural air exchange at the same time. In this context, the CNRC in collaboration with the INSQP, the University Laval, Sentinelle North, the Québec housing corporation (SHQ), the Nunavik regional board of social and health services and the Kativik municipal housing bureau (KMHB), conducted a multidisciplinary study to evaluate the optimization of the ventilation performance and the resulting efficiency on indoor air quality in Nunavik dwellings, including the airborne microbiological parameters. Air samples were collected in 56 dwellings with different type of ventilation systems: Heat Recovery Ventilator (HRV, n=17), Energy Recovery Ventilator (ERV, n=24) compare to a group control without ventilation system (n=15). The bioaerosols were sampled on filters before and after optimization of the ventilation and preheating systems using a SASS 3100 (20 m3 of air sampled at 300 L/min). After the particles elution from the filters, the bacterial DNA was extracted. The total bacteria were quantified by qPCR using universal primers and probe and the bacterial biodiversity was assessed by high-throughput sequencing targeting the universal bacterial barcode 16S rDNA. The geometric means for total airborne bacteria concentrations were 3.1*103 (GSD=3.3) copies/m3 in the group control, 3.2*103 (GSD= 3.7) copies/m3 in HRV group and 5.1*103 (GSD= 3.2.8) copies/m3 in ERV group. One dwelling was removed from the analysis. The results showed no differences in bacterial concentrations between the several types of ventilation neither between groups of optimization. The airborne bacterial biodiversity was high regardless the ventilation system or the optimization step with a median of OTUs (operational taxonomic unit) of 377. The main genera

as Staphylococcus, Streptococcus, Corynebacterium, Propionibacterium, Micrococcus and Prevotella were skin related bacteria and were found in most samples (>98% of samples). The airborne bacterial biodiversity in the dwellings investigated in Nunavik is associated with the presence and human activity, regardless of the type of ventilation system in the dwelling. The heterogeneous metadata among the same group of ventilation, the important dispersion of concentrations values and the high bacterial biodiversity suggest an important variability of microbial parameters depending on the dwellings. Regarding this variability, a global analysis including all the parameters have to be done to make conclusions about the effect of ventilation systems and their optimization on air quality.

FIRST PRIMARY PRODUCTION ESTIMATES OF MACROALGAE, SACCHARINA LATISSIMA, IN THE CANADIAN ARCTIC

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Kelp are often ignored in estimates of total annual Arctic primary production, with little information available on their diversity and distribution across Canada's Arctic. This gap of data availability is quite surprising, given the extensive rocky coastlines and thus available kelp habitat across the Canadian Arctic archipelago. Here we present the first measurements of kelp (Saccharina latissima) primary production (PP) in northern Hudson Bay. The data were collected in August 2019, when the MV William Kennedy sailed uncharted waters around Southampton Island in northern Hudson Bay. Sixteen kelp were collected from 10 to 15 m depths, or from floating rafts of detached whole thalli, at a total of fourteen stations around the island. PP was measured as a function of the natural insolation cycle and using dissolved oxygen optodes to monitor oxygen concentration inside sealed bags. Divers also quantified standing kelp biomass and the spring production (estimated from the size of new blades) for 10 individuals at each depth and site. In this work, we explore the variability of key photosynthetic parameters between kelp as a function of its depth and location around the island. Future work will incorporate these data in a numerical model being developed to estimate regional kelp primary production.

PREDICTING THE FUTURE OF PERMAFROST: AN EFFICIENT INTERFACE MODEL OF SOIL FREEZE-THAW

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Understanding freeze-thaw processes including active layer and permafrost evolution is critical for making predictions and decisions in cold regions in all domains from hydrology to engineering, planning and governance. These processes can be represented using computationally expensive numerical models which are often numerically unstable but capable of representing non-equilibrium temperature profiles and unsaturated conditions. Analytic or semi-analytic models make simplifying assumptions about the system such as linear temperature profiles and uniformly saturated conditions, avoiding computational expense at the price of neglecting some physical processes. Unlike existing models, the proposed interface model is informed by semi-analytic solutions to the heat equation with phase change which allows for time-varying, non-equilibrium temperature profiles, as well as time-varying soil moisture. The model presented is physically based, computationally efficient and unconditionally stable. It represents seasonal ground ice, active layer and permafrost evolution. Model validation is shown using the Stefan problem as well as a benchmarked numerical model including unsaturated conditions. Once validated, the proposed model is applied to a discontinuous permafrost system in the Scotty Creek research basin, Northwest Territories, to test its ability to simulate the formation and evolution of taliks (perennially thawed soil in permafrost systems). Field data are available from this research station for model benchmarking. Due to the efficiency of the model, previously computationally prohibitive long-term simulations, scenario testing, sensitivity and uncertainty analysis are now possible. It is proposed that this model be incorporated into hydrological modelling software and engineering tools to improve cold regions predictions and understanding. It is hoped that this model will be helpful in decision-making for climate change mitigation and adaptation strategies.

DECADAL CHANGES IN PHYTOPLANKTON ICE-EDGE BLOOMS OF THE ARCTIC OCEAN: A SATELLITE PERSPECTIVE

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Ocean colour satellites provide a unique insight in phytoplankton dynamics in the upper column of the Arctic Ocean. They allow tracking seasonal cycles and long-term changes of standing stocks and production of phytoplankton as sea-ice recedes due to a warming environment. In the current study, using a time series of about twenty years of satellite ocean colour imagery, we report on the spatio-temporal variability of phytoplankton ice-edge blooms (PIEB) in the entire Arctic Ocean. Our study showed that PIEB have progressed northwards at a rate of 1O per decade, reaching as north as 82ON, with strong regional disparities. While the overall primary production of the Arctic Ocean increased during that period as a results of decrease in sea-ice extent and longer open water season, the proportion of PIEB to annual primary production remained high (> 50%) at high latitudes (> 80oN), but it contributed only 10 to 20% of total primary production at lower latitudes of the Arctic Ocean. Statistical analysis revealed four regional regimes of PIEB as a function of sea-ice forcing divided into the Arctic Basin, the Western Arctic, the Russian Seas and "Nordic" Seas. As sea-ice continues to recede, the role of PIEB as an important and punctual source of food in the marine arctic ecosystem may be questioned.

USING INTEGRATED RESOURCE MANAGEMENT AND THE PUBLIC TRUST DOCTRINE TO EXAMINE WILDLIFE MANAGEMENT PRACTICES IN NORTHERN LABRADOR: A CASE STUDY ON THE GEORGE RIVER CARIBOU HUNTING BAN

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The people of Labrador, especially the Inuit, rely on their surrounding resources to sustain themselves and their culture. In particular, the Labrador Inuit depended upon the George River Caribou Herd (GRCH), once one of the largest caribou herds in the world, to provide them with a staple food supply, nourishment, materials, and facilitate the intergenerational sharing of knowledge and important social norms, all of which are critical to life in Arctic and subarctic environments. This woodland caribou population, however, has declined by 99% over much of its range resulting in a hunting ban, and consequently, a cascade of impacts on the Inuit of northern Labrador. Examining and understanding these impacts is the focus of this research. As management of wildlife in North America is to follow the Public Trust Doctrine-to manage wildlife in the public trust-this research helps bring the information of Inuit impacts into the discussion to help inform future best practices for more accountable, responsible, and locally responsive wildlife management efforts in the North.

IDENTIFICATION OF COMMUNITY PRIORITIES FOR MARINE PLANNING IN NUNATSIAVUT THROUGH COLLABORATIVE QUALITATIVE ANALYSIS

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Imappivut ("Our Oceans"), is a Nunatsiavut marine planning initiative that reflects the interests and values of Labrador Inuit. Imappivut will support the implementation of Chapter 6 (Oceans Management) and Chapter 9 (National Parks and Protected Areas) of the Labrador Inuit Land Claims Agreement. Imappivut recognizes and focuses on the connection between Labrador Inuit and the marine environment. Over the span of two years, the Imappivut team conducted interviews and participatory mapping sessions with Labrador Inuit about the marine environment in Nunatsiavut. To date, a total of 42 interviews have been done and over 2000 points have been mapped from all Nunatsiavut communities and Upper Lake Melville. The interviews asked open-ended questions which encouraged participants to describe the importance and influence of the marine environment to map important areas of use. Participants offered valuable information about how they use the marine environment,

the importance of a healthy marine ecosystem, and expressed their priorities for research and management. Two researchers were selected to conduct the analysis. The researchers brought different perspectives and expertise to the project, as one is a graduate student from Dalhousie University who stayed in the community throughout the process and the other is an Inuit researcher from the region. The two researchers co-developed an analysis protocol that can be utilized in the future to analyze additional Imappivut interviews. The study has provided some important preliminary results that can inform future planning. Analysis revealed the vital species and vital places recognized by Labrador Inuit. Community members also recognized environmental changes and highlighted topics of interest for future research. These findings were underscored by some deeply held cultural values that came out strongly in the analysis, such as the importance of preserving access to the land and marine environments, the importance of wild foods, and a link between harvesting activities and preservation of cultural values and traditions. The results suggest that future marine spatial planning in Nunatsiavut will need to consider how to balance access and conservation and will need to recognize the connectedness of terrestrial lands and species in any ecosystem management.

CHARACTERIZING THE TRANSITIONAL ROLE OF TREED BOGS ON THE HYDROLOGY OF A DISCONTINUOUS PERMAFROST PEATLAND BASIN, NWT.

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As northern regions are warming disproportionately, accelerated permafrost degradation is resulting in concomitant changes to the ecology, hydrology, and thermal regime of northern landscapes, such that landscape transition within northern regions is occurring rapidly. Permafrost loss in peatlands often results in ground subsidence, near-surface inundation, and the eventual loss of canopy cover. It has been well established that thaw induced forest loss is the dominant mechanism of landscape transition in the discontinuous permafrost zone, but increasing productivity and afforestation are a less established and emergent trend in discontinuous permafrost peatlands. Previous studies have used canopy cover as a proxy for estimating permafrost distributions, but field observations at Scotty Creek Research Station (61°18'N, 121°18'W) indicate canopy cover may exist in the form of treed bogs and can be independent of permafrost landforms, such that treed bogs are transitional features characterized by sparse black spruce (Picea mariana), ground lichen (Cladonia spp.), and Sphagnum spp. hummocks. Geophysical surveys were completed to investigate permafrost presence, daily snow surveys were completed to characterize snowmelt, depth of winter refreeze was measured in all landcovers, a series of wells were installed to calculate hydraulic gradient, and discrete soil moisture measurements were taken immediately following snowmelt to characterize differences in moisture retention. The geophysical surveys revealed that both treed bogs and treeless bogs are devoid of permafrost, but hydrological characteristics such as snow accumulation and melt, soil moisture, water level, and ground thermal dynamics vary between the two land cover types. Understanding the succession of northern landscapes due to climate warming provides an important step in predicting the trajectory of change in the North. This work provides new insights regarding the future of post-thaw landscapes in discontinuous permafrost peatlands.

CONNECTING DIVERSE WATER MONITORING INITIATIVES THROUGH DATASTREAM'S OPEN DATA PLATFORM

DuBois, Carolyn (1) Presenter, L. Day (1), P. Leclair (1)

(1) The Gordon Foundation

Tracking the health of Northern freshwater ecosystems is key to understanding and adapting to climate change. To do this, a wide diversity of research and monitoring programs are underway across the North. However, whether they be led by academics, government agencies or communities, they all face information-management and dissemination challenges. This limits the ease with which this data can be shared among monitoring and research efforts, a missed opportunity for collaboration. For western scientific water quality data -one piece of the puzzle - open access tools like DataStream are transforming how this information can be mobilized to understand changes over time and inform decision-making around land and water stewardship. Designed with communities, researchers and decision-makers at all levels in mind, DataStream is an open data platform that brings water quality monitoring results together in one place - making it easier to share and access data, and connect results in meaningful ways. DataStream

is led nationally by The Gordon Foundation and carried out in collaboration with regional partners and monitoring networks. This presentation will focus on how DataStream is meeting the needs of diverse users-from non-technical audiences to the most discerning, scientific ones. It will explore how DataStream delivers accessible user interfaces without compromising on scientifically robust systems for data visualization, storage and management, and how this combination allows for new opportunities for cross-sectoral collaboration.

DEVELOPMENT OF AN EROSION MITIGATION PLAN FOR TUKTOYAKTUK, NWT

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Baird & Associates with sub-consultants BGC Engineering Inc., Altus Group Limited, Inuvialuit Regional Corporation and the University of Toronto was retained by the GNWT and the Hamlet of Tuktoyaktuk, to develop an erosion mitigation plan for the Hamlet. The project was funded, in part, by the Federal Government's National Disaster Mitigation Program; the goals of this program include enhancement of public safety, reduction of future flood and erosion hazards and development of mitigation options to increase community resilience. This paper will provide an overview of design criteria, community engagement, development and evaluation of structural and non-structural erosion mitigation alternatives and concept designs considering climate change scenarios. The community of Tuktoyaktuk is situated on a low-lying peninsula that is vulnerable to coastal erosion and flooding, resulting in the loss of buildings and housing, and inundation during surge events. Efforts have been made to protect the shoreline with varying levels of success. The community is looking for a longer term, comprehensive mitigation approach. Shoreline erosion rates along the Tuktoyaktuk Peninsula were in the range of 0.8 m/year and 1.7 m/ year along Tuktoyaktuk Island. These recession rates were used to delineate the predicted shoreline position in 2050 and 2100. The results suggest that much of Tuktoyaktuk Peninsula and most of Tuktoyaktuk Island will be lost to erosion by the year 2050, without substantial intervention. Much of the Tuktoyaktuk community is low lying and flooding is also a concern, particularly during storm surge events. The estimated 100-year return period storm surge is approximately 2.6 m. Storm surges occur with little or no warning, flooding roads and limiting access to the community. Relative sea level rise at Tuktoyaktuk, including ground subsidence, is projected to reach 0.37 m by 2050 and 1.03 m by 2100 under the RCP8.5 scenario 95th percentile, (James et al.; 2014, 2015). Meetings were held with Tuktoyaktuk Council and Community in 2018 and 2019 to confirm priority areas for erosion and flooding mitigation. Design conditions were developed for future climate change scenarios considering relative sea level rise, duration of the ice-free (open water) season, extent of sea ice (and open-water fetch), wind, waves, sediment transport and permafrost degradation. The need for adaptive solutions that allow for adjustments in the future, in response to climate change was acknowledged and prioritized. Geothermal modelling demonstrated the high hazard potential for permafrost degradation and associated land settlement, and the need for solutions that can accommodate differential settlement. Structural and non-structural erosion and flood mitigation concepts were developed and evaluated. The structural approaches included: sand and/or cobble beaches, a quarry-run berm and a concrete slab revetment. Non-structural approaches were evaluated including restricting development to areas outside the hazard limits, and relocation. While relocation could provide a longer term solution, this would require community resolution, planning to identify a suitable location, developing a long term plan for the cemetery, and it was generally agreed that this is not an approach that could be developed in the short term. Structural protection would provide time to allow the community to consider this option further.

HOW THE ACADEMIC LITERATURE FRAMES FISHERIES AS A SOLUTION TO FOOD SECURITY

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The Arctic is abundant in marine living resources, and has valuable commercial fisheries worth hundreds of millions of dollars per year. Yet despite this abundance, food insecurity remains a problem across Inuit Nunangat, with Inuit communities and families disproportionately impacted. Changes from a nomadic lifestyle to one situated in permanent communities, a shift away from traditional foods, a history of residential schools, lack of access to housing and infrastructure, and an overabundance of high priced and highly processed food are all factors in contributing to food insecurity and poor nutritional health. In light of the current levels of food insecurity, of potential poleward shifts of fish due to climate change, and of likely increasing southern interests in exploiting Arctic marine resources, we ask the question: What is the potential of fish and seafood to support food security in the Arctic and how is this potential depicted in the literature? To answer this question, we conducted a scoping review to determine how the literature frames seafood's contribution to food security (or lack thereof) in the Arctic. We used 8 keywords in different combinations and searched five databases (Google Scholar, Scopus, Web of Science, PubMed and Sociological Abstracts), extracting the top 100 articles from each search. The articles (almost 5,000 in total) were then screened for relevance based first on their title and abstract, and then again based on the full text. The texts that were deemed relevant were then classified based on their topic (environmental, socio-economic, health, and political) and key information extracted including framing (negative, neutral or positive), analysis type (conceptual, review, meta-analysis, empirical), geographic scale (community, region, Arctic), author geographical origin (Canada, USA, Norway, Russia, etc.). Findings of this work will be useful for advising policy makers on how seafood can most effectively be used to alleviate food insecurity in the Arctic, and may also highlight where scholarly attention may have been lacking in considering the role of fish and seafood in supporting food security.

INFORMAL DISASTER GOVERNANCE ON SVALBARD

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Informality is a core element of disaster risk reduction and response (DRR/R) efforts, but it is further catalysed when formal disaster governance (FDG) fails-a common occurrence across disasters. However, despite the widely recognised importance attributed to informality in DRR/R as well as significant scholarly attention to related themes (e.g. convergence, emergence, volunteerism), informality in DRR/R has not yet been systematically studied. Rather, its limited interpretations either emphasise informality as a deviant, troublesome phenomenon that requires managing by FDG; or, uncritically hail informal DRR/R as a positive expression of participatory community-based DRR/R that results in enhanced flexibility and innovation without considering crucial nuances such as the power dynamics inherent in informal DRR/R. In both instances, a balanced counternarrative that conceptualises what actually is taking place is required. To this end, this presentation will discuss informal DRR/R using the case studies of Longyearbyen and Barentsburg on Svalbard by drawing on research conducted between July 2018 and August 2019. The data was collected as part of the researcher's PhD project as well as the "Russia and the High North/Arctic" (NORRUSS) project on disaster diplomacy on and for Svalbard (https://bit.ly/2o5dlNq). Following an extensive review of interdisciplinary literature, over 60 in-depth semi-structured interviews and 2 focus groups aided by the use of PRISM (Pictorial Representation of Illness and Self Measure) were conducted to study the drivers and dynamics of informal DRR/R actions, stakeholders and networks and the concept of Informal Disaster Governance (IDG) was developed to conceptualise its findings. In doing so, it highlights the importance of IDG, assesses its applicability within the wider context of disaster governance and calls for greater attention to informality's role as a crucial element of DRR/R.

CONCURRENT VALIDITY OF SUBJECTIVE AND OBJECTIVE MEASURES OF RESIDENTIAL OVERCROWDING IN THE CANADIAN ARCTIC

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Background: The cultural relevance of objectively defined measures of household crowding has been criticized for application in different cross-cultural

contexts, including among Indigenous populations. In Inuit Nunangat, many consider measures such as the person-per-room ratio and Canadian National Occupancy Standard to be culturally inappropriate and perpetuating the dominant settlers' culture. Some authors have suggested that subjective measures are better suited to capture household crowding as they account for cultural differences. Objective: In this paper we assess the concurrent validity of objective and subjective overcrowding, and examine variation in overcrowding by individuals' characteristics, with a focus on the relationship between overcrowding and age. Methods: Data are from the project "Housing, Health and Well-being in the Canadian Arctic", to which participated 289 adults from six communities in Nunavik and six communities in Nunavut. Data were collected using survey questionnaires. Subjective overcrowding was measured by asking participants whether they feel there are too many people in their house. Objective overcrowding was measured by the person-per-room (ppr) ratio, with household with >1 ppr considered overcrowded. Individual characteristics included age, sex, household wealth, household size, and region of residence. Social support and 'getting along with people in the house' were also considered, as the nature and quality of social relations might influence one's experience of overcrowding. We performed sensibility and specificity tests to compare objective with subjective measures of overcrowding. Box-plots were produced to examine the distribution of household size between objective or subjective overcrowding and age categories. Results: Household size is significantly higher in both objectively and subjectively defined overcrowded dwellings. Objective overcrowding presents high sensibility and specificity when compared to the subjective measure of overcrowding, suggesting that both variables are measuring a similar construct. Whereas sensibility between the two measures decreases with age, older participants lived, on average, in dwellings with fewer people. Fewer respondents living in perceived and objectively defined overcrowded conditions reported getting along with people in their house. This suggests that the quality of social relations in the house might not discriminate between living in an objectively overcrowded dwelling and perceiving to be living in such conditions. Conclusion: This study suggests that indicators of subjective and objective overcrowding are measuring the same construct. These results are discussed for their implications for research and policy.

MECHANICAL DESIGN OF TRANSPORTATION EMBANKMENT ON PERMAFROST

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Transportation infrastructure plays a vital role in the livelihood, economic development and quality of life of the people living in northern regions. The construction of transportation infrastructure affects the thermal regime of frozen soils, which can lead to their degradation. The magnitude of the problems depends on the design methods used and the extent of ice- rich permafrost and its thaw sensitivity. Many of the existing transportation infrastructures in northern Quebec and Canada were designed with inappropriate methods and standards for the northern context. In some cases, simple thermal design approaches have been used to try, with varying degrees of success, to stabilize permafrost under infrastructure. The instabilities resulting from permafrost degradation are also closely related to recent climate change. In this context, maintaining a reliable and secure transportation infrastructure network in remote northern communities is a major engineering challenge. The development of economical solutions to this growing problem requires a better understanding of the factors contributing to the degradation of permafrost under embankments and the development of rigorous thermal and mechanical design methods to ensure the reliability of infrastructure. The goal of the proposed program is to improve current capabilities in designing thermal and mechanical stable transport infrastructure and to adapt them to the effects of climate change. To achieve this goal, it will be necessary to improve knowledge of the factors that influence the performance of transportation embankments constructed on sensitive permafrost. This will allow the development of rational design methods to allow the thermal and mechanical stabilization of embankments. The main objective is to develop a practical method for the mechanical and thermal design of embankments built on permafrost based on the properties of the active layer and of the permafrost as well as the loading conditions. An existing thin section of the Inuvik-to-Tuktoyaktuk Highway built on thaw sensitive permafrost has been instrumented with thermistors, humidity gauges, stress and strain gauges. The objective is to measure the mechanical behavior of the embankment as a function of the conditions of the permafrost. The instrumented section has been used to do in-situ testing of the embankment using a loaded dump truck. The mechanical behavior of the embankment has been recorded. A summary of the

installed instrumentation and of the preliminary results of the in-situ testing will be presented. The objectives of the project is to develop damages law to help with the design of embankments build on permafrost. In-situ testing will also be done in 2020 at different time during the summer season to evaluate the impact of the thaw depth on the mechanical behavior.

WESTERN ARCTIC MARINER'S GUIDE

Dumbrille, Andrew and Manny Kudlak

WWF-Canada, Arctic Program

As traffic in the western Arctic increases, there's an urgency now to get shipping right. A new guide, released by the Inuvialuit Game Council (IGC) and WWF-Canada, informs mariners on how to strategically avoid harming wildlife and habitat in the sensitive environment of the western Arctic. The guide incorporates Inuvialuit Community Conservation Plans from the Inuvialuit Settlement Region (ISR) - recommendations in the guide are taken directly from those plans and include information such as how to avoid culturally significant areas during harvest seasons and highlights areas in which speeds must be reduced. It communicates what communities have been urging ship operators to do and is applicable to all ships entering the western Arctic. Over the past few years, the communities of Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk and Ulukhaktok in the ISR have detailed the activities that should and should not take place in their waters in order to protect marine life and ensure long-term subsistence harvesting in the region. While adherence to the guide is voluntary, it enables mariners to plan wildlife-friendly routes and limit their impacts on communities by providing explicit direction on how best to mitigate the effects of shipping in the ISR. Ultimately, what's needed is for ship operators and owners, companies and businesses, and Transport Canada and the Canadian Coast Guard to push the recommendations of this guide forward into permanent measures that will reduce shipping impacts. About the Western Arctic Mariner's Guide: Made up of three large posters to be hung on a ship's bridge • Visual identification chart that will help mariners recognize whales, seals, polar bears, and caribou. • Maps of critical habitat for whales, birds, seals, and polar bears. • Maps indicating designated conservation and harvest areas, seasonal shipping exclusion zones, and community on-ice travel routes. • Recommends courses of action regarding sensitive whale habitats, caribou sea-ice crossings, shipping in polynyas and around floe edges, ice- breaking and Inuvialuit travel routes as well as exclusion zones and travel speed. • Lists phone numbers so mariners can report sightings and incidents at both the national and community level and provides operational guidance when close to or encountering marine mammals. • Developed in collaboration between WWF-Canada and the IGC About the IGC: The Inuvialuit Game Council was established by the Inuvialuit Final Agreement to represent the collective Inuvialuit interest in wildlife, including the management of wildlife and wildlife habitat within the Inuvialuit Settlement Region. About World Wildlife Fund Canada WWF-Canada creates solutions to the environmental challenges that matter most for Canadians. We work in places that are unique and ecologically important, so that nature, wildlife and people thrive together. Because we are all wildlife. For more information, visit wwf.ca.

THE HISTORY OF THE ICE BRIDGE IN PIKIALASORSUAQ : AN UPDATE

Dumont, Dany

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Landfast ice forming in Nares Strait, referred to as the ice bridge, is a striking feature of tremendous significance for Pikialasorsuaq natural and human history. Its formation and stability until its final break-up, in other words its life cycle, is however very difficult to predict on short and long timescales. Here I present an update of a 52-year long database of the ice bridge life cycle built using ice charts from the Canadian Ice Service and the Danmarks Meteorologisk Institute. Multi-decadal observations reveal a strong interannual variability which precludes the diagnosis of clear long monotonous trends. Instead, they reveal that abrupt changes have occurred in the timing and in the shape of the ice arch. Our current knowledge of sea ice dynamics suggests that other such abrupt changes are likely to happen in the future. In an attempt to better understand the factors controlling this variability, results from a close inspection of the landfast ice edge shape and time evolution from ice charts and satellite imagery will be presented and discussed.

THE COASTAL HABITAT COMPREHENSIVE RESEARCH PROJECT IN COASTAL EEYOU ISTCHEE, QC: AN EXAMPLE OF A MULTI-COMMUNITY, CREE FIRST NATION-DRIVEN RESEARCH PROJECT

Dunn, Marc (1) (Co-presenter), E. Rabbitskin (1) (Co-presenter) and R. Tapiatic (1)

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The Coastal Habitat Comprehensive Research Project is a multi-community 4-year program located along the eastern coast of James Bay in Eeyou Istchee, Qc. The project was mandated by the Grand Council of the Crees following requests from land users to better understand important changes in eelgrass (Zostera marina) beds, highly valued ecological areas in eastern James Bay, particularly for migrating geese that Crees hunt. A Steering Committee was put in place made up of members representing local and regional Cree First Nation organizations, Hydro-Québec and the Canadian Wildlife Service. The Committee's main mandate is to oversee the research, undertaken by eight teams representing seven different Universities. The project is composed of five different components: (1) coastal oceanography; (2) river inputs; (3) eelgrass ecology; (4) waterfowl dynamics and (5) Cree Traditional Knowledge. The research questions set at the outset of the project are: (1) What are the main factors affecting the current growth of eelgrass along the eastern coast of James Bay? (2) What is the impact of the current state of eelgrass beds on waterfowl presence along the coast of James Bay and, subsequently, Cree hunting activities? Among other things, Committee members ensure a meaningful participation of Cree stakeholders in all steps of the research process, while ensuring that coastal land users play an essential role in carrying out field work on their respective traplines. In the process, the Committee is challenging dominant research paradigms regarding the meaning of quality research and active community participation in scientific enquiry. Ultimately, it is hoped that the project legacy will be greater capacity for future research, a more positive relationship between communities and the research process and results based on the dynamic interaction between science and Cree TEK.

CENTRAL ARCTIC OCEAN FISHERIES AGREEMENT - AN OVERVIEW OF INTERNATIONAL SCIENTIFIC COOPERATION

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The international Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean (CAO) was signed in October 2018 by Canada, Norway, Russia, the United States, China, Iceland, Japan, the Republic of Korea, the European Union, and Denmark in respect of Greenland and the Faroe Islands. The Agreement is a precedent as it applies the precautionary approach by prohibiting commercial fishing from occurring in the international waters of the CAO until adequate scientific information, informed by Indigenous and local knowledge, is available to inform management measures. At the core of the Agreement is the implementation of a Joint Program of Scientific Research and Monitoring (JPSRM) with an overarching aim to improve our knowledge of the CAO's fish populations and supporting ecosystems. Scientists have met five times since 2011 to review current scientific knowledge of the CAO and provide advice to policy makers during development of the Agreement. Importantly, the Agreement requires that Indigenous knowledge is taken into account, along with scientific information under the JPSRM. It also allows for the participation of Arctic Indigenous peoples and local community members in scientific and technical meetings. This presentation will give an overview of the series of scientific expert meetings which took place between 2011-2018, the preliminary research and monitoring plan framework, linkages to Canadian research projects, and work to date towards inclusion of Indigenous knowledge and participation in the JPSRM.

MODELING CHANGE TO TRADITIONAL FOOD SYSTEMS ON THE NORTHWEST TERRITORIES: FINDINGS FROM THE "STATE OF COUNTRY FOOD SYSTEMS IN THE NWT: PLANNING FOR LONG-TERM SUSTAINABILITY" STUDY

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A recent study conducted across the Northwest Territories by the Aurora Research Institute and the territorial Department of Environment and Natural Resources, in collaboration with multiple Indigenous Governments and academic partners, has provided valuable information about traditional food priorities and food systems throughout the territory. This presentation will deliver the findings of the State of Country Food Systems in the NWT: Planning for Long-term Sustainability project, a study designed to blend academic and traditional knowledge in a community-based participatory study of traditional food priorities, opportunities, and baseline data. The research team modelled key elements of the traditional food system across the five administrative regions and highlighted how observed changes impacted the complex and interconnected constructs of the food system model. Using data from community-based case studies conducted in each region, this presentation will demonstrate how traditional food systems in the NWT are interconnected and how the changes that community members have observed - changes to the land, animals, water, harvesting practices, economic opportunities, intergenerational learning, and others - impact multiple levels of life and culture for NWT communities.

VALIDATION OF THE GLOBAL PRECIPITATION MEASUREMENT IMERG PRODUCTS IN THE CANADIAN ARCTIC

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Precipitation is a meteorological variable with high spatial and temporal variability. It plays a key role in the hydrological cycle and is crucial for water resource management, reanalyses and numerical weather prediction as well as navigation. In addition, precipitation is impacted by climate change which is predicted to be most pronounced at Arctic latitudes. While the south of Canada is more densely covered by ground-based measurement stations, coverage is sparse in the northern regions. Here, satellite measurements can potentially fill the gaps. The Integrated Multi- satellitE Retrievals for GPM (IMERG) algorithm combines the so-called Global Precipitation Measurement Core Observatory (GPM-CO) and various passive microwave satellite sensors to estimate precipitation rate. IMERG features an early, a late and a final product with a latency of 4-5 hours, 18 hours and 4 months, respectively. While the final product, with maximum accuracy, is the product of choice when it comes to climatological questions, the early product is the most relevant one for near-realtime applications. Since precipitation in the Arctic is generally light, remote sensing measurements are particularly challenging. In addition, passive microwave sensors struggle with precipitation measurements over ice and snow surfaces. Hence, an extensive validation study has been performed using ground-based precipitation measurements from Environment and Climate Change Canada (ECCC) climate stations located north of 60°N. In this study, we examine Version 5.2 and 6.0 of the IMERG final monthly product.

INSHORE-OFFSHORE CONNECTIVITY AND MULTI-YEAR MOVEMENT BEHAVIOURS OF GREENLAND SHARKS (SOMNIOSUS MICROCEPHALUS) IN A DEEP-WATER ARCTIC BASIN

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In highly seasonal environments, the occurrence of resource patches can vary substantially across time and space, producing patterns which are often reflected in the movements of mobile consumers. As a result, mobile consumers drive food web stability in fluctuating resource conditions by coupling disparate food webs and by responding flexibly to environmental change. The Greenland shark (Somniosus microcephalus) is an excellent model predator with which to examine this behavioural plasticity across multiple years and a range of habitats. Seven years of data archived by an array of 286 moorings equipped with acoustic receivers and environmental sensors were used to examine the movement behaviours of Greenland sharks in the coastal fjords and offshore waters of Baffin Bay (Eastern Canadian Arctic; area 689,000 km2). Seasonal patterns in broad-scale movements, coastal residency, and inshore-offshore connectivity were compared among 113 sharks (70 Males, 43 females [mean TL = 2.6 ± 0.52 m]) tagged in 6 discrete locations spanning from Grise Fjord to Cumberland Sound (Nunavut). Sharks exhibited highly transient movements throughout the array with some evidence of site fidelity to both inshore, and offshore sites. Across all study years, shark presence in coastal fjords occurred exclusively during the coastal ice-free period (July to November), regardless of the location of tagging or detection. In contrast, presence in the offshore was recorded during the period of ice re-formation and cover (November to July). Arctic ecosystems currently face the growing impacts of anthropogenic and climate-induced stressors. As such, the development of effective marine management practices will rely on an understanding of the ability of Arctic predators to confer community stability by responding to environmental shifts. This study provides a rare and novel opportunity to examine the movements and behavioural drivers of an understudied marine predator at unprecedented spatial and temporal scales.

RESPONDING TO THE IMPACT OF A CHANGING SEA ICE AND WEATHER ON NORTHERN COMMUNITIES: A PILOT PROJECT IN 6 COMMUNITIES IN THE INUVIALUIT AND KITIKMEOT REGIONS TO IMPROVE ENVIRONMENT AND CLIMATE CHANGE CANADA'S WEATHER, SEA ICE AND CLIMATE SERVICES

Adrienne Tivy (1), Eerkes-Medrano, Laura (2)(Presenter), David Atkinson (2), Armel Castellan (3), Jack Akhiatak (6) Janet Elias (7), Manny Kudlak (8), Darrel Nasogaluak (9), Maia Hoebrechts (4), Brian Sieben (5), Tom Zagon (1), Oversight Committee Members and interview/workshop participants in the communities

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(5) Canadian Centre for Climate Services, Environment and Climate Change Canada
(6) Ulukhaktok Search and Rescue Organization
(7) Inuvialuit Lands Administration
(8) Sachs Harbour Hunters and Trappers Committee
(9) Tuktoyaktuk Hunters and Trappers Committee

The Canadian Ice Service (CIS), Meteorological Service of Canada (MSC) and the newly formed Canadian Centre for Climate Services (CCCS) have partnered with the University of Victoria and 6 communities in the Inuvialuit and Kitikmeot regions on a pilot project to improve government weather, sea ice and climate services. The project is a response to a common observation in northern communities that the sea ice, weather and sea state are more unpredictable than in the past, making decisions around travelling on the ice and land for subsistence activities more difficult. Project activities and methods for information gathering, guided by oversight committees in each community with representatives from the Hamlet, Hunters and Trapper Committees/ Organizations and the Community Corporations, have focused on interviews and workshops to facilitate discussions and information sharing between local and government experts. We will present initial results leading to the final outcomes of the project expected in 2021: 1) Evaluation of the impact of custom weather forecasts/ support, by linking MSC meteorologists/decision support desks/warning preparedness meteorologists with active hunters; 2) Evaluation of current ice services and documented community needs for ice information and

forecasts on all time-scales (daily, weekly, seasonal) including recommendations for new products; 3) Recommendations to CCCS for climate services.

INTER-SEASONAL HEAT TRANSFER, MITIGATION TECHNIQUES AND TECHNOLOGIES TO STABILIZE OR RESTORE PERMAFROST

Egorov, Igor

National Research Council Canada

Permafrost degradation, caused by natural and man induced changes in Northern climate systems is increasingly progressing. Permafrost Northern infrastructure built on and around permafrost is susceptible to distress or failure due to climate change and anthropogenic disturbances of vegetation and organic covers. Unstable thawing soils can collapse, settle or otherwise move unpredictably and result in infrastructure damage, health and safety hazards, and environmental impacts. These unstable permafrost soils should be stabilized or otherwise protected from unmitigated thawing.

A WINTER TO SUMMER TIMESERIES OF PHOTOSYNTHETICALLY ACTIVE RADIATION AT EELGRASS BEDS IN EASTERN JAMES BAY

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Eelgrass (Zostera marina) grows in sheltered bays along the east coast of James Bay. The high minimum light requirement of the plant raises concern whether light-limitation could be a factor in controlling the growth and distribution of the eelgrass. To measure photosynthetically active radiation (PAR) reaching the eelgrass beds over the seasonal cycle, two bottom-mounted moorings with PAR cosine collectors and anti-fouling wipers, along with temperature, salinity and pressure loggers, were deployed at two eelgrass beds. One mooring was placed in the southern part of Bay of Many Islands (trapline CH4) north of the La Grande River, while the other was placed in Tees Bay (trapline CH33) to the south of the river. The two moorings were deployed in about 3 m deep waters through the landfast sea ice in mid-March 2019 and recovered in early August 2019, providing a 5-minute interval timeseries of PAR levels about 30 cm above the seabed. The record captures the seasonal transition from winter conditions with snow-covered ice to late-summer open water conditions. To estimate the attenuation of PAR in the water, two additional moorings (Tees Bay and trapline V31 north of Eastmain) were deployed during the open water period (July-August 2019), each hosting two PAR scalar sensors at 2 depths (1.5 m and 3 m), and one PAR cosine collector in the air on a nearby island. Here, we compare how the observed PAR levels related to the light requirements of eelgrass published in literature. Furthermore, we present and discuss how PAR varied due to the spring melt transition of the sea ice, incoming solar radiation, the periodic changes in water levels due to tide (1-1.5 m range), wind-forced turbidity events, river water inflow from small local rivers, and the La Grande River plume.

AN EVIDENCE-BASED APPROACH FOR IMPROVED SHIPPING GOVERNANCE: A CASE STUDY IN THE KITIKMEOT REGION

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The shortening of sea ice in the summer season has caught the attention of the global shipping community due to the potential of the Northwest Passage (NWP) through the Canadian Arctic becoming a shorter and cheaper alternative route to the Panama Canal (Dawson et al., 2017). Due to this growing utilization of the Arctic ocean, the Northern Marine Transportation Corridors (NMTC) initiative was created with the goal of providing predictable levels of service to mariners transiting these waters in order to reduce risk of shipping incidents (Chernier et al., 2017). Since the corridor initiative was established, it is increasingly relevant to determine important areas for marine mammals in the region, to lessen the knowledge gap regarding the receptors to potential shipping stressors in the framework (PEW

Charitable Trusts, 2016). To date, the NMTC planning does not incorporate a cumulative risk assessment that combines different marine shipping stressors. From all anthropogenic activities on the world's oceans, marine shipping still ranks as a major concern for marine protection due to the broad range of potential environmental issues that can emerge from it: oil spills, noise pollution, air emissions, invasive species, and mammal strikes among others (Arctic Council, 2009; Hodgson et al., 2013; PEW Charitable Trusts, 2016; Ocean Conservancy, 2017; Walker et al., 2017). Therefore, an evidence-based approach for improved shipping governance is needed, including a more comprehensive cumulative risk assessment of shipping stressors. Transport Canada (TC) has recently initiated studies on better methods for cumulative effects of marine shipping through the Oceans Protection Plan, for different coastal environments around Canada including in the Eastern Arctic. Within this context, a framework for Cumulative Risk Assessment (CRA) of shipping stressors to marine receptors has been proposed through a Nunavut Research Institute sponsored project, along with an illustrative case study applied to the Kitikmeot region for shipping seasons. The stressors and receptors selected for the case study were based on local communities' concerns, as documents by Carter et al. (2018). As the basis for the case study, ship-source oil spills and noise pollution are considered to be two of the shipping stressors of greatest concern among the Northern communities. As for receptors, Beluga, Bowhead and Narwhales were included in the analysis because Inuit communities rely on them for their food security through their traditional subsistence hunting and also their cultural importance to these communities. The results from this study can be used to determine which sections of the proposed Corridors require more elaborated monitoring and regulating to reduce the impacts from vessels for a long-term safety of these marine mammals and consequently the local communities. It can also help with the allocation of public resources for risk mitigation by identifying which areas of Kitikmeot region are most at risk. Ultimately, this study also shows the benefit of including Traditional Knowledge in scientific decision models in order to gain more meaningful insights on the valuable Arctic marine ecosystem.

FACTORS INFLUENCING HOW ARCTIC GRAYLING (THYMALLUS ARCTICUS) USE BARRENLAND STREAMS NEAR BAKER LAKE, NUNAVUT

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Arctic Grayling (Thymallus arcticus) are a species of salmonid with cultural and regional significance, valued by Inuit communities, subsistence harvesters, and sport fishers. Arctic Grayling are often a focal species in environmental impact statements, as they are vulnerable to habitat fragmentation, alterations in hydrologic flow and connectivity, and changes in water quality and temperature. Arctic Grayling are found throughout the continental Canadian Arctic, including the Barrenlands, a semi-arid region of continuous permafrost that extends from eastern Northwest Territories through central Nunavut. The Barrenlands are characterized by chain lake systems, where streams provide important connections between lakes that are often only a few hundred meters to a few kilometers apart. Many Barrenland populations of Arctic Grayling rely on the connectivity of these networks of lakes and streams to migrate between lacustrine and fluvial habitats (adfluvial life history). Adults migrate during spring freshet from overwintering lakes into streams to spawn. Following emergence, young-of-year (YOY) rear in natal streams throughout the summer before migrating to lakes prior to freeze-up. The diversity of Barrenland streams and resulting suitability for Arctic Grayling habitat use are poorly understood, which limits the ability of regulators, scientists, and industry to predict potential cumulative effects, or to develop effective conservation and mitigation strategies in advance of development. In the summer of 2019, we visited 49 Barrenland streams in Nunavut, near Baker Lake and the Agnico Eagle Meadowbank mining complex. The presence/absence of Arctic Grayling YOY was assessed through visual surveys, and habitat variables were collected at each stream. Arctic Grayling YOY were observed at 33 of the 49 surveyed streams. Using occupancy modeling, we explore which environmental variables best explain the spatial variation in the presence/absence of Arctic Grayling YOY. Occupancy modeling is a method that attempts to account for variables that lead to imperfect detection, or false absences, which, if left unaccounted for, can result in misleading inferences on the relationship between occupancy and habitat. We present the physical, chemical, and biological variability of Barrenland streams near Baker Lake, and assess to what extent these variables influence

the distribution and habitat use of Arctic Grayling in the region.

INUVIALUIT CULTURAL LIFE OUT ON THE LAND

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For the Inuvialuit harvesting wildlife and plants has been essential to survival in the Canadian Arctic since time immemorial. The primary importance of harvesting is often believed to be food security. There are many aspects of harvest and harvesting that contribute positivity to an Inuvialuit's way of life, but these have not been captured holistically in a research project in the Inuvialuit Settlement Region (ISR) before. During this project, 113 Inuvialuit participants were interviewed from the six communities in the ISR: Aklavik, Inuvik, Tuktoyaktuk, Sachs Harbour, Ulukhaktok, and Paulatuk. Results from the project outline how time spent out on the land harvesting contributes to an individual's subsistence, education, culture/lifestyle, wellbeing--both mental health and physical health and relationships with both family and community.

METABARCODING OF SEDIMENTARY ANCIENT DNA (SEDADNA) TO CHARACTERIZE 3800 YEARS OF DIATOM DIVERSITY IN THE NORTH WATER POLYNYA

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The North Water (NOW) polynya in northern Baffin Bay is one of the largest Arctic polynyas and is a highly productive ecosystem, making it a critical site to study the impacts of climate-driven environmental changes. Diatoms dominate the photosynthetic communities that support the total biological production in the NOW and their fossil remains are often used as proxies for past primary production. However, taxonomic expertise is required to identify fossil remains and not all species are detected in the sediment. Sedimentary ancient DNA (sedaDNA) is an emerging tool to increase the detection and resolution of taxonomic units that were once present in the environment, and it can be combined with other sedimentary proxies to improve paleoenvironmental reconstructions. Specific sampling protocols, controls, and bioinformatic tools are required to calibrate sedaDNA because of its low concentration in the environment and degradative processes that can change the nucleotide composition. Therefore, to continue the investigation of polar diatom diversity and improve multi-proxy paleoenvironmental datasets, I am designing diatom-specific primers and employing a multi-marker (rbcL, 18S V4 region) metabarcoding approach to characterize diatom diversity in the polynya during the last 3800 years. Here, I will present the methods used in the sequencing design and future steps for twelve subsamples taken from the AMD15-Casq1 core collected in the NOW. The ultimate goal of this research will be to perform taxonomic diversity analyses at each sampling interval and compare these results to diatom microfossil counts from the same core.

MERCURY AND FOOD WEB INVESTIGATIONS IN SEA-RUN CHAR AND THE GREINER LAKE ECOSYSTEM

Evans, Marlene (1), (Presenter), Derek Muir (2), Beverly Maksagak (3), Milla Rautio (4), Guillaume Grosbois (4), Michael Power (5), Donald McLennan (6), Geoff Koehler (1), Les Harris (7), Jonathan Keating (1), and Xiaowa Wang (2)

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Arctic char are highly important in the Inuit diet, and in places such as Cambridge Bay, in local commercial

fisheries. Fish are caught during their spring and fall migrations along major river systems but also can be harvested at other times from the lakes and rivers in which they reside. There are been remarkably few studies of char in their inland environments with recent studies at Grenier Lake and its watershed beginning to address these deficits. The Grenier Lake watershed supports both sea-run and resident char with the latter smaller, younger but with higher mercury concentrations than sea-run fish. Mercury concentrations were very low (<0.1 μg/g) in both char populations. Lake trout inhabiting Grenier Lake were small (mean length ~550 mm), old (mean age 28 yr) and slow growing with average mercury concentrations exceeding 0.5 μg/g. Slow growth may be due to the fact that this species is near the northern extent of its range; great age is suggestive of light fishing pressures. Lake whitefish had average mercury concentrations of 0.2 μg/g with some fish exceeding 0.5 μg/g while mercury concentrations in least cisco averaged 0.1 μg/g. Fish utilized different regions of the lake with lake whitefish and least cisco feeding primarily on pelagic or terrestrial carbon and lake trout and resident char on littoral zone carbon. Differences in mercury concentrations among fish species appear to be related to differences in trophic feeding, age and mercury concentrations in their diet. Essential polyunsaturated fatty acids (PUFAs) have been measured in these fish and other components of the food web. Arctic char had nearly 50% greater polyunsaturated fatty acid composition (19.9% versus 12.9%) than sea-run char with lake whitefish also a good source of PUFAs (17.4%) while lake trout (12.4%) and least cisco (8.5%) were poorer sources of PUFAs. These data provide for a balanced assessment of the benefits of fish consumption given mercury considerations with char the most beneficial. Increased fishing pressures on lake trout, by reducing average fish age, may help reduce average mercury concentrations. Warming trends may enhance lake productivity and fish growth rates further reducing mercury concentrations in fish such as lake trout through enhanced growth and in lake whitefish if they shift to a more benthic diet.

FRESHWATER SOURCES AND CHARACTERISTICS OF CHROMOPHORIC DISSOLVED ORGANIC MATTER (CDOM) ALONG THE COAST OF EASTERN JAMES BAY

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Freshwater input is a key control on the ecosystem (e.g. eelgrass habitats) in the coastal area of the eastern James Bay. In this study, two freshwater tracers - the oxygen isotopic composition of water (δ18O-H2O) and the absorption coefficient of chromophoric dissolved organic matter (aCDOM) were determined to estimate the contributions of freshwater from river runoff and sea-ice melt in nearshore waters of the eastern James Bay in different seasons of 2018 and 2019. A positive, linear relationship between δ18O-H2O and salinity was observed regardless of sampling areas and seasons, suggesting that river runoff is the dominant freshwater source. The aCDOM-salinity relationship revealed multiple freshwater CDOM endmembers. La Grande River is associated with a low-CDOM endmember (aCDOM < 10 m-1) compared to the other rivers north and south (15 m-1 < aCDOM < 50 m-1).

IMPACTS OF RECENT CLIMATE CHANGE IN THE COASTAL AREA OF NORTHERN YUKON BASED ON BENTHIC FORAMINIFERA

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The Inuvialuit and the Gwich'in peoples harvest the coastline of the southern Beaufort Sea for subsidence and to maintain cultural practices. However, with the ongoing climate changes, increase coastal erosion and decrease sea-ice leading to enhanced storm frequency and intensity result in important ecological stresses, which are notably marked by high detrital particle and carbon inputs modifying the trophic structure in nearshore ecosystems. In the present study, we aim to identify the impact of the recent climate changes on coastal water properties

and food supply in nearshore coastal ecosystems based on geochemical and micropaleontological analyses in a sediment core that was collected in the Herschel Basin, a depression offshore the Yukon coastal plain. In the 40 cm long core, 210Pb measurements indicate a mean sedimentation rate of 0.86 cm/yr, which allows analyses with a near-annual resolution over the last 60 years. There is no sign of sedimentary disturbance but the uppermost part of the core covering from ~2012 to 2018 records two peaks in mass accumulation rates reaching up to ~2.4 cm·yr-1. The benthic foraminifer content showed assemblages with high species diversity (> 20 taxa) and concentrations of 10-70 tests/g, allowing to calculate fluxes of the order of 10 to 100 shells/cm2·yr. This suggests generally high carbon fluxes to the sea floor and thus, high productivity. The dominant taxa are Elphidium clavatum and Cassidulina reniforme, coherent with Arctic shelf conditions. A peak in benthic foraminifers at 2014 is associated with high abundance of Eoeponidella pulchella which points to high food supply. Concentrations are also high around 1970 and 1980 with no particular change in the general foraminiferal assemblages, but more abundant ostracod shells. The overall record suggests relatively stable conditions in nearshore settings until 2012, when significant variations in the sedimentary regime occurred. Stable isotope and mineralogical measurements are underway to document the source of particulate and dissolved organic matter (terrestrial vs. marine) over time in relation to the ecological changes inferred from benthic foraminifer communities.

ADVANCING TRANSDISCIPLINARY RESEARCH TO MONITOR CHANGING ARCTIC MARINE SOCIAL-ECOLOGICAL SYSTEMS

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Arctic marine ecosystems support a diversity of ecosystem services, from coastal buffering, to marine foods and source of cultural inspiration. These services benefit a wide range of people, but especially local communities whose livelihoods, culture, and identity are often closely connected to surrounding ecosystems. As Arctic marine ecosystems and wildlife are being impacted by climate change and other environmental pressures, so are ecosystem services and the humans who depend upon them. To fully understand how changes to marine ecosystems and wildlife are impacting northern communities, we need to recognize that natural and social systems of the Arctic are tightly coupled social-ecological systems (SES). An SES lens can help to disentangle impacts that flow from ecosystems to humans and back - such as how sea ice decline affects wildlife and the people who rely on marine foods - thus providing key insights that can inform adaptation and management. In this research, we adapted an SES lens to study ongoing and future changes in the marine Arctic; a lens that we applied through transdisciplinary approaches that crossed disciplinary and academic boundaries. The research was based in the community of Cambridge Bay (Iqaluktuutiaq) in the Kitikmeot Region of Nunavut. We first studied how the marine ecosystem and fisheries of anadromous Arctic char have changed over the past three decades by using mixed methods that combined climatic proxies, biological surveys, chemical tracers and interviews with local Inuit experts. We then explored future changes in the marine SES through participatory scenario planning; a two-year iterative process during which over a hundred community members, as well as managers and scientists provided input. In this talk, I will present the transdisciplinary approaches that we used to study the Kitikmeot marine SES as well as project outcomes. From the perspective of an early-career researcher, I will discuss the benefits of collaborating with the community, including an enhanced understanding of the system, as well as challenges and strategies for pursuing such collaborations. Overall, our research provides new insights into the ongoing and future impacts of environmental pressures on Arctic marine SES, such as the fisheries implications of shifting food webs. We also propose a set of transdisciplinary methods that others could build upon to jointly advance, in partnership with communities, comprehensive understanding of Arctic change.

WINTER OVERCOMPENSATION IN ARCTIC RODENTS

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In the Arctic, fluctuations of abundance of small rodent populations is the most important factor driving the reproduction of owls, hawks, foxes and ermines in many parts of the Arctic. As a result, the booms and busts of lemmings and voles result in a pulsatile biodiversity every 3-4 years on the tundra. Their multi-year cyclic fluctuations of abundance have now been at least partly explained by periodic lack of food or high predation, especially due to the delayed density-dependent effect of the latter factor, which means that predation is maximal shortly after the peak abundance of the prey. Recently, overcompensation, briefly defined as large declines of populations reaching densities much above the carrying capacity, has been proposed to potentially cause these population cycles. In the high Arctic, such overcompensation could be induced by the strong seasonality forcing the carrying capacity to fluctuate highly throughout the year. We hypothesised that if overcompensation is important in driving population cycles of lemmings and voles, populations should show cyclic fluctuations also in predation free environments. Alternatively, if overcompensation has a seasonal effect only, no multi-year cycles should be observed without predation. Here, we explore the population dynamics of a High Arctic population of brown lemmings (Bylot Island; 2013-2019) and of sibling voles (Svalbard; 1990-1996, 2002-2006) exposed to very low predation levels. On Bylot Island predators were excluded from the study population by a fence. However, ermines may have entered into the fence in 2017 and 2018. In both populations, the winter population growth rate was high when the previous summer population was low, and the winter population growth was low if the density was high in the previous summer. In addition, there was a strong effect of rain-on-snow on vole winter population growth. The successive positive summer growth rates following winter declines indicate no phase-dependence, meaning that the winter decline phase had no extended effect during the summer. This is probably because the winter carrying capacity was low and limited summer populations sizes to below summer carrying capacity even at unrestricted growth. There was no evidence of multi-year cycles in the resulting dynamics. We find no evidence for overcompensation to cause cyclic dynamics in Arctic rodents in predation free environments.

THE INUIT NUNANGAT HOUSING STRATEGY: WORKING TOGETHER TO IMPROVE HOUSING OUTCOMES IN INUIT NUNANGAT

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Lack of access to appropriate and affordable housing in Inuit Nunangat is a national crisis. In 2016, over half (51.7%) of Inuit in Inuit Nunangat lived in crowded housing compared to 8.5% percent of non-Indigenous Canadians. In addition, more than 70 per cent of the communities in Inuit Nunangat do not have a safe shelter for women and children experiencing family violence and where they do exist, they are over-burdened. The housing crisis, as demonstrated by consistently poor socio-economic outcomes, continues to represent a major impediment to healthy living, education and employment for Inuit. This presentation will discuss the Inuit Nunangat Housing Strategy, a joint strategy that was co-developed by Inuit and the Government of Canada with the goal of addressing and improving housing outcomes in Inuit Nunangat in line with outcomes for the rest of Canada. Context will be provided on how the strategy builds on recent direct federal investments which recognize the need for significant investments in the short to medium term and the direct role of Inuit in managing housing in Inuit communities. The need for an ongoing direct relationship between Inuit and the federal government for the provision of housing in Inuit Nunangat will also be discussed as this relationship is key to ensuring that the gains made in the short to medium term can be sustained for the long term, resulting in healthy, productive individuals, families and communities.

LOGISTIC SUPPORT FOR LONG-TERM MONITORING INT THE CANADIAN NORTH: CANADIAN NETWORK OF NORTHERN RESEARCH OPERATORS

Fishback, LeeAnn (1) , R. Flagg (2) (presenter), J. McAlister (3), H. Penn (4), G. Redvers (5)

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The Canadian Network of Northern Research Operators (CNNRO) is a network of research support facilities enabling research in the Canadian Arctic and sub-Arctic regions. CNNRO members provide the know-how and infrastructure that make research possible throughout northern Canada. The CNNRO is an organisation with great diversity of membership but with a common purpose to create a cooperative network that will advance objectives members share in common. The CNNRO is comprised of 30 regular members having permanent research infrastructure in the Arctic and 12 associate members who have an interest in CNNRO member activities, but do not operate research infrastructure in the Arctic. CNNRO member infrastructure covers every ecozone of the High-Arctic, Arctic, and sub-Arctic and it is through this diversity that the association draws its strength. Each facility is unique in its history, governance, financial structure, research objectives and interaction with the local environment and communities. The CNNRO facilities provide a unique, comprehensive Canadian research platform for northern science and innovation. They provide the essential resources for ground-breaking research in areas of physical, health and social sciences. The CNNRO ensures that the many avenues of Canadian Arctic research has continued success, that critical time series are maintained and that irreplaceable datasets from across the North remain accessible and continue to grow. In addition to strengthening Canada's northern science breadth and depth, the CNNRO also helps foster research partnerships with people who live in the North, local communities, and regions and showcases Canadian research to the circumpolar community and to the rest of the world.

TOWARDS PAN-ARCTIC SAMPLING OF MARINE MICROPLASTIC POLLUTION USING THE CONTINUOUS PLANKTON RECORDER

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The vast extent of Arctic marine waterways requires the development and demonstration of initiatives to quantify spatial variation in microplastic pollution on large spatial scales. The continuous plankton recorder (CPR) has been used around the globe for nearly 95 years to characterize pelagic plankton assemblages. Its robust mechanical operation (propeller driven towed body, 270 micron silk sampling screens, ability to sample across a range of vessel speeds, georeferenced sample analyses at scales of 10 nautical miles, plastic-free construction) has also recently proven useful to quantify the occurrence and local abundance of microplastics. The CPR's simultaneous collection of plankton and plastics -together with large-scale sampling programs in the Canadian Arctic-is facilitating new research questions related to the co-occurrence of biological and pollution 'hotspots' and important spatial variance in both. Using oceanographic and CPR data collected aboard icebreakers sampling an aggregate >5000 nautical miles in 2016, 2017, and 2019, we report on the occurrence and abundance of marine pelagic plastic pollution and compare that to co-occurring phytoplankton and zooplankton species. Of samples collected in 2017, plastics represented 12% of total abundance of individuals sampled using methods designed to target large zooplankton. Those values ranked plastic as the fourth most abundant 'taxon' relative to 24 other taxonomic groups enumerated, trailing only the dominant copepods Calanus finmarchicus, 'Hyperiidea (Total)' and Methridia longa. Similarly, plastic fragments were ranked fourth in occurrence (in 38% of all 2017 samples). This survey program's extension from Arctic proof-of concept opportunity to successful deployments aboard the CCGS Amundsen within the 2019 ArcticNet program illustrate the ability to scale up to a potential pan-Arctic sampling program involving both ships of opportunity and dedicated research vessels. Increasingly ice-free Arctic summers have the potential to both release and transport microplastics in Canadian marine waters. Such ice-free conditions will also facilitate their enumeration and comparison within local plankton assemblages using CPR.

SEA ICE VELOCITIES IN THE VICINITY OF MACKENZIE CANYON FROM A TWO YEAR-LONG MOORING ARRAY WITH COMPARISONS TO ICE VELOCITIES OBTAINED OFF THE CENTRAL MACKENZIE DELTA

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Ice velocity data from a five-mooring array extending from the inner shelf (40 m water depth) to the outer continental slope (850 m) on the western flank of Mackenzie Canyon (139 °W) are analyzed to describe the spatial and temporal variability of the ice velocities and their response to wind, ocean current and internal ice strength forcing. Four of the moorings in this array (M1 to M4, inclusive), part of the Marine Arctic Ecosystem Study (MARES), were deployed from October 2016 to early October 2018 with the ice velocities measured through the use of the uppermost Acoustic Doppler Current Profiler operated on each mooring. Ice velocity data is also analysed from other moorings operating simultaneously with the MARES moorings, through the integrated Beaufort Observatory (iBO) program, including: a mooring site further offshore from the MARES mooring transect to the west of the Mackenzie Canyon (BR-1); and five moorings in an on-offshore transect (moorings 9, 1, 2, K and G) located 175 km to the east (133.5 °W) in the central portion of the Mackenzie Delta continental shelf and slope. Sea ice in the region begins to form in October each year and expands to complete coverage by December with maximum ice thickness present in late winter and early spring. By late spring, the sea ice begins to break-up and disperse especially in the vicinity of the Mackenzie Canyon with the onset of the Mackenzie River freshet. In the fall, when ice concentrations are low to moderate, the sea ice motion is largely free drift in response to wind and ocean current forcing, reaching peak ice speeds of over 100 cm/s. Wind forcing dominates sea ice motion when wind speeds exceed 4 m/s. By early winter, as the ice concentration becomes very high and the sea ice thickens, internal ice strength begins to develop which inhibits sea ice motion, resulting in episodes of cessation of sea ice motion (less than 0.5 cm/s); large wind events result in resumption of sea ice motion. In winter and early spring, large differences in ice speeds are noted on the mooring transect line to the west of the Mackenzie Canyon with the largest ice speeds occurring at the shelf break mooring (M2) while the ice speeds at the slope moorings (M3, M4 and BR-1) are somewhat reduced on average, although variable among individual wind events. Ice speeds at the shelf mooring M1 can also reach very large values, during particularly energetic winter and early spring events. The ice speeds at the eastern moorings over the slope off the Mackenzie Delta exhibit very similar episodic variability at times of low wind speeds and high ice strength but tend to be reduced in speed during larger winds than those speeds observed to the west of the Mackenzie Canyon. During the onset of the Mackenzie River freshet and the subsequent break-up of the sea ice to the west of the Mackenzie Canyon, ice movement tends to be highly variable in time with particularly large ice movements at the shelf and shelf edge sites (M1 and M2). The nature of the ice response to the Mackenzie River freshet will be addressed in more detail. The differences in the ice speed response to forcing between the two years will also be presented.

VESSEL MONITORING IN THE KITIKMEOT - A PARTNERSHIP APPROACH

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Due to changing weather and climate conditions, it is predicted that vessel traffic through Nunavut waterways will increase in the coming years. The ability for local, real-time data monitoring of vessel traffic is critical for assessing cumulative impacts of changes to vessel traffic patterns, planning travel during the freeze-up and break-up periods, and fishing and transportation activities during the open water season. In response to the need for improved vessel traffic data, the Kugluktuk Hunters and Trappers Organization (HTO) partnered with the Nunavut Tunngavik Inc. (NTI) Inuit Marine Monitoring Program, Ocean Networks Canada (ONC) and Marine Institute, Memorial University of Newfoundland, on a project to monitor traffic in the Kugluktuk region funded through the Nunavut General Monitoring Plan (NGMP). The NTI program has been working to deploy Automatic Identification System (AIS) stations in and near communities throughout Nunavut and to augment the vessel traffic data these stations collect with observations from community members. ONC has successfully built and operated some of the world's most advanced ocean observing systems across a range of marine environments, including a cabled Community Observatory in Cambridge Bay, which has included and in-community AIS station

since September of 2013. As part of this project NTI and ONC will work with the local HTO to install two AIS stations (one in the community of Kugluktuk and one remote station north of Kugluktuk, at the western entrance to Coronation Gulf), and will also be providing data management and visualization tools along with training to community members in how to access and use the data. This presentation will discuss AIS vessel traffic data in the Kitikmeot region of Nunavut as an example of how project partnerships can leverage a broad range of unique capabilities to create more comprehensive and community-focussed outcomes that better serve science, society, and industry.

THE PLAN 319, T-SHIRT OR RIGID FRAME HOUSE - HEALTH CRISES AND THE LOGIC OF THE 'FIRST' HOUSING PROGRAMME FOR INUIT 1959-1960

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The existence of a housing crisis in Canadian Inuit communities today is a broadly acknowledged and seemingly intractable problem. Indigenous organizations, governments, researchers, and journalists all confirm the significance of housing as a key northern development and human health issue. Resources, never enough and often applied in piecemeal fashion, and policies have not been able to significantly reduce the problem. People throughout Inuit Nunangat feel the effects of overcrowded, inadequate and insufficient houses in everyday life in myriad ways. Housing is a key determinant of social well-being and physical and mental health for all peoples, and there is ample evidence that people Inuit suffer disproportionally from the effects of inadequate and deficient housing. This is not a new phenomenon. Rather, as is discussed in this paper, the housing crisis dates to before the time when most communities and houses as we think of them today existed. Produced through a discourse of public health science and professional responsibility, the initiation of government sponsored housing programs into the north was initially envisioned as a health intervention to palliate another problem - extremely high rates of infant mortality associated with respiratory diseases. The origins of the housing crisis can be seen from many professional and administrative perspectives in the thousands of pages of the historical record reaching back to the late 1950s when permanent housing first emerged as a feature of citizenship (as distinct from employment) for Inuit. Houses and communities appeared largely simultaneously and very rapidly in most of the Canadian Arctic and their appearance signals a categorical change in the way Inuit would come to dwell on their land, interact with the state, and organize socially and politically. To better understand this time and these issues, I look specifically at the development of the "first" house designed as part of a social program for Inuit in the Eastern Arctic. Known variously in English as the "Rigid Frame" or "Plan 319" house, and to Inuit in Arctic Quebec as the Uviniruujuaq or "big T-Shirt house" for its unusual sloped walls that suggest the human torso, this dwelling was an easily transported, very inexpensive, 256 sq. ft. structure intended to ease Inuit into community living while simultaneously keeping them from becoming expectant of government largesse. Focusing on this building we see the administrative logic of offering coercive, yet inadequate, services, including housing, was predicated on moralistic public health practice, ethnocentric visions of proper ways of living, and an ethos of paternalism that, I argue, together make the presence of "crisis" necessary for community development.

KNOWLEDGE MOBILIZATION ON THE LAND: AN EVALUATION OF A LAND-BASED RESULT SHARING WORKSHOP IN NAIN, NUNATSIAVUT

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There is substantial research investment in understanding the impacts of climate change in northern regions, including studies examining changes to vegetation patterns, permafrost, wildlife habitat and behaviour, changing sea ice patterns and safety, archaeological and cultural resources management needs in a changing climate, and food security and food systems research. These projects have an important part to play in decision-

making, however, the way that research is presented in communities - usually through written reports and open house presentations - can sometimes be detached from the land and environment in which the research was done. In addition, despite the interconnectedness of the socio-environmental system, research results often remain siloed by academic disciplines and related government departments with few opportunities for researchers to collaborate on findings. Furthermore, this format of having researchers present as experts can leave local people disconnected from the knowledge making process with limited opportunity to informally ask questions, exchange feedback with researchers, or highlight other linkages between research not foreseen by researchers. This talk will discuss the findings from an alternate format of results dissemination. Our research pilots a land-based knowledge-sharing workshop where community members and researchers working on projects across natural and social science came together to discuss ongoing research findings and other important questions surrounding climate change in the natural and social environments. Taking researchers out on the land reframes local people as the experts, those who know the landscape intimately. The journey traveling to the workshop location offers opportunities to talk about observed changes in the land and on-the-fly adaptations and coping strategies that are made to overcome those shifts. This model asks and enables researchers to communicate through conversation rather than presentation, opening up a greater opportunity for dialogue, questions, and suggestions for future directions of research in a way that cannot come from a short community presentation or a plain-language summary. This talk provides an evaluation of this pilot study, exploring whether land-based results dissemination can improve understanding and relevance through embedding findings within the local context, increase connection between community members and researchers, and encourage researchers to communicate collaboratively about their research.

NORTHERN DIVERSITY OF SNAILS AND THEIR TREMATODE PARASITES ACROSS THE ARCTIC

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Climatic shifts will affect the distribution of host and parasite diversity, thereby altering incidences of disease outbreaks in both humans and animals. Differences in temperature regimes may also affect host-parasite interactions, leading to local extinction and trophic cascades, impacting ecosystem function and food security. Most of the research on disease outbreaks in the north has focused on interactions between final hosts (e.g., birds, mammals, and fish) and parasites. However, to determine whether changes are occurring, baseline data for parasites and their invertebrate hosts are also essential. Yet, this critical information is lacking despite parasites and their invertebrate hosts being indicators of ecosystem health in the Arctic. Trematodes are common parasites that have indirect life cycles involving multiple host species, including invertebrates, fish, birds, and mammals. Mollusks are always the first host in trematode life cycles and their infection is a record of even a brief visit by another host in the life cycle. The presence and diversity of trematodes and their snail hosts can give indications about water quality, trophic links, and other measures of community function. Thus, trematodes and their snail hosts are sentinel organisms, making them markers of human and community health. In order to better understand the diversity of snails and their parasites play in northern freshwater communities, we will be quantifying snails and their trematodes in lentic sites across the Arctic. We plan to sample nine locations, spanning three different latitudes and longitudes, and all three northern watersheds. At each location, we will sample molluscs and parasites in six freshwater waterbodies in order to sample different types of habitat, including lakes and wetlands. In 2019, sampling was completed in Thompson, Manitoba. Snails were identified (based on morphology and genetics) and dissected for parasites. Overall, there was a high prevalence of infection (41%, 110/266), with at least five trematode morphotypes present. In 2020-2021, we will sample 8 more locations and perform DNA barcoding to better estimate trematode species diversity. We expect the diversity of snails and parasites to decrease as we sample further north. Further, we expect a shift in species of both snails and parasites as we move north reflecting reduced anthropogenic development and a change in temperature regimes. The impact of trematode parasites on their mollusc intermediate hosts may have consequences for many higher trophic species, including fish and birds, that are used for subsistence hunting in local communities. We are only beginning to understand the ecological implications of climate change and range expansion in the north, and data on disease dynamics is still lagging behind. This proposed research will provide northerners a better understanding of biological diversity as well as implications for ecosystem health and disease dynamics. The information can also be used as a baseline for the future development of management plans and

focus throughout the north in order to protect important ecosystems and mitigate the effects of climate change.

AIRBORNE AND UNDERWATER ACOUSTIC REPERTOIRE OF HOODED SEALS (CYSTOPHORA CRISTATA): NEW PERSPECTIVES FOR POPULATION MONITORING

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The hooded seal is a migratory species inhabiting the North Atlantic. They whelp and breed during mid- to late March on pack ice near Jan Mayen Island, in the Davis Strait, off the northeastern Newfoundland coast, and in the Gulf of St. Lawrence. After breeding, hooded seals return to the pack ice off eastern Greenland to moult during June and July, and then they disperse broadly for summer and fall before returning to their respective breeding areas. Passive acoustic monitoring conducted over spatial scales consistent with known and potential habitat of the hooded seal could add insight into seasonal and spatial occurrence patterns of this species. To better characterize its acoustic repertoire (notably underwater calls), airborne and underwater acoustic signals of hooded seals were recorded during their breeding season on the pack ice in the Gulf of St. Lawrence from 12 to 17 March 2018. Hood and septum noises were the predominant sounds heard from males on the ice surface. Hooded seal underwater acoustic repertoire is larger and more diverse than has been previously described. Some underwater vocalizations described in this study were found in a dataset from an extended acoustic monitoring program along Canada's East Coast, demonstrating that acoustics can become an effective means of studying this poorly understood seal species.

ACTIVE LAYER VARIATIONS EXPLAINING 25 YEARS OF ICE-WEDGE DEGRADATION

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Despite the growing attention the northern regions are now receiving, field studies spanning multiple decades are scarce and consequence assessments of permafrost thawing over many years remain speculative or limited to observations of short duration. To tackle this problem, Gagnon and Allard (2019) investigated the impact of climate change on winter ice-wedge (IW) cracking frequency and IW morphology. In this study, they revisited 16 sites in the Narsajuaq valley near Salluit (Canada) that were extensively studied between 1989 and 1991. Climate warming only started around 1993 whence mean annual air temperatures started to rise from -10°C then to about -6 °C nowadays. This gave the unique opportunity to observe and measure changes by directly comparing actual data with data pre-dating a climate warming of known amplitude. They found that based on IW tops, the active layer reached depths that were 1.2 to 3.4 times deeper than in 1991, which led to the widespread degradation of IW in the valley. Whereas 94% of the IWs unearthed in 1991 showed multiple recent growth structures, only 13% of the IWs unearthed in 2017 still had such features. However, about half of the IWs in 2017 had ice veins connecting them to the base of the active layer, an indication that the recent cooling trend (2010-now) in the region was enough to reactivate frost cracking and IW growth. This shows that the soil system can respond quickly to short-term climate variations. But the study did not quantify the system sensitivity. For this study, we aimed to determine how hanges in surface temperatures affected active layer depth and dynamics over the past 25 years in order to understand the timing and reaching times of ground temperature thresholds for soil cracking and IW degradation. Since we did not have soil temperature records for the valley, we used TONE, a one-dimensional finite-element thermal model, to simulate ground temperatures over the past 25 years. We used monthly mean air temperature from a reanalysis (1948-2016) combined with data from a weather station about 9 km west of the study area (2002-2018) to simulate the soil temperature profiles of four typical soil types found in the valley: thick sandy peat cover (>30 cm), thick peat cover (>30 cm), thin sandy peat cover (<30 cm), and fluvial sands. All organic layers overlaid sandy mineral deposits. Our results show that ALT variations were predominantly controlled by changes in thawing season air temperature with regards to the previous year. As soon as 1998, the active layer had already reached the main stages of the IWs, i.e. the largest and oldest part composing the IWs, but it is only from 2006 that the main stages started melting until 2010, an exceptionally warm year. Based on soil temperature thresholds, our results show that IWs remained active until around 2006. This means that as the active layer deepened and caused IW tops degradation,

freezing season temperatures were still cold enough to induce soil cracking and IW growth in width. After 2010, the cooling trend was enough to reactivate the IWs from as a soon as 2011. This study shows that prior to advanced degradation, IWs can melt substantively and remain active at the same time as long as freezing season temperatures are cold enough to induce soil contraction cracking. However, it is likely that pulse events such as ground collapse will cause positive feedbacks contributing to rapid IW degradation before the soil completely stops cracking.

INTERANNUAL AND SPATIAL DYNAMICS OF MICROBIAL COMMUNITIES ALONG EASTERN JAMES BAY

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James Bay is a wide and shallow basin affected by surface marine water coming from Hudson Bay and freshwater inputs from several rivers along the eastern coast. These marine and freshwater inputs influence strongly the vertical and horizontal distribution of salinity in coastal areas, which affect the physical and chemical properties of the water column which, in turn, impact the microbial community composition. This study presents the first data on the interannual and spatial changes of the microbial community distribution located between Jolicoeur and Salmon rivers, corresponding to ca. 300 km of coast. The sampling was conducted during two consecutive years (2018 and 2019) from winter to summer. During both winters, abundances of phytoplankton < 20 μm (0.3-12 □ 106 cells L-1), heterotrophic bacteria (HB) (0.2-11 □ 108 cells L-1), heterotrophic nanoflagellates (HNF) (0.1-3 □ 106 cells L-1) under the ice cover were consistently low along the coast, while the abundance of viruses was constant all year (5.1-63 □ 106 cells L-1). Between summers 2018 and 2019, significant differences in the microbial community abundance were observed, with higher abundances of bacteria, heterotrophic flagellates and virus in 2019 while phytoplankton abundance was lower (Rank sum test, p □ 0.01). Furthermore, the spatial repartition of phytoplankton abundance differed. During summer 2018, higher phytoplankton abundance was observed north of Chisasibi (Bay of Many Islands) and near Castor and Maquatua Rivers, with abundances superior to 45 □ 106 cells L-1, while higher abundance, with an average of 69 □ 106 cells L-1, were observed around Eastmain area during summer 2019 (new sampling sites). However, during both years, HB increase seems to be associated to phytoplankton producing fresh labile DOC, while high HNF abundances were found where the bacterial preys were the most abundant. Changes in microbial communities will be discussed taking account environmental factors, such as salinity, temperature, light and nutrient availability.

ARCTIC RISK MANAGEMENT NETWORK:LINKING REGIONAL PRACTITIONERS AND RESEARCHERS TO IMPROVE MITIGATION THROUGH PARTICIPATORY ACTION RESEARCH BY COMMUNITY MONITORS ABOUT EROSION AND SURGES TO IMPROVE FORECASTING

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With Alaska Sea Grant funds, this project continues the development of the Utqiagvik (Barrow) community-based coastal observation network and develops the coastal hazards forecasting system focused on the forecasting of coastal surge and flooding and coastal erosion. The existing coastal monitoring system consists of the monitoring of six cross-shore transects along the city shoreline and was initiated in 2015 by ARIES and NSB OEM. The transects monitor critical infrastructure. The coastal monitoring system was expanded. First, community observers document storm surge heights. Second, an Argus video camera is being deployed on a public utility pole to document the near-shore wave conditions and water level. Data collected by the observers and the observation system are used to calibrate and validate the storm surge, coastal flooding, and coastal erosion forecasting system. In the event of a large storm, erosion forecasts generated by the project can be provided to the AK National Weather Service and the North Slope Borough Risk and Emergency Management Office to take pro-active measures to improve control of erosion and flooding of critical infrastructure. This project serves as a demonstration of how community-based coastal monitoring efforts, coastal hazards forecasters, and emergency managers can collaborate to share knowledge

and mitigate risk. The project includes public education and workforce development with HS curricula about coastal erosion. Community volunteers and students are directly engaged with the project team and have the opportunity to learn and do projects relating to coastal monitoring, coastal forecasting, and emergency response.

ENGAGING INUIT YOUTH ON IMPACTS AND SOLUTIONS ON CLIMATE CHANGE: A PARTICIPATORY VIDEO APPROACH

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Participatory methods have been used to engage communities in documenting their social and environmental observations of change, such as the photovoice method, digital storytelling, and Participatory Video. Participatory Video is a powerful knowledge dissemination tool that can empower youth, strengthen resilience in communities and leads to effective communication avenues with decision-makers to advocate for change. In this presentation, I will share a case study and focus more on the methodology of using participatory video to engage youth in Tuktoyaktuk, NWT, on the topic they have chosen: climate change. Focusing on knowledge co-production and guided by a team of partners, these youth have interviewed community members and other youth on the topic to produce a 20-minute video called "Happening to Us". Thematic coding will be used with a grounded theory approach. The longevity of engagement of these projects is often hard to predict, but this project has already created a ripple effect in town where younger kids have shown interest in learning from the other young filmmakers, film projects have been offered to them, and connections have been made from the local, to regional, to the national level with policy-makers and practitioners. The youth participants have shown increased confidence, engagement, and leadership. Follow-up interviews will be done with partners and community members to measure indicators of success.

WEATHER IN NUNAVIK: OBSERVATIONS FROM THE CAIMAN NETWORK (2009-2019)

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The CAIMAN Network includes 30 time-lapse cameras distributed over eight Nunavik communities. The Network was gradually implemented since 2009 to support ice and climate change studies for the Quebec's ministry of transports. Therefore, most cameras are installed in coastal sites, looking towards the sea. The photo database is now comprised of more than 500 000 photos, which can be viewed through the CAIMAN Portal (www.caiman.ete.inrs.ca). The photos were analysed at first to identify the seasonal ice cycle and the behavior of ice in the vicinity of marine infrastructures. But from the same photos, we also compiled the annual snow and vegetation cycles, as well as the weather conditions (sun/clouds, precipitations, fog, wind/waves, temperature) at the time of acquisition, when apparent on the photos. Here, we present an analysis of the photo weather observations, first comparing with data from the nearest weather stations, in order to validate the relevance and accuracy of using the CAIMAN Network as a complementary climate information service. We then use the photo derived database to study weather conditions prevailing in those Nunavik communities. For example, we establish the time of year and the site with the most sun observations, fog observations or strong waves observations. Finally, we look at this data in the context of the Nunavik future bioclimatic portrait recently produced by Ouranos.

SOMETHING OLD, SOMETHING NEW, DIFFERENT PERSPECTIVES ON THE PELAGIC ZOO...(PLANKTON AND FISH OF THE LABRADOR SEA DEEP OCEAN)

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The physical oceanography of the Labrador Sea is well-studied due to its global importance in driving ocean currents, moderating climate and acting as a carbon sink. Despite the attention on the oceanography, little is known about the ecological communities that reside there and live under the influence of this unique hydrography. In other deep ocean environments, much of the ecological productivity is found in the pelagic zone, where plankton and mesopelagic fish form dense mid-water aggregations. These mesopelagic organisms are hypothesized to be responsible for the largest biomass aggregations of animal life on the planet and are crucial to the energy flow of the deep ocean. In this study we combine high resolution acoustic imaging (Wideband Autonomous Transceiver - WBAT), zooplankton imaging (Underwater Vision Profiler - UVP5) and eDNA with traditional macrozooplankton and pelagic fish midwater trawls (Isaac-Kidd Midwater Trawl -IKMT), and depth-stratified plankton net sampling (Hydrobios plankton net). Using these complimentary approaches, we describe the behavior, distribution and biodiversity of mesopelagic fishes and macroinvertebrates in the water column and across depth zones (500-3000m) in the Labrador Sea. Linkages between pelagic and benthic systems are being tracked with sediment traps and through food web analyses. This survey provides important information regarding how pelagic communities vary with oceanographic conditions and how survey results may differ depending on sampling gear choices. It will also serve as an important baseline to understand ecological responses to rapidly changing oceanographic conditions in the Labrador Sea.

NUNAMI SUKUIJAINIQ, THE MOVIE: DOING COLLABORATIVE SCIENCE ON THE GEORGE RIVER, NUNAVIK

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This first short film of the NUNAMI SUKUIJAINIQ Short Documentary Series, displays how Kangiqsualujjuamiut and the university-affiliated researchers are involved in a unique collaborative science adventure covering the George River Basin, in Nunavik. This land-based and hands- on Science Education Program specially designed for Nunavik Youth, brings together all participants in a community-based environmental monitoring and inclusive learning process about Arctic Ecology. This program actively engages youth, adults and Elders in environmental stewardship. The 2019 edition of NUNAMI SUKUIJAINIQ focused on freshwater ecology, studying a major river flowing northward on 505 km towards the Ungava Bay, from boreal forests to sub-arctic tundra. The educational activities included workshops on water quality, trace metals, plant ecology, soils, fish, macroinvertebrates, insects, bacteria, geography, local knowledge mapping, orientation, survival skills, local history and Inuit legends. Youth also took part in scientific sampling with the researchers. Camps such as this one provide great opportunities for all participants to connect with the land, and more specifically, they allow intergenerational transfer of Inuit Knowledge. In addition, the collaboration with the Nunavut Arctic College's Environmental Technology Program provides valuable mentoring occasions for Inuit youth from other regions to inspire Nunavik's youth. Finally, land camps create positive interactions between scientific and

Inuit knowledge and strengthen respectful relationship dynamics between Qallunaat and Inuit researchers and their respective ways of knowing. These factors can only contribute to further development of Inuit Science. We hope this program will foster mentorship possibilities with other indigenous communities, while assisting them to define and start a project adapted to their local environment and needs. The next editions will focus on marine and winter ecology.

USING REMOTELY PILOTED AIRCRAFT SYSTEMS (RPAS) TO SUPPORT MAPPING AND MONITORING OF CLIMATE DRIVEN CHANGES ON WESTERN ARCTIC COMMUNITIES: THE AURORA RESEARCH INSTITUTE RPAS PROGRAM

Giff, Garfield (Presenter) and C. Ferguson

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The effects of climate change can be seen across the entire planet, however, these changes are more evident in the Western Arctic. Community members, scientists, researchers, government and non-government agencies have identified a number of climate driven changes that are affecting the environment of the Western Arctic. These changes, in particular to the landscape are clearly visible along the coastlines and inland to the valleys, water channels, and along the slopes. The net effects of climate driven changes on the landscape not only affects wildlife and the quality of life of the people but also Western Arctic infrastructures. Therefore, it is important to the people of the Western Arctic that these changes are mapped and monitored to support the development of strategies for adaptation and mitigation against the effects of climate driven changes on their communities. Mapping and monitoring the effects of climate driven changes on the Western Arctic environment is an onerous and costly task due to the vast land space, the undulating terrain, and the extreme atmospheric conditions. Therefore, a key to successful mapping and monitoring of the effects of climate driven changes in the Western Arctic is the identification of cost effective, scalable, timely, accurate and precise tools. One such tool identified by the Aurora Research Institute (ARI) is Remotely Piloted Aircraft Systems (RPAS) more commonly known as drones. ARI has been using RPAS to effectively and efficiently map and monitor the effects of climate driven changes on selected Western Arctic communities for more than 3years. This presentation will review and discuss the ARI's use of RPAS to map and monitor the effects of climate driven changes on land, water bodies, wildlife, vegetation, and infrastructure in the Western Arctic.

DETERMINANTS, EFFECTS, AND COPING STRATEGIES FOR LOW-YIELD PERIODS OF HARVEST: A QUALITATIVE STUDY IN TWO COMMUNITIES IN NUNAVUT, CANADA

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Food sovereignty among Inuit in Nunavut, Canada has long meant year-round harvest of country (hunted, fished, or gathered) food. In recent decades, climatic and non-climatic challenges have complicated these subsistence activities, threatening food security. We examine the meaning of country food, identify determinants of low-yield periods of country food harvest and their effects on community health, and summarize coping strategies and ideas for sustaining food security during these "leaner" periods. Thirty semi-structured interviews were conducted in July and August of 2018 with elders and/or hunters and trappers in Cambridge Bay and Pond Inlet. We found country food holds diverse meanings in the lives of our participants, including for their diet and nutrition, health, Inuit identity and traditions, practice of harvest and subsistence, and spirituality. Participants identified reduced wildlife populations, environmental or weather issues, changing wildlife migration patterns, and financial or equipment-related constraints as determinants of low-yield periods of harvest. Community health is impacted during lean periods across four interrelated dimensions: "craving" of country food, physical health, mental health, and nutrition. Due to their lifelong reliance on country food, elders were described as being particularly vulnerable and are prioritized within

the traditional food sharing system. The most commonly cited coping strategies were turning to intra- or inter-community food sharing networks for country food and purchasing groceries. To support communities during low-yield periods of harvest, participants suggested increased support for Hunters and Trappers Organizations to acquire country food for community distribution, as well as greater financial and equipment support for harvesters.

THERMOKARST MAPPING COLLECTIVE

Gingras-Hill, Tristan (1,2) (Presenter), S. Kokelj (2), A. Rudy (2), P. Morse (3), S. Wolfe (3), C. Gibson (4), C. Beel (1), J. Baltzer (5)

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Permafrost thaw is a primary cause of climate-driven landscape change in the north and has a major effect on ecosystems and infrastructure. Understanding the distribution of thaw-sensitive terrain is critical to predicting the future state of the environment and water resources of the Northwest Territories' (NWT), and for planning community and infrastructure adaptation to climate change. Although several local-scale mapping products describing the nature, intensity, and distribution of thermokarst processes and permafrost landforms are currently available, no observationally-based maps describing the distribution of landforms indicative of permafrost thaw or sensitive terrain cover the entire NWT. Consequently, experts from across Canada formed a collective partnership to develop a methodology for identifying thermokarst landforms and map sensitive permafrost terrain to generate NWT-wide thermokarst and permafrost feature inventory maps. This project is based on the interpretation of map-based products, relies on collaboration amongst experts and involves northerners in the generation and analyses of the mapping products. Through an iterative process, Satellite imagery, combined with a 7.5 x 7.5 km gridded cell system is being used to inventory the location of features throughout the NWT using remote sensing and GIS software. A strong QA/QC processes is then applied to validate the empirically-based mapping effort. Preliminary mapping efforts are focused on areas around the 33 NWT communities. The second component of this project will involve training northern students and project partners to use this method to create inventory maps for the entire NWT and the adjacent Provincial/Territorial transboundary watershed areas. Outputs will provide information relevant to all NWT regions, inform and validate modeling efforts, and support community climate change adaptation.

EXPANDING THE GEOGRAPHIC COVERAGE OF THE CANADIAN AQUATIC BIOMONITORING NETWORK IN CANADA

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The Canadian Aquatic Biomonitoring Network (CABIN) is a national program led by Environment and Climate Change Canada (ECCC) that promotes inter-agency collaboration and data sharing through standardized collection techniques for stream biomonitoring and a national shared database for partners. Thus, allowing access to consistent and comparable data for reporting on freshwater aquatic ecosystem health. Although over 10,000 sites (mostly in stream habitats) have been sampled across Canada, national coverage has yet to be achieved as the majority of sites are in south-central areas and on the west and east coasts. Canada's north, i.e., the territories and provincial northern areas with permafrost, covers two thirds of Canada's landmass. Although monitoring in the north provides critical information about the effects of climate change, major challenges to expanding CABIN to the north includes, not only the remoteness, but also an absence of suitable streams as vast areas of Canada's north are covered by critical wetland habitat. To address these challenges, ECCC is taking a multi-level approached including; 1) promoting community based monitoring in areas of local interest, 2) developing additional training formats that may better meet community needs, 3) launching a training program for a recently released wetland sampling protocol, 4) focusing on engaging Indigenous communities, and 5) proactively reaching out to northern communities (5th CABIN Forum in Yellowknife, NT, October 2019) to

initiate dialogue and seek input during the development of a Northern Biomonitoring Plan.

PAME WORKSHOP ON MARINE PROTECTED AREA NETWORKS IN THE ARCTIC

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The Protection of the Arctic Marine (PAME) Working Group of the Arctic Council released its Framework for a Pan-Arctic Network of Marine Protected Areas (2015), which describes an "ecologically connected, representative and effectively-managed network of protected and specially managed areas". PAME further contributed to the advancement of the Framework through a series of workshops, the outcomes of which have been incorporated into the PAME Arctic MPA Toolbox, a practical, hands-on resource for MPA programs and partners in advancing the design and implementation of MPA networks in the Arctic region. Previous workshops have been on the topics of 1) Science and Tools for Developing Arctic Marine Protected Area (MPA) Networks: Understanding Connectivity and Identifying Management Models(2016), 2) Understanding MPA Networks as Tools for Resilience in a Changing Arctic(2017), 3)MPA networks in a changing Arctic Climate(2017). In March 2019, Canada, in partnership with Inuit Circumpolar Council, hosted the 4th PAME MPA workshop in Cambridge Bay, Nunavut, at the Canadian High Arctic Research Station. The focus of this workshop was to explore ways to advance Indigenous and local leadership and involvement in marine conservation in the circumpolar Arctic Ocean. The workshop convened Indigenous and community representatives, MPA experts, leaders on Indigenous and community engagement, and other Northern partners. Discussions at the workshop focused on ways to support a spectrum of Indigenous and local involvement in marine conservation, and collaborative leadership in advancing understanding of Indigenous and local involvement in the identification, design, management and monitoring of MPAs. The importance of including Indigenous and local people and knowledge in marine conservation is evident; however it is acknowledged that many challenges still remain. This presentation will provide an overview of PAME's MPA work, including the MPA Toolbox, and highlight the key outcomes from the 4th PAME MPA workshop, including successful initiatives and recommendations identified by workshop participants for future development.

MICROBIOLOGICAL AND CHEMICAL DRINKING WATER QUALITY IN POND INLET, NU

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As documented by local researchers, many residents of Pond Inlet, NU, have concerns about the quality of their drinking water. These include biological regrowth in water storage tanks and seasonal variability in aesthetic water quality parameters like turbidity. Previous work by Dalhousie University researchers also found evidence of high concentrations of metals including iron, manganese, copper, and lead in point of use drinking water samples. This study represents a comprehensive yearlong assessment of microbiological and chemical drinking water quality in Pond Inlet. Water samples were gathered from source to tap along the trucked water system by local researchers and researchers from Dalhousie University. Samples were analyzed onsite for turbidity, pH, chlorine, and adenosine triphosphate (ATP), a measure of microbiological activity. Subsamples were shipped to Dalhousie University, where they were analyzed for organics and metals. A subset of samples was also analyzed for bacterial DNA. The results indicated that many of the drinking water quality issues in the community were related to the source water quality because there is no formal water treatment. Microbiological activity as measured using ATP varied by sample location and by season and was highest in the source water and in the summer months. The bacterial communities in tap water samples from different buildings were complex and distinct from one another at the family and genus level, indicating that local conditions in each the storage tank and the plumbing system of each building influenced the microbial quality of the drinking water at the point of use. Iron, manganese, and turbidity at the

taps originated in the source water and varied over the course of one year. Other water quality issues, notably copper and lead release, were related to the premises plumbing in individual buildings. These findings have direct implications for microbiological and aesthetic water quality, lead and copper release from plumbing system components, treatability, and the development of appropriate interventions to remediate drinking-water-related health risks in Pond Inlet. The results will be used directly to inform the ongoing development of a collaborative water safety plan for the community.

UNDERSTANDING, MONITORING AND PREDICTING PERMAFROST THAW ENABLE FORWARD-LOOKING ADAPTATION

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Canada's Arctic and high-mountain areas will be pervasively and persistently reshaped by climate change during this, and likely also subsequent centuries. In this context, forward looking adaptation depends on anticipating and predicting future environmental conditions and trajectories of change. As environmental conditions move outside the realm of previous human experience, this is best enabled by approaches that combine multiple disciplines, sectors, and knowledge systems. The physical changes occurring in thawing permafrost exert key control on environments and infrastructure and also, they are relatively well understood. For this reason, improved quantification of permafrost change, including the provisioning of corresponding climate services, is likely to be an important enabler for adaptation efforts.

ASSESSING THE IMPACTS OF VESSEL TRAFFIC ON BELUGA WHALES

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Vessel traffic negatively affects marine mammals by causing behavioural disturbance, acoustic masking, contamination (i.e. oil spills), and ship strikes. Few studies have examined the effects of vessels on marine mammals in the Arctic, but beluga whales appear to be especially sensitive to vessel traffic. Here, we examine how the vocalizations of belugas are impacted by vessel traffic in the Tarium Niryutait Marine Protected Area in the Mackenzie River estuary of the western Canadian Arctic. Between one and four acoustic recorders were deployed between June and August each year between 2015 and 2018 near the only shipping channel at this site. We examined beluga vocalizations from acoustic recordings over four summers, and assessed how the distance to the nearest vessel passing the acoustic recorder affected the number of vocalizations. Beluga vocalizations within the range of the acoustic recorder decreased significantly when vessels were within 5 km of the acoustic recorder. This result suggests either that belugas are avoiding the vessel or that they reduce their vocalization in response to vessel traffic. Future work is needed to assess exactly how belugas are reacting to vessel traffic in this area, and what the long-term consequences of these reactions are. Management measures for reducing these impacts must be carefully considered, especially since these vessels are very restricted in where they can travel, and many of the vessels are necessary for the livelihoods of local communities.

UNDERWATER NOISE IN THE ARCTIC: A STATE OF KNOWLEDGE REVIEW

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Underwater noise in the Arctic has been recognized as a potentially significant issue for some time but is now of increasing concern given the recent and

expected increase in anthropogenic activity. In order to identify information gaps and potential solutions, we have conducted a review of the scientific literature on Arctic underwater noise. The Arctic submarine acoustic environment remains in many areas relatively pristine. Background noise is largely determined by ice as well as sea surface conditions and can be exceptionally quiet during the ice covered period. Sound propagation is also unique compared to other oceans, with the exception of Antarctica. Although fairly narrow in focus and geographic coverage, a substantial amount of work on anthropogenic noise impact in the Arctic has occurred. This has mostly involved bowhead whales in relation to oil and gas development in the Alaska north slope. There exists very little or no information on the acoustics of Arctic marine fish or invertebrate species. There has also been no work focusing Arctic submarine soundscapes as indicators of ecosystem response to climate change. Application of noise work from subarctic regions to the Arctic, including mitigation and management strategies, is a useful starting point but how these should be adapted and applied is an important issue that needs to be fully addressed.

TANGO WITH TALBOT: THE EFFORT TO INVESTIGATE OCEAN FORCING IN THE LARGEST ICEBERG PRODUCING INLET IN CANADA

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Talbot Inlet, on the SE coast of Ellesmere Island, contains a seemingly impenetrable mélange of icebergs. The icebergs are mainly calved from two glaciers, Trinity and Wykeham, that terminate at the head of the inlet. These two glaciers alone account for ~62% of total iceberg discharge from all of the several hundred marine-terminating glaciers in the Canadian Arctic. Since the year 2000 these two glaciers have more than doubled in speed and their termini have retreated by up to 5 km, a pattern vastly different from surrounding glaciers. What is driving the anomalous retreat of glaciers in Talbot Inlet? Here we describe a multiyear effort to investigate the potential for ocean forcing to be the driver of glacial retreat in the challenging field site of Talbot Inlet. Widespread retreat of marine-terminating glaciers in Greenland has been linked to the northward propagation of warm subsurface Atlantic Water in eastern Baffin Bay, indicating that ocean-driven melting could be an important factor in Talbot Inlet. We present new findings from a 2019 research cruise on the polar yacht Vagabond to address this question, including an extensive oceanographic and bathymetric survey of the eastern Canadian Arctic Archipelago. We provide context for recent field observations by analyzing historical ocean profiles since 1916 to understand changes in the properties and distribution of Atlantic Water, and discuss results from ocean model simulations to investigate the circulation patterns of Atlantic Water across Baffin Bay, and its potential to drive retreat of Canadian tidewater glaciers.

ARE SEABIRDS A VECTOR OF MICROPLASTICS IN ARCTIC ECOSYSTEMS?

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Plastic pollution is now known as a global contaminant of concern with documented presence and effects in both marine and freshwater ecosystems. Since 2003, Arctic seabirds have been studied to identify which northern marine seabird species are vulnerable to ingesting plastic pollution. Currently, there are a number of species known to ingest plastic pollution. Recent studies have also shown that these ingested particles are shed in the form of microplastics via guano. This suggests that Arctic marine seabirds may act as a vector for the movement of microplastics into northern ecosystems. In collaboration with local community members in Qikiqtarjuaq, Nunavut during the summer of 2018, a variety of environmental samples were taken at the Akpait and Qaqulluit National Wildlife Areas (NWA). These NWAs are vital breeding and migratory habitats for Northern Fulmars and Thick-billed

Murres. If these two species are acting as a contaminant vector, high concentrations of microplastics would be expected in and beneath the colonies. Concentrations are expected to vary depending on proximity to the colony, i.e. further distance from the colony would result in decreased microplastic concentration; thus, a halo effect. Environmental samples including water, air, sediment and blue mussels were taken to test this halo effect. Samples were collected below the cliff-side colonies, and at increasing distances from the colony edges. Samples were then analyzed for microplastic quantification and categorization. A representative subsample of particles was analyzed via Raman Spectroscopy to determine the polymer type and confirm that particles were anthropogenic. Microplastics were identified in all types of samples; however, the particle type varied among sample type, i.e. mussels, air, water, and sediment. There is a slight decreasing trend in microplastic quantity as it relates to the distance from the colony, suggesting marine seabirds are a possible vector of microplastics in the north. Yet, further research is warranted in order to understand the extent to which these seabirds transport plastics, and how concentrations may change depending on proximity to large migratory habitats. This work will contribute to our collective understanding regarding the fate and transport of microplastics in Arctic ecosystems.

NORTHERN VOICES IN A NATIONAL ASSESSMENT ON CLIMATE CHANGE ADAPTATION IN CANADA

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Natural Resources Canada (NRCan) is in the process of producing an assessment report focusing on the state of climate change adaptation in Canada. The report assesses the state of adaptation regarding issues of national scope, it also includes a series of chapters focused on adaptation on a regional scale. For this edition of NRCan's national assessment, the chapter focusing on northern Canada is being led out of Yukon College, where the coordinating lead author and coordination team are housed. This represents the first time the northern chapter has been led from northern Canada. It is being assembled using text contributions from authors across Canada's northern regions under the guidance of a northern advisory team. This presentation highlights the efforts made by the chapter's coordinating team to embed northern perspectives throughout the northern chapter of the report, and will profile the key messages identified for inclusion in the chapter: 1) Northern Canada's biophysical environment is being stressed by new forms of disturbance; 2) Impacts from extreme changes to the cryosphere are only partially understood; 3) Previously relied-upon indigenous and local knowledge about safe travel on the land are vulnerable due to the rate of climate change; 4) Climate change is impacting the health of northerners; 5) New forms of Northern resilience and vulnerability are emerging out of modern governance, innovation, and economic development; and 6) Many types of capacity are required to adapt to climate change in Canada's North. A key enabler for this work was coordination between NRCan, and Crown Indigenous Relations and Northern Affairs Canada which funded the Northern involvement in this assessment report via the Climate Change Preparedness in the North program.

BEHAVIOUR, ABUNDANCE, AND HEALTH: LEARNING ABOUT DOLPHIN AND UNION CARIBOU WITH PLACE-BASED KNOWLEDGE FROM 2003.

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Dolphin and Union caribou are central in Inuit culture and important for subsistence in Ekaluktutiak and Kugluktuk, NU. The Committee on the Status of Endangered Wildlife in Canada assessed this herd as endangered in December 2017 because of threats such as sea ice conditions, development and harvest. We need to facilitate the meaningful consideration of Traditional knowledge in co-management discussions to collaboratively protect these caribou. In 2003, the Government of Nunavut interviewed 15 Ekaluktutiakmiut and 15 Kugluktukmiut about Dolphin and Union caribou in response to concern about harvesting rates and caribou drownings. Due to capacity restraints, this data remained largely unanalyzed until a collaboration formed with the University of Calgary in 2017. We analyzed the transcripts

with thematic analysis and digitized participatory map overlays in 2018-19. Then, we organized the interview themes according to an emergent cultural framework that centres interconnectivity, caribou autonomy, intimacy with the land, and environmental deviations and considered these in context with the shape-files. In 2003, Traditional knowledge keepers indicated that caribou are seen on Victoria Island and the mainland year-round, and that the caribou migrated between the two locations but not the entire herd. Traditional knowledge keepers said when the sea ice formed later in the season, caribou crowded their staging grounds and moved eastward while waiting for the sea ice to form. They indicated that windier and warmer temperatures caused the sea ice to form later, and that more caribou fell through the ice, than had before. This is behaviour was supported by channeling on the fall migration route maps. Ekaluktutiakmiut and Kugluktukmiut also described differing caribou population statuses in 2003: Ekaluktutiakmiut reported having saw many more caribou than the 1970s, while Kugluktukmiut reported seeing fewer caribou than the 1980s. This was reflected in the contraction and shifting concentration of hunting ranges. Traditional knowledge keepers reported syndromes consistent with Brucella suis (swollen/watery legs joints and limping animals), Taenia krabbei (small, white muscle cysts), Besnoitia tarandi (rash and hairlessness on legs), and non-specific syndromes consistent with pleuritis, peritonitis, splenomegaly, and green muscle/puss. Considering the insights gained from the Traditional knowledge keepers into observed abundance, health, and behaviour together with the shape-files, the results suggest that the caribou shifted eastward sometime between 1980-2003. Maintaining the relationships between Traditional knowledge and place throughout the analysis helped to highlight the differences and similarities between Ekaluktutiakmiut and Kugluktukmiut knowledge. Future habitat research and protection for Dolphin and Union caribou should include information from across the range in order to be representative of the herd and effective for management.

INCORPORATING TRADITIONAL KNOWLEDGE INTO THE PARKS CANADA WESTERN ARCTIC FIELD UNIT ECOLOGICAL INTEGRITY MONITORING PROGRAM

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In Canada's Western Arctic, the Yukon North Slope has been and remains an active hunting territory of the Inuvialuit of the Western Arctic. From their communities in Aklavik and Inuvik in the Northwest Territories, the Inuvialuit rely on the Yukon North Slope for their subsistence livelihood, travelling by boat, foot, all-terrain vehicle or skidoo to hunt, trap and fish along the coast, foothills and mountains of the Yukon North Slope. The Inuvialuit Final Agreement (IFA) was legislated in 1984 and confirms the management priority for the Yukon North Slope including Ivvavik National Park as the conservation of the land, waters, wildlife and Inuvialuit traditional use. Working in such a vast and remote environment, undertaking long term and regular wildlife monitoring activities is a difficult and expensive endeavor. The ability to detect changes in status of wildlife populations and to use this information to act promptly with suitable management actions is challenging. The Porcupine caribou herd migrates through 250,000 km² of northern Alaska, Yukon and the Northwest Territories. Ivvavik National Park protects a significant portion of the herd's calving ground. Monitoring its population size is important for managing the herd and determining its current status in accordance with the Porcupine Caribou Management Agreement (1985). The Porcupine caribou herd population size is used as a measure to assess the ecological integrity of Ivvavik National Park. In every national park, Parks Canada monitors ecological integrity to study trends in ecosystem health over time that are relevant to park management and cooperative management partners. Currently Parks Canada does not include Traditional Knowledge in any of the Western Arctic national parks ecological integrity monitoring programs. Inuvialuit Traditional Knowledge would significantly contribute to helping understand and manage and monitor wildlife population health status. In Ivvavik National Park, Parks Canada is applying new approach to include Traditional Knowledge into the existing Porcupine Caribou Ecological Integrity measure. Specifically, data on Porcupine caribou fat thickness gathered from harvesters interviewed from the Aklavik and Inuvik Hunters and Trappers Committees will be incorporated into the existing measure. By incorporating this knowledge, observations by subsistence harvesters of thinner caribou may be able to predict an impending population decline long before detection by conventional population surveys. The Arctic Borderlands Ecological Knowledge Society (ABEKS) community monitoring program annually gathers information from active harvesters through a questionnaire. Since 1996,

ABEKS has been conducting these surveys in the Western Arctic from active community land users on recorded observations of animals, plants, land, weather and community and have developed a rich database of information for community and scientific research. Combining this knowledge into the Parks Canada's Ivvavik National Park's Ecological Integrity monitoring program will enhance Parks Canada ability to have better informed, more timely and effective decision-making on the Porcupine Caribou herd's health and conservation.

ADVANTAGES OF A PROPOSED U.S. HIGH ARCTIC RESEARCH CENTER IN THE CONTEXT OF A NORTH AMERICAN ARCTIC FACILITY COLLABORATIVE NETWORK

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There is no existing framework for developing an integrated group of North American research facilities that are inter-operational and coordinated in their efforts to maximize progress with respect to Arctic issues. There would be significant advantages to developing such a framework to facilitate collaboration between North American research facilities. The UArctic program and the Arctic Council, among others, have been coordinating research across all the Arctic Nations; with significant progress in the multilateral arena. The North American nations have the unique advantage of being close allies, with similar Arctic policies, working in close physical proximity to address environmental and security issues that affect each countries' Arctic territories and Northern populations. A framework to enhance this collaboration and partnership could greatly benefit North American nations for several reasons: 1) coordination would allow for complementary and synergistic research and resource allocation; 2) cooperation would allow for increased knowledge of, and access to, expanded capacities and facilities; and 3) collaboration would allow more efficient information sharing and thus enhanced problem-solving on North American-specific concerns. The spectrum of mutual interests across the North American Arctic include environmental stewardship, economic development, regional security, community health and wellness, domain awareness, search and rescue, and emergency response. The scarcity of infrastructure and resources to inform decision makers and address evolving and growing Arctic issues can be most effectively employed by coordinated efforts of North American countries, and by joint use of facilities to serve scientific, response, and security needs. As new facilities are developed, and old facilities refurbished, there are opportunities to coordinate and collaborate during facility planning stages to serve mutual benefits across North America. We will look at one example of a proposed new U.S. High Arctic Research Center to consider opportunities for such mutual benefits. The most expedient and flexible option for a North American Arctic Research Facilities Collaborative is to follow the example of the Arctic Coast Guard Forum (ACGF) and conclude a non-legally binding political commitment to cooperate. In this model, the U.S., Canada, and Greenland (Denmark) could sign a Joint Statement to indicate government approval and endorsement of their individual research facilities' collaboration, as embodied in a flexible, nonbinding, guidance document. Each research facility in North America working on Arctic issues would be able to sign on and operate according to such an agreed set of cooperation commitments and collaboration pathways. The guidance document for a North American Arctic Facility Collaborative should be clear and flexible, establishing regular chains of communication, common standards, terms, operating procedures, and best practices between the institutions. These parameters and strategic goals could evolve as needed to accommodate future scenarios or participants. A North American Arctic Research Collaboration could have representatives convene annually, with working groups meeting as necessary, and ongoing collaboration throughout the year. The Collaborative could potentially coordinate and communicate with Arctic Council or UArctic initiatives as directed by the relevant governments.

THE TR'ONDËK HWËCH'IN TEACHING AND WORKING FARM: IMPROVING FOOD SECURITY IN YUKON THROUGH AN INNOVATIVE SOCIAL ENTERPRISE

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Indigenous households across Canada experience food insecurity at a rate nearly twice that of non-Indigenous households (Council of Canadian Academies, 2014). To help address this issue locally, the Tr'ondëk Hwëch'in (TH) partnered with Yukon College to create a farm capable of sourcing fresh produce and other food

staples in a sustainable way within TH traditional territory and Settlement Lands. The project received $500,000 from the Arctic Inspiration Prize to build an extended-season (year-round), cold-climate greenhouse, the first of its kind in Yukon. The greenhouse will be powered by biomass (woodchips) and is initiating unique product development including horseradish, kimchi and oyster mushrooms. The farm is currently raising a number of different animals including turkeys, chickens, rabbits, pigs, ducks and one goose. And, as the North has very few worms, they have now started vermiculture production. One of the farm's proudest accomplishment to date, is becoming a registered egg grading facility - the only one in the Klondike. The farm's aim is to improve food security and create employment opportunities for marginalized individuals through an economically viable social enterprise.

MONGOLIAN REINDEER HERDERS, TRADITIONAL KNOWLEDGE AND TOURISM

Hatcherson, Jean

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Tourists to northern Mongolia increasingly visit Dukha reindeer herders' camps, a small group comprising roughly 280 people in 58 families. Remote and few in number, the migrating Dukha are the only human inhabitants of the taiga of the Eastern Sayan Mountains. While many welcome tourists, their year-round entry to Dukha camps is unregulated; the timing and context of these visits, including compensation and accommodation, unpredictable. This study is based on qualitative information obtained over three visits to the east and west taiga between 2016 and 2019. Data were obtained using: guided, open-ended interviews (N=16) and a modified pile sort (N=30 families) regarding tourism; structured interviews regarding foraging and plant use (N=6 individuals); and participant observation (N=30 families). Results show most Dukha welcome tourist visits. Some enterprising herders utilize their dominant cultural and social capital to earn more cash. Most Dukha forage wild plants for home use, not tourist consumption. While statistics show more reindeer and Dukha living in the taiga today than 10 years ago, questions of culture loss remain. Some fear the disappearance of their native Tuvan language while others worry about the effect of climate change on the survival of their reindeer, and therefore themselves. Keeping in mind research results, current literature on indigenous tourism reveals increased global interest in indigenous languages and knowledge systems, particularly in the north, in regards to sustainable land use, and the cultural importance and market potential of local foods. By supporting Dukha owned and controlled ethnographic and specially focused economic initiatives, added opportunities for tourism and for information sharing among the Dukha and others could occur. This could bolster both income and the generational transfer of cultural knowledge, thus helping to ensure the survival of Dukha traditions.

PUTTING COMMUNITY VALUES ON THE MAP: LINKING INUIT COMMUNITY CONSERVATION PRIORITIES WITH A REGIONAL CONSERVATION STRATEGY

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As nature conservation increasingly becomes a global priority, more efforts are being made to involve Indigenous and local communities. With different approaches to conservation, it is important for planning and decision-makers to encourage synergy. Here, we focus on the Inuit community of Sanikiluaq, Nunavut, Canada, that is planning a protected area known as Qikiqtait in the Belcher Islands Archipelago. We examine how conservation priorities derived from the community-driven approach compare with priority areas from a draft regional conservation plan created by a national conservation organization, the World Wildlife Fund for Nature Canada. Using geographic information systems, we elicit similarities and differences between conservation priority areas identified by the two plans. The community-driven plan was produced at a workshop in Sanikiluaq and identifies sites of interest prioritized using three levels of importance. The regional conservation plan provides three scenarios based on three different conservation targets. Those plans result from a data-driven conservation planning exercise conducted using the systematic conservation planning tool Marxan for the entire Hudson Bay region and part of the Eastern Canadian Arctic. A gap analysis illustrates how different forms of data and knowledge influence conservation priorities and a critical comparison highlights the spatial overlap and differences between both plans. We conclude by highlighting the importance and value of both approaches, and recommendations on how they can best work together

to meet the goals and strengthen relationships between all parties.

WHO IS OUT? UP TO THE MINUTE MONITORING AND SHARING FOR HUNTER SAFETY, YOUTH ENGAGEMENT, AND HARVEST STUDY USING NUNALIIT

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Economists, biologists, and geneticists looking at sustainable harvesting in Gjoa Haven, Nunavut needed a solution for understanding the frequency, duration, and costs (money & time) of harvesting activities. Hunters were interested in participating but needed a simple and useful device to help with navigation and communication, particularly in situations where their safety was at risk. A number of factors needed to be considered to have the system benefit everyone involved. - Many hunters were already interested in carrying a small GPS device with on-board maps. - A second or larger device would be too bulky. - Satellite communications were desireable enable communication between hunters and calls for assistance. - There needed to be an easy way for hunters to submit observation and event data. - Youth training opportunities would add value to the project. - The researchers needed an efficient way to collect, process, and analyze the data. - Hunters and researchers both wanted to visualize the data as it came in. The Geomatics and Cartographic Research Centre designed a unique open source solution based on the Nunaliit framework and deployed synchronizing instances of the system with distinct interfaces for hunters in Gjoa Haven and researchers in the south, including a pair of "Who Is Out?" digital map TV screens. Nunaliit (http://nunaliit.org) is an open-source framework used to build systems for interactively collecting, connecting, presenting, and preserving knowledge with a special focus on mapping and visualization. Nunaliit has been co-designed over the past 15 years with a global group of Inuit and other Indigenous community knowledge holders and researchers, academic researchers, and organizations at all scales and across a large number of disciplines. It is used by community organizations, governments, and academics for mapping traditional knowledge, documenting languages and their connections, exploring digital collections of artworks and cultural heritage objects, planning and decision support, visualizing research networks and licensing, exploring connections to place in media, and many more applications. Nunaliit is designed to be interoperable with other systems and to facilitate multiple distributed instances capable of multi-way synchronization. This has positive implications for broader research teams that include communities where offline and filtered versions of repositories need to be operated by different groups for technical, administrative, and ethical reasons. This presentation will describe how up-to-the-minute acquisition of harvest study data was added to the framework and how a multi-faceted system like Nunaliit can help to build sustainable technology capacity within communities for digital stewardship of community knowledge for science, heritage, language, etc. Bio: Amos Hayes is the Technical Manager at the Geomatics and Cartographic Research Centre at Carleton University. He is the architect of the Nunaliit atlas framework and oversees its development and deployment in partnership with dozens of community, faculty, and student researchers in Canada and internationally.

THE ROLE OF HUMMOCK MICROTOPOGRAPHY AS TRANSITIONAL FEATURES IN THE CHANGING DISCONTINUOUS PERMAFROST LANDSCAPE

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The landscape in northwestern Canada's discontinuous permafrost zone is transitioning rapidly due to climate change-induced permafrost thaw. Elevated forested peat plateaus underlain by permafrost subside with thaw and become inundated by adjacent low-lying wetlands, resulting in the loss of the tree canopy. Increasing hydrological connectivity with the loss of intervening permafrost barriers leads to the drainage of previously-isolated bogs. Hummock microtopography has been observed to develop in these drying peatland environments. However, the role of these microtopographic features in the future trajectory of the transitioning discontinuous permafrost landscape is unclear, including their potential controls on the re-establishment of trees and the hydrological mechanisms governing water movement and storage on the landscape. In order to understand the role of hummocks in the transitioning land cover types of the discontinuous permafrost zone, research was conducted at the Scotty Creek Research Station, Northwest Territories to measure hummock and black spruce tree physical characteristics and assess tree and hummock spatial coverage in peat

plateaus, bogs and the advanced transitional feature referred to as treed bogs. Canopy coverage in all land cover types of the basin was assessed using a canopy gap fraction model based on Light Detection and Ranging (LiDAR) data. Hummock areal coverage was determined from drone imagery and a digital terrain model. Hummocks, which are not underlain by permafrost, support the establishment and growth of black spruce trees. The suitability of hummocks to support tree growth is likely a function of soil moisture, with flank soil moisture of hummocks in treed bogs intermediate between those of the relatively dry, elevated forested peat plateaus and the low-lying bogs with sparse tree cover. Black spruce trees on peat plateaus and in treed bogs are significantly taller and of greater diameter than those growing in bogs. The spatial distribution of hummocks and the canopy coverage of black spruce trees in treed bogs collectively suggest that these landscape features may play an important role in the advanced stages of the permafrost thaw-driven transition of the discontinuous permafrost landscape.

BARRIERS AND ENABLERS OF MOBILIZING INUIT KNOWLEDGE IN FISHERIES CO-MANAGEMENT IN NUNAVUT

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Since its signing in 1993, the Nunavut Land Claims Agreement (NLCA) has mandated that all wildlife management in Nunavut be a collaborative effort between government and harvesters (while the ultimate authority remains with the relevant minister). To that end, the NLCA established a co-management board, namely the Nunavut Wildlife Management Board (NWMB), along with regional wildlife organizations. While co-management is by definition collaborative, the extent of the shared and/or devolved responsibilities varies. Nunavut fisheries co-management has repeatedly been found to be a predominantly top-down approach that relies heavily on western scientific data collected and compiled by DFO scientists. Investigating if and how different knowledge systems are incorporated into fisheries governance in Nunavut, I interviewed 29 harvesters and Elders in three different Nunavut communities (Naujaat, Pond Inlet and Iglulik). The thematic analysis of their answers revealed a number of barriers as well as enablers of mobilizing Inuit knowledge in wildlife co-management in Nunavut. Prominent among the barriers are the colonial history, language barriers, and various imbalances between the ones governing and the ones being governed. Further, there seems to be widespread disappointment in how the NLCA has been implemented to date. Changes in the significance of hunting as well as some erosion of the traditional Inuit knowledge system also pose challenges to the inclusion of the latter in today's wildlife co-management. On the other hand, the documentation of traditional Inuit knowledge, intercultural and intergenerational learning as well as Inuit-led research and knowledge co-production have been identified as enablers of Inuit knowledge mobilization. These enablers point towards greater collaboration and equal footing among the co-management partners. The barriers, in contrast, are all reflections of a current imbalance that is the result of colonization. While the traditional balances that guided life in pre-contact times cannot be recreated due to colonial disruption, new balances are still attainable and need to be sought out in the continued implementation of the NLCA, including in wildlife co-management.

TOXOPLASMA GONDII IN CARIBOU (RANGIFER TARANDUS) FROM NUNAVIK, CANADA.

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Caribou (Rangifer tarandus) are considered cultural keystone species by Inuit communities in Canada, making them part of Inuit livelihoods, knowledge and identities for generations. As well, caribou are important for food security, ranked within the top five dietary sources of energy for Canadian Inuit. The consumption of wildlife, like caribou, is generally desirable but may also increase the risk of infectious disease transmission to humans, including Toxoplasma gondii, a protozoan that has been reported in Nunavik communities with a prevalence of 60%. The aim of our study is to search for evidence of the parasite in caribou samples using serological and molecular techniques. In collaboration with the Nunavik Hunting, Fishing and Trapping Association (NHFTA), heart and brain samples were obtained from 53 hunted caribou between 2017 and 2018, from 2 different

communities in Nunavik (Tasiujaq and Umiujaq). Heart fluid was recovered from hearts and tested by an enzyme-linked immunosorbent assay (ELISA), an indirect fluorescent antibody test (IFAT), and a modified agglutination test (MAT). The overall prevalence of antibody to T. gondii in heart fluid samples by ELISA was 19%; however, all samples were negative by IFAT and MAT. DNA of T. gondii was not detected on magnetic capture sequence-specific DNA extraction and quantitative PCR (MC qPCR) in brain and heart. To resolve these discordant results, we will perform PCR targeting different loci; any positives will be sequenced to determine the presence of other coccidian parasites or atypical strains of T. gondii that might not be detected using the magnetic capture method. This study provides insight into the currently available tools to detect T. gondii as a food-borne hazard, and will help better understand if there is a potential risk of transmission to human populations who harvest and consume caribou.

QUALITATIVE EVALUATION OF A WORK-INTEGRATION SOCIAL ENTERPRISE APPROACH FOR TRAINING AND EMPLOYING INUIT YOUTH IN THEIR COMMUNITIES - THE SMARTICE TECHNOLOGY PRODUCTION CENTRE

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In northern Labrador, Inuit youth face a host of structural challenges that create barriers to employment. These challenges include a rapidly changing climate, food insecurity, trauma exposure, and limited access to sustainable employment options. Little is known about how training programs can be adapted from high-infrastructure, urban environments to remote Indigenous settings like Nunatsiavut in Inuit Nunangat. SmartICE, an innovative, work integrated social enterprise, is contributing new knowledge in this area through its northern-based technology production centre (NPC) located in Nain, Nunatsiavut. Inuit youth trainees at the NPC learn how to assemble the SmartBUOY, a stationary sea-ice thickness sensor for deployment in communities across Inuit Nunangat. Training is holistic, person-centered, and culturally responsive. The technical training components of the program are coupled with employment supports, social emotional skill development, and time spent engaging in traditional activities. SmartICE has partnered with SRDC to conduct a developmental evaluation of the NPC program. Semi-structured, open-ended qualitative interviews were conducted with trainees (n=4) and trainers (n=3) at the NPC. Early findings indicate positive program outcomes and underline the importance of providing emotional support to trainees; establishing a safe and inclusive learning environment; and offering opportunities for self-directed and hands-on learning. These findings have been used to inform the development of a quantitative outcomes survey piloted with a subsequent cohort of trainees. The SmartICE NPC program constitutes a promising model for sustainably training and employing Inuit youth within their local context. Evaluation findings contribute to our emerging understanding of best practices for adapting a work-integration social enterprise approach for Inuit youth seeking employment in their communities.

HOW EXISTING MARINE PROTECTED AREAS CAN HELP INFORM THE CREATION OF AN INUIT-LED MANAGEMENT AREA FOR THE PIKIALASORSUAQ

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The Pikialasorsuaq/North Water Polynya (NOW) is located in northern Baffin Bay/Smith Sound and is shared by Canada and Greenland. Because of its standing as the largest and most productive polynya in the Arctic, the NOW was identified as an Ecologically and Biologically Significant Area (EBSA) in 2011. It is a summer refuge for birds and provides valuable summer mating, rearing, feeding, and resting habitat for many Arctic marine mammals (e.g., beluga, narwhal, bowhead whales, walrus, and several pinniped species), many of which are also known to overwinter in the polynya. The Pikialasorsuaq faces numerous threats, including climatic and environmental change, increased shipping activities, tourism, oil and gas exploration, and development. Because Inuit are best placed to monitor and manage the region, efforts are underway for the

Government of Canada, together with Greenland and Denmark, to support Inuit in leading and developing an integrated management framework for Pikialasorsuaq. If successful, this framework would bring together Canadian and Greenlandic communities, international partners and governments, and NGOs to work cooperatively to manage and conserve this important area. To help inform this process, scientific and local Indigenous knowledge can assist in identifying important ecological features, knowledge gaps, and stressors to Pikialasorsuaq. Additionally, we can look to existing Marine Protected Areas (MPAs) or protection plans which employ integrated management frameworks to provide guidance in the development of conservation objectives and priorities for the Pikialasorsuaq. In this presentation, we compare such networks, including the Barents Sea - Lofoten Area Management Plan - one of the first management plans to apply a management framework across sectors and between government levels, balancing fisheries management actions with those in other marine sectors - and the Beaufort Sea Beaufort Sea Large Ocean Management Area (LOMA), the first in the Arctic to apply the EBSA process, and included data from scientists and local knowledge holders. We will highlight the successes of collaboratively created and managed MPAs within the Beaufort Sea LOMA, and discuss ways these successes can guide the future management for the Pikialasorsuaq Area.

THE IMPORTANCE OF CONTINUOUS DIALOGUE IN COMMUNITY-BASED WILDLIFE MONITORING: CASE STUDIES OF DZAN AND ŁUK DAGAII IN THE GWICH'IN SETTLEMENT AREA

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Rapid environmental change in the Arctic raises numerous concerns for ecosystems, natural resources, and ways of life. Robust monitoring is essential to adaptation and management in the face of these challenges, and community-based monitoring (CBM) programs offer a strong approach for monitoring wildlife species by highlighting local knowledge and resources, ensuring that questions are locally-important, and informing natural resources conservation and management. Implementation of CBM programs can vary widely depending on project goals, the communities, and the partners involved. Here, we describe two examples of CBM programs in the Gwich'in Settlement Area (GSA), Canada, and highlight the process through which local management agencies set research priorities. Dzan (muskrat; Ondatra zibethicus) and łuk dagaii (broad whitefish; Coregonus nasus) are species of great cultural importance and the focus of community-based monitoring programs with concurrent social science dimensions. We share challenges and lessons from our experiences, and provide insight into operating CBM projects in the GSA. Further, we summarize context for working in the GSA, and offer a set of resources for researchers interested in pursuing wildlife projects in this region. CBM projects provide rich opportunities to benefit managers, communities, and external researchers, but careful consideration and thoughtful implementation are necessary.

A MULTI-STAKEHOLDER ASSESSMENT ON SHIPPING RISK GOVERNANCE: CASE STUDY ON THE PROPOSED BAN ON THE USE AND CARRIAGE OF HEAVY FUEL OIL BY SHIPS IN THE ARCTIC

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Global interest in Arctic shipping is increasing as a result of melting sea ice and climate change. The potential risks of increased emissions, oil spills, and noise pollution can substantially affect coastal communities and commercial entities living and working in the Arctic. The International Maritime Organization (IMO) is the intergovernmental body that enables regulations on international shipping activities and is working on banning Heavy Fuel Oil (HFO) in the Arctic. The IMO uses the Formal Safety Assessment (FSA) as a systematic cost-benefit assessment process to evaluate the risks associated with maritime safety and marine environmental protection. The aim of the study is to understand the rationale behind developing the ban on HFO and in particular how and

why FSA was used or not used. By analyzing the method taken for banning HFO, the research evaluates how the risk management process affects high- level decision-making for shipping-related issues in the Arctic region. Preliminary results indicate variance in how stakeholders view a spill of HFO in the Arctic and how the framing of the risk affects input data for assessments, implementation of risk mitigation strategies, and overall risk governance approaches. Results will be used to inform policymakers and ocean governance actors on the Formal Safety Assessment as a risk management strategy for shipping and any risk governance deficits needed to be addressed for effective marine environmental protection of the Arctic region.

BUILDING CAPACITY BY TRAINING EARLY CAREER RESEARCHERS TO CONDUCT PROJECTS THAT ARE CULTURALLY SENSITIVE AND COMMUNITY-COLLABORATIVE

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As the National Committee of APECS (the Association of Polar Early Career Researchers), APECS Canada represents a growing population of polar Early Career Researchers (ECRs) with aims to foster community-collaborative research that is scientifically sound and culturally meaningful. Northern traditional knowledge should be forming the foundational basis of community-based research, however historical approaches to research have often excluded Indigenous voices and traditional ways of knowing. Despite the importance of community-collaboration, many ECRs are uncertain of how to conduct this type of research, feel constrained by funding or time, or are compelled to conform to classic research paradigms. In this presentation, we discuss a framework for a project that will address gaps in the training provided for ECRs working in Canada's North for conducting community-collaborative research. This type of training could build capacity for ECRs working in Canada's North as they pursue careers in social, health and natural sciences, thus leading to greater collaboration between researchers from different disciplines and Indigenous communities. By training researchers at the beginning of their careers, we are building a stronger and more inclusive research environment for the future.

MULTISPECTRAL SERIAL LASER IMAGING FOR UNDERWATER SPECTRAL DISCRIMINATION OF MACROALGAE

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Ice and benthic algal communities are increasingly affected by climate change. These communities provide essential ecosystem services to polar regions and understanding their spatial distribution and abundance is crucial to anticipate the effects of global changes. The development of innovative underwater detection and imaging methods such as LiDAR and multispectral laser serial imaging techniques provides new ways of studying Arctic algal communities. The objective of this work is to develop an automated classifier designed to detect and identify macroalgae and other underwater substrates such as ice algae and coral based on imagery from an underwater multispectral laser serial imager. Macroalgae can be categorized into green (Chlorophycae), red (Rhodophycae) and brown (Phaeophycae) color types based on photopigment assemblages consisting of chlorophylls, carotenoids and phycobilins within their tissues. Photosynthesis in these algae is the result of these photopigments harvesting light energy at certain wavelengths, and differences in

light harvesting efficiencies between photopigments can allow us to associate specific spectral responses to algal types. Since algae have evolved to use parts of the visible light spectrum (i.e. □ 400 - 700 nm), we must work within this interval when using spectral responses to discriminate between algal color types. Hence, by using multiple laser sources within this light spectrum interval as a means to illuminate benthic environments, it is possible to characterize elastic (i.e. reflectance) and inelastic (i.e. fluorescence) spectral responses at different wavelengths by recording the reflected or emitted light from the algae. The information gained through this process can enable us to evaluate the potential for an automated algal substrate classifier. Spectral response images generated using the multispectral laser serial imager initially underwent k-means clustering analysis to evaluate basic automated classification. Although no segmentation (i.e. unsupervised) is done for this analysis, differences in spectral response are apparent and as expected between algal color types. Further, a pixel-wise segmentation and signal / noise filtering was performed using signal intensity thresholding of the same spectral response images. Analysis of the processed data indicates variations in spectral responses between the three algal color groups, corresponding to expected spectral responses based on photopigment efficiency at harvesting light energy. Spectral response probability statistics between macroalgae color types will be evaluated to explore more advanced supervised classification methods and improve classification.

ECOLOGICAL GRIEF IN JAMES BAY: COPING WITH EELGRASS AND WATERFOWL DECLINES IN THE EASTERN SUBARCTIC

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Waterfowl has been pivotal for coastal Cree livelihoods and many aspects of their culture; however, the Cree from Eastern James Bay have experienced drastic declines in the abundance of eelgrass beds and the waterfowl that depend on them. These changes begin in the 1970s following the building of La Grande Complex hydroelectric development. This research is carried out in the context of the Niskamoon Corporation, a university consortium and the Cree Nation in an effort to generate interdisciplinary knowledge to understand and respond to changes in migratory waterfowl and their habitats. In this presentation, I use the concept of ecological grief to examine the sense of loss associated with the multiple ways that ecological change has impacted individuals and communities in Eastern James Bay. I draw on data from fieldwork carried out in the communities of Chisasibi, Wemindji and Eastmain in the summer of 2019. Cree land users report significant changes to the coast biophysical environment that are affecting the abundance of waterfowl in James Bay. They observe changes in salinity and turbidity that are associated with drastic declines in eelgrass beds, a key resource for migratory geese species. These regional level changes affecting the abundance of geese have been compounded by broader environmental change, including Climate Change. These environmental changes have in turn affected traditional land use activities. Geese hunting has been a keystone activity historically associated with local livelihoods and cultural practices. The decline in migratory geese has led to profound, interconnected losses. These include: opportunities to go out on the land for extended periods of time with family, a valued food source and associated flavours and recipes, erosion of local land use management institutions, and knowledge continuity between generations. This research provides empirical evidence of the profound impacts that climate change has in traditional land use activities in Northern Communities. Understanding these impacts can provide a basis to develop culturally sensitive adaptation strategies and reduce vulnerabilities to climate change.

LOCAL ROOTS FOR MPA MANAGEMENT

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The Anguniaqvia niqiqyuam Marine Protected Area (ANMPA), designated in 2016, is Canada's second Arctic MPA, and is the first with a conservation objective (CO) solely based on Traditional Knowledge (TK). The objective of the TK CO is "to maintain the habitat to support populations of key species including beluga whales, Arctic char, and ringed and bearded seals". The knowledge and guidance from Inuvialuit organizations and especially the community of Paulatuk were integral in the designation of the MPA, and are now full partners in the monitoring and management of the ANMPA.In September

2018, the ANMPA Working Group was established, with membership consisting of Paulatuk Hunters and Trappers Committee (HTC) (4 regular members and 1 youth member), Fisheries Joint Management Committee (FJMC) (1 member), and Fisheries and Oceans (DFO) (1 member). The Chair of the Paulatuk HTC joins most meetings, and support staff from the Inuvialuit Joint Secretariat and DFO also attend. Over the last year, the ANMPA Working Group has met five times, focused on development of the ANMPA monitoring plan and developing community-based priorities. The draft Monitoring Plan seeks to generate realistic data and outcomes against which future monitoring results can be evaluated in a credible and defensible way. Consultation, iteration, careful planning, flexibility and paced implementation are critical elements of this first version and cycle of the Monitoring Plan. Eight theme-areas have been adopted for the first ANMPA monitoring plan: Harvest, TK, Unusual Ecological Events, Pressure/threats, Governance, Socio-Economic, Offshore, and Nearshore. Through Working Group meetings, actionable long-term and short-term goals have been developed for each theme. Currently, there are monitoring programs established in the ANMPA, which have already started the process of collecting baseline data to inform future monitoring. The Paulatuk HTC, ANMPA Working Group, and community members have demonstrated leadership in these programs, providing guidance on program delivery, ensuring Inuvialuit rights under the Inuvialuit Final Agreement (IFA) are adhered to, ensuring important land and animals are protected, and by actively participating and leading monitoring programs. Having an active role in governing and participating in the monitoring programs, together with TK, has provided the ANMPA Working Group the expertise and experience needed to lead the development of the ANMPA Monitoring Plan. The Chair of the ANMPA Working Group will describe the importance of integrated management and monitoring of MPAs. He will share his personal experience harvesting on the land, experience working in the ANMPA, and working as a member on Inuvialuit governing bodies, including the ANMPA WG. This will foster discussions on present governance structure, illustrate the importance of integrating TK and Science in monitoring, and mention strengths and challenges from past experiences. This will also showcase the community of Paulatuk's role in developing, implementing and communicating community-based monitoring in the ANMPA.

LOCAL OBSERVATIONS OF A CHANGING ARCTIC AND THEIR ROLE IN FISHERIES CO-MANAGEMENT: THE INUVIALUIT SETTLEMENT REGION

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The effects of climate change on fish, marine mammals, and their supporting ecosystems are becoming increasingly evident in the western Arctic. This presentation compiles observations and concerns from Inuvialuit communities and individuals, outlines how these inform fisheries co-management in the Inuvialuit Settlement Region (ISR), and calls for increased action and research effort to cope with the changes. In 2019, an unusual number and magnitude of changes on the land was observed, including: increased frequency of uncommon and invasive species, unusual timing of major storms, high occurrences of marine mammal mortalities, low water levels in the Mackenzie River, early leads in the sea-ice, unusual tidal patterns, and increased shipping traffic. The Fisheries Joint Management Committee (FJMC) is a co-management body established from the Inuvialuit Final Agreement to assist the Inuvialuit and Canada in fulfilling their rights and obligations within the agreement. The FJMC works with the ISR communities, Fisheries and Oceans Canada (DFO), universities, and other non-governmental organizations, to gather information and ensure effective co-management of fish and marine mammals. The observations from 2019 and past observations have informed FJMC research priorities and funding of relevant research projects, including the ringed seal monitoring project, DFO's Arctic Salmon Project, and the Beluga Monitoring Program. They have also led to the development of partnerships with other organizations and governments to better understand and manage the shared resources. For example, the Inuvialuit-Inupiat Beluga Whale Commission, which meets annually to compare and discuss harvest numbers, unusual observations, and current research, as well as share data and provide recommendations on the shared eastern Beaufort Sea beluga stock. These initiatives have been invaluable in adapting to the environmental changes so far, yet there are increasing pressures as climate change continues to progress. There is concern over the future of the western Arctic ecosystem, where recent changes are directly and indirectly impacting fish, marine mammals, and the traditional lifeways of the Inuvialuit.

THE TUKTOYAKTUK COMMUNITY CLIMATE RESILIENCE PROJECT

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All Arctic communities are faced with similar challenges in a changing climate; the challenge to better understand what the climate driven changes will mean to the future of the Arctic landscape and to the future of the people who live and rely on it for their livelihood. The Tuktoyaktuk Community Climate Resilience Project (TCCRP) was created by the community to tackle this challenge head on. This project under the Tuktoyaktuk Community Corporation (TCC) of the Inuvialuit Regional Corporation (IRC) serves as a means to empower locals to build capacity and knowledge while monitoring climate driven change in the region. The project has three main objectives: 1. Build community awareness and capacity to act on climate change; 2. Empower locals to regularly observe, collect, record and report data about climate change and its impacts; 3. Supporting local educational and leadership weaving traditional knowledge and western science approaches. The TCCRP has trained numerous local climate monitors and has facilitated the continuous monitoring of ice break-up, ice forming, active layer thicknesses, water turbidity and temperature, wind speed, air temperature and plant/leaf bloom dates. This information is being collected on a bi-weekly and even daily basis during the appropriate seasons. The goal of the TCCRP is to establish a series of baseline scientific information, empower community based monitors, youth and the community to take action against climate change. Although still in the early stages, we believe the TCCRP has already been a success story integrating science and traditional knowledge together to build a sustainable program for future generations to learn and adapt to climate change.

BIOTIC INTERACTIONS GOVERN THE DISTRIBUTION OF COEXISTING UNGULATES IN THE ARCTIC ARCHIPELAGO - A CASE FOR CONSERVATION PLANNING

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Coupled with climate change, the mounting loss of biological diversity and wildlife habitat amplify the need for robust conservation planning, even in the most remote areas of the world. In the Arctic, where a warming climate has heightened interest in both marine and terrestrial resources, protected areas may be insufficient (in size and location) to safeguard important habitat of wide-ranging species. At such broad scales, species distribution models (SDMs) can help identify critical habitat for reserve selection and the conservation of biological diversity. In keeping with the Eltonian Noise Hypothesis (ENH) these models are often based on physical variables alone, overlooking fundamental biotic interactions (e.g. herbivory, competition) that might shape a species range. To test the ENH, we estimated the late-winter distribution of two key Arctic ungulates, Peary caribou and muskoxen, whose interactions, although a longstanding concern, remain unresolved. To do so, we applied a maximum entropy modelling algorithm (MaxEnt) using extensive location data - 541 observations of caribou and 1536 observations of muskoxen - sampled from 65 islands and 800,000 km2 in the Canadian Arctic Archipelago. By fitting models using two sets of predictor variables - (1) abiotic only (i.e. topographic, climatic) and (2) abiotic + biotic (i.e. vegetation communities, distance-to-heterospecifics) - we estimated and mapped the habitat suitability for each species and evaluated model performance. We found both sets of models had good predictive ability, although model performance was improved by incorporating biotic variables, specifically, vegetation cover. The strong and positive relationship between late-winter habitat suitability and proportions of grass-lichen-moss and barren-lichen-moss communities suggested that forage resources were a critical limiting

factor for both species - signaling herbivory as the likely driver. Although niche overlap was high based on habitat suitability predictions for each species, areas with high suitability scores were separated spatially and occurred largely outside (~ 85%) protected areas. Importantly, we reject the ENH and demonstrate that biotic predictors can strength the performance of SDMs while sharpening spatial predictions of habitat suitability to include areas of critical resources. For Peary caribou and muskoxen, our findings underscore both similarities and differences in niche characteristics, and a protected areas system that falls short of protecting their critical late-winter habitat.

LIGHT ENVIRONMENT WITHIN AN ARCTIC RIVER PLUME: NEARSHORE CONSEQUENCES, SHORT-TERM PATTERNS, AND UNCERTAIN FUTURE

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Many characteristics of marine plant habitats, such as vertical limits and species composition, can be determined by the availability of light in the environment, which in turn is determined by both the light available at the surface and its attenuation in the water column. In arctic marine environments, annual variation due to the strong seasonality of solar radiation is compounded by the presence of sea ice as well as turbidity in the water column caused by suspended inorganic and organic material (i.e., seston). Rivers and streams can greatly affect the loading of seston in adjacent coastal waters, but little is known of the magnitude and extent of this effect on water column properties and associated plant assemblages in arctic environments. Furthermore, these factors are temporally segregated in arctic environments, with the ice-free summer period also being the period of greatest freshwater runoff. The Salmon River, located near the Inuit village of Mittimatalik (Pond Inlet), drains a large watershed of North Baffin Island into the nearshore environment of Eclipse Sound, and unidirectional longshore currents create a persistent sediment plume along the shore to the east during the ice-free summer months. However, its exact extent varies substantially from day to day, depending on meteorological conditions. In late summer of 2019, we measured the light environment inside and outside of the river plume using a LI-COR PAR sensor for light attenuation profiles and Odyssey PAR loggers for longer term measurements on the bottom at a depth of 20 m. As expected, light attenuated faster within the plume, and this effect persisted for several kilometers along the shore. Bottom levels of PAR at a site within the plume near the river mouth were approximately half those observed at a site just upstream but outside of the plume. In situ observations indicate that a thin surface layer of high turbidity was associated with the freshwater lens created by the river input. Corresponding CTD profiles confirmed that the freshwater signature of the river remained confined to the first few meters of the water column. Sedimentation was also high inside the plume and may directly limit the development of macroalgal assemblages, especially near the river mouth where no macroalgae were observed. In contrast, abundant populations of the dominant kelp, Agarum cribrosum, occurred to depths of 25 m depth at sites upstream of the river mouth. Sedimentation may thus directly limit the development of macroalgal assemblages (either by covering rocky substrata or smothering early life stages) and may be more important than the indirect effects on light availability - untangling these multifaceted effects of turbidity will be challenging. Given the pilot nature of this work, future sampling, especially over different time scales incorporating both seasonal and meteorological variations, is essential for understanding the impact of riverine inputs to coastal marine systems, especially in times of rapid climate change where melting permafrost will contribute substantially to seston loading. Moreover, the relative contribution of such terrigenous factors on the coastal light environment needs to be compared to those of attenuation by sea ice cover and phytoplankton blooms, which are also dynamic and are predicted to change dramatically in the face of global warming.

COUNTRY FOOD PROCESSING TRAINING: AN ON-SITE INITIATIVE IN TWO REGIONS IN THE NORTHWEST TERRITORIES

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Food insecurity remains a serious problem for Indigenous communities in northern Canada, despite proposed and implemented interventions. How governments and bureaucracies create and implement interventions needs to be reconsidered, in order to better align with community-based solutions, participatory research, and current reconciliation efforts. It has been identified that in northern Indigenous communities, there is a lack of necessary training and food processing facilities to produce country foods for trade, communal sales, and food security. A collaborative, community-based training has been conducted in three communities in the Northwest Territories (NWT) as a tool to increase the food processing capacity of communities by teaching food safety, soft business skills, value-added processing, commercial food preparation, and thermal processing. This presentation will highlight the country food processing training held in several northern Indigenous communities and the results of an evaluation on the most recent training session held in Déljne, NWT. The evaluation was conducted to better understand if the training was implemented as planned, if objectives were met and if intended outcomes were achieved. The training was an intensive two-week program with six students from the community. Each student completed pre- and post- questionnaires, and an interview within the training timeline. Interviews were conducted to better understand the perspectives of students on the mobile food processing facility, new food processing techniques, and the new country food products. The pre-questionnaire was used to establish eight outcome indicators on student's knowledge of food safety and various teaching objectives of the training program. The purpose of the post-questionnaire was to measure any change in the established indicators from the beginning of the training and to understand student's experiences with processing country foods. Results indicated that students had an overall positive experience, with a general increase in all of outcome indicators. In addition, the majority of students expressed interest in using the new country food processing methods in cooking not only for the community, but also for economic opportunity. Through interviews, students elaborated on the different options on how they thought the mobile food processing facility should be managed and operated. While the direction for economic opportunity differed among students, all agreed it should be used in some capacity to help those in need within the community. This evaluation is the direct result of relationship building and capacity development from prior research conducted in Déljne. The next step in the path towards food security and sustainability will require communities to decide if a model can be developed that aligns with the vision and needs of the people, appropriate refrigeration infrastructure, and food safety protocols.

AMAP'S NEW LITTER AND MICROPLASTIC EXPERT GROUP

Kalhok Bourque , S. (1) (Presenter), JF Provencher (2)

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Plastic pollution has gained global recognition as a persistent environmental pollutant that can have negative effects on ecosystems and the environment. The Arctic Council's working groups have several ongoing projects that aims to examine how plastic pollution is affecting the Arctic. The Arctic Monitoring and Assessment Program (AMAP) has recently formed the Litter and Microplastic Expert Group (LMEG) that is carrying out a review of all plastic pollution data available in the Arctic, and proposing a suite of monitoring tools that may be employed throughout the region by Arctic nations looking to track plastic pollution and measure how action plans and new policies may lead to changes in environmental levels. We will review the work currently being done by the expert group, and the workplan over the coming years that will be done by the expert group, including the Canadian representatives.

BRIDGING OCEAN AND HEALTH SCIENCE IN THE ARCTIC: CONCEPTS, COMPLEXITY AND COLLABORATION

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The health and well being of coastal communities in the Arctic is inextricably linked to the state marine environments, ecosytems and species. Efforts to account for, and ensure the sustainable continuity of health benefits from the Arctic ocean for coastal communities, as well as to anticipate and proactively respond to emerging public health threats from climate-driven ocean change, must recognize complexity, transcend disciplines, involve multi-stakeholder participation. In this presentation, we elaborate a social-ecological systems framweork to order

the complex, dynamic, and multisectoral interactions and causal interconnections between climate, oceans, and human health in coastal Arctic communities. Embedded in this framework is a crucial need to include Indigenous knowledge and conceptions of health as they relate to marine species, as well as the vast diversity in local contextual factors that mediate relationships between changing ocean conditions and human health. As a case study, we present recent mixed-methods research on selenoneine, a selenium compound found in Arctic marine mammals, that exemplifies the importance of complexity, trans-disciplinarity, and incorporation of Inuit traditional knowledge in toxicology and human nutrition research.

DISTINGUISHING ALPINE VALLEY TERRAIN TYPES BASED ON SURFACE AND SUBSURFACE HYDROLOGICAL PARAMETERS

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As permafrost thaw progresses throughout the north, the corridors northerners use to navigate across the land continue to change. Peat plateaus and other ice rich permafrost features are transitioning to thermokarst and wetland complexes, and the rivers sourced from these contributing areas often exhibit less predictable flow regimes. This transition in landforms puts our infrastructure and water resources at risk as the structural integrity and reliable flow paths previously maintained by the frozen soils become compromised. Alpine systems are particularly susceptible to such changes due to the amplification of the effects of climate warming with elevation; yet the inherent spatial heterogeneity of these same systems makes attempts to quantify the impacts and implications for basin water balance problematic. Hydrological models often apply lumped representations of a given study basin. This is common when few point observations are available within an area of interest. The findings of such work often do not capture the spatial heterogeneity of water inputs, storage compartments, and flow paths responsible for a given basin's water balance. While this approach may be appropriate for areas with relatively homogeneous extents, alpine systems present highly variable hydrological characteristics associated with slope, exposure, and a range of surface and subsurface characteristics. As such, accurate representations of water basin's with contributions sourced from alpine areas would benefit from a detailed account of the current terrain types present and their respective hydrological characteristics. The objective of this study is to describe the dominant terrain types present in a Mackenzie Mountain alpine valley system based on key surface and subsurface hydrological parameters. This presentation documents the range of hydrological parameters considered and the methods by which results are compared to assign values within and between the four distinct terrain types found in the basin. Riparian, mineral rich uplands, organic rich lowlands, and open water are the terrain types classified with this work. Hydrological parameters of interest above ground include evapotranspiration, surface roughness, winter maximum snow water equivalent, slope, and relief. Subsurface parameters considered include hydraulic conductivity, infiltration capacity, field capacity, soil temperature, water table depth, and maximum thaw depth. The findings of this work will provide valuable observations of the spatial and temporal heterogeneity in hydrological parameters of alpine valley systems. The range of observations found in and between terrain types accounts for the spatial component, while varying responses to freshet and summer-fall precipitation events reflect the temporal trends of interest. This work will establish a vital precursor necessary for development of distributed hydrological models that strive to represent and predict the future state of northern permafrost basins and the alpine areas they encompass.

SPRING FLOODING RISK, RECURRING EVACUATIONS, AND VULNERABILITY AND RESILIENCE OF REMOTE INDIGENOUS PEOPLES: THE CASE OF KASHECHEWAN FIRST NATION, NORTHERN ONTARIO, CANADA.

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This article examines how Kashechewan First Nation, located in the flood-prone southwestern James Bay region of northern Ontario, Canada, is affected by the frequent risk of spring flooding. Kashechewan is an isolated and remote Indigenous community (in Treaty 9) located on the North Channel of the Albany River, which is the second-largest river (982-km-long) in Ontario. It consists of the three sub-rivers, the Mammamattawa, Ogoki, and Kengogami. The First Nation has been evacuated 13 times to 20 different host communities across the Ontario province since 2004 (consecutively from 2012-2019) because of actual flooding events or flooding risk and the potential failure of the 5.3 kilometers long and 3.5 meters high ring-shaped dyke wall. Through a collaboration with the First Nation, qualitative semi-structured interviews were conducted with 41 participants. In recent years, spring flood risk has significantly increased the community's physical and socio-cognitive vulnerability. Spring flooding frequently impacts the community infrastructure, traditional spring hunting and harvesting, and the local economy. Results indicate that dealing with the regular flooding risk during spring and recurring emergency experiences have helped to improve the community's disaster preparedness and coping capacity, but residents' experiences during the evacuations are negatively affecting their well-being during and after the evacuations.

"WE NEED TO FIND OUT WHAT WE CAN DO. WE NEED TO TALK ABOUT IT": COMMUNITY-BASED ORGANIZATIONS, EMERGENCY MANAGEMENT, AND COMMUNITY RESILIENCE IN THE KITIKMEOT REGION OF NUNAVUT

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In the face of increasing human activity and natural hazards in the Canadian Arctic, effective community-based emergency response capabilities have never been more essential. In the North, this community approach is essential because of the dispersed population, the limited federal response capabilities in the region, and the vast distances involved. Based on community capacity mapping workshops held in Gjoa Haven, Taloyoak, Cambridge Bay, and Kugluktuk, this presentation will explore the role that community-based organizations such as the Canadian Coast Guard Auxiliary, local Search and Rescue committees, the Canadian Rangers, and other community groups play in bolstering community safety and resilience in the Kitikmeot region of Nunavut. It will discuss the wide array of roles and responsibilities that these groups have assumed, the equipment and training they utilize, how they work together, and lessons learned from their past activities. Finally, this presentation will provide suggestions as to how these community-based capabilities might be strengthened and expanded moving forward.

ASSESSING THE RELATIONSHIP BETWEEN PALSA THERMAL REGIME AND THE TEMPERATURE SENSITIVITY OF GREENHOUSE GAS PRODUCTION

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The Hudson Bay Lowlands (HBL) is the second largest northern peatland in the world, and constitutes a sensitive and globally significant storage of carbon, holding approximately 30 Pg. Much of this carbon is stored in permafrost which, in the Northern portion of the HBL, occurs in palsa fields. However, permafrost degradation in this area has been occurring rapidly as a result of regional climate warming. The purpose of this research is to examine the thermal regimes of palsas and adjacent degradation features, and link this information to the temperature sensitivity of greenhouse gas production from thawed peat, specifically for methane (CH_4) and carbon dioxide (CO_2), to improve understanding of the biogeochemical cycling of carbon in these changing permafrost systems. A representative palsa was selected and, along a transect extending from the palsa surface to the adjacent thermokarst feature, thaw depth was measured by probing in late August 2018 and four thermal monitoring stations were installed. At each station ground surface and top of permafrost temperatures were recorded using MX2303 Hobo data loggers (resolution: 0.04°C; accuracy; ±0.25°C from -40 to 0°C), and snowpack development was monitored using a set of MX2201 (resolution: 0.04°C; accuracy; ±0.5°C from -20 to 70°C) pendant loggers attached to a stake. Peat cores from active layer, permafrost, and thermokarst were collected,

and subjected to long-term anaerobic incubations at 4°C and 14°C to determine CH4 and CO2 production. From this data, Q10 values, which indicate the sensitivity of greenhouse gas production to increased temperatures, were calculated. We found that CH4 had high Q10 values, indicating that production was sensitive to increased temperatures, especially in the active layer. CO2 production was less sensitive, with Q10 values consistently around 2 for all peat types. Oxidation of CH4 is also temperature dependent, where larger amounts of CH4 were oxidized to CO2 at higher temperatures. Thermal monitoring data indicated that thermokarst features adjacent to palsas had warmer conditions at the ground surface with a thermal regime amplitude narrowing rapidly with increasing depth. Due to the drier nature of the palsa, the amplitude of the thermal regime was wider, with high temperatures at the top of the active layer during the warmer months (July and August). The wide temperature range observed in palsas and the high Q10 values of CH4 indicate that palsas may be conducive to short periods of high CH4 production in the lower anaerobic portions of the active layer during the thawing season. However, since CH4 oxidation also increases at higher temperatures where there are dry conditions, much of the CH4 produced at depth is likely to be oxidized during diffusion through the upper aerobic portion of the active layer. Conversely, thermokarst has the potential to produce and emit consistent amounts of CH4 given the steady warm temperatures. Despite the rapidly narrowing thermal regime, the highest rates of CH4 production were observed from samples at the surface of thermokarst, where temperature variations will likely affect CH4 production. In areas such as the HBL where permafrost is degrading and there is a wealth of C available for decomposition, it is important to elucidate physical processes such as temperature that impact biological production of CH4 and CO2 so they can be better accounted for in permafrost carbon feedback models.

EVALUATING SHIP-SOURCE NOISE EXPOSURE FOR MARINE MAMMALS IN THE TALLURUTIUP IMANGA NATIONAL MARINE CONSERVATION AREA

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Tallurutiup Imanga (Lancaster Sound) is a marine area that was established as a National Marine Conservation Area (NMCA) in the summer of 2019. It spans approximately 110,000 square kilometers and is located at the eastern entrance of the Northwest Passage. The area is rich in ecological and cultural significance and provides key habitat for marine mammals such as narwhals, belugas and bowhead whales. Since 1990 traffic in Tallurutiup Imanga has increased dramatically, with the total distance travelled by all vessels doubling between 1990 (51,584 km) and 2016 (124,693 km). It is also expected that the future traffic will also increase due to reductions in sea ice and an expected increase in shipping activities including tourism, fisheries and trade. Therefore, it is important to examine the potential impacts of ship-source noise on marine mammals in this area considering the observed overlap in species location and ship traffic. This ongoing research project aims to: 1) Quantify changing shipping trends in the NMCA from 2015 to 2018 using Automatic Identification System (AIS) data; 2) model the current vessel noise profiles from ship traffic on relevant marine mammal species; 3) estimate areas of high risk noise exposure to marine mammals in the NMCA; and 4) propose management options for reducing noise impacts from increased marine traffic. Our work will provide valuable insight for the current and future impacts of vessel traffic noise and will provide support for the policy and management decisions taken in preparing the NMCA.

IKAARVIK: NEXT STEPS FOR EMPOWERING YOUTH AND COMMUNITY-DRIVEN RESEARCH IN INDIGENOUS COMMUNITIES ACROSS THE NORTH

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Now, more than ever, Arctic Indigenous communities need to be leaders and partners in determining solutions-focused northern research agendas, methodologies, interpretation and communication of results. Ikaarvik is a Laureate of the 2013 Arctic Inspiration Prize and works with northern Indigenous

youth and their communities to identify and act on local research priorities through mentoring, training and capacity building in ways that integrate western scientific and Indigenous world views. Based in Pond Inlet, Nunavut and administered by Ocean Wise Conservation Association, Ikaarvik knows that Northern youth are uniquely equipped to understand, appreciate and utilize Indigenous and science-based ways of knowing and are trained to act as the bridge between scientific research and their communities. Working side-by-side with Inuit, First Nations and research mentors, researchers and community members, Ikaarvik youth facilitate meaningful dialogue to ensure both scientific and local Indigenous perspectives, objectives, interests and concerns are mutually understood and incorporated into Arctic research. Once local research priorities are identified, Ikaarvik youth are empowered to conduct research projects that address one or more of their communities' priorities, receiving training and mentorship from Indigenous and non-Indigenous research scientists, community leaders and Ikaarvik Mentors. To date, northern Indigenous Ikaarvik youth in six communities in Nunavut and Yukon have worked with local leaders to identify research priorities. Some examples of youth-led community-directed projects include impacts of ship traffic on Arctic wildlife, invasive species monitoring, sea ice change, and monitoring changes in Arctic rivers. Ikaarvik youth have also created and published a one-of-a-kind report and recommendations on the integration of Inuit Qaujimajatuqangit (IQ) and science and the meaningful engagement of Indigenous communities in northern research. The concept, called "ScIQ" is based on the idea that researchers are often asked how they intend to incorporate IQ in their research but receive no training on what IQ is or practical ways this can be achieved. In the ScIQ report, the Ikaarvik youth identify over 40 specific recommendations for actions, behaviours and attitudes that can be implemented before, during and after a research project. Each are ways to incorporate IQ into research and lead to more meaningful engagement of Indigenous communities. In 2019, Ikaarvik created new full and part-time positions in four Nunavut communities in order to ensure we continue to build a strong foundation as a for-the-North, by-the-North program. Near-term goals for Ikaarvik include continuing to grow the capacity within Ikaarvik communities to set and implement the vision for the program moving forward, co-developing research projects to address priorities identified by Yukon Ikaarvik First Nations youth and advancing the ScIQ concept among researchers and Indigenous communities. Long-term goals include responding to the demand for the expansion of Ikaarvik across Inuit Nunangat, northern First Nations, with Inuit communities in Alaska and Greenland, and other Northern communities seeking to support youth to grab hold of the power of community-relevant research.

A FRAMEWORK FOR FISHERIES MANAGEMENT USING SOCIOECONOMIC AND SOCIAL-ECOLOGICAL INDICATORS

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The purpose of this paper is to stimulate discussion and broaden the understanding of the use of indicators as a tool for managing fisheries. Indicators rank high in importance and are seen as an influential tool in policy-making and often used in public debate given that they are designed in ways that can be understood by the general public. A lot of the initiatives involving indicators for renewable resource management tend to draw from natural sciences only, which alone can not address the complexity and challenges that marine resource conservation managers face. This paper surveys and synthesizes literature on indicators for natural resource management and then discusses their applicability in marine resource management, where their application remains limited. Despite a number of fishery performance indicators and broader marine resource governance indicators that have appeared in the literature over the past two decades their usefulness in informing decision-making and supporting policy decisions is not always clear. The paper focuses on the role of indicators for coastal communities across Inuit Nunangat (Northern Labrador) that are unique compared to where much of the indicators work has been developed and applied before. These differences are to a large extent grounded in the difficulties associated with the geographically challenged locations of those communities, resulting in high expenses related to ongoing data collection and monitoring, as well as to the presence and importance of an Inuit Knowledge system and difficulties in properly accounting for this knowledge system in indicator development and use. Meanwhile, taking into account the ongoing rapid shifts in Arctic ecosystems, the need for developing a monitoring framework for marine resource management that is responsive to the values and the changing needs of the communities that are dependent upon those resources, has never been greater. Social and economic analysis generally has been absent from design and evaluation of indicators for the management of fisheries. This paper sets up an analytical framework that aims to encompass such considerations into the

development of indicators so as to enable evaluating feedbacks between ecological and socioeconomic systems and help provide a better understanding of trade-offs.

PERMAFROST HYDROGEOLOGY: NORTHERN WATER RESOURCES AND IMPLICATIONS OF UNSEEN SUBSURFACE CHANGE

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Climate change is transforming arctic and subarctic hydrologic systems and water resources. Much of our knowledge of these changes is based on data collected at or near the land surface from localized field studies or through remote sensing observations. While these studies yield information about shifts in surface water and ground ice distribution, river discharge, and soil moisture, the underpinnings of many of these water-related changes are linked to changing hydrogeologic conditions. Permafrost thaw is opening new perennial and seasonal subsurface pathways for groundwater flow such as lateral taliks, thereby altering fluxes and distribution of water, energy, and solutes. We briefly review these processes and recent modeling efforts and identify different ways that these changes may impact northern society, including the potential for increased contaminant transport, modification to water resources, and enhanced rates of infrastructure (e.g. buildings and roads) damage. Further, as permafrost thaws it allows groundwater to transport carbon and nutrients from terrestrial to aquatic environments via progressively deeper subsurface flowpaths. Groundwater has the potential to catalyze environmental change in the Arctic and is a critical driver of how the Arctic will respond to climate change, both physically and socially. Our presentation will highlight field- and model-based research advances in permafrost hydrogeology and discuss the future implications for northern water security.

CO-DEVELOPING AND CO-MONITORING WILDLIFE HEALTH INDICATORS: BRIDGING LOCAL, TRADITIONAL AND SCIENTIFIC KNOWLEDGE TO IMPROVE WILDLIFE HEALTH SURVEILLANCE AND RESPONSE IN THE ARCTIC

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Effective wildlife management requires accurate and timely information on population status and trends and knowledge of the factors driving population change. Reliable monitoring is central to achieving this but conventional scientific monitoring alone is not sufficient. Combining different approaches and knowledge systems can provide understanding that scientific monitoring alone cannot and can bridge gaps in monitoring of remote and sparsely populated areas. Local and traditional knowledge (LK/TK) are core to the wildlife co-management mandate of the northern Canadian territories, and are usually included via extensive consultation resulting in co-informed species assessments and management plans. We propose an assessment framework that formalizes the inclusion of LK/TK from the initial stages of status assessments by encompassing pro-active and ongoing monitoring of wildlife health at the community level. We describe how LK/TK and science can be used to both identify and inform metrics and indicators of health. Different knowledge systems, documented through conventional scientific monitoring, hunter-based sampling, and interviews, can be combined for early detection of wildlife population changes and to inform status assessments. The resulting collective body of knowledge can provide broad spatial and temporal resolution and coverage, and allow for timely detection of changes in wildlife health and population status.

PERFORMANCE ASSESSMENT OF LARGE-SCALE ADAPTATION STRATEGIES FOR TRANSPORT INFRASTRUCTURES BUILT ON SENSITIVE PERMAFROST, NORTHERN QUEBEC

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Nunavik is a vast territory located in the northernmost part of Quebec. Inaccessible by road, air links are the only year-round means of transportation available. Between 1984 and 1992, twelve airports were built in the region by the MTQ (Quebec Ministry of Transportation). Since 2000, many of the runways show signs of permafrost disturbance as some localized differential settlements have begun to take place. Several studies initiated by MTQ were undertaken by the CEN to evaluate the permafrost conditions at airport sites in Nunavik. The integrative permafrost science framework developed during those studies have been very useful to support adaptation of transport infrastructure under a changing climate. By using this integrative framework, site-specific mitigation technics were proposed to minimize further permafrost degradation indeed even restore initial thermal conditions. Those technics were chosen depending on the extent and the location of the sensitive permafrost zones to protect, the characteristics of the infrastructure (embankment thicknesses, widths, slopes, etc.), the importance of water (surficial or groundwater flows) and snowdrift accumulation in the permafrost degradation processes. Over the past 10 years, large-scale adaptation strategies for transport infrastructure were implemented at many sites in Nunavik along with a monitoring program to assess their performance. The monitoring program focuses on the thermal and mechanical behaviour of the adapted infrastructure and subgrade and the efficiency of the mitigation measure in reducing snow insolation and latent heat input through summer-warmed water seepage. For many sites, multiyear post adaptation ground temperature and deformation data along with visual observation gave insight on the performance of the implemented technics. Preliminary results show that many of the selected technics are efficient. Upcoming long-term monitoring data and further analyses will improve the performance assessment, which will contribute to redefining best practices for the design, implementation and maintenance of adapted transport infrastructure in permafrost zones.

EELGRASS, WATER TURBIDITY AND FOREST FIRE AS SEEN FROM LANDSAT AND UAV IMAGES: A CASE STUDY IN EEYOU ISTCHEE

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In June and July 2013, there was an extensive wildfire affecting various watersheds of Eeyou Istchee. After the fire, running water transported the organic matter of burned peat bogs into rivers and bays. The paper presents results obtained from a time series of Landsat images acquired over various watersheds and bays of Eeyou Istchee between 2010 and 2019 in order to determine whether Landsat images can be used to assess the effect of the 2013 big fire on the water turbidity of rivers and coastal waters and on the eelgrass bed mapping. In particular, the images are used to determine how long since the fire, the effects of the fire can be seen in the water turbidity of the rivers and coastal waters. Such effect is also assessed as a function of the distance from the fire. Preliminary results show that the most impacted river and associated coastal water is the Eastmain River and that the 2019 images continue to show high water turbidity in the river and the coastal water. The resulting water turbidity has a huge impact on UAV RGB imagery acquired in 2019 over eelgrass beds located along the coast, particularly near the mouth of the Eastmain River. However, it seems that Landsat-8 OLI images can differentiate eelgrass beds from the turbid water thanks to its ultra-blue wavelength.

FURTHER EVALUATION OF AN EXPLOITED DEMERSAL FISH ASSEMBLAGE: VARIATIONS AND TRENDS IN WEST GREENLAND

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It has long been recognized that single-species-based fisheries management approaches should be complemented by multispecies and/or ecosystem-based approaches in order to provide a broader context of the ecosystem (environmental, ecological, and socioeconomic) for species management. In addition, the abundance and distribution of marine fishes are quickly changing during the last decades due to climate change and overfishing. For this purpose, we evaluate the status of an important exploited marine ecosystem for one of the largest fisheries in Greenland, Greenland halibut in west Greenland offshore. We use bottom trawl data survey from 1997 to 2019, in West Greenland (NAFO 1CD survey), from 400 to 1500m depth, and we examine how the mean trophic level and three diversity indicators (species evenness, species diversity, and species richness) have changed through time. Furthermore, we also analyse their relationship with climate (bottom temperature and NAO) and effect of fishing (fishing effort). This research has the aim of demonstrating the importance of taking into account ecological indicators and the convenience of estimating the indices for spatial and temporal correlations under different climate conditions and fishing pressures to provide a further understanding of the ecosystem status.

INTERNATIONAL COLLABORATION AS A FOUNDATION FOR CIRCUMPOLAR-SCALE ASSESSMENTS OF BIODIVERSITY: BUILDING THE CAFF-CBMP STATE OF ARCTIC FRESHWATER BIODIVERSITY REPORT

Lento, Jennifer (1), J. Culp (2), W. Goedkoop (3), T. Christensen (4), K.S. Christoffersen (5), E. Fefilova (6), K.R. Lárusson (7), P. Liljaniemi (8), J.S. Ólafsson (9), S. Sandøy (10), C. Zimmerman (11)

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The Circumpolar Biodiversity Monitoring Program (CBMP) is the cornerstone program of the Conservation of Arctic Flora and Fauna (CAFF) working group of the Arctic Council. The CBMP is an international network of scientists, government agencies, Indigenous organizations and conservation groups that is working to facilitate more rapid detection, communication, and response to biodiversity-related trends and pressures in the Arctic. This is achieved by promoting coordination, harmonization, and collaboration in monitoring and assessment of Arctic ecosystems including freshwater, marine, terrestrial, and coastal habitats. The freshwater group of the CBMP (CBMP-Freshwater) has recently completed the first circumpolar assessments of freshwater flora and fauna to determine the state of Arctic freshwaters. Working with scientists from all countries, the CBMP-Freshwater created a database of biodiversity data and supporting abiotic data for lakes and rivers from across the circumpolar region, and assessed spatial and temporal trends of alpha and beta diversity to establish a baseline upon which future monitoring efforts can be built. In addition to providing an overview of the collaborative process and the resulting database and assessment, this presentation will outline the needs for harmonization and coordination of Arctic freshwater monitoring that were identified through this work.

CO-PRODUCTION OF NEW KNOWLEDGE ON PERMAFROST COASTS

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Permafrost coasts are extensive in scale and complex in nature, undergoing rates of change that are highly variable. Understanding these environments, the processes driving erosion and subsidence, and the wider impacts of these changes on local communities, ecology

and global systems requires a truly collaborative approach: international, interdisciplinary and crossing different knowledge bases. Here we present an overview of recent UK-Canada research on the Beaufort Sea coast that contains amongst the highest coastline erosion rates in the world and vital infrastructure at imminent risk of damage. We show how new partnerships between UK and Canadian researchers and between scientists, indigenous people and exciting new community-led initiatives, are underpinning scientific advances to quantify the changes, anticipate future dynamics and, ultimately, enhance resilience to these evolving threats. Key advances centre on novel methods to assess the impact of spatial and temporal scales on understanding permafrost coast behaviour; exploring new approaches to map the variability of in situ conditions; producing quantitative data on the varied responses to environmental drivers such as temperature rise and storm intensity; and the wider impacts of material and gaseous fluxes. This on-going and shared learning is helping inform municipal decision-making, interpret research outputs more widely, empower and support community-based projects and raise awareness of the magnitude, extent and impacts of this changing landscape.

COLLABORATIVE SURVEY DEVELOPMENT AND TRAINING TO UNDERSTAND INUIT USES AND NEEDS FOR WEATHER, WATER, ICE AND CLIMATE INFORMATION

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Weather, water, and ice conditions in Inuit Nunangat (Inuit homelands) have become increasingly unpredictable due to the combined effects of climate change and industrial development. Rapid social and political change has also impacted the inter-generational transfer of Inuit knowledge and subsistence harvesting practices, creating challenges for Inuit to travel safely on the land (including water and ice). Our team of 24 Inuit, northern, and southern researchers connects long-term research partnerships in 9 Nunavut, 3 Nunavik, and 3 Inuvialuit communities. For years we have been hearing that weather, water, ice, and climate (WWIC) information and services are not meeting Inuit and other northerners' local needs considering the scale, accessibility, usability, language, and technological barriers that arise for remote northern communities. As a recently funded Phase 5 ArcticNet project, our goal in working together is to help improve the information that is available, and how it is communicated in northern communities. To accomplish this goal, we developed a survey to get feedback from partner communities in three regions of Inuit Nunangat. This presentation will outline the process of collaborative survey development, and training Local Research Coordinators, that we have undertaken to date. We follow the Aajiiqatigingniq research framework, outlined by the Aqqiumavvik Society working with Elders from across Nunavut. This framework guides our collaborative efforts at consensus-building and decision-making. Survey questions are tailored to learn what kinds of WWIC information community members use to make safe travel decisions. Survey responses will provide valuable information regarding: travel habits; important environmental conditions; uses of community information sources; uses of information from regional, national, and other polar service providers; and related opportunities and challenges. Ultimately we hope that results of this project will help service providers and decision-makers make their information more relevant and accurate for Inuit and northerners, in support of safe travel.

PIRURVIK - A PLACE TO GROW: EARLY CHILDHOOD EDUCATION FOR NUNAVUMMIUT

Lochhead, Tessa (1) Karen Nutarak (2) (and/or) Leah Kippomee (3)

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The Pirurvik Preschool in Pond Inlet provides early childhood education (ECE) that is child centered and based on the Inuit Qaujimajatuqangit (IQ) principles and is enriched through the use of Montessori materials for the four-year-old child. The Pirurvik Preschool team was awarded the 2018 Arctic Inspiration Prize, to develop new programming and innovative training through research and application by providing support for seven community daycares that span across all three regions in Nunavut in Pond Inlet, Igloolik, Arctic Bay, Tumikuluit in Iqaluit, Cambridge Bay, Taloyoak, and in Rankin Inlet. We are working with each of the community daycares by applying the local knowledge that is necessary to develop an IQ-Montessori localized framework rooted in Inunnguiniq, that is applicable for infants, toddlers and

preschoolers in one cohesive environment, whom are often cared for in a one-room daycare facility. The Pirurvik preschool team aims to improve the social well-being of children, families and communities and will undoubtedly positively impact the lives of hundreds of young children and their families by providing a positive first experience with education. Pirurvik Preschool is actively creating environments that speak to the communities' own needs and values by reflecting Inunnguiniq practices in these positive educational experiences for children, and their families. The action research framework will be conducted by the Qaujigiartiit Health Research Centre (QHRC) over the course of these projects, and will provide feedback on the effectiveness of each of these program sites. The evaluation of each of these daycare projects will support the need to build ECE models that are worth investing in. Our vision is to support high quality, Inuit-specific ECE initiatives and programming across Nunavut. This is evidence based, culturally relevant and community focused programming, which demonstrates the demand for quality ECE in Nunavut. Pirurvik Preschool is indeed a place to grow for Inuit children, teachers in training, literacy, community capacity, and the dreams of Nunavut. In this presentation we will discuss how we are attempting to structure, organize and reorganize programming to suit each communities needs, so that we may understand what the existing environmental factors are that help each program to be successful.

THE DEVELOPMENT OF AN INUIT NUNANGAT RESEARCH PROGRAM

Loring, Eric (1)

(1) Inuit Tapiriit Kanatami

Explore how a national research program development has emerged by using the National Inuit Strategy on Research (NISR) as a guide. In Canada, Inuit have the right to self-determination in all facets of life, including in the area of research. These rights are entrenched in the land claim agreements and the constitution. Inuit envision research as producing new knowledge that empowers Inuit in meeting the needs and priorities of their families and communities. Inuit see achieving self-determination in research as the means for ensuring that research governance bodies, policies, and practices are consistent with this vision. Strong public policies, informed by the best available evidence, can support optimal outcomes for Inuit. This includes setting the research agenda, monitoring compliance with guidelines for ethical research and determining how data and information about Inuit, wildlife, and environment is collected, stored, used, and shared. The development of the ArcticNet Inuit Nunangat Research Program is a chance for Inuit to lead research, build capacity, strengthen governance and support self-determination. It can be seen as shifting the dynamics between Inuit and academia. This talk will be about how this fledging program has developed, using the guidance and direction outlined in the ITK National Inuit Strategy on Research.

BELUGA (DELPHINAPTERUS LEUCAS), QILALUKKAQ MORTALITIES IN THE EASTERN BEAUFORT SEA: WHAT HAPPENED?

Loseto, Lisa L. (1) (Presenter), Denis Arey (2), Dwayne Beniot (2), Davonna Kasook (3), Emilie Couture (4), Emily Way-Nee (3), Gerry Inglangasuk (5) Greg O'Corry-Crowe (6), Greg Elias (7), Jen Lam (3), Jeremy Hansen (1), Jimmy Kalinek (8), John Noksana Sr. (9) John Noksana Jr. (5), Lawrence Kaglik (10), Laura Murray (1), Linney Day (10), Luke Storrie (11), Patrick Akhiatak (12), Nigel Hussey (13), Norman Anikina (14), Ray Ett (9), Shannon MacPhee (1), Stephane Lair (4), Vernon Amos (8)

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Seven beluga carcasses were found on shores of the Beaufort Sea, 3 of the carcasses were belugas that were tagged as part of the 2019 tagging program and four were not tagged and included one adult and three newborns. An

additional 5 tagged belugas are presumed deceased based on data obtained from a secondary tag that had a mortality function. Twenty belugas were live handled and tagged and an additional 20 belugas were tagged using remote tagging approaches. To date no mortalities have been identified with the remote tagging. In 2018, 10 belugas were live captured and tagged using the same methods and crew as 2019 with zero mortalities occurring. The 8 tagged beluga deaths represents 40% of the whales that underwent live capture and tagging and is unprecedented for any Arctic cetacean tagging program. The 2019 mortalities occurred within 1 to 3 days following capture and tagging indicating a common course or cause of death. This raises several key questions such as what was different about 2019 belugas and tagging procedure? Are mortalities of untagged belugas (and other untagged marine mammals) linked? Preliminary analyses of video footage of capture and handling reveal whales appear healthy and techniques and handling times are much improved from 2018 tagging. Multiple health measurements taken from belugas during the tagging process to assess the condition of the whale in early capture and assess impacts or stress during the capture (e.g. cortisol, lactate blood gases, pH etc). Preliminary analyses of live captured whales presented good body condition and hematologic and biochemistry analyses were within reported values for belugas suggesting a lack of debilitating pre-existing condition. Similar stress responses to 2018 measurements (i.e. plasma cortisol levels) were observed for 2019. Our preliminary analyses of capture and handling parameters showed that techniques and handling time were improved relative to 2018. We continue to complete our health analyses including the pathology of the tagged carcasses to address causes of death. To assess pre condition of belugas as a population we evaluated harvested whales in the region. Fitness and condition metrics of harvested belugas harvested were conflicting and showed condition metrics (i.e. blubber thickness) are within the range of past whales that were deemed healthy; however chronic indicators of stress (outer blubber cortisol) and diet metrics (fatty acids inner blubber) indicate higher stress levels and a diet devoid of their preferred prey, Arctic cod. The concept of broader environmental stressors locally and regionally are also being investigated. At the local level we are evaluating water temperature, air temperature, wind patterns, in particular noting increased storm events. At a regional level we are considering wide scale environmental drivers (i.e. high Sea Surface Temperatures) to determine if broader ecosystem levels changes, including those that may explain recent mass mortalities of higher trophic level species in the Bering Sea, may also explain recent events.

GENOMIC APPROACHES FOR NON-INVASIVE, SCAT-BASED MONITORING OF POLAR BEARS

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The polar bear is an apex arctic predator that may be profoundly impacted by climate change and changes in sea ice. Canada is home to ~15,000 polar bears or approximately two-thirds of the global population, with Nunavut and Northwest Territories having management jurisdiction over most. Of 19 defined polar bear management units, 13 fall within Canada, with many monitored infrequently with insufficient data to access population trends. Polar bears play a pivotal role in Inuit culture and traditional knowledge systems, and provide economic value to areas with high unemployment. Inuit communities desire monitoring methods that do not require handling bears, and that directly incorporate them and their perspectives in management. In response to these needs, we are developing a novel scat-based, non-invasive monitoring approach that brings together genomics, other bioassays, and northern peoples. We have used genomic markers (Single Nucleotide Polymorphisms) to map bear population structure across the Canadian Arctic using archived harvest samples. From these we selected approximately 350 SNPs for a Genotyping-in-Thousands (GTSeq) assay that allows us to identify individual bears (including sex) from scat alone. The GTSeq assay is the foundation of a toolkit that includes diet assessment using DNA barcoding, and evaluation of contaminants. We are working with communities to see whether this toolkit can be incorporated into a community-based monitoring program that includes community insights and provides remuneration for samples.

THE PLANKTONIC PAN-ARCTIC BIOME: WILL THE LINE HOLD?

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Since the International Polar Year there have been both small and grand expeditions taking the temperature and living pulse of the Arctic Ocean, with a notable contribution by ArcticNet researchers. Currently temperature change is coming from the northward intrusion of warmer Atlantic and Pacific waters and freshwater is invading from the interior with an influx from melting multiyear ice and glaciers. Biologically, the Arctic is exceptional compared to other oceans and many species from whales to nanoflagellates are restricted to the Arctic Ocean and have pan-arctic distributions. Even bacteria seem to have Arctic-specific clades, indicating an integrated, evolutionarily distinct ocean. The Arctic biome is currently protected by physical oceanographic conditions, creating a line that separates the Arctic from other oceans. However, with ongoing loss of multiyear ice and potential changes in the oceanographic structure, this line may be breached resulting in conditions that could drive this unique biome to extinction. While the Arctic is both warming and freshening faster than any ocean on the planet, the vulnerability of single celled organisms to these two assaults is unknown. As a first approach to answering these questions, I review what is known about species distributions in the Arctic, explore some of the genetic underpinnings of Arctic plankton success including widespread horizontal gene transfers in single celled organisms, and evaluate the sensitivity of the Arctic Ocean to future change.

FISHING SMARTER NOT HARDER- AN OPPORTUNITY TO DEVELOP INNOVATIVE HARVESTING AND ENVIRONMENTAL CHARACTERIZATION TECHNOLOGIES TO SUPPORT SUSTAINABLE FISHERIES

Moret, Kelly (1) Burke, Brian (2) O'reilly, Alastair (3)

(1) Centre For Sustainable Aquatic Resources, Fisheries And Marine Institute, Memorial University
(2) Nunavut Fisheries Association
(3) Northern Shrimp Research Foundation

The Canadian Offshore Fisheries Consortium is a consortium of Canada's major fishing organizations, who collectively represent close to 30 commercially active offshore fishing companies operating throughout Canada's Atlantic and Eastern Arctic regions. As a strategic collaboration, the COFC aims to take a leadership role in advancing technology development and utilization in the commercial harvesting sector while positioning the harvesting sector as a key player in Canada's newly emerging Ocean Super Cluster. The Northern Shrimp Research Foundation (14 companies) and the Nunavut Fisheries Association (4 companies) are two key organizations driving this initiative. This initiative seeks to utilize the talents of Canadian SMEs in the ocean technology sector to address significant challenges facing members of the COFC and the offshore fishery in general. The project will seek to make advancements in environmental characterization that will not only benefit the fishing sector but also other ocean sectors. The commercial fishing industry is continuously challenged by unpredictable changes including aggressive international competition, a rapidly shifting ecosystem, an ever-changing regulatory and market landscape (policy, consumer preferences) and potential threats to the resource/stock itself. Consequently, the industry identified the following technical challenges as priority areas for technology innovation and development. Harvesting/ Operational Priorities: 1. Increase Fuel efficiency 2. Optimize By-catch Avoidance 3. Optimize Real-Time Monitoring of Catch 4. Reduce Time Searching for Resource 5. Reduce Seabed Impact Environmental characterization priorities: 1. Optimize Collection of key environmental data 2. Optimize Collection of eDNA data 3. Optimize Environmental Scanning for seabed/ habitat characterization In collaboration with fishing industry technology and broader ocean technology SMEs in Canada, COFC will seek to develop and integrate disruptive technologies to address the challenges outlined above. The goals of COFC and this initiative, is ensure the long terms sustainability of the resource, increase ROIs and the competitiveness and knowledge base of members. Disruptive technology developments will be created to grow and enhance the competitiveness of Canada's fishery sector, while also enabling our Canadian SMEs to compete and take advantage of worldwide markets to grow and expand their businesses.

AGARUM SAVANNAHS: THE SURPRISING ARCTIC KELP ASSEMBLAGES IN MITTIMATALIK (POND INLET)

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Shallow subtidal rocky reefs are areas of high potential productivity and diversity worldwide. Changes in these areas can have correspondingly large effects on the biodiversity and functioning of marine ecosystems. In temperate waters, rocky reefs are often dominated by habitat-forming macroalgae such as kelp, which form dense assemblages, the character of which (e.g., habitat structure, primary productivity) is determined by the species composition. Such marine forests are not only a phenomenal source of primary productivity, but also create three-dimensional structure that provides habitat for a wide range of organisms, acting as both nursery grounds and critical foraging habitat for many harvested species. Although the potential distribution of kelp in the Canadian Arctic is astoundingly large (1000s of km of rocky coastline), there is a lack of information on the distribution, abundance and character of kelp assemblages there. We conducted surveys of subtidal rocky areas Eclipse Sound around the community of Mittimatalik (Pond Inlet) in northern Baffin Island (Nunavut, Canada) during September 2019. Sites surveyed covered 160 km of coastline from Ragged Island in the west to Guy's Bight in the east. A total of 39 sites were sampled using a drop camera at depths of 5, 10 and 15 m. At 6 of the 39 sites, SCUBA divers also sampled transects at 5 and 10 m depths. Work elsewhere in the Arctic and previously in this area had led us to believe that kelp assemblages would be composed of a mix of species, dominated by Alaria esculenta in shallower waters and by Saccharina latissima and Laminaira solidungula at deeper depths with a patchy distribution of Agarum clathratum in the deepest waters or in more marginal habitats where grazing rates are high or light more limiting. Instead we found an overwhelming dominance by A. clathratum at almost all sites and all depths, with an average cover on rocky substrata of almost 50%, often approaching 100% at depths ranging from 2 to 30 m. Although the other kelp species were present in the area, particularly more sheltered sites, every site sampled was overwhelmingly dominated by dense populations of A. clathratum, generally from 3-5 ind/m2 (maximum densities of 13 ind/m2 were observed at 2 out of the 6 sites sampled using SCUBA). Individual plants were large and healthy, and small juveniles were observed at many sites. These Agarum beds were clearly functioning as important habitat for a large number of species with fish (cod and sculpins) and numerous invertebrate species (sea stars, brittle stars and anemones) being strikingly abundant. The dominant rocky subtidal habitat in this area thus appears to be more akin to descriptions of Agarum 'savannahs' (sensu Adey and Hayek 2011) in the Labrador Sea than to observations in other arctic regions. Given the importance of nearshore benthic primary productivity for arctic ecosystems and the undeniable rapid change in abiotic conditions currently underway in the Arctic at both local and pan-arctic scales as the climate warms, an understanding both of the current state of these ecosystems and how these areas are likely to be impacted by future conditions is critical. This work is one of the first attempts to quantitatively describe subtidal rocky reefs in the eastern Canadian Arctic and as such provides an essential baseline for further work.

THE INUVIK DART: CO-DESIGN, DEVELOPMENT, AND FIELD PILOT OF A NEW REMOTE DEPLOYMENT SYSTEM FOR TAGGING BELUGA WHALES (DELPHINAPTERUS LEUCAS)

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Marine mammal telemetry is a powerful tool that provides information on movement, behavior and habitat use, generating critical data to support conservation and management measures. However, the invasive capture, handling, and implantation of transmitters presents risk to the animal and contravenes Inuit cultural norms to respect wildlife. During community meetings to propose a new beluga (Delphinapterus leucas) telemetry program in the Inuvialuit Settlement Region, community members challenged our research team to develop an alternative to the traditional live capture method for tagging belugas that would be less invasive, hunter-deployed, and still return location and dive data. A harpoon or jabstick remote deployment method was identified as appropriate in the Inuvialuit context due to knowledge and skills developed through traditional beluga harvesting practices. During the 2018 Eastern Beaufort Sea beluga tagging program, 4 whales were instrumented with towed transmitters attached with commercially available anchors that were designed for other species, and modified for harpoon deployment on beluga whales by Inuvialuit harvesters. While this demonstrated proof-of-concept, tag retention times were low (4 - 14d) and the method required further development. We held a workshop to co-design the new harpoon tagging method, including development of the attachment system, deployment protocols, study design, and selection of tag type. Key system design features were based on Inuvialuit traditional knowledge of beluga behavior, anatomy and harpooning techniques; technical expertise from the tag manufacturer, animal care considerations, and scientific needs for data collection. Together, we developed a prototype of a single subdermal attachment anchor, the "Inuvik Dart". We tested the prototype on slabs of maktak in the laboratory and on harvested whales landed at the research site prior to deployment on free-ranging belugas. In total, 20 belugas were instrumented with four types of towed transmitters using the new remote deployment method during the 2019 program. The entire procedure, including biopsy collection, could be completed in <20min, and often in <10min. Tag retention times were significantly increased with the new anchor design, and ranged from 2 - 85d, with 69% of tags retained for >3wks. We discuss lessons learned in the design and application of the tags, and type and quality of data returned, including a comparison of movement and dive data from towed tags and traditional back-mounted transmitters. Overall, the new remote deployment method demonstrates potential as an innovative solution to address short-term or local-scale questions about beluga behavior, movement, and habitat use, while eliminating risks associated with the live capture and handling of wild belugas.

BUILDING CAPACITY THROUGH INDIGENOUS SHIPPING MONITORING INITIATIVES IN THE ARCTIC

Maksagak, Beverly (1), (Presenter) Radi, Tyrone (2), Presenter

(1) Ekaluktutiak Hunters & Trappers Organization
(2) Tuktoyaktuk Hunters & Trappers Organization

Building Indigenous capacity through local community-driven shipping monitoring initiatives have shown to be effective for addressing vessel traffic issues in the Arctic. These types of initiatives require the establishment of multi-stakeholder governance structures that are equipped with the necessary resources to enable the participation of local community members in the decisions that impact their waterways. In this presentation, we will highlight how two Arctic communities - Tuktoyaktuk, NWT and Cambridge Bay, NU have implemented, in partnership with the Government of Canada, community-driven monitoring initiatives to identify and address marine vessel traffic issues through the implementation of collaborative solutions that incorporate real-time vessel traffic information as well as traditional and scientific knowledge. In addition, we will demonstrate how these initiatives have contributed to community stewardship and capacity while ensuring that their waterways remain thriving ecosystems.

THE OUTER MACKENZIE DELTA IN A CHANGING CLIMATE: INCREASING NEARSHORE SEDIMENTS FROM ACCELERATED EROSION OF ICE-RICH CLIFFS? AN EXAMPLE FROM PELLY ISLAND.

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Ice-rich coastlines along the Circumpolar Arctic are eroding at 0.5 m/yr (Lantuit et al. 2012), in the past two decades there has been an acceleration of erosion in particular areas which have large ice-rich cliffs like Pelly Island. Pelly Island is located 20km offshore of the Mackenzie Delta front which places it within the Mackenzie sediment plume. This research focuses on quantifying the spatial and temporal variability of shoreline change of the ice-rich cliffs of Pelly Island and the volume of sediment delivered to the nearshore. The rapidly eroding cliffs of Pelly Island provide an opportunity to study the contribution of sediments to the nearshore from an exposed coastal source of sediment. Sediment deposition from erosion in the nearshore region of the Mackenzie shelf impacts navigation safety and alters natural ecosystems. While sediment deposition at the delta front is considered dominated by sediment discharge from the Mackenzie River, in some areas, including Pelly Island, accelerated coastal erosion may be contributing more sediment to the nearshore than in previous decades. In order to better understand the rapid changes occurring on Pelly Island we are conducting a volumetric analysis of sediment resulting from cliff erosion on an annual basis using digital elevation models (DEMs) created from aerial photogrammetry, which were collected using unmanned aerial vehicles (UAVs) during field surveys between 2016 and 2019. Software using structure from motion (SfM) processing is being used to create 3D models of the coastal cliffs from 2D aerial photos. Due to both thermal and mechanical erosion processes, 20 m high ice-rich cliffs on the NW side of the island have been retreating at an average rate of 20.9 m/yr since 2000, which is more than double the 1950-2000 average of 8.2 m/yr (Solomon 2005). Since 1950, up to 1.4 km of coastal retreat occurred, resulting in the release of large amounts of sediment into the nearshore environment. Satellite and aerial imagery are being used to refine historical surface geology mapping of the island and to digitize shoreline position between the years 1950 and 2019. These datasets will be analyzed and visualized using AMBUR (Analyzing Moving Boundaries Using R) package for the R software environment in order to quantify distances and rates of shoreline movement, detect classification changes across time, and forecast future location of shoreline. New approaches for spatio-temporal analysis is expected to provide an accurate and up-to-date assessment of coastal erosion rates along with estimates of the volume of sediment delivered to this highly dynamic coastal sedimentary system in a warming climate.

ALGAL LIPID SYNTHESIS VARIES IN RESPONSE TO TEMPERATURE AND PH IN THE CANADIAN ARCTIC AND SUBARCTIC

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The resilience of polar marine ecosystems and their ability to produce harvestable living resources depends on efficient nutrient transfers from microalgae to consumers. In this regard, the lipids produced by phytoplankton represent a crucial source of essential molecules for upper trophic levels. In addition to their energetic value, algal lipids also include essential polyunsaturated fatty acids (PUFAs) that animals cannot synthesize and must acquire from their diet. PUFAs (e.g. ω3 FAs) are considered essential for the healthy development and function of organisms. Moreover, the high energy potential of monounsaturated fatty acids (MUFAs) is of particular importance in cold water and saturated fatty acid (SFA) proportions are known to respond to stressful environmental conditions. Since phytoplankton growth is affected by numerous factors (e.g., temperature, light, salinity, pH and nutrients), variability and gradients in the environment can potentially alter lipid synthesis, either directly, by altering algal physiology, or indirectly, by promoting shifts in phytoplankton species composition. We investigated these two possibilities by sampling along a 3000-km transect spanning 28 degrees of latitude across the subarctic and Arctic domains of Canada. Here we report on the lipid profiles of particulate organic matter taken from the surface and the subsurface chlorophyll maximum and relate these profiles to environmental variables. As expected, the lipid profiles of organic matter are largely affected by taxonomic composition. We find

a strong positive correlation between C16:C18 MUFAs and diatoms while the proportion of PUFAs increased with flagellate abundance. Fatty acid tracers such as EPA (20:5ω3) were positively correlated with centric diatoms but not with pennate diatoms and our dataset does not demonstrate the expected relationship between DHA (22:6ω3) and dinoflagellates. Overall particulate organic matter with higher C:N is related to a decreasing proportion of ω3 FAs. Finally, our results reveal that acidic seawater affected EPA and MUFA proportions in phytoplankton while DHA proportions tended to increase with higher temperature. This study, based on a large-scale field sampling, provides new insights into the ecological determinants of essential fatty acids in the changing Arctic.

THE CANADA C3 SCIENCE PROGRAM - COMMUNICATING THE WORK OF 13 INSTITUTIONS, 23 PROJECTS, 40 SCIENTISTS, 150 DAYS AND HUNDREDS OF SAMPLES.

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Canada C3, led by the Students on Ice Foundation, was an epic 150-day, 25,000 km sailing expedition from Toronto to Victoria via the Northwest Passage, to mark Canada's 150th anniversary of Confederation. The Canada C3 pan-Canadian Science Program undertaken during the expedition, consisted of 23 research projects, grouped into 15 topics, carried out by 40 scientists, hailing from 13 different institutions. The projects covered a broad range of research topics, including two (e)DNA projects, research into the impact of microplastics, shoreline biodiversity, algal taxonomy, plants and lichens, surveys of marine mammals and birds, and research focused on pizzly / grolar bears. The Canada C3 expedition was unique in a number of ways but not least as a floating communications platform. Prior, during and since the expedition, the C3 researchers shared the stories of coastal communities and showcased scientific research, connecting Canadians from North to South, and from coast to coast to coast. In particular, the C3 researchers: -Engaged with communities and drew on traditional knowledge, contributing further to their areas of research, and providing inspiration for future studies; - Showcased their work to Canadians across the country via a series of interactive multimedia updates, including: YouTube and Facebook Live videos prior, during and after the expedition, 360° videos of science activities, Google Hangouts with classrooms across the country, live interactive underwater dives transmitted directly to the public, 14 interactive museum hubs at museums and science centres across the country and through the Canada C3 award-winning Digital Classroom. - Continue to share emerging results through papers, posters, blogs, talks, and infographic tools and intend to continue ensuring that the C3 Science is communicated back to communities, and to general, non-scientific audiences as well as within traditional science circles. Over the course of the next few years, the aim is to continue sharing results from the 100s of samples taken over 150 days, with both scientific and non-scientific audiences, and especially with the communities sampled. The ultimate hope is that Canada C3's rich, pan-Canadian Science Program will serve to expand the scientific knowledge base for future projects and to engage future generations from coast to coast to coast, in much the same way that the Canada C3 expedition did.

AN EXPERIMENTAL STUDY OF THE NATURAL AND ARTIFICIALLY ENHANCED GROUND COOLING CAPACITY IN THE ZONE OF DISCONTINUOUS PERMAFROST, SCOTTY CREEK , NORTHWEST TERRITORIES

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Northwestern Canada has been one of the most rapidly warming regions on Earth. The southern limit of discontinuous permafrost zone is very sensitive to small climatic fluctuations and is presently experiencing a rapid landscape change due to accelerated permafrost thaw, which is further exacerbated by anthropogenic disturbances such as seismic lines. Recent research has begun to examine both natural and mechanical approaches to minimize permafrost loss, although the utility of such

methods in peatland environments is not well understood. This study explored the efficiency and limitations of natural and artificial ground cooling processes in peat-based environment by evaluating snow exclusion and thermosyphon methods. Thermosyphon research conducted since 2013 at the Scotty Creek Research Station, Northwest Territories, Canada was assessed with detailed analysis of design evolution and performance. Four individual snow shading cones and one snow shading cone conjoined with a single-phase thermosyphon were installed along the seismic line in the Scotty Creek watershed. Thermosyphon technology demonstrated a significant ground cooling capacity in a highly saturated peat environment. The most efficient design reached minimum ground temperatures between -13.3 to-14.2 o C 80 cm below the ground surface. The initial thermosyphon cooling rate was improved by eliminating snow around the thermosyphon. Natural ground cooling by direct coupling of air and ground temperatures is strongly limited by the presence of snow however, ground temperatures in the snow-free areas remained lower by only 2-4 o C then in the snow-covered areas, which suggests that moisture content controls natural ground cooling range. However, at the end of the summer both snow-free areas maintained a 15 cm thick frozen layer below a 60 cm thick active layer suggesting that lowering the temperatures by 2-4 o C can support annual sub-zero conditions below 60 cm depending on the landcover type. We have shown that the insulating influence of snow on the ground thermal regime and subsequent annual thermal profile varies depending on land cover type. This investigation is projected to support the development of low cost, readily-deployable ground cooling devices that may serve to mitigate permafrost thaw and improve the adaptability of engineering designs to a wide range of changing environmental conditions.

FROM RESEARCHER-DRIVEN TO COMMUNITY-BASED: MUSKOX AND CARIBOU HEALTH SURVEILLANCE IN ULUKHAKTOK, NORTHWEST TERRITORIES

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Monitoring of wildlife in the Arctic is associated with many challenges. For researchers and governmental biologists, the huge costs and logistic difficulties of traveling and maintaining a presence in one of the most remote regions of the globe often impair the quantity, quality and temporal distribution of samples and data collected. For Arctic community-members, although great progress has been made in the past decades regarding co-management and inclusion of traditional knowledge in mainstream science, there are still situations when their expertise is being by-passed in the monitoring/decision-making process and where they feel left as observers, their voices inadequately represented in conservation and management efforts. Here we detail how the collaborative muskox and caribou health monitoring in Ulukhaktok, Northwest Territories, is addressing some of those difficulties. The program started in 2016 as a university-based initiative aiming at improving the timely detection of changes in the local muskox population. Since then, it has transitioned to a community-based monitoring program for muskox and caribou surveillance, led by the Olokhaktomiut Hunter's and Trapper's Committee and funded by the Indigenous Community-Based Climate Monitoring Program (Crown-Indigenous Relations and Northern Affairs Canada). The monitoring program has successfully brought together the community of Ulukhaktok, governmental agencies and academic researchers to guide the monitoring effort and enhance the flow of information and knowledge between all parties. It has also built capacity in the community through the training of community-members championing the program and through the engagement of youth in scientific monitoring. Through a harvester-based sampling scheme, 75 sample kits have been collected since 2016 and samples have been analyzed for relevant diseases and health traits. To complement lab results, we also collect information through sample kit questionnaires and annual harvester interviews to better capture trends in muskox and caribou populations and health. In muskoxen, we could document a high rate (23%) of exposure to Erysipelothrix rhusiopathiae a bacterium which has been associated with widespread muskox mortalities on Banks and Victoria Islands in 2009-2013. Similarly, we could document an increase in Brucellosis in the sampled muskoxen (9 % in 2016-2019 compared to 0% in 1994-1999, n= 68 and 405 respectively). The program has also enhanced the reporting of abnormalities by harvesters which has led to the isolation of Brucella spp. in lesions from two harvested muskoxen. This documented increase in Brucella cases

is of particular importance as the bacterium can be transmitted to people when handling or consuming raw/ undercooked meat. Following our results, steps have been taken to alert Public Health Agencies and communicate on the disease in the community. This transdisciplinary approach will help tailor future monitoring efforts and contextualize the obtained results. It will also serve as a baseline to better track changes in health and population trends through time. The insight gained through the monitoring program is shared between all project partners and with the community of Ulukhaktok and with management organizations such as the Inuvialuit Game Council and the Wildlife Management Advisory Council. We believe that the current program in Ulukhaktok provides the framework for a long-lasting, multi-partner, community-drive

PLASTICITY OF MIGRATORY BEHAVIOUR AMONG SEASON AND POPULATIONS IN A NORTHERN APEX PREDATOR, THE GOLDEN EAGLE

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Migration is used in birds as a strategy to maximize survival and fitness by avoiding seasonal depletion of resources. Migration behaviour can be very plastic among season and populations, calibrating schedule and routes to various environmental changes in order to reduce trade-off between survival and reproduction. Yet quantifying such plasticity is still a major challenge, especially to predict how migratory species can respond to environmental changes. The goal of this study is to measure plasticity in timing and duration across key environmental factors (i.e., precipitation and temperature as proxies to depletion of resources) during migration for two populations of Golden Eagles (Aquila chrysaetos). This northern apex predator is a partial migrant with both resident and migratory individuals. We contrasted the individual and population levels of migration timing and duration displayed by the Golden Eagle to evaluate plasticity using individual repeatability measures. We hypothesized that plasticity will be different between seasons. We used a quantitative measure of plasticity with migratory repeatability, calculated as the proportion of the total variation explained by the individuals. We predicted that the repeatability of migration (i.e., phenology, distance, duration) will be highest in spring to reduce delays on upcoming reproduction season in both populations. The plasticity of breeding area residency time, spring migration duration, and spring arrival date was ~30% lower in the eastern population compared to the Alaskan population, whereas fall departure from breeding sites and fall arrival on wintering grounds were ~60% higher in the eastern population. Breeding area residency time increased by 6 weeks when the average seasonal temperature on the breeding ground increased by 5° in both populations. Duration of fall migration was longer when both precipitation and average temperature were low. Contrary to our prediction, these results suggest that plasticity of migratory behaviour is both population and seasonally driven and change in environmental conditions could affect the populations differently.

UNDERSTANDING THE PAST, PREDICTING THE FUTURE: WATER VULNERABILITY IN A WARMING ARCTIC

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Sustainable sources of clean freshwater are critical for northern development planning, and the health and well-being of Inuit. Yet, Arctic regions face looming water crises due to multiple cascading effects of environmental change. Many northern communities in Canada lack baseline knowledge of local existing freshwater supply, quality, or influence of the catchment. As such, assessing the vulnerability of freshwater supply and planning for adaptation options in the context of a warming future is particularly difficult. Here, we explore a novel integrative modelling method for quantifying water security for the Arctic that incorporates parallel and interactive social-human health dimensions on top of surface and subsurface modelling of water quality and water-balances. We calibrate our analysis using hydrological and paleolimnological information obtained from lakes to address the lack of data needed to make decisions for adaptation and management planning. Paleolimnology is the study of chemical, physical, and biological indicators

preserved in lake sediment through time. As this modelling approach also incorporates metrics generated in the social-human health dimension, it will allows for holistic projections of vulnerability that will directly assist with the management of freshwater supply. In a study of Igloolik and Hall Beach, Nunavut, our projections show a realized increase in mean-July temperature from ~9.0 - 11.5 °C over the last century. This 2.0-2.5°C increase in temperature has had a strong influence on the longevity of freshwater provisioning infrastructure. Calibration of models using these paleolimnological-derived parameters indicate susceptibility of the freshwater reservoirs for each community examined. The vulnerability for each freshwater supply is heightened by variability in weather in any given year. The results of our study will hopefully lead to direct recommendations for further study and continued engagement with local and regional water managers to identify further supplemental sources of potable water, as well as continued assessment of changes to productivity within these systems that may also inherently influence water quality.

THE CANADIAN ARCTIC WEATHER SCIENCE PROJECT

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Weather-related hazards, including blizzards, high winds, and low visibility are primary contributing factors to many Search and Rescue events in the Arctic, affecting both the safety and mobility of those living and operating in the North. The possibility that such hazardous conditions will become more frequent, longer in duration, or less predictable under scenarios of anthropogenic climate change (Ford et al. 2013) only adds to the concern and supports further investigation of prevention and response measures and strategies. While little can be done to control the state of hazardous weather conditions, many actions may be taken to help reduce exposure, sensitivity and vulnerability to related threats and avoid, or at least lessen, their negative consequences. One such measure is the provision of weather conditions information that can help individuals, groups and organizations make informed decisions about when to safely travel, conduct particular activities, and take precautionary or protective actions. As the Federal lead for meteorology, Environment and Climate Change Canada (ECCC), through its Meteorological Service and supporting Science and Technology branches, has traditionally developed and offered weather monitoring and forecasting services in Northern, remote and Indigenous communities. Recognizing significant limitations in monitoring infrastructure (i.e., spatial and temporal coverage) and weather prediction skill in Canada's North, ECCC Science and Technology Branch has since 2015 made significant on-going investments in Arctic-focused monitoring and prediction systems and associated R&D that will contribute to more precise, frequent, accurate, and reliable observations and numerical forecasts states. The Canadian Arctic Weather Science (CAWS) Project aims at advance the knowledge necessary to enhance the performance of the Canadian weather prediction system over the Canadian Arctic region. The first phase of the Project focussed at testing of technologies for characterization of atmospheric processes within the boundary layer. Two supersites were commissioned with instruments such as Doppler weather radars and lidars, water vapour and aerosol lidars, radiation flux sensors, and different fog and precipitation measurement devices. The two supersites, one at Iqaluit (64oN, 69oW) and another at Whitehorse (61oN, 135oW), are enabling process studies, the testing of new technologies, evaluation of their applicability to support the numerical weather prediction system, and validation of satellite measurements. They provided significant contribution to the World Meteorological Organization's Year of Polar Prediction (YOPP). This presentation will discuss the CAWS Project, present some research results and describe future plans.

BY THE NORTH, FOR THE NORTH: CELEBRATING ARCTIC INSPIRATION PRIZE SUCCESS STORIES

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Celebrating its 8th annual prize cycle, the Arctic Inspiration Prize (AIP) - represented by its outstanding Laureates - is having far reaching impact across the North and the South. It is the largest annual prize in Canada with a specific focus on the Arctic. Each year, up to $3 million is awarded across three categories: one $1 million prize, up to four prizes of up to $500,000, and up to seven youth prizes of up to $100,000. The AIP enables innovative, community-driven projects in everything from education and preserving traditional knowledge and language, to community inclusion in science and sustainable housing, to the performing arts and health. The AIP, and the

projects it supports, represent the best of creativity and collaboration in a way that is truly by the North and for the North.

SKILL OF SNOW WATER EQUIVALENT PRODUCTS OVER CANADA

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Daily continental-domain snow water equivalent (SWE) datasets are required for climate model evaluation, verification of seasonal forecasts, annual updates to climate assessments, and determination of freshwater availability. Numerous spatially continuous SWE datasets derived using various approaches are available. Here, the accuracy of seven different SWE products is assessed over Canada for the 2000-2010 period through comparisons with snow course measurements. Snow course measurements are used to assess the gridded SWE products as they are more representative on scales of 10-100km compared to point measurements. Each of the products falls into one of three categories: (1) those utilizing some form of reanalysis (the Global Land Data Assimilation System version 2 - GLDAS; the European Centre for Medium-Range Forecasts interim land surface reanalysis - ERA-land; the NASA Modern-Era Retrospective Analysis for Research and Applications - MERRA; the Crocus snow model driven ERA-Interim meteorology - Crocus); (2) passive microwave remote sensing combined with surface observations (GlobSnow); and (3) standalone passive microwave retrievals (AMSR-E operational and historical products). This evaluation found that the standalone passive microwave retrievals exhibited weak skill compared to the other products, with higher RMSE and bias, and lower correlation. While the Crocus snow model driven by ERA-Interim meteorology performed best over Canada, multi-product SWE ensembles of four or five datasets (excluding the AMSR-E products) that included Crocus and/or MERRA had higher correlations and lower RMSE than any individual product. Together this suggests that in data-sparse regions such as Canada, a moderately sophisticated snowpack model forced by modern reanalysis data provides reasonably accurate estimates compared to those using passive microwave data alone.

UNPACKING COMMUNITY PARTICIPATION: INSIGHTS FROM ALASKA

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The combined impacts of fast-paced social change and environmental change in the Arctic has disproportionately affected Alaska Native peoples. This has attracted research in environment, health, education and other fields at the local scale. Much of this research acknowledges the contentious histories of colonial, extractive research that, at best did not benefit Alaska Native peoples, and at worst, caused them harm. Community-based participatory research (CBPR) is therefore the preferred approach in these contexts, as it seeks to actively involve participants in research, ensuring research is relevant to community concerns, and instigates positive social change. Nevertheless, concepts such as 'participation' and 'community' have been critiqued, which are not necessarily considered within CBPR. Equally, there are concerns that CBPR has become a buzzword, with tokenistic participation of communities in Arctic research. Therefore, this research systematically evaluates how CBPR is operationalised in Alaska in relation to critical notions of community, participation, as well as ethical and political dimensions of researching with Indigenous peoples. This is important to ensure that research does not perpetuate existing unequal power structures within communities, as well as between researchers and communities more broadly. Key findings show that, although researchers across disciplines largely do engage participants through each phase of the research (from research development through to research dissemination), there is a lack of critical consideration of what a community is, and how community heterogeneity may influence research. Given that participatory approaches are advocated for by many Indigenous organisations, this brings into question that appropriateness of applying Western sociological critiques of community to Indigenous contexts.

INFLUENCE OF PERMAFROST DISTURBANCES AND INCREASED TURBIDITY ON TRENDS OF MERCURY AND POPS IN LANDLOCKED ARCTIC CHAR IN EAST AND WEST LAKE, MELVILLE ISLAND, NUNAVUT

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The Cape Bounty Arctic Watershed Observatory (CBAWO) includes two adjacent, geologically similar watersheds, West and East, which are currently undergoing climate-driven changes. Climate over the period 2007-2012 was unusually warm during summer months and resulted in changing hydrology and permafrost degradation (including physical disturbances, and thermal perturbation (deep thaw) across the area. In addition, West Lake experienced subaqueous slumps over this period, which may also be related to permafrost thawing along the shoreline. The East Lake catchment has experienced only minor permafrost disturbances, and no change in turbidity. These alterations to water chemistry in the lakes and inflowing streams are also driving changes in the biogeochemical cycles of pollutants. We are investigating whether these changes are also seen in bioaccumulation of mercury (Hg), as well as persistent organic pollutants (POPs), in landlocked Arctic char (Salvelinus alpinus) and the food webs of West and East Lakes. We hypothesize that the increase of catchment inputs of organic carbon and increased turbidity in West Lake, will result in increasing Hg concentrations and POPs such as polychlorinated biphenyls (PCBs) in char. To investigate this, Arctic char have been collected annually at the end of July, from 2008 to 2019 (except for 2010), and analysed for total Hg using USEPA Method 7473 (thermal decomposition/amalgamation and AA detection) and for POPs using a modified method based on USEPA Method 1699. Carbon (C) and nitrogen (N) stable isotope analysis showed that char have significantly more depleted ?13C in adult char (>200 g) in East vs West Lake (mean ± SD; -27.3±0.8 ‰ (N=98) vs -24.7±1.2 ‰ (N=97)) indicative of greater terrestrial and benthic carbon inputs to West Lake. Also δ15N is significantly lower in West Lake char (10.2±1.0 ‰ vs 11.3±0.5 ‰) suggesting differences in food sources. The combined results from 2008 to 2018 collections show that the West Lake adult char have significantly higher concentrations of Hg in muscle (means 169±84 ng/g wet weight, respectively) compared to East Lake (86±36 ng/g) and this difference is even greater if results are adjusted for δ15N or length using analysis of covariance. Lipid normalized PCB concentrations (sum of 87 congeners; 87-PCB) increased in West Lake (2008-2016; 2.1%/yr) while declining in East Lake (1.4%/yr) over the same time period. Total DDT and polybrominated diphenyl ethers (PBDEs) also increased at a similar rate in West Lake while declining in East Lake. Concentrations of 87-PCBs were also higher in fish stomach contents from West Lake compared to East Lake, indicating the contaminants were associated with dietary uptake. Hg concentrations have also declined in East Lake char over the period 2008 to 2019 (averaging -5.3%/yr) while increasing (4.6%/yr) in West Lake from 2009-2017. No char were caught in West Lake in 2019 indicating that the turbidity may have extirpated the adult population. The higher concentrations and increasing Hg and POPs in West Lake char are consistent with higher inputs resulting from extensive permafrost disturbance in the watershed as well as from higher concentrations in lake waters and suspended particulate due to the turbidity.

DEVELOPING AN INTERCONNECTED CANADIAN DATA MANAGEMENT SYSTEM TO FACILITATE KNOWLEDGE SYNTHESIS.

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The Canadian Consortium for Arctic Data Interoperability (CCADI) is an initiative that aims to advance the partnership of Canadian Arctic data centres through the development of an interconnected data management system that facilitates information discovery and knowledge synthesis, establishes standards and mechanisms for metadata and data sharing and enables interoperability among existing data platforms that will facilitate international data sharing for use at individual to international scales.

HIGH RESOLUTION NEMO MODELLING FOR NORTHERN BAFFIN BAY AND THE PIKIALASORSUAQ (NORTH WATER POLYNYA) REGION

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The numerical modelling framework of the Nucleus for the European Modelling of the Ocean (NEMO) is now widely used throughout Canada. Here we use the Arctic and Northern Hemisphere Atlantic (ANHA) regional configuration developed at the University of Alberta to present an overview of modelling capabilities and results for the Pikialasorsuaq (North Water Polynya) region and northern Baffin Bay. As well as base 1/4 and 1/12 degree resolution configurations, we considered the application of 1/12 and 1/60 degree nests for the Canadian Arctic, using the AGRIF grid refinement package. The use of the TOP package for passive tracers, integration of a Lagrangian iceberg module and coupling to the biogeochemical model BLING will be discussed. The role of the inclusion of explicit tidal mixing will be examined. A specific application of using model output and the Lagrangian float tool Ariane to examine regions of sensitivity to potential pollutant spills along regional shipping routes will also be presented. Additional discussion will focus on mixed layer depths and the potential origins of Baffin Bay deep water, as well as the penetration of warm Atlantic Water into this region. Given the general scarcity of oceanographic observations in the Canadian Arctic, model simulations have the potential to provide critical insight into ocean processes and guide the development of observational and management initiatives.

KNOWLEDGE MOBILIZATION BY WILDLIFE CO-MANAGEMENT IN THE INUVIALUIT SETTLEMENT REGION

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(2) Inuvialuit Game Council

As the co-management body for terrestrial wildlife in the Western Arctic Region in the Inuvialuit Settlement Region (ISR) of the Northwest Territories (NWT), Canada, the Wildlife Management Advisory Council (WMAC (NWT), or the Council) informs each of its recommendations with the best available scientific and community or traditional knowledge information. The Council is one piece of a larger co-management system responsible for all wildlife and Inuvialuit rights respecting wildlife in the ISR. This talk will present successful ongoing work, as well as challenges, that the WMAC (NWT) undertakes to channel the best available information through wildlife co-management. One example is participation in the Advisory Committee for Cooperation on Wildlife Management (ACCWM), which is composed of the chairs of every renewable resource board/council across the ranges of barren-ground caribou herds in the NWT. Each management authority collects and mobilizes information, from direct community observations and scientific monitoring, to inform annual status assessments of each of the herds. The status assessments then lead to collaborative implementation of management actions; the process thus bridges multiple ways of knowing into a co-management process that crosses territorial and land claim boundaries. The second example of knowledge mobilization for wildlife co-management faces more challenges as the work is still in early stages. The Management Plan for the Dolphin and Union Caribou in the NWT and Nunavut was adopted in 2018, and co-management is working to implement it. The efforts of the Inuvialuit Game Council, WMAC (NWT), Nunavut Tunngavik Inc, territorial and federal governments, and user communities have resulted in a new transboundary co-management working group, whose roles and compilation of multiple sources of information remain very much in development. Ongoing experiences will be shared of how co-management partners and academic collaborators are collecting and mobilizing scientific and traditional knowledge in order to inform collaborative transboundary management. Within the ISR the wildlife co-management system established by the Inuvialuit Final Agreement land claim is a powerful structure that effectively works to mobilize information for the benefit of everyone in the complex interjurisdictional landscape of the north.

REAL-TIME MONITORING OF RISK AND VULNERABILITY IN THE CANADIAN ARCTIC

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The application of vulnerability approaches to study human-environment interactions has been critical for assessing the ways in which arctic communities are experiencing and responding to climate change. However, a lack of dynamic methodologies to evaluate complex problems, and a dominance of short-term projects, which depend heavily on participant recall, has developed a static, baseline understanding of the multiplicity of stressors, adaptive responses, and exposures that typify livelihoods in a changing arctic environment. The Tooniktoyok project represents a collaborative effort between researchers and a cohort of 10 Inuit hunters from Ulukhaktok, Northwest Territories to facilitate and document the two-way sharing of observations, experiences, and knowledge pertaining to altered climatic and environmental conditions, and the costs associated with hunting. Adopting a novel community-based monitoring methodology, the research asks hunters to record their land-use activities in real-time using GPS tracking units, and to then discuss their tracked trails in open bi-weekly participatory mapping sessions. Discussion topics include hunters' choice of trails, problems encountered, the economic costs of subsistence, and broader observations about the environment, commodity usage, and determinants of hunting success. This presentation expands further upon the conceptual and methodological basis for the project, and presents preliminary findings from the 2018-2019 field season. It discusses the roles that traditional knowledge, social relationships, entitlements, and financial capital play in affecting exposure and adaptive capacity within the Ulukhaktomuit subsistence economy.

USE OF CONTINUOUS LAKE LEVEL MEASUREMENTS FOR HYDROLOGICAL MONITORING OF A COMPLEX NORTHERN FRESHWATER LANDSCAPE

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The Peace-Athabasca Delta (PAD; northern Alberta) spans roughly 6000 km2 and is a complex northern freshwater landscape. The PAD is recognized as a Ramsar Wetland of International Importance and is located mainly within Wood Buffalo National Park, a UNESCO World Heritage Site. The PAD contains hundreds of small, shallow lakes and several large flow-through lakes that provide important ecosystem services, including wildlife habitat and navigation for First Nations on traditional lands. Increasing concern over declining freshwater availability has highlighted the need for monitoring approaches that can track status and trends of contemporary lake hydrological conditions over space and time. To address this need, we are using water isotope tracers and lake water-level loggers because they have capability to provide complementary hydrological information and are effective in large regions containing a diversity of lake types. Here, we focus on continuous measurements of water levels at ~60 lakes across the PAD during the ice-free season (May-September) in 2018 and 2019, and water isotope data from the same lakes collected once in May, July and September of the same years. Study lakes span the entire hydrological spectrum, including closed-, restricted- and open-drainage settings reflecting the gradient of influence of river floodwaters on lake hydrological balances. Measurements of water levels were obtained hourly, which provide an exceptionally high-resolution record. Preliminary assessment of water isotope results from July 2019 suggest that river floodwaters may have entered several of the lakes during the early summer. Changes in lake water-level are being compiled to compare to the water isotope results, which will be used to delineate the extent and magnitude of river flooding in 2019. For lakes that did not receive river floodwaters in 2019, isotopic enrichment occurred due to evaporation, which will be further quantified using the water-level data. We anticipate that integration of both water isotope tracers

and lake water-level loggers will provide a comprehensive approach for systematic hydrological monitoring of lakes in the PAD, and contribute directly to execution of the Wood Buffalo National Park Action Plan.

COMMUNICATION STRATEGIES FOR EFFECTIVE ADAPTATION TO NEW WILDLIFE IN NUNAVIK

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New species of wildlife that are appearing, expanding, and establishing in northern regions are of concern to local communities because of their potential impacts on local ecosystems, traditional food species, food security, and wellness. This presentation will use the example of the expansion of beavers beyond the tree line in Nunavik to demonstrate approaches to disseminating information that can help equip and prepare communities to adapt to these changes.

PRESERVING ARCTIC CHARR HABITAT AND INDIGENOUS FISHERIES IN WESTERN HUDSON BAY

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Inuit have relied on Nunavut's Arctic charr populations for centuries. They provide an important supplemental food source making up to 45% of the country food harvested by Inuit. Arctic charr are also economically important to Nunavut with existing commercial fishery in the Kivalliq and Kitikmeot Regions. Available migratory routes have diminished over the preceding decades as a result of cumulative stressors. Isostatic rebound has reduced water levels along key migratory routes; creeks which previously had few if any obstructions now have many due to dropping water levels. Climate change has begun to alter stream hydrology in the critical migratory period and has increased the risk of permafrost slumping which may create new barriers (either physical or chemical) in the future, potentially further limiting migratory pathways of the local charr population. Inuit traditional knowledge provides corresponding observations of changing water depths in charr rivers and impeded access to spawning habitat for anadromous populations. Concerns have been raised with respect to the stability of local fisheries. To address these concerns, we have begun implementing a three-year project that will remove existing migratory barriers that increase stress on culturally important Arctic charr populations in the Kivalliq Region. In this initial year of the project, we have adapted the "One Voice" approach to integrating western science with indigenous traditional knowledge to identify sites presenting ephemeral or permanent barriers to Arctic charr migration. Impacted sites were identified along the coast of Hudson Bay both north and south of Rankin Inlet through semidirected interviews and an associated mapping exercise with local Elders and Knowledge Holders. Impacted sites were subsequently visited and characterized using western science approaches to assess the extent of the migratory barriers identified by local interviewees and to determine whether the migratory route could be feasibility restored. We are now developing a restoration plan for implementation during the open water season of 2020, using community input for each candidate site. The plan will include simple, mechanical methods to improve migration opportunities (e.g. pry bars and come alongs) following the example of other similar restoration initiatives in Nunavut such as those used to successfully restore Nulahugyuk Creek near Bernard Harbour. The restoration team will include local Inuit and will work to create channelized flow at each restoration site. This will facilitate fish passage under varied hydrological conditions ensuring the local population has unimpeded access to both inland and marine habitats. Inuit will be trained to collect data inputs to habitat occupancy modeling during restoration activities in year two (2020), and as part of follow up monitoring in year three (2021). Identified migratory barriers that cannot be feasibly restored as part of this initiative will be recorded as a bank of potential restoration projects in the future. The approach taken for this project is intended to serve as a model for local community groups and organizations to identify migratory barriers that impact anadromous populations and the associated subsistence fisheries using both indigenous knowledge and western science, and build the local capacity to develop and implement effective restoration initiatives in the future.

SHARING COUNTRY FOOD: CONNECTING HEALTH AND WELLBEING, FOOD SECURITY, AND CULTURAL CONTINUITY IN CHESTERFIELD INLET, NUNAVUT

Newell, Sarah L. (1) (Presenter), N.C. Doubleday (2) and the Community of Chesterfield Inlet (3)

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Background: Food security is a complex topic that goes beyond the adequate provision of sufficient, nutritious food to include cost, safety, and cultural considerations. In Inuit communities in Arctic Canada, food security is intimately connected to culture through traditional methods of harvesting food. Establishing how food, culture, and community wellbeing are linked provides the foundation for demonstrating how changes in shipping practices and climate impact these links. Using the case study of Chesterfield Inlet, Nunavut, this research aims to develop a theoretical framework of how food security, cultural continuity, and community health and wellbeing are interconnected to allow for a richer understanding of how increased shipping, climate, and social changes are impacting community members. Located on the western coast of Hudson Bay, Chesterfield Inlet has a population of approximately 400 people, the majority of whom are Inuit who continue to harvest and consume country food on a regular basis. Methods: Community-based research was conducted in collaboration with community members. Data was collected through interviews with 27 current hunters and elders, and through a community meeting that included an additional 7 participants. Various community members participated in the design of the research project and engaged in results discussions through community consultations. Data were used to explore the interconnections between and among food security, cultural continuity, and community health and wellbeing. Results: In Chesterfield Inlet, Nunavut, sharing of freshly harvested country food links food, culture, and community health and wellbeing. Current hunters and elders described a preference for country food, which they consume whenever possible. They highlighted the importance of sharing freshly harvested country food as a way of passing on Inuit cultural practices and values, while also supporting the food security of fellow community members, particularly elders. Participants also described the positive impact that sharing, rather than selling, of country food has on promoting community health and wellbeing. A theoretical framework was developed to create a baseline upon which community members can demonstrate the impact that shipping and climate changes are having on wildlife, and on themselves as a result. In combination, increased shipping activity and climate change stress the ability of current hunters to harvest sufficient country food to both support food security in their households and have excess to share. Further, the study recognizes and reinforces the importance of existing community efforts aimed at protecting food security from the impacts of changing shipping practices. Discussion: This study demonstrates that policy aimed at addressing food security and health and wellbeing in Nunavut must support the harvesting, consumption of and sharing of country food within communities such as Chesterfield Inlet. Examples include supporting harvesting programs through the Government of Nunavut and altering shipping practices to nearby mines to prevent interference with the harvesting of marine mammals. This study highlights the importance of including local voices in policy development and decision-making processes that have implications for community livelihoods and wellbeing.

RETREAT PATTERN OF GLACIERS CONTROLS THE OCCURRENCE OF TURBIDITY CURRENTS IN HIGH LATITUDE FJORD DELTAS (EASTERN BAFFIN ISLAND)

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Glacier and ice sheet mass loss as a result of climate change is driving important coastal changes in Arctic fjords. Yet limited information exists for Arctic coasts regarding the influence of glacial erosion and ice mass loss on the occurrence and character of turbidity currents in fjords, which themselves affect delta dynamics. Here

we show how glacial erosion and the production of meltwaters and sediments associated with the melting of retreating glaciers control the generation of turbidity currents in fjords of eastern Baffin Island (Canada). The subaqueous parts of 31 river mouths along eastern Baffin Island were mapped by high resolution swath bathymetry in order to assess the presence or absence of sediment waves formed by turbidity currents on delta fronts. By extracting glaciological and hydrological watershed characteristics of these river mouths, we demonstrate that the presence and areal extent of glaciers are a key control for generating turbidity currents in fjords. However, lakes formed upstream during glacial retreat significantly alter the course of sediment routing to the deltas by forming temporary sinks, leading to the cessation of turbidity currents in the fjords. Due to the different deglaciation stages of watersheds in eastern Baffin Island, we put these results into a temporal framework of watershed deglaciation to demonstrate how the retreat pattern of glaciers, through the formation and filling of proglacial lakes, affects the turbidity current activity of deltas.

THE ECOLOGY AND CURRENT STATUS OF EELGRASS IN JAMES BAY, QUEBEC

O'Connor, Mary(1) (Presenter), Noisette, Fanny(2), Davis, Kaleigh(1), Leblanc, Melanie(3), Richer, Lou(2).

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Eelgrass is a foundation species that can dominate shallow coastal habitats throughout the northern hemisphere. Its role as a foundation species provides food for geese, which in turn provide a cultural and provisioning services to coastal communities in the Cree first nation along the eastern shores of James Bay, QC. Until the late 1990's James Bay was home to an extensive eelgrass meadow (Zostera marina L.) that was thought to be among the largest in North America. The extent of eelgrass habitat, as well as canopy density and height, have declined since 1998. Over this same period, Cree report severe declines in goose abundance during their spring and fall hunting seasons, and they attribute the changes in goose abundance to declines in eelgrass. In partnership with the Cree land users, we surveyed coastal areas likely to host eelgrass along James Bay's eastern coastline in summer 2019 to document its current abundance, distribution, and associated biota. This is the first publicly available survey on this scale of James Bay eelgrass assemblages. We documented shoot density, height, epibiota composition, and used eelgrass morphometric indicators to assess growth rates and reconstruct recent growth. We are testing hypotheses that salinity, ice-off and water quality affect eelgrass presence and growth. We also compared James Bay eelgrass and its associates to eelgrass meadows on the Pacific Coast of Canada and in the St. Lawrence River (QC). Understanding the status of eelgrass communities in James Bay is critical to connecting eelgrass decline to the decline of dependent species and preserving the cultures and economies of James Bay Cree communities.

ILLINIAVUGUT NUNAMI (LEARNING FROM THE LAND): AN INVESTIGATION OF THE ROLE OF FORMAL LAND-BASED LEARNING PROGRAMS ON STUDENT LEARNING

Obed, Diane (1) (presenter) K. Snow (2) (presenter)

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McGregor (2010) in Inuit Education and Schools in the Eastern Arctic, describes what Inuit believe are the differences between formal and informal learning by outlining the meaning of the words ilisayuaq and isumaqsayuaq. Isumaqsayuq is the traditional way of sharing knowledge through observation and imitation embedded in daily family and community life learning. Fundamentally based on the principles of Inuit Qaujimajatuqangit, isumaqsavuq which encompasses land-based learning is known to help promote language revival, cultural practices, and positive self and cultural identities that will sustain youth. Indigenous land-based education is viewed as not only a source of resistance against a capitalist settler state (Coulthard, 2015), but it is also important for environmental stewardship, climate change adaptation (Watt-Cloutier, 2015), and most importantly, promoting and maintaining Inuit autonomy and sovereignty (Petrasek MacDonald, 2014; Price, 2007; Wildcat et al., 2014). However formal ilisavuaq learning for these same objectives in K-12 schools is challenged by funding and policy restrictions that make opportunities to "go off" for youth in school more "special events" than inherent in education. School districts across Inuit Nunangat are increasingly adopting land-based programs to inspire, however, it is still not enough to

(re)balance ilisayuaq and isumaqsayuaq away from the dominating colonial education system to fully support a holistic education for all students. The information in this presentation has been developed from two different lenses. Through her masters thesis Diane Obed conducted an in-depth examination of the role of land-based education as a means to decolonize education, while Kathy, working in the context of the ArcticNet funded project (2016-2018) examined Inuit student persistence and success, and noted land-based education as an emergent theme from youth, parents and Elders across Inuit Nunangat. These two perspectives, decolonizing education through land-based learning, and the role of land-based learning in formal schooling across Inuit Nunangat have been combined to build an argument for greater funding and support for land-based initiatives in a reframing of culturally responsive education.

SHIPWRECKS IN THE ARCTIC - KNOWLEDGE GAPS ILLUSTRATED BY A CASE FROM SVALBARD

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In the marine Arctic areas surrounding the Svalbard archipelago, estimates suggest that more than 1000 historical wreckings have occurred. For different reasons, i.a. operational conditions such as safety and logistics, there have been very few documented efforts to survey and investigate underwater cultural heritage (UCH) in these areas. Recent developments in underwater technology, sensors and computer science are currently enabling marine archaeology in remote areas such as ultra-deep and Arctic waters. In the last five years, several interdisciplinary research missions utilising advanced underwater robotics have focused on UCH around Svalbard. In January 2016 and June 2019, small class autonomous underwater vehicles and remotely operated vehicles (ROV) were deployed to survey for at least 17 Dutch and German whaling ships that were sunk near Smeerenburg on the Northwestern coast of Spitsbergen in a French naval campaign in 1693. Approximately 10 square kilometres were surveyed with high-resolution side-scanning sonars (SSS), generating a list of >50 possible objects of interest. A few of these were inspected with mini ROV, but no wreck sites could be confirmed. Based on the SSS seabed imagery, it appears that there are no well-preserved structurally intact wrecks in the survey area. Together with the discovery of a wood eating organism in the Arctic Rijp fjord east of the survey area, preliminary results supports a hypothesis that environmental conditions beneficial for preservation of wrecks, as e.g. seen in the Canadian Arctic, are not present in this area. The long-term preservation of shipwrecks, after reaching equilibrium, depends on environmental conditions. Wrecks, as human made reefs (HMR) can form local eco-systems with structures that can have detrimental effects on typical wreck site materials. These structures are less known in deep and Arctic waters, but appear to be different from shallow or temperate waters. A better understanding of how HMR form and develop is needed to make informed management decisions regarding shipwrecks. With apparent changes in the ocean environment, like atlantification due to climate change, the dynamics of larger areas and systems must be taken into account. We propose a collaborative effort were data from selected areas in Canada, Greenland and Svalbard are compared over time to assess the current situation and possibly predict the impact any changes in the ocean environment may have on underwater cultural heritage sites in the marine Arctic.

PERFORMANCE ISSUES AND MONITORING OF RESIDENTIAL HEAT/ENERGY RECOVERY VENTILATORS IN NUNAVIK

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Adequate and effective ventilation is essential to provide acceptable indoor air quality (IAQ) and control moisture in Northern homes. However, ensuring proper ventilation while minimizing energy costs can be a challenge in housing in Canada's North due to several factors including harsh climate, incorrect installation, lack of regular maintenance, equipment failures (freezing of cores, etc.). An increasingly common method to provide a healthier indoor environment, control moisture build-up and reduce energy costs is to install a heat/energy recovery ventilator (HRV/ERV). These ventilation systems are a mature and proven technology for energy-efficient Canadian homes; but underperform or fail and are plagued with problems when operating in Canada's North of 50°. Homes with inadequate ventilation and poor IAQ are particularly common in northern communities and contribute to increased cases of associated health issues. There has been limited research on the impact of inadequate ventilation on IAQ and the respiratory health of children in Arctic dwelling. This in part motivated the present study where we monitored the ventilation and thermal performance of heat and energy recovery ventilators installed in occupied dwellings in Kuujjuaq (Nunavik), identified and documented issues and common problems that affect their performance; and in particular, evaluated the impact of a proper installation, optimization and maintenance of these units on the ventilation capacity, the concentrations of indoor pollutants, and the potential improvement in the respiratory health of children enrolled in the study. Objectives of this field study were to gain insights about HRV/ERV performance issues in Nunavik, collect and share information with local housing corporation to stimulate discussion and identify future work to improve the performance of HRVs/ERVs in Nunavik housing, and measure the effectiveness of a targeted optimization of existing heating and ventilation systems at improving ventilation, IAQ, and health of children. The intervention following an initial assessment of the system's performance by an intervention team (field technician and local housing corporation maintenance personnel) conducted an optimization of the existing HRV, ERV, or mechanical ventilation systems (bathroom' exhaust fan, etc.). For the ERVs/HRVs the intervention included balancing the system, washing/cleaning the core and ensuring that the balancing dampers are fully open. In all cases, an optimization or replacement of the localized exhaust system (kitchen, bathroom) was also conducted and the activated charcoal filter in the extractor fans were replaced and checked that they are connected to the outdoors. This presentation will focus on how residential HRV/ERV are designed, certified, installed, commissioned, operated and maintained in the Arctic and specifically in Kuujjuaq (Nunavik). Results from extended monitoring of HRVs and ERVs installed in mechanical rooms of occupied dwellings and their performance before and after an intervention will be presented. This study has shown that many problems that are minor issues for HRV/ERV systems installed in southern Canada become major problems in the North, concerns persist that many HRVs/ERVs did not have all aspects of the systems installed correctly. This field study demonstrated that targeted preventative maintenance and optimization of ventilation systems can significantly improve ventilation and IAQ as a result.

COMMUNITY-BASED COASTAL RESTORATION IN NUNAVUT

Owen, Jade (1, 2)(Presenter), L. Fanning (1), Presenter* (3) *A representative from the Nangmautaq Hunters and Trappers Organization in Clyde River will co-present if the submission is successful.

(1) Marine Affairs Program, Dalhousie Unviversity
(2) Fisheries and Sealing, Government of Nunavut
(3) Nangmautaq Hunters and Trappers Organization

To maintain healthy fisheries, there must be an understanding of the small- and large-scale changes that can negatively impact Nunavut's cultural or commercial activities in marine waterways. Coastal Restoration Nunavut is a collaborative research project between Dalhousie University, the Government of Nunavut, and Hunters and Trappers Organizations. The project is conducting community consultations and feasibility studies to identify and mitigate the stressors impacting aquatic species in each of Nunavut's 25 communities. Bringing together Inuit Qaujimajatuqangit and science, the project is identifying data gaps in coastal habitat health, habitat fragmentation and fish health within the context of a changing climate. The project team is engaging communities to identify and document any coastal changes that harm fish, fishing, fish habitat or other marine life. The project is informed by Inuit Qaujimajatuqangit, ensuring the local knowledge of experienced harvesters, Elders and traditional resource users is prioritized. Since February 2018, the start of the project, 16 communities have been visited by the research team: Clyde River, Sanikiluaq, Arviat, Whale Cove, Chesterfield Inlet,

Coral Harbour, Pangnirtung, Igloolik, Hall Beach, Resolute Bay, Grise Fiord, Kugluktuk, Cambridge Bay, Taloyoak, Kugaaruk and Gjoa Haven. The remaining nine consultations are planned for 2020. Identified restoration needs have included restoration of migratory corridors for arctic char and key shellfish beds; mapping of dynamic marine habitats in order to monitor for the long-term sustainability of species and their habitats; identification of marine stressors that are negatively impacting marine or freshwater species; impediments to fish passage; changes to migration patterns impacting availability and accessibility of aquatic species; and fortifying the integrity of degraded or eroded fish habitat. A pilot restoration project was completed in the community of Clyde River in fall 2019. This project includes the development of a community-led coastal restoration and monitoring plan and implementation of the priority project as identified by local stakeholders. Specifically, the Nangmautaq Hunters and Trappers Organization had requested assistance to restore and enhance the Nilaqtarvik River. An old and no longer used quarry road was built through the river, enabling trucks and heavy machinery to drive through a key migratory corridor for char. This road adversely affects the adjacent char population migrating in and out of Nilaqtarvik Lake. The restoration will improve the quality of habitat in the Nilaqtarvik system, as well as the wider ecosystem in Clyde Inlet - both benefit from a higher and more robust population of arctic char. Subsistence fishing and cultural activities are also strengthened by protecting the abundance of the arctic char population. Prior to the restoration work, a monitoring fence numerated upstream char passage in summer 2018. Lessons learned from the community-led pilot restoration and monitoring project will be shared, informing subsequent site rehabilitations across the region. Funding for the project is provided by DFO's Coastal Restoration Fund (2017-2022).

CONTRASTING WINTER OXYGEN DYNAMICS IN CONSECUTIVE YEARS ALTERS ARSENIC CYCLING IN A SMALL SUBARCTIC LAKE

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The seasonal development of an ice cover has an important influence on the biogeochemical cycling of elements in high latitude lakes. In shallow systems, the winter development of water column anoxia can alter the mobilization of redox sensitive elements, such as iron (Fe), manganese (Mn), and arsenic (As) from sediments to overlying waters. In this study, we conducted comprehensive geochemical characterization of surface waters, sediment porewaters and lake sediments across seasons in a shallow subarctic lake (max. depth 2.9 m) impacted by 60 years of atmospheric mining emissions to explore As cycling during two consecutive years with contrasting winter oxygen conditions. During the open water season in both study years the water column was well mixed and a thin oxic layer was present in near-surface lake sediments, which limited the mobilization of As to the overlying water through attenuation by Fe-oxyhydroxide minerals. As ice cover developed in both winters, oxygen in near-surface sediments was depleted and lake sediments became a source of As to the overlying water column. During the first winter, low water levels resulted in the lake being hydrologically disconnected from the surrounding watershed and anoxia developed through the entire water column which resulted in a large increase in water column As and Fe, through the reductive dissolution of As-bearing Fe-oxyhydroxide minerals. The persistence of anoxia for > 3 months promoted sulfate (SO4) reducing conditions in the water column leading to late winter removal of As from the water column, possibly via precipitation of As-S minerals. In early spring, oxidation of the water column was initiated near the sediment boundary, likely from benthic oxygen production in lake bottom microbial mats. Snowmelt intrusion to the lake led to the complete oxidation of the water column two weeks prior to ice-off and coincided with the removal of As from the water column, likely via adsorption on precipitated ferric oxide particles. High summer rainfall in the second year of the study raised water levels in the watershed and open water flow persisted at the lake inlet and outlet during the second winter. Water column As concentrations remained low in the second winter because the upward migration of Fe and SO4 redox boundaries were suppressed by the continued supply of oxygenated water through the lake inlet. This work provides insight on how climate and landscape factors, such as ice cover duration and hydrological connectivity influence the coupling of As, Fe, and S cycling in shallow seasonally ice-covered subarctic lakes.

THE NATIONAL INUIT STRATEGY ON RESEARCH AND DATA SOVEREIGNTY: PROGRESS ON THE IMPLEMENTATION OF PRIORITY AREA 4 AND THE NATIONAL INUIT DATA MANAGEMENT COMMITTEE

Parrott, Jenn (1) (Presenter), A. Kora (2)

(1) National Inuit Data Management Committee
(2) Inuit Tapiriit Kanatami

The National Inuit Strategy on Research (NISR), launched in March, 2018, calls for changes in all aspects of research and the research process that will better serve Inuit. Often times, the data and information collected through these projects and initiatives is largely inaccessible or unavailable to Inuit, or shared inconsistently and intermittently. This creates situations of imbalance where non-Inuit researchers and institutions have Inuit-specific data and information, but may act unilaterally to publish, disseminate, or utilise this data or information without either consulting with or the being provided the express consent from Inuit to do so. Research data and information has the potential to improve and provide support for evidence-base decision-making of Inuit representational organisations to advocate and work for change that is sustainable and impactful for our people. To move this forward, the National Inuit Data Management Committee (NIDMC) is tasked with the mandate of ensuring the objectives and actions of Priority Area 4 of the NISR, Ensure Inuit access, ownership and control over data and information, are implemented. The NIDMC membership is composed of two representatives from each of the four Inuit Land Claims Organizations. This work entails shifting Inuit representational organisations from places of data and information deficit, to creating centralised, sustainable, and effective data and information hubs that are managed, owned and accessible by Inuit. This presentation will provide updates on the progress on the implementation of Priority Area 4 as well as the work of the NIDMC.

UTILIZING RPAS TO MONITOR PERMAFROST RETROGRESSIVE THAW SLUMP GEOMORPHOLOGICAL CHANGE AND ASSOCIATED DOWNSTREAM BIOGEOCHEMICAL IMPACTS

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Permafrost retrogressive thaw slumps (RTSs) have become prominent features along the shorelines of lakes and rivers across many landscapes in northwestern Canada. Recent formation of RTSs have been observed along the Old Crow River drainage network in Old Crow Flats (OCF), Yukon. This 14,500-km2 basin is the traditional territory of the Vuntut Gwitchin First Nation who are concerned about the impacts RTSs will continue to have on boat access and downstream water quality. Our research program aims to provide insight into the size and frequency of RTSs along the Old Crow River and associated biogeochemical impacts including the downstream transport of carbon. We showcase the utility of fixed-wing and multirotor remotely piloted aircraft systems (RPAS) equipped with multispectral and thermal sensors to monitor RTS geomorphological properties and changes. The largest RTS along the Old Crow River has been monitored with five post-processing kinematic RPAS surveys since it initiated during wet conditions in June-July 2016. The initial pulse exported approximately 29,000 m3 of sediment within the first month. By August 2018 it had exported a total of 47,509 m3. More sediment was exported during the relatively hot and dry summer 2017 than during the cooler and wetter summer 2018. Carbon and nitrogen (C and N) concentrations and bulk density measurements were coupled with photogrammetry results to estimate the volume of carbon and nitrogen export to the river. Representing ~1% of the thawed sediment, C and N cumulative export was calculated to increase from an initial 463 t and 36 t in 2016 to 754 t and 59 t in August 2018, respectively. However, the influence of the exported material on water quality has been highly variable and episodic depending on meteorological conditions. Downstream dissolved organic and inorganic carbon (DOC and DIC) concentrations were notably higher during wet conditions in 2016 when the RTS was highly active compared to subsequent sampling campaigns. These data are being complimented with ongoing C and N analysis of additional RTS sediment samples and analysis of downstream total suspended sediment concentrations. Thermal imaging of the slump is currently being used to characterize geomorphological properties of the RTS including spatial variation in flow patterns. Mapping of RTSs was also expanded during spring 2016 to include sites at varying stages of re-established vegetation cover to investigate whether RPAS may be used to determine the age and frequency of RTSs. This research demonstrates how RPAS can be utilized in accessibility-limited areas

to provide important insight of climate-change driven landscape impacts.

HYDROGRAPHICAL VARIATIONS IN THE UNDER-ICE RIVER PLUME OF THE LA GRANDE RIVER AND INFLUENCE ON SALINITY AT JAMES BAY EELGRASS BEDS

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Hydroelectric development on the La Grande River in northern Quebec (Eeyou Istchee, James Bay) has increased discharge and shifted peak flows into winter to meet the high demand for electrical energy. Although studies conducted after initial stages of development in the 1980s showed an increase in under-ice plume extent in relation to increased winter river discharge, the variability in the plume caused by tides and storms, and the influence of the plume on salinity of nearby coastal waters is not known. This uncertainty is a problem because coastal areas of northeast James Bay harbour extensive subtidal meadows of eelgrass (Zostera marina), which is not tolerant of very low salinity. This study, which was supported by the Cree Nation of Chisasibi and the Arctic Eider Society, sought to characterize the variations in the La Grande plume under the ice cover and assess its effects on seasonal and daily salinity variations at nearby coastal sites hosting eelgrass. Here, we show that the thick (5m) under-ice plume delivers low-salinity water to some embayments while others receive saltier water because of more tidal mixing of inflowing plume waters. During the summer, the highly stratified river plume is constrained to the mouth of the river, and the coast has generally a higher salinity over all. During the winter, when a stratified plume extends several tens of kilometers from the river mouth, salinity and temperature variations at each site reflect the spring-neap tidal cycle and temporal variability in the vertical properties of the plume while storm events in winter were associated with increases in the salinity of the surface layer and decreases in the salinity of the deeper layer, implying enhanced vertical mixing. Interpretation of data collected under the ice concurrently within the plume and nearby eelgrass beds suggests that while very fresh surface waters from the river plume circulate freely into the unprotected bays close to the river mouth, brackish waters produced by vertical mixing of fresh surface waters and saline deep waters circulate into protected embayments further north. The higher salinities in embayments protected from direct influence of the river plume presumably provide more favourable conditions for eelgrass growth. This study concluded that the plume not only extends further under the landfast ice cover than in previous decades with lower winter flows but also that the plume circulates into nearby coastal embayments that provide a potential habitat for eelgrass.

ESTABLISHING A BASE-LINE FOR LIMACINA HELICINA TOLERANCE TO INCREASING ACIDIFICATION IN THE CANADIAN ARCTIC.

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Arctic marine waters are experiencing widespread and rapid ocean acidification. Ocean acidification is so advanced in one area of the Canadian Arctic Archipelago that shallow waters are already perennially undersaturated with respect to the aragonite. Shelled pteropods, commonly referred to as sea butterflies, are free-swimming pelagic molluscs that thrive in the water column of polar seas. Within the Canadian Arctic Archipelago, Limacina helicina is frequently found amongst the top 10 most abundant taxa within zooplankton sampling stations. Limacina helicina have thin, translucent aragonitic shells, ranging in size from a few tens of microns in the larval stage to 4-5 mm as an adult. Exposure to waters undersaturated with respect to aragonite is widely considered to be detrimental to pteropods, causing them to struggle to build their shell and for their shell to dissolve. Since 2017, the UK-Canada bursary programme has funded two projects to establish a baseline for the distribution and shell condition of L. helicina throughout the Canadian Arctic Archipelago. We incorporate a time-series of population structure within Queen Maud Gulf, Nunavut, a central area perennially undersaturated with respect to aragonite, to better understand the tolerances of polar pteropods to the widely varying carbonate chemistry within the Arctic and to allow us to predict the impact of future ocean acidification on the Arctic ecosystem.

USING ECOSYSTEM MODELLING TO FOSTER SUSTAINABILITY OF MARINE HARVEST AND FOOD SECURITY IN COASTAL COMMUNITIES OF THE CANADIAN ARCTIC FACING CLIMATE CHANGE

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Recent changes in local marine food webs deeply affect food security in the Arctic, i.e. the availability, accessibility, quality and sustainability of country foods for Inuit. With significant changes in sea ice coverage, Arctic species are facing habitat loss and difficulties to find their usual prey, with consequences for their abundance and/or nutritional flesh quality, which may be aggravated by the increasing presence of sub-Arctic species in Arctic waters. Indeed, marine species, such as Arctic char, beluga and seals are part of the cultural identity of Inuit and rich sources of nutrients, such as vitamins and omega-3 fats. Yet, there is still a knowledge gap when it comes to linking climate change, marine ecosystem structure and health, and food security in the North. Here we aim to 1) create mass-balance ecosystem models using Ecopath with Ecosim in western Baffin Bay (Nunavut) and eastern Hudson Bay (Nunavik) to predict changes in biomass, and contaminant dynamics in marine food webs; and 2) build future scenarios through participatory research with the community of Qikiqtarjuaq in Nunavut. We are currently fitting bioecological and environmental parameters from the oceanographic project GreenEdge in Baffin Bay, and the multidisciplinary project BriGHT in Nunavik, along with harvest data and published data on species diet and abundance in Ecopath to create the mass-balance models. Next, we will add effects of environmental and climate drivers to forecast future changes in the availability and nutritional content of marine species relevant for Inuit. Through participatory research with community representatives in Qikiqtarjuaq (e.g. hamlet, hunters, fishermen), we will validate results from the marine ecosystem model in Baffin Bay based on Inuit knowledge and observations. Further, we will develop community-relevant scenarios that can better inform adaptation plans to support food security and sustainable marine harvest. By merging interdisciplinary scientific and Inuit knowledge, the ecosystem models created here will provide a thorough understanding of marine food webs under rapid changes, and how that relates to Inuit food security. The research approach taken here may serve as a model to other coastal regions dealing with similar food (in)security challenges.

FINE-SCALE GENETIC STRUCTURE IN ANADROMOUS ARCTIC CHAR IN LOWER NORTHWEST PASSAGE: GENOMIC INSIGHTS FOR A SUSTAINABLE FISHERY

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Climate change is having profound and potentially irrevocable ecological impacts worldwide, but is predicted to have the greatest influence on northern ecosystems and peoples. The decline in sea ice extent as a result of climate change is predicted to bring huge changes to ecosystems in the Canadian Arctic, especially in the Lower Northwest Passage (LNWP), Nunavut. While providing easier access for commercial fisheries, reduced sea ice may also make it more challenging for subsistence fishing for Indigenous people. The Canadian Arctic represents arguably the last remaining under-exploited fishery in the world, and, as Arctic waterways become increasingly navigable, will attract significant attention. The Arctic char (Salvelinus alpinus) is an important traditional food for Inuit communities, and is also valued in global fish markets. This changing environmental context affords both opportunities and challenges to territorial and Canadian governments, in terms of establishing a sustainable fishery for the benefit of Indigenous peoples of Nunavut. As part of our Genome Canada-funded research project, "Towards a Sustainable Fishery for Nunavummiut", we are using genomic tools to help provide insight into the delineation of management units for a sustainable Arctic char fishery by evaluating fine-scale genetic population structure in char from the LNWP. We examined 413 samples from 18 LNWP sites selected using Inuit Traditional Ecological Knowledge. We found marked genetic structure at two scales: (i) Between King William Island sites and mainland Chantrey Inlet locales, (ii) Among rivers at scales less than

120 kilometers. Our results suggest that natal homing in char causes differentiation among even adjacent rivers, that other factors (e.g. colonization history, marine foraging patterns) cause deeper population divisions, and that individuals may over-winter in non-natal rivers. Our study illustrates the power of genomics to study cryptic population structure in non-model organisms, which will help guide management strategies for sustainable char fisheries.

BUILDING WITH THE CHANGING CLIMATE IN MIND: CASE STUDIES FROM NORTHERN CANADA

Pendakur, Kala

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The North is on the front line of climate change. The Arctic is warming faster than even the most pessimistic models predicted. For the foreseeable future, changing permafrost conditions will be of utmost concern to the design, building, and maintenance of infrastructure in Canada's North. When permafrost thaws, it can change solid earth into a muddy consistency. As a result, the ground can "slump" leading to failures in any structures built upon it. This discussion will present an overview of some of the northern infrastructure projects that are considering permafrost conditions, and how changing permafrost have dictated the design, and build of community infrastructure.

BUILDING A CLIMATE-RESILIENT FUTURE WITH NEW NORTHERN STANDARDS

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Nearly all permafrost in Canada is, or will be, experiencing some degree of thaw this century. As permafrost warms, infrastructure in the north will need to be built or retrofitted to accommodate ground settlements. Standards can support the resilience of infrastructure by providing design professionals (like engineers) with vetted technical requirements and detailed guidance. New northern standards are now being developed to support community infrastructure adaptation to the changing climate. These standards are helping northerners adapt homes, solid waste sites, community drainage systems, and more to permafrost thaw. This discussion will present an overview of some of the northern-centric standards developed to date, how they are being implemented in Canada's territories, and what further standards could still be developed.

WHAT'S IN A NAME? OFFICIAL AND "PENDING" PLACE NAMING IN NUNAVUT

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Inuit Heritage Trust Incorporated

Decades of place names research and map production by the Inuit Heritage Trust (IHT) have made place names information available not only to Nunavummiut but to those outside Nunavut as well. From innovative talking maps on the internet in the mid-90s (thanks to the NPC) to the paper maps we are distributing in communities today, we've come a long way in enabling the sharing of Inuit intergenerational knowledge. While making traditional place names official is still a priority, and though progress is slow, map makers at all levels should be availing themselves of the (new) official names. IHT has also been focusing on producing paper maps which are much appreciated by hunters who use the maps while on the land. Named places indicate areas of significance, including potential hazards (like shoals, currents (indicating thin ice in winter)) but also passages, fishing lakes, and so much more. The mere fact of places on the land having names indicates their significance, compared to places without names. Local search and rescue efforts, and regular communication amongst hunters while on the land, are only a couple of the reasons why maps with traditional place names are invaluable. Together with sharing general insights about Inuit place naming and issues relating the names being official (or not) we will provide details about IHT's current map products which include larger place names maps of areas of significance for Southampton Island (Salliq), the Belcher Islands (Sanikiluaq area), Gjoa Haven, Chesterfield Inlet and Rankin Inlet and other ongoing projects.

DIEL VERTICAL MIGRATION OF ZOOPLANKTON IN THE ARCTIC MARINE ENVIRONMENTS

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Here, we discuss diel vertical migration (DVM) of zooplankton at three locations: Young Sound fjord in Northeast Greenland, northeast of Churchill in Hudson and the Southeastern Beaufort Sea in the Canadian Arctic. At all three locations, we deployed ice-tethered or bottom-anchored moorings equipped with Acoustic Doppler Current Profilers (ADCP), and conductivity and temperature (CT) sensors. At three locations the backscatter intensity and vertical velocity time series from the mooring ADCPs revealed a typical pattern for zooplankton DVM, even under sea-ice during winter. Using existing models for solar and lunar illuminance, and the transmission of this light through the sea ice and snow covers, we estimated under ice illuminance and compared it with the known light sensitivity of Arctic zooplankton. From the acquired data we observed the interaction of vertical migration with lunar light, tides, water and sea ice dynamics. In all three locations, we observed DVM modification or completely disruption during either highly energetic current, upwelling, downwelling or spring tide events. In Young Sound, our modelled analysis suggests that the zooplankton in question have an outstanding sensitivity to low illuminance levels of lunar light attenuated by sea ice and snow cover. Unlike the other Arctic and sub-Arctic locations, DVM in Hudson Bay is controlled by solar illumination throughout the whole year, not by moonlight. The disruption of DVM in Hudson Bay are also of the lunar origin, but they should be attributed to the tidal dynamics rather than the moonlight because disruptions occurred during the full moon and new moon phases. The presented data constitutes a first-ever observed presence of DVM in Hudson Bay during winter as well as its interaction with the tidal dynamics.

SEASONAL RESIDENCY OF GREENLAND COD IN A COASTAL EMBAYMENT NEAR ULUKHAKTOK, NORTHWEST TERRITORIES

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Characterizing habitat use and movements of endemic fishes associated with coastal ecosystems in the Arctic can inform how climate change could impact ecological interactions that may influence their prevalence and distribution. The nearshore marine environment is critical for subsistence fisheries in northern communities and changes in how fish utilize this habitat may have important consequences on their catchability in traditional fisheries. Greenland cod (Gadus macrocephalus ogac) is an important species used for subsistence in some Arctic communities yet relatively little is known about their seasonal movements and habitat use. We used acoustic telemetry to examine the movement behaviour and residency patterns of Greenland cod in a coastal embayment near Ulukhaktok, NT in the western Canadian Arctic. Tagged cod (n= 50) at large for one year (July 2018 - 2019) yielded over 11 million detections from an array of 27 receivers. Early findings indicate many individuals move towards deeper rocky habitat (>50m) within Safety Channel (Prince Albert Sound) during freeze up in October, some move deeper in December and few individuals remain in relatively shallow sand/silt habitat (<30m) throughout the year. Distinct movements across the array towards nearshore shallow waters in April and returning to deeper waters (>30m) in May/June that match predicted spawning time suggests these could be movements to and from nearby spawning grounds. In June 2019, one individual moved the full length of Safety Channel in Prince Albert Sound (est. swim speed 0.01-0.02m/s, 45k in 27 days). Temperature, salinity, light levels and current strength measured throughout the study period were examined as potential drivers of seasonal habitat-specific residency patterns. We discuss potential implications of size-dependent movement behaviour on population-level response to ecosystem change and potential parallels with cod behaviour in more southern latitudes, including other closely related Gadids.

IMPROVEMENT OF INDOOR AIR QUALITY IN NUNAVIK DWELLINGS; CAN OPTIMIZATION OF VENTILATION TRANSLATE INTO HEALTH BENEFITS FOR CHILDREN?

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In relation to hospitalizations for diseases of the respiratory system in children less than one year old, there is a gap between the population of Nunavik (4144/10000 between 2007 and 2012) and the population of Quebec (625/10000). Considering that Inuit communities spend a lot of time in their homes, particularly because of adverse weather conditions, it is plausible that Indoor Air Quality (IAQ) is an important determinant of children's respiratory health. This is why IAQ and housing are becoming important factors in the analysis of the issue of respiratory health in northern regions. Based on the hypothesis that improved home ventilation is likely to decrease the prevalence of childhood respiratory infections in the Inuit population, a study was conducted to verify the impact of optimizing the different types of ventilation systems (heat recovery ventilator (HRV) and energy recovery ventilator (ERV)), already in place in Nunavik, on the incidence rates of respiratory infections in children from 0 to 10 years old. A number of 119 children of 10 years old and less, living in 4 types of dwellings (controls: 33, without ventilation system: 26, HRV = 25, ERV = 35) were recruited. The medical records of the children were retrospectively analyzed over a period of 50 weeks before and after the optimization work was completed. A retrospective follow-up of the events (clinical consultation for respiratory disease) and episodes (events occurring after an asymptomatic period of at least 7 days) was carried out. All the clinical diagnoses listed in the medical files were identified and divided into 4 categories; upper respiratory infections (URTI), lower respiratory infections (LRTI), ear infections (EI) and clinical symptoms / signs related to asthma (AS) and two groups of pathologies (URTI+EI; URTI+EI+LRTI). They were then categorized into events / episodes and reported in relation to the timing of the consultation (before or after optimization) and the type of housing inhabited by the child. Frequency distributions of the number of events and episodes were performed, and the data were analyzed by means of negative binomial regressions. The multivariate results adjusted for age and sex show a decrease in URTI + EI and URTI + EI + LRTI episodes in all types of dwellings during the post-optimization period, including in the control dwellings. This decrease was more marked and significant in the HRV dwellings for the two groups of respiratory diseases (URTI + EI: -50.9%, URTI + EI + LRTI: -53%), but there was also a significant decrease for the group URTI + EI + LRTI in the control dwellings (URTI + EI + LRTI: -29.3%). For the two groups of pathologies, a nonsignificant decrease in episodes in the ERV dwellings (URTI + EI: -25.7%, URTI + EI + LRTI: -19.3 %%) was documented. However, for these dwellings, the LRTI increased slightly in a non-significant manner after optimization (LRTI: control: -62.8%, HRV: -57.8%, ERV: 16.7%). Optimization of HRV systems appears to be associated with significant decreases in respiratory conditions, particularly episodes of URTI + EI. Such an effect was not obtained after optimization of ERVs. Various hypotheses need to be explored to better understand the factors that may have affected the effectiveness of optimization of ERVs in this project.

IMPROVEMENT OF INDOOR AIR QUALITY IN NUNAVIK'S HOMES: FRAMEWORK OF A MULTIDISCIPLINARY PROJECT OF VENTILATION OPTIMIZATION IN BUILDINGS.

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Maintaining the indoor air quality (IAQ) of residential housing is a critical aspect of Arctic environments where weather conditions are especially hostile generally forcing its occupants to shelter and stay longer inside. In an effort to save energy and meet the requirements of the latest versions of building codes, changes in building practices in the past decades have made recent and newly renovated homes better insulated

and watertight. Because of these modifications passive natural ventilation (infiltration and exfiltration of air through the interstices of the envelope) or voluntary ventilation (exchange of air by the doors and windows) can be insufficient (even hard to apply or to control) to provide adequate ventilation of living spaces. It is in this context that the optimization of mechanized ventilation systems is of major importance to ensure the maintenance of IAQ especially during heating periods. In the wake of the planning of real estate upgrades in Nunavik, an interdisciplinary research group was formed to evaluate the impact of the optimization of ventilation devices on IAQ and the potential health benefits for occupants, namely young children, in dwellings in Nunavik. To do this, the research team first documented the relative efficiency of the different types of centralized ventilation systems already in place in the investigated buildings. In a second step, the same facilities were optimized. This pre/post-intervention study with a control group was based on a sample of 55 (J2.2, J2.4 and M4.2 types) residential buildings in Kuujjuaq equipped with separate ventilation devices (without system, HRV and ERV) and retrospective tracking of medical records of children in participating households. Visual inspection of housing and mechanical systems, monitoring of a building subgroup, monitoring of environmental conditions (T, HR, CO, CO2, VOC, Bact., PM, ventilation), analysis of perceptions and behaviors of the occupants (e.g. occupation, ventilation, smoking) as well as the follow-up of the medical files of the 119 children recruited allowed to generate useful data for the identification of the factors potentially involved in the degradation or improvement of IAQ in northern residential areas. To this end, certain issues associated with the understanding of the control interfaces of these systems, the opening of ventilation flaps, the maintenance of particle filters and ducts, the operation of the fresh air preheating system and the general condition of the windows were also studied. The partnership developed with local authorities, property managers and experts in ventilation systems and indoor air quality has validated the relevance of conducting regular preventive maintenance on ventilation systems in place and articulate communication activities to promote appropriate behaviors with occupants to maintain good IAQ.

UNDER-ICE VERTICAL DISTRIBUTION OF PELAGIC ORGANISMS IN THE ARCTIC OCEAN DURING THE MIDNIGHT SUN

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Arctic scattering layers have only recently received attention from the scientific community, but animals within these layers are a key component of the pelagic ecosystem. Using ice-tethered and ship-based echosounders, we document the vertical distribution and migrations of Arctic scattering layers over the Yermak Plateau from the layer under the ice down to 600 m depth. Multifrequency analysis of volume backscatter, target strength analyses, and nets towed by a remotely operated vehicle (ROV), were used to infer potential species composition. Correlations between backscatter and environmental covariates were modeled using hierarchical generalized additive models (HGAM). We observed a shallow scattering layer (SSL) from the surface down to 100 m depth associated with polar surface water, a deep scattering layer (DSL) associated with Atlantic water between 300 and 600 m depth, and intermittent shoaling in between these layers. Multifrequency analysis of volume backscattering strength and ROV nets showed that the SSL was made up of copepods, and the DSL and shoals, of swimbladdered fish. The TS analysis suggests that a combination of small polar cod, capelin, lanternfish, beaked redfish, Atlantic cod, haddock, and siphonophores possibly composed the DSL and shoals. We did not observe diel vertical migration patterns in response to change in underwater irradiance. Models showed strong relationships between temperature and backscatter, and between time of day, underwater irradiance and mean depth of the scattering layers.

THE CANADIAN CONSORTIUM FOR ARCTIC DATA INTEROPERABILITY: A NETWORK AND PLATFORM FOR ETHICALLY SHARING DATA ACROSS SCALES

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The Canadian Consortium for Arctic Data Interoperability (CCADI) is a newly funded initiative to advance collaboration, both nationally and internationally, through the development of an Arctic Research Data Infrastructure (ARDI). Using existing and new data infrastructure, CCADI, and the ARDI that it creates will enable multiple social and technical functions. The ARDI will facilitate data description and discovery, enhance near real-time and general research information access, and provide online analysis and visualization capabilities. Our network will enable organizational and technical interoperability among several existing Canadian Arctic data management systems. In this presentation, we provide an overview of the CCADI system architecture while highlighting specific system components. Broadly, we discuss the use of standards and protocols for supporting data interoperability across multiple scientific and knowledge domains (i.e., data and information based on Inuit Knowledge; data from numerous scientific disciplines). Specific methods and technologies are examined: i) the use of schema.org markup to share data descriptions (metadata); ii) sensor web technology to enable near real-time data access; iii) semantic web methods to mediate knowledge domains; iv) a cloud-based online analytical platform for integrating and analyzing data from distributed resources. At present, CCADI comprises six Canadian universities, two Canadian federal agencies, two Inuit organizations, and three non-profit partners. For example, the CCADI works with its partner Inuit Tapiriit Kanatami and with regional Inuit organizations to ensure that Inuit information is included ethically, with full Inuit involvement in the design of systems, and in the management and use of their data. Moreover, CCADI is playing a lead role in the broader national and international data infrastructure development process through bodies such as the Arctic Data Committee and the Global Cryosphere Watch. Ultimately, the CCADI ARDI will connect and, where appropriate, integrate a wide range of different data and information types. Linking these various data resources will enable a more holistic approach to research in and for the Arctic region and beyond. This presentation focuses on the technical system that underpins current and future ARDI functionality.

KITIKMEOT CARIBOU INUIT QAUJIMAJATUQANGIT: DEVELOPING AN INUIT-LED MONITORING PROGRAM

Qaggutaq, Ema (1) (Presenter), P. Wong (2) (Co-Presenter), P. Evans (2), and Ekaluktutiak Hunters and Trappers (3), Gjoa Haven Hunters and Trappers (4), Kugluktuk Hunters and Trappers (5), Kurtairujuark Hunters and Trappers (6), and Spence Bay Hunters and Trappers (7) Organizations

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We report on our efforts to initiate a community-based caribou monitoring program in the Kitikmeot region of Nunavut. Working with Trailmark Systems collaborators, we developed a digital information management system and tool based on Inuit qaujimajatuqangit (IQ) for the Kitikmeot Regional Wildlife Board (KRWB) to enable existing data archival, access, query, retrieval, and sharing. We hired and provided research and technical training to KRWB and Hunters and Trappers Organization (HTO) staff, as well as community researchers/data clerks in who led the work in their communities. We documented new IQ data on caribou in five Kitikmeot communities through interviews with Elders and initiated mobile-based data collection by active harvesters using survey forms synced to our information management system. We also hosted an HTO manager workshop to identify and discuss capacity and information needs across the region. Interviews and monitoring data provided updated knowledge on caribou ecology and distribution (and confirmed knowledge shared in previous research). Elders and monitors also shared information needs, concerns, and monitoring recommendations. More work is needed to locate and review existing datasets and collect new data across the region. We are also developing a regional data management strategy and protocol to enable IQ access and sharing. Further, we will continue to explore capacity needs and opportunities to support sustainable, long-term regional monitoring networks. Programs that can gather information on caribou while supporting community needs have the potential to provide invaluable historical, contemporary, and evolving IQ-based data that is otherwise unavailable.

UQAUSIRISIMAJAVUT: WHAT WE HAVE SAID. THE INUIT VIEW OF HOW OIL AND GAS DEVELOPMENT COULD IMPACT OUR LIVES.

Qikiqtani Inuit Association, Steven Lonsdale and Rosanne D'Orazio.

Qikiqtani Inuit Association, Iqaluit, Nunavut, X0A 0H0

In preparing this effects assessment for the Nunavut Impact Review Board (NIRB) strategic environmental assessment (SEA) of oil and gas activities in Baffin Bay and Davis Strait, QIA put Inuit Qaujimajangit (IQ) front and centre; this submission is intentionally driven by IQ and IQ holders. Even the more apparently modern or "process related" recommendations were made using the lens of Inuit values, interests and culture. This report was based on earlier work commissioned by QIA and two workshops with an IQ Advisory Committee established specifically for this project. QIA is aware that there have been multiple expressions for Inuit knowledge and culture, also commonly known as Inuit Qaujimajatuqangit or traditional knowledge. QIA is aware of the definition provided by the NIRB in their Final Scope document. Inuit Qaujimajatuqangit generally connotes something from the past; the ancient; the original. For QIA, IQ includes the past and the present. It cannot be separated in Inuit. It is intertwined with who they are. Inuit Qaujimajangit is Inuit knowledge living and adapting, and very much part of the present day and present-day life. It is the way the world is seen by Inuit. In this case, it is distinct and specific to the Qikiqtani Arctic environment. It cannot be duplicated anywhere else. During the preparation of this report, QIA sought to organise the information in such a way that it matched Inuit worldviews and perspectives. QIA started with critical relationships. The first was, "If something is changed in the environment, then what does it mean for Inuit?" The second was, "If oil and gas activities happen, what benefits and opportunities can Inuit expect?" Therefore, QIA concentrated its effects assessment on four inter-related areas of interest: Wildlife and wildlife habitat; Cultural changes; Food security; and; Benefits and opportunities. In addition, to assist the NIRB with understanding priority recommendations, QIA organized its recommendations according to conditions that should be met before considering lifting the moratorium and what actions need to be taken if the moratorium is lifted. FINDINGS AND RECOMMENDATIONS: The effects assessment was based on the IQ for the Baffin Bay and Davis Strait marine environments. The centre of the assessment was the seasonal cycle of marine mammals, the Puijiit. QIA also used IQ collected for this project to understand how marine mammals might respond to changes and what marine mammals are sensitive to. For example, harvesters all talked about their sensitivity to noise, and how noise would cause marine mammals to change locations. Marine mammals such as whales, walrus, and seals spend their winters in the offshore area of Baffin Bay and Davis Strait, which is near the potential oil and gas development areas. Based on IQ, it is expected that: Marine mammals will move away from oil and gas activities because of their sensitivity to noise; May be affected by loss of prey species; May find it harder to hunt; and May change where they go in the summer in response to oil/gas activities. The planning, process, and eventual findings of the report were rooted and deeply connected to the Inuit traditional knowledge base known as Inuit Qaujimajatuqangit- a knowledge and belief system

at the core of Inuit identity that governs Inuit society. It is strongest within the Inuit generation that was born before western influence so it is from them that we draw upon the conclusions

NUTRITIOUS AND DELICIOUS: HEALTHY ARCTIC CHAR AND WHITEFISH AS A BASIS FOR SUSTAINABLE FISHERIES FOR GJOA HAVEN?

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Fish have been an important source of nutrition for generations of Inuit living along the shores of the lower Northwest Passage. Today, iqaluk (Arctic char), and kakkiviaqtuuq or pikugtuuq (whitefish) are not only part of the culture but offer the prospect of enhanced employment and food security. This is because warming temperatures may result in increased access to such resources. Thus community leaders, elders and youth are investigating the possibility of a fishery for Gjoa Haven in collaboration with a large-scale Genome Canada-supported project, "Towards a Sustainable Fishery for Nunavummiut". Key to future marketing of these resources, either locally or across the territorial boundaries, is the assurance that these salmonid fish are healthy as well as safe to eat. We have identified and collected parasites from sampled fish in order to develop genetic barcodes to facilitate future enumeration. We have also assayed fish muscle samples for contaminants. Concentrations of the man-made chemicals, polychlorinated biphenyls (PCBs) and their congeners varied, but were generally consistent with levels found in more extensively studied North American waters. Testing showed that both salmonids fished from all examined traditional subsistence as well as possible commercial fishing sites were relatively low for toxic elements, including mercury, in every age class. Unfortunately, this was not true for ihok (lake trout), another salmonid, which migrates through the same waters. More than 130 of these trout were assayed showing mean levels of mercury that were above recommended subsistence levels. As such, we would suggest that efforts to promote an ecologically sensitive fishery be targeted to Arctic char and whitefish. To this end, we have subjected muscle samples from these two salmonids from different fishing sites for nutritional analysis. Overall, "Gjoa Haven char and whitefish" are excellent sources of vitamin D, crucially important for strong bones in young children and at levels sufficient to prevent rickets, which is a concern because of its prevalence in Nunavut. Further, these fish also showed beneficial levels of omega fatty acids and other valuable nutrients. The distribution of these particular country foods within the community and more widely, based on a fair return for fishers, would thus be welcomed, both for the local economy and for community wellness. Acknowledgements: This work was funded by the Government of Canada through Genome Canada and the Ontario Genomics Institute (OGI-096). We also acknowledge funding from the Natural Sciences and Engineering Research Council (Canada), the Ontario Ministry of Research and Innovation, CanNor, the Government of Nunavut, and the Northern Scientific Training Program (Polar Knowledge Canada). We warmly thank the Gjoa Haven, NU community residents, the Hunters and Trappers Association (HTA), and all of the associated supporters of the Towards a Sustainable Fishery for Nunavummiut, as well as sampling personnel that provided invaluable help in the field, and particularly the Gjoa Haven fishermen who were integral to the fish sampling efforts.

THE DEHCHO COLLABORATIVE ON PERMAFROST: WORKING WITH COMMUNITIES TO MANAGE PERMAFROST THAW

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Climate warming and human disturbance in the Dehcho region of the Northwest Territories (NWT), Canada, has led to widespread permafrost thaw and land cover change that has disrupted the hydrological cycle and the ecosystems and human activities that depend on it. There is a growing awareness in the Dehcho that permafrost thaw is negatively affecting the region's economy, and the health, well-being and livelihoods of its residents. However, there is lack of information on permafrost distribution, evolution, and resultant landscape change trajectory in this region. As a result, the ability to manage and respond to this new and growing threat to the Dehcho is extremely limited. There is therefore an urgent need to develop and mobilise knowledge on permafrost thaw in the Dehcho and elsewhere in the subarctic, develop new, practical and customised predictive tools and strategies to adapt to permafrost thaw, and to provide interactive training to decision makers and other users. In direct response to this need, the Scotty Creek Research Station (SCRS) and the Dehcho First Nations (DFN), co-propose the Dehcho Collaborative on Permafrost (DCoP), a Dehcho-wide initiative whose overall objective is to generate a fusion of leading-edge scientific and Indigenous knowledge on permafrost, and to use it as a basis to co-develop new predictive decision support tools and innovative risk management strategies to inventory and manage permafrost and adapt to permafrost thaw.

TOWARDS REPRODUCIBLE, REUSABLE, SCALABLE AND MORE DEMOCRATIC RESEARCH IN POLAR SCIENCE

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Production and usage of scientific knowledge can benefit from the involvement of local and non-scientific communities as well as non-specialist scientists. This approach depends on open access to research methodologies. Two factors directly impede such a democratization of science. First, the ever-increasing complexity of different data sources that need to be combined leads to a proliferation of data manipulation steps often done with custom computer scripts that are rarely made available or useful without the right context. Additionally, several petabytes of data are generated each year by continuous environmental monitoring as well as modelling of the earth system. Datasets thus easily exceed the limits of what can comfortably be handled by single computers, even in the traditionally undersampled Arctic. Yet, the traditional model of data analysis, where researchers download single data files to analyze them on their machines, is still widely employed. This situation also contributes to the reproducibility crisis in science. With science-oriented software package managers and the affordability of cloud computing services, a new approach to data science is emerging. We outline such workflows using the example of autonomous marine profilers, so-called biogeochemical Argo floats, which have recently been adapted to work under sea ice and thus generated novel insights into annual Arctic phytoplankton dynamics. We extend their operational data acquisition pipeline, which already generates large amounts of data, down to the final research product. Along with the conclusions, data, analyses, and visualizations can then be reproduced, tweaked, and reused anywhere, effectively sharing the research itself and not only the resulting journal article. In order to encourage the adoption of new technologies and create an even more collaborative research environment also in Polar Science, we hence need to build data science literacy and push for appropriate infrastructure development.

EFFECT OF PERMAFROST THAW ON PLANKTON AND FISH IN ARCTIC LAKES

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Frozen tundra soils cover only 15% of Earth's total soil area but store more than 30% of the global surface soil carbon in the form of organic matter. Climate warming and the associated permafrost thaw release a large fraction of this carbon into circumpolar lakes, inducing extreme browning that fuels the heterotrophic microbial food web. How this permafrost carbon affects organisms higher in the food chain remains unknown. Using dissolved organic matter (DOM) optics, total phosphorus (TP), chlorophyll a (Chl a), fatty acids (FA), and stable isotopes (SI), we investigated the influence of thawing permafrost on primary producers, zooplankton and fish. We studied

>250 circumarctic lakes that were differently affected by permafrost carbon. Our results highlight the stimulating influence of eroding and degrading ice-rich permafrost on nutrients and planktonic algae. Relative to the non-thaw lakes, the permafrost thaw-influenced lakes had higher TP concentrations. This in turn led to a higher Chl a and seston omega-3 FA concentrations despite significantly reduced light for primary production. Differences between the thaw and non-thaw lakes ceased at higher trophic levels. Zooplankton and fish did not respond to the higher omega-3 availability in the thaw lakes but rather assimilated the high-quality FA equally in all lakes and according to the species-specific requirements. However, the lower quality terrestrial carbon compounds from permafrost ended up in the zooplankton body mass, resulting in a higher assimilation of terrestrial carbon in lakes affected by permafrost thaw. Our findings demonstrate that while the effect of permafrost thaw ranges from markedly stimulating planktonic primary producers to an almost negligible effect on zooplankton and fish omega-3 content, the increased input of terrestrial DOM clearly affects primary producer composition and shifts the feeding of higher trophic level organisms toward a lower quality terrestrial diet.

A MULTISPECTRAL PULSED LASER LINE SCANNING SUBSEA LIDAR FOR STUDYING ARCTIC BENTHIC MACROALGAE AND ICE-BOTTOM MICROALGAE WITH AUVS

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The physical and biological properties of Arctic sea-ice and coastal benthos remain poorly understood due to the difficulty of accessing these substrates in ice-covered waters. A LiDAR system deployed on an autonomous underwater vehicle (AUV) can interrogate these 3D surfaces for physical and biological properties simultaneously. We present the results of initial field tests of a pulsed laser line scanning subsea LiDAR utilizing a single excitation wavelength (532 nm) and two detection wavelengths (532 nm, 685 nm). We evaluate the 3-D imagery of calibration, man-made, and macroalgal targets using elastic and inelastic fluorescence returns from the LiDAR during pole-mount ship-based testing. AUV deployment constrains LiDAR power and volume. To resolve Arctic macroalgae on the coastal seafloor as well as O(10 cm) patches of Arctic micro-algae on the bottom of sea-ice, a ground sample distance of ~2 cm is required. Arctic bio-optical conditions at a distance of 10-15 m requires laser energy of ~10 μJ / pulse. These design constraints are met by using a commercially-available pulsed fibre laser (200-400 kHz), scanned horizontally at 200 lines/sec using a rotating polygon mirror. To minimize collection of near-field scattered light, four overlapping optical receiver assemblies are used, each with a narrow (~15°) instantaneous field of view. Analog-to-digital conversion of detector output at 2.5 GHz yields O(5 cm) range resolution. The digitized time history of each pulse return is post-processed to create range and elastic scattering images with 60° field of at 532 nm. Alternatively, two pairs of detectors can be aligned in parallel to achieve simultaneous elastic (532 nm) and fluorescence (685 nm) imaging at 30° field of view. Initial results from technical targets confirm the ability to resolve cross-track features of less than 2 cm. Using the multispectral mode during field deployments on small research vessels, we resolved fine details of sub-meter benthic macroalgae in both elastic and fluorescence images, yielding five dimensions of data (x, y, range, elastic intensity, and fluorescence intensity). Per-return fluorescence information is key to confirming that a target is living (chlorophyll-containing) material. Comparison and fusion of these point clouds with other 3D data sets will be presented.

STORM SURGE PROXIES IN A DATA POOR LANDSCAPE: A BASELINE MONITORING METHOD FOR COMMUNITIES VULNERABLE TO CLIMATE CHANGE

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After 10 years of documenting the traditional ecological knowledge of climate change in Shaktoolik,

Alaska, storms remain the most critical element of change for the community. In this presentation we show the latest storm surge maps developed for the community that establish a baseline to monitor storm surge going forward. The baseline map from a major storm in 2011 is compared to maps from 2013 and 2019 storms to monitor their relative intensity. Such monitoring is called for by the community in their Strategic Management Plan of 2016 when the Alaskans Sharing Indigenous Knowledge (AKSIK.org) began working on this monitoring program. Monitoring key vulnerabilities is also a significant component of effective climate change adaptation. The monitoring process in Shaktoolik involves post-storm GPS measurements taken by cell phone in the village and are overlaid on remote sensing elevation data at St. Lawrence University. This village-university partnership can be scaled-up throughout coastal settlements in the Arctic, and elsewhere, as a low cost and immediate action to monitor storms in areas without weather stations or observation networks like Shaktoolik.

TANDEM-X- AND TERRASAR-X-BASED SPRING FLOOD SIMULATION ON THE LENA DELTA, SIBERIA

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Arctic watersheds heavily influence the oceans and the mean global temperature. They are the largest source of freshwater to the Arctic Ocean and affecting the sea ice cover and the ocean conveyor belt. An example of these impacts is the 7% rise of the average annual freshwater discharge from the six largest Eurasian rivers to the Arctic Ocean over the last century. The interaction between the Arctic water budget and climate change makes the study of arctic surface water important for climate- and environment-related research. The river Lena is one of the four main contributors to the Arctic Ocean freshwater, the others being Yenisei, Ob, and Mackenzie. It is the 10th longest natural river in the world, located in eastern Siberia with a basin the size of 2.4 × 106 km2 and an average annual water runoff of > 500 km3. Extreme spring flood events take place annually in Lena, due to the melting of the accumulated snow from the previous winter. During this flood event, around 40% of its annual discharge is released to the ocean. The study area consisted of the central part of the Lena river delta where the main channel diverges into its major distributaries, namely the Trofimowskaya, Bykowskaya and Olenekskaya channels. This area consists of a braided river system with a vast floodplain area, surrounded by cliffs on its east and west side. Most of the floodplain area was flooded during the spring flood. This remote area cannot be easily accessed, making data acquisition challenging and costly. The aim of this study is to implement a hydraulic modeling method using the TerraSAR-X and TanDEM-X datasets during the annual spring flood events between 2013 and 2019. This approach combined remote sensing and river hydraulic methods. This integration is widely known as remote sensing of rivers and has been an emerging sub-discipline on river hydraulic studies. The remotely-sensed datasets provided the parameters for hydraulic measures on poorly gauged regions, whereas hydraulic modeling helped derive parameters which could not be acquired by remote sensing. HEC-RAS by the US Army Corps of Engineers was selected as the hydraulic modeling tool. The selected module for the simulation was the 1-dimensional unsteady flow analysis. The resulting simulated inundation boundaries were validated using multi-temporal TerraSAR-X images. The other hydraulic variables, such as flow velocity and surface water level, were also extracted from the simulation. In the future, the method can be extended for further study of Lena , such as sediment transport, water quality, freshwater-seawater interaction, or ecological modeling.

ASSESSMENT AND MONITORING OF RETROGRESSIVE THAW SLUMPS ALONG YUKON HIGHWAYS: A COMPARISON OF TWO SITES LOCATED IN CONTINUOUS AND DISCONTINUOUS PERMAFROST.

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The thaw of ice rich ground is responsible for numerous infrastructure failures accompanied by severe hazards (thaw settlement, slope failures, thermal erosion). Much of the transportation infrastructure in the North is now impacted by permafrost. In the most dramatic cases, permafrost related hazards such as landslides and sinkholes

can damage infrastructure in a single event to such a degree that the on-site traffic is completely disrupted, and the damaged section will present an immediate life-threatening hazard to users. This presentation will focus on two retrogressive thaw slumps (RTS) located in distinct permafrost environments. The first is situated approximately 25 km north-west of Whitehorse, between the Takhini river and the Alaska Highway. It is 200 m west of another RTS that first started in 1979 and stabilized in 2004. Between these two features stands a highly disturbed wooded area where a third RTS may eventually develop. The exposure on the RTS wall showed ice-rich permafrost with some 10-20 cm thick ice layers. Although the head scarp is currently about 60 m away from the road embankment, it is progressing rapidly, and several multi-meter long tension cracks have formed between the failure and the road as close as 20 m from the road embankment. The 1979 RTS remained active for 25 years; and the present RTS did not start before 2013, based on air imagery. This RTS will potentially expand for several years, and will likely be active next summer, and the following ones, with the risk that it eventually impacts the road. Km 115 of the Dempster Highway is impacted by fast processes that can be caused by rapid events such as heavy rain, heat waves, and unusually warm summer temperatures. These conditions are preceded by pre-conditioning processes such as localized heat flow, ground water flow, thaw settlements, and deformation. Where the road passes between Chapman Lake (north/left-hand side) and the Blackstone River (south/right-hand side) Yukon Highway and Public Works was forced to realign the highway to the north as a result of landslides that occurred along the cliff. The permafrost is very ice-rich, and relatively cold (below -2 °C). The combined thicknesses of upper wedge ice (up to 8 m) and of deeper massive ice bodies (>6 m) may exceed 14 m at some locations. General subsidence was observed along this entire section and groundwater movement may play an important role in this matter. To better understand the impact of these two sites on their respective infrastructure, we developed an innovative research program including geotechnical drilling, geophysics, ground surface movement with D-GPS, imaging and topography monitoring using UAV (drone) and photogrammetry, ground temperature monitoring, time-lapse camera monitoring, and inclinometers. We hope that this multi-technical monitoring approach will eventually be used for the development of geohazard alarm systems and to mitigate the threat caused by RTS on road corridors.

CLIMATE CHANGES ALONG THE LABRADOR COASTS DURING THE HOLOCENE BASED FROM POLLEN ASSEMBLAGES

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The rapid ongoing warming recorded across northern regions is unprecedented. This warming is however not uniform across the territory and large regional discrepancies exist. It is therefore relevant to document the variations of climate in the past in both time and space in order to understand the regional climate dynamics. However, in Labrador, instrumental and historical data are rare and only cover a short period of time. Our knowledge of the natural evolution of the climate is therefore limited, which hampers our capacity to evaluate the natural modes of variability and simulate changes at regional scales. From this viewpoint, quantitative climate reconstructions from pollen assemblages are useful because they allow the development of time series covering long periods of time. Here, we report on pollen data from peat and lake sediments collected in the area of Hebron, Okak, Nain and Dog Island along the Labrador coast. These data are used for climate reconstruction over the last millennia, thus allowing to document natural climate variability at regional scale. The climate parameters we reconstruct by the means of the modern analogue technique include the summer temperature, sunshine and precipitation. The results provide new insights about the climate of Labrador at local to regional scale, illustrating notably the importance of the Labrador Current on climatic conditions at nearshore locations. In fact, our climate reconstructions demonstrate a disparity with the regional climate curve which may testify of the east-west climatic gradient between islands and the land.

A PRELIMINARY ASSESSMENT OF RISK ASSOCIATED WITH PERMAFROST DISTRIBUTION AND GROUND ICE ALONG THE PROPOSED KIVALIQ HYDRO-FIBRE LINE CORRIDOR

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The Kivalliq Hydro-Fibre Link project aims to connect several Nunavut communities and mines to hydropower in an effort to reduce the use of diesel for power generation. The hydro-fibre link infrastructure will rely on piles, anchored in frozen sediment and/or bedrock at 300 to 500 m intervals along 1200 km of line. The proposed corridor of interest for the hydro-fibre link extends over a large latitudinal gradient (from N56 to N64), crosses the forest-tundra transition, and includes varied Quaternary deposit units (e.g. morainal, glacio-lacustrine, glacio-marine, organic). Pile design, installation depth, and expected lifetime are affected by substrate conditions including permafrost distribution, thickness, ice content, and thermal regime, however there are nearly no field observations of permafrost conditions near the proposed corridor. This project aimed to produce a preliminary assessment of thermokarst risks associated with the potential degradation of ice rich permafrost to support a preliminary cost assessment, and to identify priorities for a field campaign beginning in summer 2020. We complemented existing models of potential ground ice distribution (O'Neill et al. 2019), permafrost sustainability (Obu et al. 2019), and climate predictions with higher resolution surficial geology data as well as land cover information including tree density near the forest-tundra transition, fire history, and greening and browning trends. This information was used to infer expected changes to the permafrost distribution in the area and to identify landscape units where permafrost degradation may lead to pronounced subsidence or thermokarst development. Landscape units were defined on the basis of Quaternary history, climate, and land cover. A risk factor was assigned to each landscape unit based on modelled current and expected permafrost sustainability combined with expected ground-ice content and whether signs of thermokarst were observed on remotely sensed imagery. Since this preliminary assessment was for the planning of a hydro line specifically, the estimated risk factor was moderated were the overburden was sufficiently thin to allow drilling of the piles into bedrock. Preliminary results point to the importance of considering the distribution of tundra and taiga patches to capture ice wedge distribution near the forest-tundra transition, and highlight the difficulty of planning infrastructure in parts of Canada where field observations of permafrost conditions are very scarce and model predictions are largely untested. Obu, J., Westermann, S., Bartsch, A., et al. 2019. Northern Hemisphere permafrost map based on TTOP modelling for 2000-2016 at 1 km2 scale. Earth-Science Reviews 193 : 299-316. O'Neill, H.B., Wolfe, S.A. & Duchesne, C. 2019. New ground ice maps for Canada using a paleogeographic modelling approach. The Cryosphere 13 : 753-773.

IMPLEMENTING AN APPLIED PERMAFROST RESEARCH PROGRAM: THE DEMPSTER - INUVIK TO TUKTOYAKTUK HIGHWAY RESEARCH CORRIDOR

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The Beaufort Delta region is one of the most rapidly warming areas on Earth. Societal consequences of permafrost thaw are significant as the area hosts the highest density of Arctic communities and the longest road network constructed on ice-rich permafrost in Canada. The Dempster and Inuvik to Tuktoyaktuk Highways (ITH) comprise a 400-km corridor connecting the Beaufort Delta region with southern Canada. The highways traverse warm (0 to -2 °C) to cold (<-4 °C) permafrost, cross diverse terrain with varying ice contents, and intersect a range of hydrological and ecological environments. In this region, the diversity of sensitive permafrost environments and the rich legacy of research, scientific infrastructure, and traditional environmental knowledge facilitates the study of permafrost variability and Arctic change. The Dempster-ITH road corridor has provided a unique opportunity to develop a societally relevant, northern-driven permafrost research agenda to support planning and maintenance of infrastructure, regulation, and monitoring of climate change impacts and informed adaptation. In 2017, the GNWT, in collaboration with Federal and Academic partners, implemented a state of the art ground temperature-monitoring network along the Dempster-ITH corridor. This, in combination with the maintenance of the Dempster Highway and recent design and construction of the ITH, has created a national legacy of permafrost geotechnical, terrain and geohazard information. The objectives of this program are to integrate existing and new data to synthesize physiographic, hydrological,

thermal, and geotechnical conditions along the corridor, and to develop applied permafrost research projects that support planning and maintenance of this critical northern infrastructure. In this presentation, we highlight: 1) a collaborative research framework that builds northern capacity and involves northerners in the generation of knowledge and its application; 2) summaries of existing infrastructure datasets and their foundation for research; and 3) new projects that address emerging climate-driven infrastructure stressors. As the effects of climate change on permafrost environments, infrastructure and communities continue to increase, the need for northern scientific capacity and applied research to support informed decision-making, climate change adaptation and risk management will become increasingly critical.

EFFECT OF SNOW MICROSTRUCTURE VARIABILITY ON KU-BAND RADAR SNOW WATER EQUIVALENT RETRIEVALS

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Spatial variability in snowpack properties negatively impacts our capacity to make direct measurements of snow water equivalent (SWE) using satellites. A comprehensive data set of snow microstructure (94 profiles at 36 sites) and snow layer thickness (9000 vertical profiles across 9 trenches) collected over two winters at Trail Valley Creek, NWT, Canada, were applied in synthetic radiative transfer experiments. This allowed robust assessment of the impact of estimation accuracy of unknown snow microstructural characteristics on the viability of SWE retrievals. Depth hoar layer thickness varied over the shortest horizontal distances, controlled by subnivean vegetation and topography, while variability of total snowpack thickness approximated that of wind slab layers. Mean horizontal correlation lengths of layer thickness were sub-metre for all layers. Depth hoar was consistently ~30% of total depth, and with increasing total depth the proportion of wind slab increased at the expense of the decreasing surface snow layer. Distinct differences were evident between distributions of layer properties; a single median value represented density and specific surface area (SSA) of each layer well. Spatial variability in microstructure of depth hoar layers dominated SWE retrieval errors. A depth hoar SSA estimate of around 7% under the median value was needed to accurately retrieve SWE. In shallow snowpacks <0.6m, depth hoar SSA estimates of ±5-10% around the optimal retrieval SSA allowed SWE retrievals within a tolerance of ±30 mm. Where snowpacks were deeper than ~30cm, accurate values of representative SSA for depth hoar became critical as retrieval errors were exceeded if the median depth hoar SSA was applied.

USING AN UNMANNED AERIAL SYSTEM TO MONITOR A THREATENED BELUGA WHALE POPULATION IN CUMBERLAND SOUND, NUNAVUT

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Photographic identification is a valuable tool in the monitoring and management of at-risk marine mammal populations, providing insights into their movements, site fidelity, social structure, and reproductive history. Using unmanned aerial systems (UAS) to collect these photographic data allows for the monitoring of evasive populations in otherwise inaccessible locations. In this study, we used UAS to establish a photographic identification catalog of an isolated and threatened beluga whale population in Cumberland Sound, Baffin Island, Nunavut. This population was commercially exploited for several decades until the 1960s, reduced from over 8,000 whales to its current size of approximately 1,400 whales. It is still harvested by the local Inuit community Pangnirtung at a rate of 41 whales landed per year. The objective of our study was to develop a catalog for future

analyses, including a capture-mark-recapture technique to estimate population abundance. Photographs of beluga whales were taken in August 2017, 2018, and 2019 using a DJI Phantom 4 drone and supplemented with boat-based photographs in 2018 and 2019. Group sizes ranged from 1-16 whales with an average group size of 3.7 whales. Approximately 70% of the population were classified as adults, 16% as juveniles, 7% as calves, and the remainder were unknown; these classifications were made based on colour, size, and proximity to adults. Individual whales were identified using scars from natural sources and from hunting wounds. In 2017 at least 43 whales were photographed with markings that appeared to be unique and likely to persist over long periods of time, and analyses of the 2017 and 2018 images indicate that approximately 40% of the population is marked. Four whales were photographed and identified in both 2017 and 2018. Creating a photographic identification catalog for this population will allow us to infer life-history characteristics (e.g. calving rate and survival) which is needed for understanding population growth and for monitoring the population. In addition, gaining a better understanding of the Cumberland Sound beluga whale population demography will allow for the development of more effective conservation and management strategies.

VASCULAR PLANT BIODIVERSITY OF VICTORIA ISLAND (NORTHWEST TERRITORIES/NUNAVUT, CANADA): A NEW COLLECTIONS-BASED BASELINE BASED ON 100+ YEARS OF FLORISTIC EXPLORATION

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The flora of an area refers to all plant species and taxa at other ranks occurring in the area; it is a principal measure of biodiversity. Exploration and documentation of the vascular plant flora of the Canadian Arctic Archipelago has been ongoing for nearly two centuries, yet many areas remain poorly known. Here, we report the results of a collections-based floristic study of vascular plant diversity of Victoria Island, which is the eighth largest island in the world and the second largest in Canada. Our study synthesizes existing published and unpublished information, including new results from five field seasons of botanical collecting across the island. We have reviewed some 7000 collections gathered on the island. A total of 289 taxa in 109 genera are recorded from the island. Thirty-six taxa are known on the island from a single collection. Twenty-three taxa in ten families are newly recorded for the flora of Victoria Island, and nine of these are newly recorded for the flora of the Canadian Arctic Archipelago. Of the eight general areas on Victoria Island that have been botanically explored the most, the greatest diversity of vascular plants is recorded in Ulukhaktok (187 species), followed by the Cambridge Bay area (176 species). We have generated new distribution maps for all species on the island and taxonomic keys to facilitate identification of all vascular plant taxa. Our results represent a new, up to date baseline of knowledge on which continued exploration of the flora of the island can build.

UNDERSTANDING THE ROLE OF INUIT YOUTH ENGAGEMENT IN ENVIRONMENTAL RESEARCH IN NUNAVUT

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There is a growing movement for researchers to be more inclusive of local interests, organizations, and individuals in Northern scientific research. As this inclusion becomes more common place and researchers seek partnerships with knowledgeable, skilled community members, opportunities for employment and education in research also increase for local Inuit. Experienced harvesters are often hired by researchers, as they possess the resources and land-based knowledge necessary to accommodate environmental research, frequently spending time on the land participating in hunting, fishing, gathering, and trapping activities. However, opportunities for Inuit youth to engage in similar research relationships are limited. Given that Northern scientific research may generate unrecognized opportunities and benefit from greater youth engagement and benefit-sharing, we will present the results of a two-year project, with partners in Pond Inlet, Nunavut, that explored i) pathways for Inuit youth to develop scientific literacy through land-based activities linked to environmental research ii) the role of researchers in enhancing scientific literacy, and

iii) the potential outcomes of Inuit youth engagement in environmental research. Nunavummiut believe that researchers have the responsibility to include Inuit youth in environmental research and enhance their scientific literacy through research engagement. It was found that youth engagement in environmental research may be enhanced by factors such as access to research mentors and a balance of town-based and land-based opportunities to participate. In addition, researchers may play an important role in supporting upcoming generations of Inuit environmental researchers and resources managers in Inuit Nunangat. It was also found that youth may be able to make important contributions to environmental, land-based research.

SOIL CHEMISTRY, NOT AGE, IS THE PRIMARY DRIVING FACTOR CORRELATED TO DIFFERENCES IN PLEISTOCENE AND HOLOCENE AGED PERMAFROST MICROBIOMES

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Despite the presence of well-documented signals of change in vegetation and faunal community structure at the Pleistocene-Holocene transition, it is still unknown whether these signals have been preserved at the soil microbial level. Activity and composition of temperate soil microorganisms are directly influenced by both local biogeochemical and climate parameters. However, recent studies of permafrost microbial community structure in ancient permafrost samples do not show a clear connection between soil parameters and community structure; rather, microbial communities tend to cluster based on the age of the permafrost alone. Such an age effect may preclude permafrost microbiome-climate studies since these microbial community structures might have only responded to the stresses in the permafrost and not climate change. However, the lack of correlation between soil chemistry and soil microbiology in permafrost may be due to insufficient resolution of both characteristics. In our study, we used accurately dated permafrost segments and subsampled in close proximity to the well-preserved Pleistocene-Holocene transition zone under strict sterile conditions developed for ancient DNA studies. Our ordination analyses of microbial community composition based on 16S RNA genes and chemical composition of the soil samples resulted into two distinct clusters based on epoch, while samples within an epoch were not differentiable by age. A distinctive set of chemical parameter characterized all samples for each epoch and were not found in samples from the other. In addition, a many generalized linear model and network analysis showed that the samples from the two different epochs had different microbial and soil chemical composition, but within each epoch no statistically significant changes at microbial and chemical levels were demonstrated. Thus, it appears that both soil chemical and microbial parameters are fairly stable until a "tipping point" is reached during climate change, after which there is a shift to a new set of chemical and microbial parameters. Modern anthropogenic climate change may lead to a similar shift in the state for the soil biogeochemical system if the shift is large enough to reach a similar tipping point.

ASSESSING THE IMPACTS OF WASTEWATER EFFLUENT ON THE ENERGETICS OF THE TRUNCATE SOFT-SHELLED CLAM MYA TRUNCATA IN FROBISHER BAY, NUNAVUT.

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The truncate soft-shelled clam, Mya truncata, a popular food among Inuit, has lately undergone a steep decline throughout its circumboreal distribution. While climate change is a contributing factor, unregulated wastewater effluent enhances potential stressors such as reduced salinity, increased temperature, low levels of dissolved oxygen, effluent toxicity, contamination of sediments, and increased nutrient loading leading to harmful algae blooms. In Iqaluit, water and waste management have become increasingly challenging as the local human population continues to rise often leading to episodes of raw sewage overflowing into the marine ecosystem. These challenges bring an urgency to study the ability of M. truncata to physiologically cope with local conditions while addressing concerns of the local community associated with contamination in a popular

Arctic country-food. In this study, soft-shelled clams were sampled from several locations in Frobisher Bay that are exposed to varying levels of wastewater effluent, as well as from two nearby reference sites. We took a field study approach by investigating the relationship between periodic sewage effluent release and the effects on the bivalve's annual shell growth and population-size structure. Growth rates were analyzed with the hypothesis that unregulated wastewater release would negatively impact clam growth. This work contributes to a baseline monitoring program for the protection and conservation of Canadian marine environments and investigates how chronic wastewater effluent exposure, alongside climate change, can negatively impact the truncate soft-shelled clam.

UPRIVER DISPLACEMENT OF BELUGAS: KNOWLEDGE CO-PRODUCTION ON LINKING ENVIRONMENTAL DRIVERS OF BELUGA MOVEMENT

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Each summer the Eastern Beaufort Sea beluga (Delphinapterus leucas) population form large aggregations in the Mackenzie River Estuary, believed to be linked to the warm, fresh conditions provided by the river outflow. In 2018, more than 50 belugas were observed over 60km upriver, near the community of Aklavik, and far from typical areas of aggregation in the estuary. Community members noted that this was an unusual event and suggested that wind and high water levels in the Mackenzie River were a primary driver. We investigated this explanation by searching past communications and reports for documentation of beluga sightings upriver and identifying storm surges and changes in water level at hydrometric stations in the Mackenzie Delta. We found 3 previous occurrences, dating back to 2000, all of which followed prominent surges in river level attributable to storms. While acknowledging a small sample size, we advocate that this provides evidence of causation, warranting further investigation. To collect more information, we initiated a traditional local knowledge study focused on beluga movements during storms and other historical events. Interviews were carried out in Aklavik through the ISR Community Based Monitoring Program (CBMP), where trained Community Resource Technicians (CRTs) interviewed 20 community members about the event. Community members that were interviewed were identified by the Aklavik HTC. In the past, large storm surges have rarely occurred in July, except in recent years, so there is a pressing need for a better understanding of these unusual beluga movements. As climate driven changes cause increases in the frequency and intensity of Arctic storm surges, we may expect storms to increasingly overlap with the summer beluga aggregation, causing events like this to increase in the future.

MESOZOOPLANKTON COMMUNITIES IN THE HUDSON BAY SYSTEM

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Between spring and late summer, zooplankton species assemblages in the Canadian Arctic are not known to undergo strong seasonal changes, the taxa and their relative abundance remaining relatively constant at this timescale. Contrary to most Arctic seas, subarctic Hudson Bay undergoes a complete cycle of full ice cover in winter and fully open water in summer. River discharge contributes an average 80-cm layer of freshwater, most of which flows into the bay in summer. The Hudson Bay is known to be oligotrophic and zooplankton biomass is relatively low. In this meta-analysis, we describe spatio-temporal differences in mesozooplankton assemblages in Hudson Bay from the ice break-up period through to late summer and investigate which physical variables are associated with each assemblage. Data from five different CCGS Amundsen cruises in Hudson Bay are combined. In 2005, 2010, 2012, 2017 and 2018, 200-μm mesh nets were towed vertically from the ocean floor to the surface at various stations, collecting zooplankton from the whole water column. Two main zooplankton assemblages were observed. A first assemblage dominated by pan-arctic, boreal and estuarine species such as Pseudocalanus sp. and Acartia sp. was distributed in shallow areas (< 100 m). A second assemblage characterized by Calanus glacialis and Metridia longa was observed at deeper stations. Salinity was not found to significantly affect the type of species present. The zooplankton in Hudson Bay also show a certain amount of seasonality, with a higher abundance of Microcalanus sp. and cirriped nauplii in spring being

followed by an increase in Pseudocalanus sp. and bivalves by mid-summer.

THE RELATIONSHIP BETWEEN ARCTIC KELPS AND THEIR PHYSICAL ENVIRONMENT

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Little is known about the presence or extent of kelp forests in the Arctic. Less is known about the relationship between these kelps and their physical environment. In order to characterise the environmental preferences for the different families of kelp observed in the Arctic we related presence and abundance data from dive sites to the following NAPA model physical variable: sea ice cover, temperature, salinity, currents, and river run-off. We conclude by discussing the observed patterns of presence and abundance in kelps throughout the Arctic as well as what their relationships to their physical environment may mean in a changing Arctic.

SUSTAINABLE HARVESTING AND COUNTRY FOOD DISTRIBUTION IN A CHANGING SOCIETY AND LANDSCAPE

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The transition to a wage-based economy has altered the traditional sharing of country food practiced in many Northern communities, yet the degree of impact is relatively unknown. At the same time, response to food insecurity often identifies increasing commercialization of natural resources such as fisheries or the trading of country food as a solution. The trading of traditionally shared foods may not benefit everyone in the community, and decreased sharing may negatively impact vulnerable households that historically received food through the sharing networks. Sharing behaviour may also be linked to spatiotemporal variation in the availability of harvested species. We present the results of a preliminary multi-year harvest study paired with a socio-economic survey conducted in Gjoa Haven, Nunavut. We strive to identify the direct and indirect costs associated with harvesting country food, socioeconomic barriers to harvesting, seasonal trends in harvesting, and how these factors interact to influence sharing behaviour. We investigate the costs and benefits of hunting and fishing efforts and the relationship between employment and harvest and sharing practices. We examine the distribution of country food, and how sharing varies by season, type of hunter and mode of transport (snowmobile, boat and ATV). We discuss how our results could be used and linked with other data sources to ensure a rebalancing of power in co-management of wildlife and fisheries, better assessment of fish stocks, and the reform of current hunter support and food security support programmes in Canada.

INFORMING SEA ICE TRAFFICABILITY THROUGH REMOTE SENSING, GOOGLE EARTH ENGINE, AND SIKU

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Residents in the Arctic communities of Cambridge Bay, Kugluktuk, Gjoa Haven, and Taloyoak are interested in accessing remotely sensed image data and enhanced image products to help plan safe travel and activities on sea ice. Our overarching goal is to identify and map sea ice features of interest to residents by improving the utility of satellite remote sensing technology. One emergent theme from interviews and workshops, conducted from 2017 to 2019, is the need for sea ice surface roughness information due to its impact on landfast sea ice trafficability and safety. Three sea ice roughness classes corresponding to local dialect were determined: smooth ice (manniqtuk hiku); moderately rough ice (manitutun hiku); and rough ice (manitpiatuk hiku; dialect is Inuinnaqtun). Sentinel-1, a synthetic aperture radar (SAR) capable of imaging at high-resolution (metre-scale) independently of sunlight and cloud cover, was linked to LiDAR-derived measurements of sea ice roughness and topography. Calibrated Sentinel-1 SAR backscatter data (in horizontal transmit-receive polarization) can be used to estimate landfast first-year sea ice roughness. However, volume scattering contributions to backscatter preclude mapping the roughness of multiyear ice floes and areas of freshened ice, such as in

estuaries. We outline a method for using Google Earth Engine to process continually updated collections of Sentinel-1 imagery, and for automatically delivering roughness maps to northern residents using the Arctic Eider Society's online SIKU platform. Community experts describe SAR maps as highly accurate, with benefits including improved safety, travel time, route planning, and fuel efficiency. By using SIKU, residents can also log sea ice observations on the SIKU platform and contribute to the continued development of community-focused satellite remote sensing tools. To promote accessibility, hard-copy maps and graphs are being delivered via local partnerships.

HOW CAN RESEARCH BETTER SERVE NUNAVUMMIUT?: ASSESSING RESEARCH TRENDS IN NUNAVUT

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Intensive research in Inuit Nunangat has brought benefits and challenges to Inuit communities and organizations, as highlighted in the National Inuit Strategy on Research. Improving communication and understanding between researchers and communities has been identified as a strategy to support relevant research that includes and benefits Inuit. The Nunavut Research Institute (NRI) is responsible for assessing and issuing research licenses to ensure that research does not harm or interfere with the natural or social environment in Nunavut. Most scientific research projects in Nunavut are subject to licensing under Nunavut's Scientists Act, and through this process NRI has developed the longest running digital research database in Nunavut. The research licensing database contains details on more than 1300 research projects undertaken in Nunavut over 25 years in the natural, physical, health, and social sciences (including studies of Inuit knowledge, culture, and language). There is an opportunity to use this database to better understand the scope of research in Nunavut and to inform the development of research priorities. This presentation reviews preliminary results from analyzing the digital licensing database, including research trends across Nunavut since 2005, community research intensity, and geographic and topical trends. This analysis provides insight into the current state of research in Nunavut and how it has changed over the last fourteen years. Developing this important baseline and understanding research trends supports decision-makers, communities, and researchers in moving forward with research policies, projects, and administration. NRI is working to ensure that research is a resource for the well-being of Nunavummiut by developing better metrics to track research impacts and benefits in Nunavut and improving the research licensing process. NRI aims to make research results more accessible to Nunavummiut, foster better Inuit engagement in research, reduce community research fatigue, and encourage research on priority issues for Inuit.

THE CANADIAN CENTRE FOR CLIMATE SERVICES, A NEW RESOURCE TO SUPPORT NORTHERN CLIMATE CHANGE DECISION MAKING

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The Canadian Centre for Climate Services (CCCS) is a new dedicated service established by Environment and Climate Change Canada (ECCC) so that Canadians have the information and support they need to understand and reduce risks from climate change. CCCS offers reliable climate information, data, and tools, and provides user support to help advance climate resilience across Canada. User support and training are among our key offerings, including a national support desk. CCCS supports a continuum of climate data portals suitable for a diverse set of users. Portals in the suite include the Climate Atlas of Canada, Climatedata.ca and PAVICS. CCCS is working to address northern climate services needs and unique challenges. To increase access to northern climate services, CCCS has based staff in the north, is assisting northern clients, undertaking needs assessments, inventorying available products, conducting outreach, and developing projects to enhance northern climate products. CCCS is working with Territorial governments and others to explore options to enhance northern capacity through a potential northern climate services organization.

COOPERATION OF HETEROGENEOUS SENSOR PLATFORMS

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Digital solutions, advanced analytics and robotics provide technologies enabling the creation of new concepts for operation of offshore fields. At the core is potential for improved safety and reduced carbon footprint in addition to the cost saving value creation. One vital component in this digital transformation is drones in all shapes and forms. In this context, we regard drones as robotic sensor platforms in sea, on the sea surface, on land, on the installations, in air and in space. A way to describe these different drones with associated capacities is through the concept of the "observational pyramid". This presentation will focus on how drones can interact across levels in the observational pyramid. We do not consider only drones with sensing capabilities, but also more advanced manipulator performance. The potential associated with performance enhancing interplay between such heterogeneous sensor platforms will be discussed. All sensor platforms have limitations to their performance. Enhancing performance for a specific drone comes at a cost. Interaction between heterogeneous sensor platforms could remedy individual weaknesses. Ability to deliberate and adapt, not only for the individual drone and task at hand, but also for coordination and cooperation between drones could provide efficiency and versatility to operations.

EXAMINING LARGE-SCALE ICE ISLAND FRACTURE EVENTS WITH A FINITE ELEMENT MODEL

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Ice islands, very large tabular icebergs, which calve from floating ice tongues and ice shelves are known to break into fragments as they drift. However, the processes that cause ice islands to fracture when they are free-floating are poorly understood. One proposed process, the footloose mechanism, occurs when a large protuberance, known as a ram, develops along the submerged edge of the ice island and induces a bending stress due to buoyancy. To examine the relationship between ram size and/or configuration on ice island fracture, we used 2D geospatial polygons of ice islands from the Canadian Ice Island Drift, Detection, and Deterioration (CI2D3) database to create simplified 3-D meshes of ice islands of a nominal thickness and synthesized rams of various dimensions. The associated stresses and fracture occurrence were predicted using a Finite Element Model (FEM) with an element erosion scheme. The resulting ice island fragments from the FEM were compared to the fragments that were observed from the CI2D3 database. Rams that were uniformly distributed around the entire ice island perimeter caused unrealistic stress distributions and breakup patterns. However, when rams of a sufficient size were restricted to the side of the ice island near where the calving actually took place, the predicted fractures tended to match the observed calving. Modelled stresses were analyzed as a function of various ice island and ram dimensions. The extent to which the ram protruded from the edge of the ice island (ram width) and percentage of the ice island volume contained in the ram were found to be important determinants of stress magnitude, whereas the length of the ram (distance along the perimeter of the ice island) was less important. These findings suggest that differences in sidewall erosion that promote ram growth along one particular edge of an island are ultimately responsible for calving of fragments up to 9% of the ice island surface area via the footloose mechanism. If ice island ram shape and location is known or can be estimated, it may be possible to use empirical relationships derived from our analysis to predict whether a footloose-related fracture will occur along with the size of the resultant fragments. This predictive tool can then be incorporated into an operational ice island drift and deterioration model that can be used to forecast and risk-manage these glacial ice hazards for the shipping and offshore oil industries.

OVERWINTERING ECOLOGY OF ANADROMOUS ARCTIC CHAR (SALVELINUS ALPINUS) IN A LARGE FLUVIAL SYSTEM NEAR KUGLUKTUK, NUNAVUT

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Arctic Char (Salvelinus alpinus) are an important component of subsistence diets in Inuit communities across the Arctic. Like many aquatic species, Arctic Char are subject to stressors stemming from climate change and industrial development, including changing hydrologic regimes, higher water temperatures, and increased competition that is resulting from range expansion of southern species. Anadromous (i.e., sea-run) Arctic Char, which feed in the ocean during the summer months and return to freshwater systems in the fall to spawn and overwinter, are particularly vulnerable to environmental changes because they use both freshwater and marine environments, including fluvial migratory corridors. While the diversity of life history strategies and migration patterns exhibited by Arctic Char likely contributes to their utilization of a wide variety of environments and persistence across a challenging landscape, this diversity also necessitates population-level information to identify stressors and effectively manage subsistence fisheries. However, there are still many knowledge gaps in Char ecology. For instance, although Arctic aquatic systems are ice-covered for much of the year, under-ice Char movements and habitat use have been largely understudied. The winter movements of Arctic Char have been studied in lakes, where they typically overwinter. However, a few populations are known to overwinter in large river systems, such as the Coppermine River in the Kitikmeot region of Nunavut, which has historically supported an important char fishery for the community of Kugluktuk. Local fishers know that Char use the river during winter, because they set subsistence nets in November and December. However, the winter ecology of Arctic Char has not previously been studied in this or other rivers, largely due to challenging environmental conditions, including dramatic ice break-up. In 2018 and 2019, acoustic transmitting tags were surgically implanted in 164 healthy adult Arctic Char captured in the Coppermine River and Coronation Gulf. An array of 49 acoustic receivers was deployed in the study area, with a subset left to detect winter movements in the Coppermine River. Consistent with local knowledge, we present scientific evidence that some Arctic Char overwinter in this large fluvial system and do not enter upstream lakes, and we characterize winter movements and habitat use in subsections of the lower river.

"WE'RE MADE CRIMINALS JUST TO EAT OFF THE LAND, EAT OUR FOOD THAT OUR ANCESTORS ATE."

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Tuktuit (caribou/Rangifer tarandus), have always been integral to Inuit culture, livelihood strategies, and health. Many caribou populations across the Circumpolar North are declining. While Inuit Knowledge has documented natural cycles in caribou populations, recent and extended population declines are causing concern for the sustainability of the herd. Inuit in the Nunatsiavut region of Labrador, Canada, have long relied on several caribou herds, including the Mealy Mountain (MM) sub-population, a woodland caribou group. The MM herd is sedentary, with a discrete range south of the Inuit community of Rigolet, and overlapping with traditional homelands and historic villages for many of the Rigolet families, as well as the Labrador Inuit Settlement Area as defined in the 2005 Inuit Land Claims Agreement. Although the MM herd was essential to Inuit food security and wellbeing, a hunting moratorium has been in place since 1975, and the MM herd is currently listed in Schedule 1 of the Federal Species at Risk Act (SARA) as Threatened, and also under the Newfoundland and Labrador Endangered Species Act (ESA) as Threatened. In order to better understand Inuit relationships to the MM herd, the long-term impacts of the hunting ban, and strategies for caribou management moving forward, this research examines the relationship between Rigolet Inuit and MM caribou. The main goal of this research was to determine community priorities for the research, monitoring, and management of the MM caribou, by documenting Inuit values, with the intent of enhancing

the management system. This research used a qualitative case study approach, following the principles of Inuit-led research as outlined in the National Inuit Strategy on Research. Data were collected through: a community open house and participatory mapping session, where people shared photos, stories, thoughts, and geographic references to where MM caribou herds are still being seen; semi-structured conversational interviews with 21 people from Rigolet (total interview time: 11h09). Interviews were conducted by local researchers and a graduate student. All interviews were recorded, with consent, and transcribed. Transcripts were imported into NVivo 12 software and coded inductively to facilitate additional annotations, word searches, memo writing, data visualizations, and reflections. Using a constant comparative method, the research team also held regular debriefs and teleconferences to talk about co-analyze the data. Preliminary results of the research demonstrate a wealth of Inuit knowledge about the MM herd. The research highlights the loss of an important country food and a risk to cultural continuity by a long-standing hunting ban; the ways in which a lack of quality research led to questions about decision-making; and the lack of inclusion of Inuit rights or knowledge when management decisions were made. Research participants indicated a strong sense of not being heard by decision-makers. Moving forward, Inuit from Rigolet indicated the need to re-connect to the MM caribou through land-based initiatives and ongoing monitoring, as well as identified the need for Inuit to be more involved in, and lead, conservation and monitoring efforts. This research provides ideas and opportunities for potential interventions in the future that may strengthen cultural ties, stewardship, and enhanced levels of health equity between Indigenous peoples in the region.

ARCHIVAL FIELDWORK: NEW ARCTIC PLANT BIODIVERSITY DATA FROM BACKLOGGED HERBARIUM SPECIMENS

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Plant and lichen collections deposited in herbaria around the world underpin our knowledge on species distribution and taxonomy, but time and resource constraints often limit the ability of herbaria to identify, prepare, and/or digitize these specimens. As a result, backlogs of material not yet part of the active collection can accumulate, particularly in cases where there is no immediate institutional pressure to include the specimens in a project, or when the original collector is not available to shepherd the specimens through processing. While these lots may be safely stored and adequately preserved, the biodiversity data represented by the specimens remains locked away and invisible to users of both physical and virtual (on-line) collections. Botany collection and research professionals at the Canadian Museum of Nature's National Herbarium of Canada have been working to process the backlogged collections of three prominent Arctic botanists: Dr. Sylvia Edlund, Margaret Oldenburg, and Dr. Nicholas Polunin. Together these three lots, of 2700+, 4300+, and 5000+ specimens respectively, represent a combined 28 years of collecting effort between 1933 and 1991. These specimens, collected across the Canadian Arctic ecozone, include species occurrence information from locations not visited since; and specimens from well-botanized sites where repeatedly-collected species can support temporal understanding of species distribution and phenology. We conducted archival searches, interpreted field notes, and communicated with collectors' relatives to fill in missing label data. We also identified specimens or confirmed their identifications. Completed batches were then mounted and digitized by co-op students and herbarium volunteers, with help from project funding earmarked by Museum administrators for backlog reduction. This funding has also created the opportunity to launch a detailed inventory of the backlog, to permit assessment and prioritization of future backlog projects. To date, we have completely processed the Edlund backlog lot, and are nearing completion of the Oldenburg lot; the Polunin specimens are still undergoing identification. We will present the floristic results from these efforts and place these important collections in historical context. Additionally, we will discuss the practical issues that may arise while processing backlogged material from Arctic collections.

COLLABORATIONS TO STRENGTHEN AND SUSTAIN COMMUNITY-BASED WATER MONITORING AND RESULTS SHARING IN THE NORTHWEST TERRITORIES

Somers, Gila, C. DuBois, L. Day

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Community-based and community-led water monitoring initiatives are generating valuable information to track the health and changes of Northern freshwater ecosystems. The Northwest Territories (NWT)-Wide

Community-Based Water Quality Monitoring Program supports training of local monitors while collecting information that can contribute to answering community questions and concerns about water quality. Now in its 8th field season, the program has grown to include 21 communities that collect data from over 40 sites across the territory. The program is coordinated by the Government of the Northwest Territories (GNWT) Environment and Natural Resources department in collaboration with community partners, with the aim of providing training and support so that communities can coordinate and undertake local water monitoring on an independent basis. Results are shared on Mackenzie DataStream, an open data platform that was developed through a unique collaboration between the GNWT and The Gordon Foundation. Designed with communities, researchers and decision-makers at all levels in mind, DataStream provides user-friendly access to water quality datasets collected across the Mackenzie River Basin, an area spanning the NWT, Northern Alberta, Northeastern British Columbia, as well as parts of the Yukon, Saskatchewan and Nunavut. This presentation will discuss how the NWT-Wide Community-Based Water Quality Monitoring program has evolved over time to strengthen community participation and leadership, and the role Mackenzie DataStream is playing in providing access to water quality data in accessible and scientifically robust ways.

LANDSCAPE-DRIVEN CARBON EXPORT FROM SMALL COASTAL PERMAFROST WATERSHEDS

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Ongoing climate warming in the western Canadian Arctic is leading to thawing of permafrost soils and subsequent mobilization of its organic matter (OM) pool. Part of this mobilized OM enters the aquatic system as dissolved organic matter (DOM) and is laterally transported from land to sea. Mobilized DOM is an important source of nutrients for aquatic ecosystems and becomes available for microbial breakdown with and the turnover of the dissolved organic carbon (DOC) fraction as a potential source of greenhouse gases. We are beginning to understand spatial controls on the release of DOM as well as the quantities and fate of this material in large Arctic rivers, but these processes remain systematically understudied in small, high-arctic watersheds. These small watersheds that drain directly into the neighboring Arctic Ocean, a region that is undergoing rapid changes due to rising temperatures and retreating sea-ice, serve as ideal locations to study terrestrial-aquatic couplings on a small scale. We sampled soil and water (porewater, stream water) from two catchments along the Yukon coast during the summer of 2018 and 2019. We use DOC, 13C-DOC, C/N ratios, optical properties, incubation experiments, as well as nutrients and water isotopes to assess the mobilization, lateral transport and turnover of DOM. We classify and compare different landscape units by quantitative and qualitative change across gradients from soil stocks all the way to the catchment outflow. Using landscape classification, we will upscale fluxes for the panarctic coastal zone. Our results show that substantial variation in DOC concentrations exists among various landscape units as well as between active layer and permafrost. We find relatively high carbon contents and that permafrost DOM is utilized rapidly. Under current climate projections and with continued permafrost thaw this may have profound impacts on the arctic aquatic ecosystem and Arctic carbon cycling.

WHAT IS THE FUTURE OF AGRICULTURE IN THE NORTH?

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Climate change is causing profound impacts on the ecosystems across Canada's North. As food systems in the Northwest Territories (NWT) depend on the health of the land and waters and the availability of traditional foods, impacts to the land in response to changing climatic conditions are having negative effects on communities. For many communities where food insecurity is already an issue, these impacts can further threaten community food systems, health and well-being. As communities

continue to adapt to these changing conditions to ensure that traditional foods remain as the basis of their food systems, many are also turning to the local production of food, mainly through community gardens, to make food more available. As climate change continues to impact the NWT, there may be more opportunities for local food production, even small-scale agriculture, as temperature warm and ecosystems shift. Developing agricultural opportunities in the NWT can work to alleviate some of the complex issues surrounding high levels of food insecurity in the NWT and provide economic benefits to communities. However, many important barriers exist that may limit the ability of communities to adapt and take advantage of this opportunity, including land suitability and availability, community capacity and knowledge of food growing, and limits to plant productivity. For NWT communities, ensuring that agriculture is developed in a way that meets the needs of local residents and does not diminish the overall health of the ecosystem is important. This presentation outlines research being conducted with four communities in the South Slave and Dehcho regions of the NWT, to support place-based food systems where local food production enhances opportunities to promote sustainability, soil and ecosystem health, carbon sequestration, and economic opportunities. Preliminary research involving soil testing and GIS analysis to identify and map out potential areas that are likely to be suitable for agriculture under climate scenarios will be highlighted. This project will also look for innovative opportunities and case studies where communities are planning for the future of agriculture. Kakisa, for example, is interested in growing food in a fire break that will be installed around the community. Furthermore, communities are interested in building soil through the composting of organic waste, and in particular, fish waste. For other communities building and implementing agriculture strategies is the short-term priority to define their vision for small-scale agriculture as a part of their overall food system. Given the diverse partnerships of the research team, innovative field studies of growing food at local scales, and links to global movements of agroecology, there is the opportunity to shape the future of agriculture in the NWT. Finally, opportunities for knowledge sharing between communities through regional workshops and a communication plan to highlight case studies from this project, will support broader community action around the NWT. This will also build capacity and support for communities to work together to address complex issues of climate change and food security.

THE COST OF LIFE IN THE SLOW LANE: ESTIMATING THE RESTING AND FIELD METABOLIC RATES OF GREENLAND SHARKS (SOMNIOSUS MICROCEPHALUS)

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Very little is known about the metabolism of Greenland sharks, a large, long-lived and regionally abundant species inhabiting Arctic waters. The metabolic theory of ecology states that the rate at which an organism uses energy is a key driver of its ecology and can provide a framework for the study of its behaviour, life history, population dynamics, and impact on the broader ecosystem. Given the steady increase in commercial fishing pressure and rapidly changing abiotic and biotic conditions in the Arctic, developing a greater understanding of the Greenland shark's ecological role is essential to developing effective fisheries management policies and to predicting ecosystem trends moving forward. Furthermore, studying the metabolic rate of Greenland sharks extends our current understanding of temperature and mass dependent metabolic scaling in sharks, which is currently limited to small bodied individuals living in warm or temperate environments. Here, we combine static respirometry (n = 4) with biologged acceleration and temperature data (n = 31) in order to estimate the resting routine metabolic rate (rRMR) and field metabolic rate (FMR) of Greenland sharks. As predicted, Greenland sharks have the lowest resting and field metabolic rates of any shark species studied to date; however, when adjusted for temperature, rRMR and FMR results are similar to those observed across other species. Finally, using long term temperature data from individuals tagged with pop-up archival satellite tags (PSATs), we extend our FMR estimates to encompass a year in the life of a Greenland shark. The low cost of life estimated for this species has implications for its role as a consumer in the rapidly changing Arctic marine ecosystem.

TOPOGRAPHIC CONTROLS ON FIRN-PACK STRUCTURE ON WHITE GLACIER, AXEL HEIBERG ISLAND, NUNAVUT.

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Arctic warming has led to and will continue to lead to, accelerating mass loss of land ice in the Canadian Arctic Archipelago. One uncertainty in estimating glacier response to climate warming is the processes that occur in the firn-pack in the accumulation area of glaciers, such as densification and meltwater retention. Observations of increasing firn densities have been observed on Devon and Penny ice caps in the Canadian Arctic, but similar investigations have not been made on more northerly glaciers. Determining temporal changes to the density distribution of the firn-pack is difficult as it requires repeat measurements of density using time-consuming ice coring techniques. Additionally, the spatial heterogeneity of firn properties creates uncertainty when extrapolating point measurements. To resolve these issues, we used non-destructive ground penetrating radar measurements of changes in firn-pack extent over the period 2013 to 2019 on White Glacier, Axel Heiberg Island, Nunavut. White Glacier provides an ideal location for this research as it is a World Glacier Monitoring Service reference glacier with extensive datasets that provide important historical context, including >30 years of detailed snow accumulation information. Our focus is on how the firn-pack changes in extent, depth, and density distribution over time in 500 and 250 MHz radar surveys along the glacier centreline and across the accumulation area. Radar data interpretations are validated using firn cores collected in 2019. Preliminary results indicate that elevation is the main control on firn distribution with aspect being the next control. Results also suggest that there is a slow upglacier retreat of the firn pack with some areas showing firn being buried by layers of ice. This study will contribute to understandings of firn-pack response to climate forcing potentially impacting meltwater retention, assumptions of glacier density, and thermal conditions of the accumulation area.

KEY SUMMER FORAGING HABITATS FOR EASTERN BEAUFORT SEA BELUGA WHALES IDENTIFIED FROM TELEMETRY DATA

Storrie, Luke (1,2) (Presenter), L. Loseto (1,2), N. Hussey (3), S. MacPhee (2), G. O'Corry-Crowe (4), J. Iacozza (1) and D. Barber (1)

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The Beaufort Sea is an important summer foraging ground for one of the largest populations of beluga whales (Delphinapterus leucas); the Eastern Beaufort Sea (EBS) population. Recent effects of climate change including a decrease in total sea ice extent, and alterations to the date of sea ice freeze-up and break-up may have direct and indirect effects on the movement patterns and migration timing of this population; whilst declines in body condition have been associated with a climate-induced shift in the prey assemblage. Predicted continuation of these patterns as well as the increase in shipping traffic associated with the opening up of the Northwest Passage may pose significant threats to this population. This necessitates a greater understanding of the key foraging habitats and foraging behaviour of EBS beluga whales. Improvements in the technology of satellite-linked transmitters now enable questions on cetacean behaviour and ecology to be answered over greater time scales and to a higher accuracy than was previously possible. In July 2018 satellite tags were deployed on 10 beluga whales in the Mackenzie Estuary, Northwest Territories. Tags were programmed to record depth data every 75 s, and Fastloc-GPS locations each time the whale surfaced. Such data facilitates the application of more sophisticated models for inferring animal behaviour than in traditional hotspot analysis or state-space models. Here a discrete-time hidden Markov model (HMM) is being implemented using the R package "momentuHMM". The HMM uses step-length, turning angle, and number of dives to specific depth bins to fit three states (transiting, resting and foraging) to the animal track. Covariate data including bathymetry and sea-ice concentration are also included in the model to explore how behaviour varies under different environmental conditions. Viscount Melville Sound and the Amundsen Gulf, both part of the Northwest Passage, were identified as critical foraging habitats between mid-July and mid-

August. Preliminary analyses on the role of bathymetry suggest that foraging occurred most frequently in water depths between 400-500 m. Whales continued to make occasional deep foraging-type dives even when transiting between more productive foraging grounds. The findings from this study will be essential in informing management decisions in these areas of the Beaufort Sea, Amundsen Gulf and Northwest Passage, and will also build into later bioenergetic studies to better predict the response of this population to climate change.

MIXED METHODS: INDIGENOUS AND WESTERN SCIENCE IN ASSESSING RINGED SEAL HEALTH

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Methodologies, tools and approaches to conducting wildlife research in Nunavut has been rapidly evolving to include the voices of community members, Elders and even Indigenous researchers themselves. As scientists across the natural disciplines are expanding into the social sciences, there is more room for collaborations, but also methodological errors, as natural scientists attempt to navigate the social fabric of Inuit culture. As more mixed-methods based studies emerge across the north, we have learned from each study how we, as scientists, should approach communities and conduct more ethical research. However, there remains a landscape that emerging Indigenous researchers must navigate: how to conduct research in our communities as a community member. The goal of this presentation is to explore different methodologies for conducting wildlife research in Nunavut , underpinned through an example of my research on Ringed seal health. Specifically, there are two aims: Aim 1: To define and identify different indigenous and Western methodologies. This includes Western methodologies based in natural science, the differences between them, historical perspectives, and where they can work together. Aim 2: Exploring mixed-methods research through ringed seal health. Using both Western methods, through serology, and Indigenous methods, through oral knowledge exchanges, to explore the status of ringed seal in Iqaluit. The material of this presentation is intended to add to the round-table discussion following the ArcticNet session "methods and approaches for community-based wildlife monitoring in Canada's north: building a transdisciplinary community of practice".

COMMUNITY-DRIVEN AND INDIGENOUS PARTNERED RESEARCH ON FISH MERCURY LEVELS IN THE DEHCHO REGION, NT.

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Leadership and community members in the Dehcho region of the Northwest Territories, Canada, are concerned about levels of mercury ([Hg]) in food fishes such as Northern Pike (Esox lucius) and Walleye (Sander vitreus) that are used as subsistence food sources. Mercury levels in food fishes vary widely across lakes in a relatively small geographic area, with some lakes having high fish [Hg] and associated consumption advisories. Previous research has been unable to elucidate the main drivers of among-lake differences in fish [Hg] in this region. From 2013-2018, 10 remote Dehcho lakes were sampled for fish, benthic invertebrates, zooplankton, sediment, and water by a collaborative team that included First Nations and academic researchers in weeks-long, on-the-land camps. Sampling locations were chosen by our First Nations partners, and included sites that had recently undergone landscape change, such as permafrost slumps. Fish mercury concentrations were related to a suite of possible explanatory variables that reflect fish ecology, catchment size and land cover, composition of invertebrate and zooplankton communities, and lake and sediment chemistry. Results to date indicate that the drivers of among-lake differences in size-standardized [Hg] differ among fish species. Variability in Walleye [Hg] is best explained by chlorophyll-a, whereas variability in Northern Pike [Hg] reflects a fascinating and complex interaction among catchment composition, water clarity, and fish ecology. Biomagnification of Hg through invertebrate and zooplankton communities also varies among lakes, and appears to reflect catchment characteristics and community composition. Results of this ongoing and Indigenous-partnered research are discussed in the context of causal mechanisms, consumption advice

for northern fishers, striking a balance between benefits and risks of consuming fish, and a resulting mercury mitigation strategy that was initiated by Dehcho First Nations and supported by University researchers. Other results that arose from local and traditional knowledge, such as analyses of tissues not routinely analyzed, are also discussed.

CHANGING BIOGEOCHEMICAL FUNCTION IN THAW-DISTURBED FRESHWATER NETWORKS OF THE PEEL PLATEAU, WESTERN CANADIAN ARCTIC

Tank, Suzanne(1) (Presenter), C. Littlefair(1), S. Zolkos(1), S. Shakil(1), E. MacDonald(1), S. Kokelj(2)

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The Peel Plateau is a characteristic ice-marginal glaciated landscape, typified by deposits of deep glacial tills and massive ground ice that enable catastrophic retrogressive thaw slump activity. Our work aims to understand the biogeochemical effects of permafrost thaw in this region, with a consideration of effects across slump features of various morphologies, and scales ranging from the immediate downstream-of-slump environment, to the full catchment scale. Thaw slump effects occur overwhelmingly in the particulate and inorganic phase on the Peel Plateau, with releases of particulate organic carbon that dwarf those for organic carbon in the dissolved phase, and changes to chemical weathering that cause fundamental alterations to carbon cycling at the terrestrial-freshwater interface. These effects propagate downstream, particularly when associated with the particulate phase. Our results underscore the importance of accounting for variability within and across Arctic regions when seeking to understand the biogeochemical effects of permafrost thaw.

CARBON DEGRADATION AND CO2 PRODUCTION ALONG ERODING PERMAFROST COASTLINES

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Permafrost coasts are the key interface between the terrestrial and marine systems in the Arctic. Erosion of these coasts at rates of approximately half a meter per year transfers large amounts of organic matter into the ocean, adding to the input from Arctic rivers, streams and creeks. Warming air and sea temperatures, longer open-water seasons and sea-level rise promote the erosion of permafrost coasts due to the combined effects of protective sea-ice loss, wave action, permafrost thaw and ground ice melt. With erosion, the extensive pool of permafrost organic carbon (OC) is accessed and organic material is transported into the ocean, where it is metabolized, sequestrated or transported further offshore. Although the understanding of biogeochemical processes upon gradual permafrost thaw on land and permafrost OC transport on the shelf are improving, little is known about the immediate biogeochemical response during the abrupt coastal erosion process and associated greenhouse gas production. We mimicked different coastal erosion scenarios with incubation experiments by mixing in-situ permafrost and thawed permafrost debris (i.e. mud lobes, cliff toe debris) without and with ambient seawater to assess potential carbon dioxide (CO2) release from onshore and nearshore zones. CO2 production was measured for 2 months at 4°C under aerobic conditions. Organic carbon, nutrients (N), carbon isotopes (13C, 14C) as well as biomarkers (n-alkanoic acids, n-alkanes) were analysed prior and after incubations. Our results show that substantial amounts of CO2 are being produced under all erosion scenarios and that seawater facilitates

the production of CO2. Incubations of in-situ permafrost and cliff toe debris revealed particularly strong CO2 production when mixed with seawater compared to mud lobes. Although C/N-ratios and stable carbon isotope signatures do not reflect OC degradation explicitly, carbon preference indexes and high-to-low molecular weight ratios of n-alkanoic acids and n-alkanes indicate ongoing degradation which corresponds to observed CO2 production. The incubations show that permafrost OC is rapidly degrading upon thaw and that this process can be catalyzed by the presence of seawater. We conclude that erosion of permafrost coasts is an "incubator" for terrestrial organic matter before transport to the offshore marine system and potentially releases substantial amounts of CO2 from onshore and nearshore zones to the atmosphere. We emphasize the importance of coastal erosion for carbon cycling and models, especially under the Earth´s current climate trajectory and the accelerated environmental forcing on Arctic permafrost coastlines.

INVESTIGATING CURRENT AND HISTORIC IMPACTS OF TRANSPORTATION INFRASTRUCTURE ON WATER QUALITY AND FISHING OPPORTUNITIES IN THE GWICH'IN SETTLEMENT AREA, NORTHWEST TERRITORIES

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Anthropogenic additions of fine sediment to lotic systems can have adverse effects on water quality and downstream macroinvertebrate communities. In the Northwest Territories, the addition of foreign sediment to build ferry landings on the Mackenzie and Peel Rivers has been an ongoing concern for Gwich'in communities that depend on the rivers for their food and livelihoods. Specifically, there are concerns that sediment from the ferry landings is degrading water quality, harming fishing opportunities, and changing river morphology downstream. To study the impact of the added sediment from the ferry landings on water quality, I collected samples at 30 sites both upstream and downstream of ferry landings on both the Mackenzie and Peel Rivers after ice breakup in June 2018 and 2019. At each site, I collected depth-integrated total suspended solids samples, bed load samples, substrate sediments, and benthic macroinvertebrates. While the scientific sampling provided direct feedback on current impacts, elders and other knowledge holders from each community provided information on long-term changes in each river through formal interviews and meetings. Preliminary scientific results suggest that ferry landings are not altering downstream water quality or total suspended solids in each river, and that there are no significant differences in macroinvertebrate communities between upstream and downstream locations. Preliminary information from Traditional Knowledge interviews suggests that changes in the rivers are occurring upstream and downstream of the ferry landings. Both the Traditional Knowledge and scientific results suggest that changes in the Mackenzie and Peel Rivers are not due to the ferry landings.

THE NTRAIN PROJECT: RESOLVING MARINE NUTRIENT TRANSPORTS TO ASSESS THE BIOLOGICAL CARRYING CAPACITY OF THE CANADIAN ARCTIC.

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Marine wildlife is an integral part of food security and culture in the Inuit Nunangat and the abundance, visual appeal and nutritional value of this wildlife are sensitive to climate-driven changes in ocean properties and nutrient availability in particular. Using light as an energy source, phytoplankton and sea-ice algae assimilate carbon and nutrients to grow and produce the organic matter that sustains the food web and synthesize vital molecules (e.g., essential omega-3) that promote animal fitness and human well-being. The ocean currents that connect the Canadian Arctic (CA) with the Pacific and Atlantic Oceans bring variable quantities of nutrients and these quantities can be impacted positively or negatively by environmental change, with repercussions on the entire food web and Inuit food security. While nutrient inputs and outputs should balance for the whole Arctic Ocean, recent attempts at balancing nutrient budgets produced equivocal answers and raised several questions that will be addressed here. This presentation will introduce ArcticNet's new NTRAIN

project, which aims to evaluate how components of the Arctic nutrient distribution network connect and respond to the changing physical environment and how this affects the magnitude and nutritional quality of organic matter production within the CA. Specific objectives are to 1) Measure nutrient concentrations and estimate their transports across major gateways leading in and out of the CA, 2) evaluate how microbial processes affect and are affected by changing N inventories and nutrient ratios along flow, 3) assess how the nutritional value of algal assemblages is affected by physical and chemical water properties. A sampling network involving partners from northern organizations, Fisheries and Oceans Canada (DFO), and international partners has been assembled to train students and produce evidence-based assessments of the CA's capacity to support harvestable marine wildlife. Preliminary results from the 2019 expedition of CCGS Amundsen will be presented and discussed with respect to the time-series that were assembled in previous phases of ArcticNet.

CULTURE AND THE SOCIAL-ECOLOGY OF LOCAL FOOD USE BY INDIGENOUS COMMUNITIES

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Social-ecological and biocultural systems connect people to their environment and blur distinctions between nature and culture. Conceptualizing people and the environment as distinct or separable entities is especially incommensurate with the worldviews of many Indigenous Peoples, whose traditional knowledge emphasizes relationships between human and non-human life and the animate and inanimate world. Local Indigenous food systems involve the harvest of locally available, non-domesticated wildlife for human consumption and are inextricably linked with the identity, food security, and well-being of Indigenous Peoples throughout the world. By their nature, local food systems are assumed to be both ecologically-determined and culturally-defined, but evidence for this arises largely from qualitative case studies. Here, we analyze standardized local food consumption surveys conducted in 21 Indigenous communities across northern North America. Using measures of dietary similarity from the ecological sciences and a variance partitioning statistical approach, we reveal a profound and prevailing importance of culture in defining the types and amounts of animal species consumed as food. These results provide the first quantitative, multi-community assessment of the biocultural drivers of local food use by Indigenous Peoples and highlight the importance of cultural-ecological coupling in an era of accelerating social and environmental change.

THE UNDER-ICE ECOSYSTEMS OF STUCKBERRY VALLEY LAKES: OXYGEN DYNAMICS AND ENVIRONMENTAL CHANGES

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Under-ice lake dynamics is an emerging field of study, especially regarding High Arctic lakes, which can be ice-covered 10 to 12 months of the year. Biogeochemical cycles occurring under the ice will shift with climate warming, and many studies have shown that even the world's most northern ecosystems have already been affected. Projections suggest that the northern coast of Ellesmere Island lies within a region that will experience the greatest annual warming in Arctic North America over the next 80 years. There is therefore an immediate need to study its ecosystems before further changes occur. This will enable more accurate predictions to be made regarding how the functioning of lakes will respond to future environmental change. As part of a transdisciplinary team, I have studied the phototrophic microbiomes of a series of four northern Ellesmere Island lakes in Stuckberry Valley (82º54 N, 66º56 W) to give insight into High Arctic aquatic ecosystems and geosystems and their place in the global climate system. These lakes are an excellent example of the complex environments found in the north, revealing a surprising diversity of ecosystem types. Shallow lakes (7-9m deep) were found to have hypoxic to anoxic waters below spring ice and a sulfuric smell,

while deeper lakes (27-49m) contained fully oxygenated water columns. To better understand the ecology of these lakes, we analyzed the chemistry of water samples taken throughout their water columns. Phytoplankton samples were split into the picoplanktonic fraction and the total community prior to High Performance Liquid Chromatography (HPLC) pigment analysis in order to determine relationships between lake microbiomes and differing physical and chemical conditions, and to improve the understanding of High Arctic under-ice aquatic environments under the context of accelerating climate change. Results distinguish two different lake types based on morphology and depth. The primary factor responsible for differences in the phytoplankton communities within and between lakes was oxygen concentration, rather than nutrients. A suite of bacterial pigments was found only in the anoxic zones of the shallow lakes, indicating the presence of anoxygenic bacterial photosynthesis. As increased mixing of shallow lakes is expected with concurrent rises in air temperature and lengthening of the ice-free season, the water columns of these lakes may become more oxygenated over time. Given that the bacteria present are obligate anaerobes, water column oxygenation would result in the disappearance of this bacterial community. As part of a multidisciplinary project combining researchers from several fields of study, this research addresses a knowledge gap about under-ice microbial ecology in High Arctic lakes.

REMOTE MULTI-VARIABLE MONITORING OF ANNUAL SNOW DEPTH

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In coastal Labrador and northern Québec (including Nunavik, Nunatsiavut and NunatuKavut), changes in snow conditions impact local vegetation, permafrost distribution and wildlife habitat. Low-snow years also negatively affect travel, food security and cultural activities for traditional land users and Indigenous people in the region. Despite the importance of snow for ecosystems and communities in the north, many snow characteristics, including snow depth, are not reliably measured across large spatial domains in northern Canada. Existing approaches for observing snow depth are limited to in situ field data collection, the establishment of costly full weather stations or low-cost data logger-based methods that can produce uncertain results. A common cost-effective technique widely-adopted in ecological and permafrost studies is to use vertically arranged temperature loggers (typically Thermochron iButtons, Model DS1921G) (see Lewkowicz, 2008) for snow depth estimation. While this method is cost-effective and accessible to northern researchers, interpretation of iButton data is often challenged by their relatively low precision (+/-0.58 degrees Celsius) and sampling frequency (4-h sampling rate for a year of data). Further, iButtons commonly exhibit data errors and gaps due to internal clock slippage, imperfect waterproofing and inconsistent output formatting. In this study, we propose a new alternative method for estimating snow depth using vertically arranged combination light/temperature loggers. In the summer of 2018, six snow stakes using the newly-proposed light/temperature method were installed at field sites in Subarctic and Arctic regions of Labrador. Snow stakes were outfitted with vertically arranged light/temperature data loggers at increments of 10, 20, 30, 40, 50, 60, 80, 100, 120 and 160cm at sites selected to reflect typical environmental conditions in the region (Subarctic forests and Low Arctic shrub-tundra). Preliminary results from one-year of field data indicate that daily maximum light intensity (lux) measured at snow-covered sensors is diminished by an order of magnitude compared to uncovered sensors. This contrast enables differentiation between complete and incomplete snow coverage at sensor heights. The collected data also shows attenuation of light intensity through the snowpack with depth and significant variations in light penetration of the snowpack through time. Validation of the light/temperature technique is still needed to resolve ambiguities with light intensity thresholds for snow detection and to elucidate the impacts of snow density on retrieved light profiles. However, the preliminary results presented in this study suggest that the proposed technique represents a significant improvement over prior methods for snow depth estimation in terms of practicality, simplicity, versatility and cost-effectiveness.

Lewkowicz, AG. 2008. Evaluation of miniature temperature loggers to monitor snowpack evolution at mountain permafrost sites. Permafrost Periglacial Processes.

BUILDING INUIT SELF-DETERMINATION IN RESEARCH THROUGH THE DESIGN AND IMPLEMENTATION OF QANUIPPITAA? NATIONAL INUIT HEALTH SURVEY

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The presentation will focus on describing the upcoming Qanuippitaa? National Inuit Health Survey, which is the first national health research program of its kind to be entirely led by Inuit. The survey is being developed and implemented by the four Inuit Regions and Inuit Tapiriit Kanatami. It is a permanent health survey, funded by a 2018 federal budget allocation of $82 million over 10 years with $6 million a year ongoing. The survey will collect up-to-date information on Inuit health and the social determinants of Inuit health that will help program and policy makers at the local, regional and national levels better understand how the health status of Inuit is changing and guide Inuit health program development. It will also contribute to Inuit governance and empowerment in the fields of research and health. In recent years, Inuit have become increasingly involved in health research activities taking place in Inuit Nunangat (the Inuit homeland); however, colonial approaches to research endure, particularly in the realm of health research. Inuit are still not consistently involved in setting the research agenda, establishing and monitoring compliance with ethical guidelines, and determining how data and information are collected, analyzed, stored, used, and shared. The National Inuit Strategy on Research (NISR) advocates for research that empowers Inuit and meets the needs of Inuit families and communities. Advancing Inuit self-determination in health research through projects like Qanuippitaa? National Inuit Health Survey is imperative. Ensuring that Inuit are leading all steps of the research project will greatly enhance the efficacy, impact, and cultural safety of research relating to Inuit and Inuit Nunangat and ensure that research results in the improvement of health and well-being for Inuit without causing them harm. The results from Qanuippitaa? National Inuit Health Survey will provide information about Inuit health status over time and will highlight Inuit health strengths using a strength-based approach that focuses on learning and solutions. The survey design and implementation processes will provide Inuit with the training and resources required to conduct surveys on an ongoing basis. Data collection is expected to begin in 2021 and take place every five years. The presentation will highlight the unique elements of the project and will describe how every aspect of survey development and implementation is designed to advance Inuit self-determination in research. The authors will describe how the project's governance structure allows for Inuit land claims and representative organizations to be at the center of the research and decision making processes. They will further outline how the survey's questionnaire content development process, sampling methodology, ethical review, data management, and analysis and dissemination plans are being designed to ensure both methodological rigour and Inuit ownership and control.

DOES THE CHANGING ICE DYNAMIC IN THE ARCTIC INFLUENCE THE NUTRITIONAL VALUE OF THE BENTHIC FOOD WEB IN NUNAVIK, CANADA?

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In Canada, global change is of concern for northern populations that depend on the Arctic Ocean. This ocean is affected by climate change faster than other oceans. As part of the BriGHT (Bridging Global Change, Inuit Health and the Transforming Arctic Ocean) program, this project focuses on the benthic food web, particularly on the species consumed by Inuit populations such as mussels and sea urchins. The primary source of food for many benthic organisms is likely to change from ice algae to phytoplankton due to the loss of the ice cover. This change in food source could influence the availability of essential fatty acids and antioxidants that have important roles in the reduction of cardiovascular diseases and Inuit health. The main objective of this project is to determine if the abundance of specific fatty acids, selenium, selenoneine, and carotenoid pigments in benthic organisms changes with food source across different areas of Nunavik. We also want to know if there is bioamplification of these elements according to trophic level. We have characterized fatty acid profiles and will do the same with selenium, selenoneine, and carotenoid abundance in benthic organisms. We then establish comparisons between species and villages. According to the fatty acid profiles of mussels, scallops, sea urchins and sea stars, there is

bioamplification according to trophic level in important fatty acids such as EPA. These results will help better understand the impacts of climate change on the benthic food web and Inuit diet.

ASSESSMENT OF COASTAL EROSION AND FLOODING HAZARD IN THE BEAUFORT SEA COAST

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Arctic permafrost coasts are major carbon (Schuur et al., 2015) and mercury pools (Schuster et al 2018) and represent about 34% of Earth's coastline, with large sectors affected by high erosion rates (Fritz et al, 2017), increasingly affecting coastal communities. Year-round reduction in Arctic sea ice is forecasted and by the end of the 21st century, models indicate a decrease in sea ice area from 43 to 94% in September and from 8 to 34% in February (IPCC, 2014). An increase of the sea-ice free season duration will further expose coasts to wave action, with changing climate also modifying the contribution of terrestrial erosion (Fritz et al., 2015, Ramage et al 2018, Irrgang et al 2018). Within the project NUNATARYUK, we are updating the mapping of the Arctic coast and assessing the hazard exposure of communities, with the Beaufort Sea as a case-study. The surveying methodology includes: i. a high resolution update of the coastline mapping and change rates using Pleiades (CNES) satellite acquisitions from 2018, ii. a survey using RTK-UAV aerial imagery of long-term monitoring sites from the Canada-US border to King Point, as well as sites in Amundsen Bay, and iii. ultra high-resolution surveys of coastal settlements using RTK-UAV in collaboration with communities aiming at improving coastal hazard assessment (e.g. Tuktoyaktuk and Paulatuk). This presentation shows the updates from this integrated coastal assessment with the field data from the summer of 2019.

SURVEILLANCE FOR ARBOVIRUSES IN ARTHROPOD VECTORS IN THE CANADIAN ARCTIC

Villeneuve, Carol-Anne(1,2) (Presenter) , N. Lecomte(2), K. Buhler(3), A. Elliot(4), M. Iranpour(5), E. Jenkins(3), R. Lindsay(5), M. Wardekker(4) and P. Leighton(1)

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Vector-borne diseases are an important yet underexplored topic in the Canadian Arctic. At present, the scientific literature about the diversity of arthropod vectors and their infectious status is both incomplete and out-of-date. This study examines the current composition of mosquito populations and the prevalence of arboviruses in the Northwest Territories (Hendrickson Island), Nunavut (Cambridge Bay and Karrak Lake) and northern Quebec (Kuujjuaq). We examined these four sites over the summer of 2018 by systematic sampling (figure-eight sweep of the net, total of 100 sweeps, 3 times/day, and 3 days/week). Species were determined visually with an identification key and pooled by 50 individuals. We further confirmed our morphological species identification by polymerase chain reaction (PCR) and sequencing of the CO1 gene for 10% of the mosquito pools. For this, an individual mosquito was selected from the pool, and then DNA was extracted from 3 legs of the individual. CO1 sequences were edited and BLASTed via the gene bank (GenBank) for confirmation of morphological identification. For arboviruses identification, pools were then subjected to RNA extraction followed by PCR amplification. Next, species diversity was estimated using the Shannon Index (H'). We have identified a total of 8 species from the Ochlerotatus genus, in which Ochlerotatus nigripes (52% of total mosquito individuals sampled), Ochlerotatus impiger (23%) and Ochlerotatus hexodontus (15%) were the most abundant and widely distributed. Notably, we also identified Ochlerotatus abserratus in Kuujjuaq, which is not usually found that far north. Overall mosquito diversity was relatively low, with the lowest in Kuujjuaq (H'=0.56) and the highest in Cambridge Bay (H'=1.24). It has previously been reported that mosquitoes likely play a role in amplification of the arboviruses of interest in

this study: Johnston Canyon Virus (JCV), Snowshoe Hare Virus (SHV) and Cache Valley Virus (CVV). However, we did not detect any of these arboviruses in our samples from year one, likely due to an unusually cold summer that could have affected sample size. In conclusion, although our first year of sampling did provide some new information, the picture is not yet complete. Since sample size and time period can directly impact the result, we cannot conclude that these viruses are definitively absent from the studied Arctic environment. Thus, a second year of sampling with a larger sample size and more sites is currently underway. Since the rapid change of the Arctic climate can alter the distributions of the vectors and pathogens, building a baseline dataset of arbovirus occurrence will serve as a reference for future studies and help us to anticipate the impact on public health as the Arctic continues to warm.

TEMPORAL DYNAMICS OF PLANT-POLLINATOR NETWORKS IN THE CANADIAN ARCTIC ARCHIPELAGO

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In the Canadian Arctic, climate change is disrupting pollination services and reducing plant community robustness by diminishing pollinator diversity, shifting flowering phenology, and rearranging plant-pollinator networks. This study aims to describe the properties and temporal dynamics of an arctic plant-pollinator network across a flowering season. Thus, we actively sampled 2,346 pollinators in two habitats types, recorded 4,002 plant-insect interactions, and measured the flowering phenology of 20 plant species on Victoria Island, Nunavut, in summer 2018. Preliminary results suggest the presence of pollination syndromes across major pollinator groups and generalization within groups. Next, we will ID insect specimens to improve the resolution of the plant-pollinator network and to determine the properties of the network. Describing this network will facilitate making testable predictions of climate change effects on plant and insect communities in the Arctic.

EFFECTS OF PERMAFROST DEGRADATION ON VEGETATION COMPOSITION AND ITS NUTRITIONAL AND CULTURAL VALUES IN JEAN MARIE RIVER, NORTHWEST TERRITORIES

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Jean Marie River First Nation (JMRFN), NWT, is a remote northern community whose population relies heavily on country food harvested from their traditional territory. Climate change-driven permafrost thaw is reducing the ability of people to travel on the land and access harvesting sites, as well as altering habitats that support the animals harvested by JMRFN. Permafrost covers over half of JMRFN territory, but community members and scientists have found that much of this permafrost is rapidly thawing. Between 30 and 40% of key plant and wildlife habitats overlap with highly vulnerable permafrost and are therefore likely to be impacted. These habitats are critical to the health of JMRFN citizens, providing food security in a remote northern community, and supporting activities central to cultural identity. Understanding the direction and magnitude of ecosystem changes throughout the JMRFN traditional territory, and their potential impacts on travel, vegetation, and wildlife, is crucial to maintaining food security and health of the community, as well as supporting climate change adaptation. By surveying vegetation in areas of varying permafrost degradation and analyzing the characteristics of underlying permafrost, this research aims to understand and quantify the relationship between permafrost thaw and vegetation composition, shedding light on the overall ecosystem health, and subsequent impacts on JMRFNs ability to access country foods.

COMMUNITY-LEVEL PHENOLOGY OF PLANT-POLLINATOR INTERACTIONS IN FOUR ARCTIC ECOSYSTEMS NEAR CAMBRIDGE BAY, VICTORIA ISLAND, NUNAVUT

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In the brief growing season of the Arctic, plants need to flower within a short time frame. Such "flush flowering" may lead to pollinator limitation, and to competition among plants for pollinators. At the level of individual flowers (per flower capita), this can translate into both intra- and interspecific competition. Within plant species, a higher abundance of conspecific flowers can result in fewer pollinator visits per flower, and thus in reduced seed set for individuals flowering during the peak season. Among plant species, a higher abundance of heterospecific flowers can also result in fewer pollinator visits per flower, with similar consequences. The realized strength of intra- and interspecific competition at a given time is thus affected by a) the contemporary abundance of conspecific flowers, b) the contemporary abundance of heterospecific flowers, and c) the availability of pollinating insects and their pollen carrying capacity. This study attempts to resolve the strength of competition as a result of these three factors, and measure its impact on net seed set. During the growing season of 2019, four study sites have been established in ecosystems corresponding to shrub fen, mesic tundra, dry upland, and snowbed. From the beginning of June to late September, the phenology of insect-pollinated plant species has been recorded by direct observations in the four sites, while the availability and phenology of pollinators have been determined by malaise traps deployed in each of the sites. In order to determine flower abundance, flowers were counted along predetermined transects. The pollen-carrying capacity of individual pollinators is determined by pollen counting on captured insects. For establishing how the above-mentioned three factors translate to pollinator visits per flower, and the impact of these visits on seed formation, a set of experiments have been performed on Dryas integrifolia. This genus was selected as being the most abundant vascular plants in many circumpolar Arctic terrestrial ecosystems. To determine pollinator visits per individual flower, insect traps mimicking Dryas flowers were deployed in the field for set periods of time during early, peak, and late flowering times, as well as two weeks after flower senescence in this species. These "sticky flowers" were manufactured from white and yellow sticky paper mounted on wire "stalks", and placed among Dryas plants in order to capture pollinators seeking to visit the flowers of this plant. To generate a baseline towards which to determine the impact of insect visits on seed set in Dryas, pollinator exclosure cages were installed over floral buds using the same timing as for the deployment of the "sticky flowers". At the end of the season, seed set inside and outside of these exclosure cages was determined by counting the flowers falling into various categories of seed formation (or lack thereof). Here we present the preliminary results of this initial year of our plant-pollinator interaction study. The project will be continued over multiple years, thereby providing direct insight into how climatic variation and climate change may affect insect-plant interactions, revealing: i) the impact of the (mis)match in plant-insect timing on insect densities, ii) temporal tends in the relative synchrony of different species pairs (both insect-insect and insect-plant pairs), iii) changes in the composition of the pollen-carrying community.

MEASURING SNOW FROM THE SKY: HIGH-RESOLUTION OBSERVATIONS OF ACCUMULATION AND SNOWMELT USING RPAS-UAS

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Arctic tundra environments are characterized by a spatially heterogenous end-of-winter snow distribution resulting in large spatial variations in snow depth, density and water equivalent. Understanding the distribution of snow across tundra environments is important as the snow accumulation in the Canadian Western Arctic accounts for over half of the annual precipitation. Currently, our ability to accurately measure snow using in-situ and remote sensing techniques has proven difficult where traditional methods often fail to accurately represent small-scale variations in snow cover at catchment scales. Furthermore, the accumulation patterns at landscape scales are poorly documented resulting from technical and environmental limitations. In this study we document spatial variations in snow accumulation and ablation across a shrub-tundra catchment as part of the TVCSnow campaign from Trail Valley Creek, NWT. We applied Structure-from-Motion photogrammetry using a fixed-wing Unmanned Aerial System (UAS) resulting in high-resolution snow depth mapping (1 meter) at key periods of snow accumulation and throughout the snowmelt period. In combination with UAS aerial surveys, snow depth and water equivalent measurements were recorded across the winter accumulation period resulting in a detailed documentation of snow accumulation and ablation for various key

landcover types. The ability to capture high-resolution spatio-temporal changes to tundra snow cover furthers our understanding of the relative importance of various land cover types on winter snow accumulation and ablation which has strong implications on the hydrological system during the spring freshet.

TRAJECTORIES OF FROZEN GROUND FOLLOWING FOREST FIRE IN NUNATSIAVUT, NL

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Forest fires are a significant natural disturbance to permafrost landscapes. Following fire, forests undergo succession, with progressive stages of vegetation establishment and abundance. In areas where frozen ground is ice-poor, thermokarst does not develop. In these areas, the thermal state of the ground responds to changes in the surface vegetation as the forest recovers, either resulting in vertical degradation of permafrost or recovery as ecosystem-driven permafrost. This project examines the thermal state of the ground and explores the likelihood of post-fire permafrost recovery at three burned sites near the coastal Nunatsiavut communities of Nain (Tikkoatokak Bay and Webb Bay) and Postville (Beaver River). All three of these sites burned between 1996 and 2004 and are still at relatively early successional stages, with a shrub-dominated vegetation cover. Air and ground temperatures and snow depths were monitored at the study sites from 2017-2019. Direct current electrical resistivity tomography (ERT) surveys were performed across burned to unburned transitions in order to determine the presence or absence of frozen ground. Shrub height and density, canopy cover, organic layer depth, snow depth, and sediment characteristics were recorded along the ERT survey lines. Based on results from western North America, it was hypothesized that ground temperatures would be lower in the undisturbed closed-canopy forest than in the adjacent burned areas, due to greater interception of snow, an undisturbed thick organic mat, and greater shading of the ground. Burned areas were expected to have lesser organic mat thicknesses due to combustion, and greater shrub cover, which would trap snow in winter. It was expected that permafrost, if present, would be located beneath forest cover, while concurrently absent or degrading in the burned areas. Field observations showed no significant difference in snow depths, but cooler ground surface temperatures in summer within the intact, unburned forest. Frozen ground conditions varied, with only seasonal frost in the unburned area near Postville and possible permafrost in the unburned area at one of the sites near Nain. A crucial difference between our results and those from western Canada is the insulation provided by deep (typically 1.3 to 1.5 m) snow in winter, which appears to limit the thermal impacts of shrub cover on the ground thermal regime. In situ field data are being used to validate our ground temperature modelling process, performed with TEMP/W (Geoslope). Thermal modelling will be used to identify the recovery or degradation trajectory of frozen ground at the three sites, in response to both past and future climate change and to the impacts of fire. In conjunction with a warming climate, post-fire landscape succession and associated shrub regeneration and organic material reduction are expected to promote the thaw and vertical degradation of existing frozen ground. These results, combined with collaborative studies on post-fire vegetation community composition and tree regeneration, will provide insight into fire-associated ecosystem change in Nunatsiavut.

A TRIAL OF PLANETSCOPE CONSTELLATION SATELLITES FOR ECOSYSTEM-WIDE MAPPING OF ARCTIC EELGRASS

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In 2016, the Cree Nation Government and Hydro-Québec, launched a research program on eelgrass off the east coast of James Bay. The goal of the research is to identify the various factors influencing the growth of eelgrass. Eelgrass provides many important ecosystem functions, including providing shelter, food, and spawning surfaces for many species of invertebrates, fish, and waterfowl. Indigenous knowledge from trappers in the area

who hunt waterfowl suggest that changes in the amount of eelgrass is are being observed, resulting in less waterfowl. A small portion of this broader research project, and the focus of this work, is to understand and investigate the usefulness of satellite imagery to map the aerial extent of eelgrass beds along the south coast of James Bay. Satellite imagery is useful for large areas in isolated locations, thus the study area seemed appropriate for such an endeavor. Logistically, for best results, satellite imagery should be acquired as near to low tide as possible, not directly after a rain event and during cloud free conditions. PlanetScope imagery was acquired for the entire Study Area on August 27, 2017. PlanetScope imagery is acquired by a series of 140 small satellites known as doves, which orbit one after the other in a constellation. The imagery is acquired in small tiles (7 km by 25 km) and then mosaicked together to create a full image set that covers the entire Study Area. The imagery has a spatial resolution of 3 m and captures four multispectral bands, including blue, green, red and near-infrared. The PlanetScope imagery was collected on August 27, 2017at 12:00 EST, just before a low tide of 0.2 m (chart datum). A maximum likelihood supervised classification method was applied to the imagery. Research partners at the University of New Hampshire, in conjunction with Hydro-Quebec and Cree Nation, provided 261 in-situ field indicating presence or absence of eelgrass. A portion of these field points we're used to build training areas as input into the maximum likelihood classification. The remaining points we're used to conduct the error assessment. The areal coverage of potential eelgrass was estimated to be 36.50 km^2. An overall accuracy of 73.7% was achieved with consumer and producer accuracies respectively of 93.5% and 59.0% for eelgrass presence data. The kappa value of 0.50 indicates fair agreement between the satellite classification and the groundtruth points ($z = 7.87$, $p < 0.001$). Overall, this research project proved useful for large-scale detection of eelgrass using supervised classification applied to a mosaic dataset of PlanetScope imagery. Water turbidity and high suspended sediment levels in some locations indicate a possible under-estimation of eelgrass coverage. Areas of submerged eelgrass may have been overlooked due to the loss of spectral signals as water depth increases. Patches of low-density eelgrass may also be overlooked because of low spectral response as well as their relative size compared to the spatial resolution of the satellite imagery. Future plans for research in this area are to build a machine learning algorithm to recognize and map eelgrass beds, using PlantScope Imagery, to be able to provide continual monitoring programs and highlight areas where a reduction in the aerial extent of eelgrass are happening. This research may help to infer possible environmental or human related factor and how they are related to changes in eelgrass.

A NOVEL WILD FOOD VALUATION FRAMEWORK USING LOCAL RETAIL REPLACEMENT COSTS IN NUNAVUT

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Historical valuations of wild foods have varied greatly, through time, regionally, between contexts, and under different methodologies. Additionally, wild food systems do not get treated consistently in the reporting of household wealth and economic productivity. In Nunavut, the high retail cost of food in markets and increasing food insecurity are both despite the Nutrition North program administered by the Canadian Government to subsidise the cost of food in Canada's north. Some previous valuations do not consider local markets in their valuations of wild food, while some other valuations have been made based on unrealistic market conditions. Our study proposes a refined and novel approach for valuing wild food by comparing the nutritional content (energy and protein) of harvested food, to prices in local Nutrition North subsidised retail markets for those same nutrients. This analysis based on nutritional content emphasises the nutritional density of wild foods (higher in iron, zinc, and potassium content than market foods while being lower in sodium, fat, saturated fat and sucrose content) and the disproportionate contributions wild foods make to Inuit micronutrient intake, proportional to their contributions to total energy intake. This approach used harvest data from the 1996-2000 Nunavut Wildlife Harvest Study, and nutritional content data from both Health Canada and the traditional animal food nutritional database published by McGill Centre for Indigenous People's Nutrition and Environment. Income data and economic productivity by sector data from the Nunavut Bureau of Statistics were also used for comparison purposes. This is the first community-specific approximation of the replacement value of partial nutritional content for the harvested wildlife in Nunavut. Our study has arrived at an average value of wild foods harvest greater than $50 per kilogram, using the cost to replace the protein it contains at a local food market. Based on this, we have estimated the value of the protein harvested in the Nunavut wild food system, between 1996-2000, at almost $150 million a

year, five times the currently estimated value of the food system reported by the territorial government, 50 time the currently GDP reported for hunting, fishing and trapping, and approximately equal to the size of the current oil and gas sector.

ENHANCED CLIMATE AND WEATHER MONITORING IN NUNATSIAVUT AND NUNATUKAVUT

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Ongoing and future climate change is predicted to negatively affect northern ecological and earth systems to a greater degree than those in the south with direct impacts on the adaptive capacity of Indigenous people in northern Canada. In coastal Labrador, northeast Canada, trail routes are a critical means of inter-community travel and provide access to traditional subsistence and foraging areas in the winter and can be accessed via speedboat on nearby waterbodies in the summer. Traditional winter trail routes are often the cheapest means to travel between communities because there is no road access to communities in northern Labrador, and because air travel is both expensive and unreliable due to frequent weather delays caused by notoriously challenging coastal weather conditions. The Coastal Labrador Climate and Weather Monitoring Program (CLCWMP) is a new initiative launched by the Northern Environmental Geoscience Laboratory at Queen's University in the summer of 2018 in concert with local community partners, the Labrador Institute, the Nunatsiavut Government, the NunatuKavut Community Council and the Government of Newfoundland and Labrador. This project aims to enhance weather and climate monitoring infrastructure in coastal Labrador by establishing remote automated weather stations (RAWS) in the vicinity of communities and along heavy use travel routes throughout the region. This program is funded through the Indigenous Community-Based Climate Monitoring Program from Crown-Indigenous Relations and Northern Affairs Canada. After a year of consultation with project partners, satellite-based RAWS were established over the course of July and August of 2019 near the communities of Black Tickle, North West River, Postville, Red Bay and Rigolet, with a sixth station established along the Trans Labrador Highway in eastern Labrador. Each RAWS measures critical weather and climate variables including air temperature, relative humidity, barometric pressure, soil temperature, soil moisture, snow depth, rainfall, wind speed, wind direction and incoming solar radiation. Recorded data are transmitted each hour via satellite and are then uploaded in near-real time to a public web portal and display interface developed by the Government of Newfoundland and Labrador's Municipal Affairs and Environment department. In this contribution, we will discuss the implementation of this ambitious project while acknowledging the logistical and technical hurdles that challenge the development of these types of RAWS networks in the North. We will also highlight some of the advantages and disadvantages of northerner-led but southern University-based projects.

WORKING GROUP MODEL FOR FISHERIES CO-MANAGEMENT: EXAMPLES FROM THE WESTERN CANADIAN ARCTIC

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Over 25 years ago, a framework for harvester-based working groups was developed in the Inuvialuit Settlement Region (ISR) and an area of shared fish stocks in the Gwich'in Settlement Area (GSA). The purpose of the working groups was to provide a forum that would foster the inclusion of subsistence harvesters in the management of declining Arctic char (Salvelinus alpinus) and Dolly Varden char (Salvelinus malma) stocks in a meaningful way. Four stock-specific working groups were formed with harvesters from the communities of Aklavik, Paulatuk, Ulukhaktok, Sachs Harbour, and Fort McPherson, Northwest Territories, which have retaining members across decades. Working groups have representation from the community, Fisheries and Oceans Canada (DFO), and the Fisheries Joint Management Committee (FJMC), a co-management body established from the Inuvialuit Final Agreement. The working groups assess issues related to the char stocks, collect, document, and evaluate relevant scientific and Indigenous knowledge, determine appropriate harvest-based monitoring practices, provide recommendations on safe harvest levels that consider community needs, and ensure that community members are informed on issues related to the char stocks. The working group framework has produced opportunities and

a forum for communities to develop their own voluntary solutions to maintaining sustainable harvest levels. These measures are evaluated annually at the working group meetings. Since the formation of the working groups and implementation of community-based measures, the char stocks have begun to recover and stabilize. Additionally, the working groups have built up strong relationships between the stakeholders involved and allowed for common understanding of issues, so that management of the stocks can move forward in collective agreement. These working groups serve as a model of co-management that has proven successful in the ISR, where the same working group framework has since also been adopted for the co-management of two marine protected areas. There is potential for this framework to be adapted and applied in other regions of the Canadian Arctic.

IDENTIFYING WHERE CRUISE SHIPS DISEMBARK PASSENGERS IN THE CANADIAN ARCTIC

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The Canadian Arctic has been receiving an enormous amount of attention related to sovereignty, tourism and commercial navigability. The Arctic cruise industry is drawn to Canada's immense natural environment, culture and history, with increasing focus on the Northwest Passage and the history of the Franklin Expedition. Cruise companies have already developed itineraries centered entirely around the Northwest Passage and The Franklin Expedition (e.g. Adventure Canada's The Northwest Passage and One Ocean's Pathways to Franklin). The presence and expansion of the marine tourism industry could be highly advantageous for coastal Arctic communities, given the potential for enhanced economic development. However, despite the development of the cruise ship industry in the late 1990s, there is limited data on where cruise ships disembark passengers and the activities they are engaging in. Thus, this research compiled public cruise ship itineraries from 2008 to 2019 to identify use levels within the Canadian Arctic industry. The resulting database advances and improves our understanding of the industry and can provide useful information to communities, tourism planners and cruise operators, and aid stakeholders in their policy development. This information is vital for the management and planning of a sustainable tourism industry that ensures both respect of the northern ecosystems and environment and rights and traditions of Indigenous northerners.

AFTER THE ICE AGE: STUDYING THE EFFECTS OF FEDERAL MEDIA POLICY CHANGES ON NORTHERN SCIENCE COMMUNICATION AND THE CANADIAN SCIENCE-TO-POLICY INTERFACE DURING THE HARPER ERA.

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The Arctic is changing. A rise in global temperatures over the past forty years, in tandem with polar amplification means that the Arctic is warming at a rate three times that the rest of the earth; this is occurring with major implications for the landscapes, populations, and political entities within the region. The consequences of climate change will not be limited to the environment, nor will they be isolated within the region. A reduction in the seasonal extent of Arctic sea-ice and the changing timing of freeze-up and break-up will drastically alter the accessibility of the region-opening Northern landscapes and communities to a host of new and expanding interests, actors and risks. These implications are accompanied by a need for government leadership in managing change within the region through the use of strong scientific research to inform adaptive governance and policy initiatives. From 2006-2015, the Canadian government, led by Prime Minister Stephen Harper, frequently asserted the importance of the Arctic, speaking to the environmental challenges facing the region. Consistent with this, the Government of Canada invested substantial In early 2008, journalist Margaret Munro wrote the first story on what would become a decade-long fixture in the Canadian news media: the muzzling of Canada's federal scientists by the Conservative government under the leadership of Prime Minister Stephen Harper. Her article, Environment Canada 'muzzles' scientists' dealings with media, came on the heels of changes to Environment Canada's media policy, governing how federal scientists are contacted and communicate with journalists. The implications of these changes on scientists and other actors operating at the science-to-policy interface have not been studied and a significant gap in our understanding of the effects of this era remains. As a period of significant scientific and political consequence for Canada and the Canadian North, it warrants examination. The objective of this study is to answer the following research question:

How did the changes to the federal departmental media policies affect the communication of Northern science and the actors operating within this space, and how did it shape the science-to-policy interface in Canada from 2006 to 2015? This research identifies key groups of actors and illuminates their roles during this time and more broadly within the science-to-policy interface through the use of semi-structured qualitative interviews. The research question is answered through the analyses of qualitative data and fulfills three focuses. First, it outlines the relevance of Northern science and the audiences of Northern science and media. Second, it explains the challenges and barriers to the successful communication of Northern scientific research to non-scientific audiences, including the effects of the changes to departmental media policies from 2006-2015. And third, it documents how Northern Scientists and Northern Federal Scientists, perceive and define their role in the science communication and policy creation processes. In its entirety, this paper aims to highlight the importance of science communication in Canada; better prepare Northern scientists to participate in and contribute to Northern policymaking and public discourse through the communication of their research; and provide policymakers with an increased capacity to reflect on and include Northern science in Northern and federal policy.

SCALING-UP ARCTIC FOOD SECURITY GOVERNANCE IN THE INUVIALUIT SETTLEMENT REGION

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Recent changes in social-ecological systems challenge the integrity of both country (wild) food and market food components of Inuit food systems. In the Inuvialuit Settlement Region (ISR), the western-most Inuit region in Canada, 46% of households experience some level of food insecurity-a rate far exceeding the Canadian average. Through an ongoing research partnership between the Inuvialuit Regional Corporation and university researchers, and collaboration with local community researchers, we are addressing food security in the six ISR communities. Taking a 'food security governance' lens, we aim to assess what is transpiring on-the-ground and identify structural and process-based issues to support the alignment of regional-scale decision-making both with existing initiatives and with community and regional priorities. Here, we report on outcomes from a community engagement process that identified community assets, gaps, priorities, and actions to address food security, and discuss the process of working collaboratively (from research to action) to address ISR food insecurity, with a focus on country food sustainability. We collected data from 12 focus groups and 19 key informant interviews conducted in the six ISR communities: Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk, and Ulukhaktok. The focus groups were designed to identify community perspectives and priorities surrounding each of seven key goals pertaining to aspects of country food, market food and locally-cultivated food. The key informant interviews involved representatives from food transportation, food retail, and health policy sectors. Focus group notes and interviews were transcribed and coded using Dedoose qualitative data analysis software. Findings were verified at the community scale in 2019. Focus group data highlighted country food system sustainability as a key priority across all communities. While market foods are procured and used on a daily basis, related challenges were perceived to be systemic in nature, and not readily influenced by local needs, priorities or actions. In contrast, participants indicated a greater sense of community-scale control and power to influence the country food system. Furthermore, while support for locally-cultivated food production garnered interest by specific groups in several communities, interest was not universal, and this sector was generally perceived to play a limited role in the broader ISR food system. While each community had certain unique interests and priorities, trends were identified across all six communities, including those related to country food (storage, sharing, harvester support, skills and knowledge, and commercialization), market food (healthfulness and affordability), and local food system potential (cultivation and distribution). At the regional scale, interviewees indicated key challenges to food security related to food retail, food transportation, and health policy sectors. Numerous solutions were also proposed. Across communities and sectors, encouraging inclusion of all community members and equitable resource distribution were key identified features of a more sustainable food system. Our co-developed framework aims to scale-up results and align local and regional goals. Research outcomes will help decision-makers identify gaps and opportunities for action on food security, align resources across sectors, and contribute to currently developing policy frameworks at multiple scales.

CAPTURING SEASONAL CHANGES TO COASTLINES IN THE BEAUFORT SEA

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The Canadian Arctic coastal zone (in particular the Beaufort Region) contained within the Inuvialuit Settlement Region is one of the most vulnerable to climate change. Over the last few decades, the rate of coastal change in some parts of the Beaufort Region has accelerated due to declining sea ice, warming temperatures and stronger climate forcing (increased storminess). The rapidly increasing burden on vulnerable Arctic ecosystems, infrastructure, and communities in the region necessitates urgent re-assessment and a better understanding of the coastal systems in the region. Natural Resources Canada has been conducting 'on the ground' coastal research in the region for close to 50 years. During that time span a total of 50 coastal monitoring sites were established to ensure continuous monitoring of the coastline. Much of the coastline is known to be eroding at long term rates of 1-2 m/yr but can be in excess of 20 m/yr. Past studies using historical air photos (cira. 1947) have suggested that decadal rates of change for this region have remained relatively constant over the last 50-60 years. New data suggests that portions of the coast are actually experiencing an acceleration in coastal erosion over the last 10-15 years, however the mechanisms and relationship to local and seasonal forcing events (coastal storms) is not fully understood. In 2019, we were able to capture coastline positions using Unmanned Aerial Vehicles (UAVs) spanning half of the open water season (8 weeks) from June to August and just 48 hours before and after a major storm event in early August. Using these repeat surveys we believe the short-term analysis of 3-D coastal positions paired with local climatology and physical oceanography will help to gain a better understanding of the critical short-term drivers of change in this region. Research has shown the region is experiencing an increased number and duration of coastal storms during the open water season. In 2019, a series of oceanographic moorings (waves and water temperature), and coastal observatories (wind amplitude and direction, air temperature and precipitation) were installed and will be used as a critical driving component of the observed coastal change in such a short time span. This information provides the means to improve our knowledge of physical conditions and rapid changes to critical eco-systems in the coastal zone. This will undoubtedly help government agencies, corporations, and local residents understand, mitigate and reduce the impacts of these natural changes.

UNDERSTANDING CHANGES IN NORTH AMERICAN BEAVER OCCUPANCY IN NORTHERN ENVIRONMENTS

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Under climatic and environmental change, species distributions are shifting and population densities are changing, leading to expansion of some boreal species in to arctic environments. Where invading species alter habitats by dramatically changing ecosystem structure, this can transform ecosystems. Range expansions and increasing local densities of beavers have been observed in North America and have substantial consequences for both people and ecosystems. Beavers can make channels impassable and contaminate water bodies with Giardia, substantially impacting local use of an area. Further, as an ecosystem engineer beavers can have substantial hydrological impacts which themselves create further impacts on ecosystems. To understand the factors driving beaver distribution change in northern Canada we studied occupancy in two sites; Tombstone Territorial Park, Yukon Territory and Canadian Wildlife Service's Fur Resource Study Area in Mackenzie Delta, Northwest Territories and compared these to previous records. In alpine areas, beaver occurrences have been reported at increasingly high elevation tundra sites, a process potentially facilitated by shrubification, while within the delta region, increasing densities had been reported and hydrological changes in lakes and rivers have the potential to affect beaver distribution and their impacts. We will present results of surveys in these two regions and associations with key biophysical variables related to hydrological and vegetation change to examine changes in beaver

distribution and density and the drivers of these observed changes.

FROM ICE TO OCEAN: TRACKING THE COMPOSITION, FATE, AND IMPACT OF SUBMARINE GLACIAL DISCHARGE IN THE NEARSHORE COASTAL OCEAN IN THE CANADIAN ARCTIC ARCHIPELAGO

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As glaciers melt, erosion, chemical weathering, biological reactions, and hydrologic fluxes transform and export entrained sediments and dissolved species to the ocean. This glacial runoff may influence biological productivity in nearshore coastal ecosystems by supplying essential nutrients and carbon. Previous studies of glacially-derived solute export to the ocean have either been conducted on rivers draining land-terminating glaciers or solely in fjords. These studies are limited in that they must speculate about either downstream effects (river studies) or upstream causes (fjord studies). We conduct a novel ice-to-ocean study at a large marine-terminating glacier in a previously uncharacterized Arctic region, the Canadian Arctic Archipelago. We present data from ice and meltwater collected on the glacier surface and margins in the spring and summer, in conjunction with marine measurements spanning the submarine discharge plume within 1 to 25-km of the glacier terminus. We track the biogeochemical properties of glacial runoff and its fate in the ocean by characterizing the downstream evolution of its sediment, carbon, nutrient, and biological community composition. Profiles of temperature, salinity, turbidity, and chlorophyll a provide broad-scale physical and biological oceanographic context and insight into meltwater plume extent and dynamics. Finally, an array of time-lapse cameras as well as historical satellite, meteorological, and global positioning station data are used to constrain the seasonal evolution of the glacier drainage system and its relationship to plume development at the terminus, placing our measurements in the broader seasonal context. Results from this ice-to-ocean study will help to clarify current uncertainties regarding the source, fate and biological impact of glacially-derived nutrients and carbon in the ocean, providing important insight into how Arctic coastal productivity will be impacted by future climate warming.

THE SIKUMIUT MODEL: CHANGING THE ROLE OF NON-INDIGENOUS PARTNERS TO SUPPORT INUIT SELF-DETERMINATION IN RESEARCH

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The Sikumiut Model is a co-developed research methodology for Inuit and non-Indigenous partners interested in: community-based research; and supporting the broader goal of Inuit self-determination in research. Sikumiut means "people of the sea ice" in Inuktitut and is the self-titled name of the Inuit management committee in Mittimatalik (Pond Inlet, Nunavut) that governs the SmartICE community-based sea-ice monitoring program (smartice.org). In this presentation, we outline how the research relationship was co-developed with Sikumiut over the last four years. We describe how the Sikumiut research model redefines the roles of research partners when Inuit govern the research, Inuit youth conduct the research, and non-Indigenous partners train and mentor Inuit youth researchers. We discuss how having Inuit govern the research ensures ownership and accessibility of their data, and control over how their knowledge is documented, interpreted, communicated and respected for its own scientific merit. We also outline the benefits and potential of building the research capacity of Inuit youth and describe lessons learned to date in supporting Inuit self-determination in research.

RECENT ACCELERATION OF THAW-DRIVEN MASS-WASTING IN THE CENTRAL MACKENZIE MOUNTAIN FOOTHILLS IS INTENSIFIED BY DECADAL-SCALE FOREST FIRE CONDITIONING

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Thermokarst mass-wasting encapsulates climate-driven geomorphic processes in ice-rich hillslope terrains that can rapidly mobilize large accumulations of thawed material into the surrounding environment. We identify over 400 recent mass-wasting features, including retrogressive thaw slumps, active layer detachments, and deeper-seated translational landslides within the upper Keele and Redstone River watersheds (~ 4000 km2) in the central Mackenzie Mountain foothills, NWT, Canada. This area represents the southernmost concentration of widespread thaw slump related permafrost mass-wasting in northwestern Canada. The surficial geology is wide-ranging and of variably thickness, although till units up to 20 m thick are widely distributed in plateaued areas, with lacustrine, alluvial, and colluvial sediments typically accommodating lower river valleys. Examination of satellite imagery (1993-present) show the majority of these features have initiated and proliferated in the last 10-15 years. Increases in disturbance size and growth rate are consistent with regional increases in air and ground temperatures and summer precipitation during this timespan. Additionally, the patterns of accelerated mass-wasting are well-constrained by the extents of forest fire activity from the mid to late 1990s. The close association between historic fire and permafrost mass-wasting suggests a legacy influence of thermal disturbance from forest fires as a primary preconditioning mechanism for the initiation of these permafrost mass-wasting features. Several thaw slumps that were visited display headwalls consisting of diamicts from the late Wisconsinan Laurentide Ice Sheet and include meter-scale ice lenses at their bases. The largest retrogressive thaw slump documented initiated post-2005 and can be termed a 'mega-slump', with a headwall height of over 25 m and total disturbance area of ~ 25 ha. The acceleration of such disturbances is also associated with the translocation of large volumes of thawed sediment into underlying river valleys, exceeding river transport capacity and creating distinct valley-fill deposits. Using ground-truthed satellite and unmanned aerial vehicle (UAV) mapping, in conjunction with novel lab-based permafrost characterization, we aim to provide a basis for evaluating climate-driven trajectories of comparable terrains in northern Canada.

Poster Presentations

INTERACTIONS BETWEEN BREEDING AND MIGRATION BEHAVIOUR IN A SUBARCTIC BREEDING SHOREBIRD

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Arctic breeding shorebirds spend a significant portion of their lifecycle on migration, yet our understanding of ultimate and proximate drivers of migration behaviour remains limited. For small-bodied (< 60 g) species, this is largely due to weight limitations imposed by currently available tracking devices. Here, we used small (< 0.8 g) VHF transmitters and the Motus Wildlife Tracking System to monitor individual semipalmated plovers (Charadrius semipalmatus) across two key periods, breeding and fall migration, with the aims of identifying migration routes and understanding migratory patterns in the context of preceding parental investment. We hypothesized that time and energy invested in breeding carries over to influence migration behaviour (departure timing, migration route, location and duration of stops en route). We predicted that individuals with lower reproductive investment (i.e. females and failed breeders) would depart breeding areas earlier, show more variable migration routes and stop more frequently and/or for longer durations than individuals with higher reproductive investment (i.e. males and successful breeders), as the latter individuals have less time and energy available for migration. Preliminary analyses found three distinct migration routes of individuals departing from breeding sites near Churchill, Manitoba. Contrary to our prediction, choice of route and stopover characteristics were not related to breeding outcome or sex. Breeding outcome had no influence on departure timing, suggesting that failed breeders remain in breeding areas for potential re-nesting opportunities. Females departed breeding areas an average of 9 days earlier than males. This study identifies high variation in migration strategies within a single breeding population, highlights areas of conservation importance and validates the use of automated radio-telemetry in a subarctic shorebird system.

CHARACTERIZATION OF PERMAFROST CORES FROM THE INUVIK-TUKTOYAKTUK CORRIDOR

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Thawing permafrost poses a significant threat to geochemical, hydrological and ecological stability of northern environments; additionally, it can dramatically damage infrastructure, including roads and building. Permafrost is ground that remains frozen (below 0˚C) for a minimum of two years, underlying an immense amount of terrain in northern Canada. In order to better understand permafrost and paleoenvironmental conditions near the newly developed Inuvik-Tuktoyaktuk Highway (ITH), NWT, permafrost cores were collected in the winter of 2017. This study analyzed three cores (BH-1, BH-4, and BH-8) collected at peatlands ~20, 44 and 75 km north of Inuvik to a depth of 11.2, 7.7 and 11.4 m, respectively. Cores were analyzed for cryostructures, organic content, water isotopes (δ18O and δ2H) and underwent radiocarbon dating in order to determine the origin of the sedimentary records and associated ground ice. The cores record a variety of depositional environments, all of which are ice rich. Ice-rich diamictons are present near the base of the BH-1 and BH-4 cores. These diamictons are fine-

grained and have δ18O water isotope values of -18 to -20 ‰ with a co-isotope slope less than the local meteoric water line. These values are more enriched than primary glacial diamictons in the area, suggesting they have been modified by thaw and refreezing. A prominent 4 m thick massive ice body, with a Holocene radiocarbon age near its surface, is present in BH-1 between the diamicton and the base of the peat. Water isotopes from the massive ice body are depleted relative to the values from the rest of the cores and fall on the local meteoric water line, suggesting the preservation of buried snow. Core BH-8 contains ice rich silt and clay near the base overlain by ~ 4m of peat. Cryostructures of the fine-grained sediments are mostly layered and lenticular with reticulate structuring. Radiocarbon dates and sedimentary structures indicate accumulation in a local lake from ~11,500 to 9000 years ago followed by its drainage, development of epigenetic permafrost, and a shift to syngenetic peat in the early Holocene. Collectively, these deposits suggest preservation of a relict permafrost landscape affected by thaw in the early Holocene, followed by subsequent stabilization and permafrost aggradation. Future work will focus on placing these cores into a regional Quaternary geologic context and understanding the sensitivity of these landscapes to future warming and thaw.

MULTI-SCALE MAPPING AND MONITORING OF CHANGING PERMAFROST CONDITIONS IN A HIGH ARCTIC POLAR DESERT

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With the Arctic increasing in temperature at twice the rate of the rest of the planet and climate models predicting continued warming, permafrost landscapes are faced with the potential for accelerated thawing and thermokarst; which refers to many forms of ground subsidence and deformations such as thaw slumps, thaw ponds, ice wedge subsidence and various forms of slope instability. In the face of this change, it is critical to continually monitor Artic landscapes. However, the remoteness, inaccessibility, and vastness of Arctic sites can make high spatial and spectral resolution data collection difficult, and therefore mapping and monitoring problematic. To comprehensively evaluate the ground surface conditions in such environments, we propose a multi-scale remote sensing framework, combining medium and high resolution multi-spectral imagery (Landsat 7 and 8, Worldview 2 and 3, Planetscope) with high resolution unmanned aerial vehicle (UAV) RGB and thermal imagery, and field observations. The derived surface conditions can be used as a proxy for changes in sub-surface conditions such as active layer depth or thermokarst. This framework was applied in the Eureka Sound Lowlands of Ellesmere Island, Nunavut to characterize past and current permafrost conditions. Medium and high resolution multispectral imagery were used to compute land surface temperature and various vegetation and soil moisture indices such as NDVI, NSMI, SAVI and the Tasseled Cap indices for greenness, wetness and brightness over 20 years on a regional scale. UAV RGB and thermal images were used to create high resolution surface models using structure from motion algorithms on a local or landform scale to inform and validate the coarser satellite imagery analysis. Overall, the presented framework effectively bridges the gap between ground data collection, which is typically accurate, but limited in scope and satellite remote sensing, which covers large spatial extents, but is limited in accuracy.

BUILDING INUIT SELF-DETERMINATION IN RESEARCH THROUGH THE DESIGN AND IMPLEMENTATION OF QANUIPPITAA? NATIONAL INUIT HEALTH SURVEY

Anawak, Gerald (1) Belleau, Mona(2) Etter, Meghan (3) McTavish, Kristeen(4) Usborne, Esther(5)(Presenter)

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(3) Inuvialuit Regional Corporation
(4) Nunatsiavut Government
(5) Inuit Tapiriit Kanatami

The presentation will focus on describing the upcoming Qanuippitaa? National Inuit Health Survey,which is the first national health research program of its kind to be entirely led by Inuit. The survey is being developed and implemented by the four Inuit Regions and Inuit Tapiriit Kanatami. It is a permanent health survey, funded by a 2018 federal budget allocation of $82 million over 10 years with $6 million a year ongoing. The survey will collect up-to-date information on Inuit health and the social determinants of Inuit health that will help program and policy makers at the local, regional and national levels better understand how the health status of Inuit is changing and guide Inuit health program development. It will also contribute to Inuit governance and empowerment in the fields of research and health. In recent years, Inuit have become increasingly involved in health research activities

taking place in Inuit Nunangat (the Inuit homeland); however, colonial approaches to research endure, particularly in the realm of health research. Inuit are still not consistently involved in setting the research agenda, establishing and monitoring compliance with ethical guidelines, and determining how data and information are collected, analyzed, stored, used, and shared. The National Inuit Strategy on Research (NISR) advocates for research that empowers Inuit and meets the needs of Inuit families and communities. Advancing Inuit self-determination in health research through projects like Qanuippitaa? National Inuit Health Survey is imperative. Ensuring that Inuit are leading all steps of the research project will greatly enhance the efficacy, impact, and cultural safety of research relating to Inuit and Inuit Nunangat and ensure that research results in the improvement of health and well-being for Inuit without causing them harm. The results from Qanuippitaa? National Inuit Health Survey will provide information about Inuit health status over time and will highlight Inuit health strengths using a strength-based approach that focuses on learning and solutions. The survey design and implementation processes will provide Inuit with the training and resources required to conduct surveys on an ongoing basis. Data collection is expected to begin in 2021 and take place every five years. The presentation will highlight the unique elements of the project and will describe how every aspect of survey development and implementation is designed to advance Inuit self-determination in research. The authors will describe how the project's governance structure allows for Inuit land claims and representative organizations to be at the center of the research and decision making processes. They will further outline how the survey's questionnaire content development process, sampling methodology, ethical review, data management, and analysis and dissemination plans are being designed to ensure both methodological rigour and Inuit ownership and control.

REPRESENTATIONS OF THE ICE EDGE JET IN A COUPLED WAVE-ICE MODEL

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Waves can provide significant local forcing on sea ice, particularly near the ice edge. This impact can now be represented in models thanks to their increasing resolution. On the ice modeling side, recent work has concentrated on describing the pressure applied by waves as they enter the ice pack. Over large scales, this is usually observable as a displacement of the ice edge. At smaller scale, the breaking and rafting of floes increase ice thickness until the resistance provided by the internal ice strength can balance the wave pressure. If waves are not orthogonal to the ice edge, a component of the force generated is also applied parallel to the edge, a direction along which the ice move more freely. This can lead to the creation of a jet. Model simulations of this jet performed with different formulations of ice strength and wave attenuation for a range of wave angles of incidence will be presented. The possibility of using jet characteristics, primarily width and maximum speed, as a companion to equilibrium ice thickness and wave energy profiles when assessing attenuation schemes and ice representations will also be discussed.

BELUGA USE OF ESTUARY HABITAT IN THE WESTERN HUDSON BAY

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Knowing what features make habitat suitable for a species can give insight on important aspects of life history and improve understanding of key habitat areas for a population. Estuaries and coastline along the western Hudson Bay are summer habitat for the Western Hudson Bay (WHB) beluga population. The habitat features associated with beluga migration to and use of the Nelson, Seal and Churchill estuaries every summer are not fully understood, but theories include that shallow waters provide protection from predators, warm estuary water has metabolic benefits for growth and molting, and that estuary habitat is rich in prey. Spatial analysis and mapping programs have been used to determine key habitat areas for marine mammals and can be a useful tool for understanding WHB beluga habitat. Beluga locations will be entered in to ArcMap from georeferenced aerial photos collected during the summer 2018 BaySys cruise. Relationships between location, habitat characteristics (distance to coast, tide), and beluga features (age class, group size) will be examined by testing for patterns in distribution. These data will reveal beluga habitat

associations in and out of estuaries that will provide information on critical habitat. Key habitat features along the coast of the western Hudson Bay will be analyzed by running generalized linear models based on a grid system. Results will be used to create a map of key summer habitat along the coast and in estuaries. This poster will describe methods and give initial findings on habitat associations. Decreasing ice cover in the Hudson Bay will result in increased shipping traffic and increased beluga predator range. Improving understanding on beluga estuary use and critical habitat areas will assist in management as warming temperatures result in habitat-based risks to the WHB beluga population.

PERMAFROST CHARACTERIZATION USING GROUND PENETRATING RADAR (GPR) FOR TERRITORIAL DEVELOPMENT, INUKJUAK, NUNAVIK

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With climate warming affecting the high latitudes, there is a growing need of knowledge concerning the cryostratigraphy and the stability of permafrost for land use planning in the inhabited environments. Since a strong demographic growth is occurring in the community of Inukjuak, there is an increasing need for housing development and municipal infrastructure. It is therefore essential to proceed to high resolution permafrost characterization (about 100 m2) to support urban land use planning and to select foundation designs for buildings in accordance with local permafrost conditions. The main objective of this project is to map the depth to bedrock, the distribution of surface geological units and strata and the zones of ice-rich permafrost zones in the community area and to provide necessary information for selecting the best choices of foundation designs such as pads, piles to bedrock, adjustable studs and thermosiphons throughout the urban area. To achieve this goal, a total of 21 km of GPR profiles surveyed in the summers of 2015 and 2017 were interpreted with the help of other sources of information such as analysis of aerial photographs, surficial geology maps, excavations, drill holes and field observations. Although some sectors of the Inukjuak area are underlain by thaw sensitive permafrost, some other ones such as the southern sector of the community on marine sands have bedrock at rather shallow depths, i.e. between 3,5 and 6,5 m below the surface. The compilation of permafrost data and the map of depth to bedrock shall help decision making for the community and the supporting regional government and will be a tool to develop an adaptation strategy to climate change.

IMPACT OF SHIPPING ON NARWHAL (MONODON MONOCEROS) BEHAVIOUR AND HABITAT USE IN ECLIPSE SOUND, NUNAVUT.

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Increasing natural resources exploitation in the Canadian Arctic is placing previously pristine habitats under new anthropic pressure. Combined with climate-associated change specifically longer ice-free season, shipping routes are increasing as well as the number of large boats. Shipping activities can affect several aspects of marine mammal ecology and biology including migration, behaviour, feeding and breathing patterns. The narwhal (Monodon monoceros) is one of few endemic Arctic marine mammals. Evolving in a rapidly changing environment and being of great economical and cultural importance for Inuit communities, narwhal have been designated as special concern by the Committee On the Status of Endangered Wildlife In Canada (COSEWIC). During summer, large numbers of narwhal migrate in fjord systems of Baffin Island, such as Eclipse Sound (Nunavut). Since the construction of "Baffinland's Mary river" iron ore mine in 2015, this Sound is now exposed to an increased shipping traffic during the open water season as well as ice-breaking activities in Spring and Fall. In these periods, an estimated 12,000 narwhals can be found in the area, placing them in close range of large vessels. Consequently, the goal of this research project is to assess the impact of shipping on the behaviour and habitat use of narwhals in Eclipse Sound. The project has two main objectives: 1) Quantifying the interaction and overlap of narwhals with shipping during the open water seasons in 2017, 2018 and with the ice-breaking activities in Fall 2018 and ; 2) Evaluate the effect of shipping and ice-breaking activities on narwhal's movement and diving patterns. To

meet these objectives, the project will use data collected by the Department of Fisheries and Oceans (DFO) on 20 narwhals equipped with satellite transmitters in 2017-2018, as well as shipping traffic and ice-breaking activity data acquired from ships Automatic Identification System (AIS). This research will provide valuable information on shipping impacts on narwhal for the management and protection of narwhal populations across the Arctic.

UNDERWATER SOUNDSCAPE OF CAMBRIDGE BAY

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Ocean Networks Canada (ONC), an initiative of the University of Victoria, operates a cabled seafloor observatory in Cambridge Bay, Nunavut that has been providing near real-time data time from a variety of instruments since 2013. Using hydrophone recordings combined with ice measurements, CTD, and meteorological data, a year-long study of the underwater soundscape was conducted over 2015. Unlike other Arctic locations considered to date, this site was louder when covered in ice with the loudest times occurring in April. Sounds of anthropogenic origin were found to dominate the soundscape with about ten times more snowmobile traffic on ice than open water boat traffic. The bay was quietest during the ice-break up in July, possibly because it was unsafe for both snowmobiles and boats. Over the course of the year precipitation, wind and ice noise were the other major contributors to the underwater soundscape and non-human biological sources were not significant.

EVALUATION OF SLUSH DETECTION AND THICKNESS MEASUREMENT ON THE SMARTQAMUTIK TO ENHANCE SPRING TRAVEL SAFETY IN INUIT NUNANGAT

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Slush forms between snow and sea ice when thick snow overlies thin ice and seawater floods the ice surface. It can be difficult to detect while travelling on the surface, causing snowmobilers to sink in and get stuck, potentially triggering a search-and-rescue response if far from their community. Such conditions are projected to be more common with changing climate as snow accumulation increases on thinning landfast ice. In partnership with the northern social enterprise SmartICE, we are developing a remote monitoring method to detect and map slush in real time while driving on the ice, and incorporate the technology into their mobile sea-ice thickness mapping system - the SmartQAMUTIK. Adapting proven concepts from case studies, we are modifying an inversion algorithm to retrieve sea ice, snow and slush thicknesses over seawater using measurements with the multi-frequency electromagnetic induction sounder Geophex GEM-2. Instrument performance and the functionality of the developed algorithms were verified by means of in-situ field tests carried out in collaboration with local SmartICE operators in the Nunavut community of Qikiqtarjuaq in spring 2019. Specifically, ice, snow and slush thicknesses were measured at 255 drill holes along 9 different GEM-2 survey lines over a combined length of ca. 4.5 km. While ice was on average 0.72 m thick (range 0.5-1.18 m) along the profiles, slush and snow combined was on average about half this thickness (range 0.18-0.53 m), while slush alone reached a maximum thickness of 0.36 m (mean 0.09 m). Preliminary results indicate the resolvability of the slush layer thickness with an average accuracy of 7 cm while the total thickness of snow, slush and ice layers combined may be determined with an average accuracy of 10 cm. In order to make this technology widely available in Inuit communities, the developed algorithms will be integrated into the SmartQAMUTIK controls and user interface software to permit display of snow, slush and ice thickness data in real time for the operator. Additionally, operating protocols and training materials will be developed, tested and demonstrated collaboratively with SmartICE operators.

SURFICIAL SEDIMENTS OF PARRY CHANNEL, NORTHWEST TERRITORIES AND NUNAVUT

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Geological data is sparse in the channels of the Canadian Arctic Archipelago and the seabed geology in this region is poorly understood. Previous work focussed on the subsurface geology of Parry Channel from just below the seabed to about ~100 m depth using acoustic data and sediment samples, however, little work has been completed on the thin layer of surface sediment that cannot be resolved by acoustic profiles. A surficial geology map of Lancaster Sound and Barrow Strait by Dirschl (1982) is the only regional surficial geology map in the Canadian Arctic Archipelago. The objective of this study is to use seabed samples and grain size analyses collected since 1982 to refine the existing Dirschl map and extend the surficial geology west into Viscount Melville Sound. Parry Channel is an east - west oriented channel through the center of the Canadian Arctic Archipelago connecting Baffin Bay with the Arctic Ocean. It is made up of the named waterbodies (from west to east) M' Clure Strait, Viscount-Melville Sound, Barrow Strait, and Lancaster Sound. The regional shallow geology of Parry Channel records a late Quaternary cycle of glacial sedimentation where ice-contact till and ice-proximal glaciomarine sediments are discontinuously overlain by variable thicknesses of postglacial sediments. Current sedimentation rates in Parry Channel are low due to the lack of large fluvial systems or other significant sediment inputs to the Canadian Arctic Archipelago. The upper few centimeters of sediment comprises particles with a large range of grain sizes (clay to gravel), suggesting that they are derived from glacial sources. The Geological Survey of Canada's (GSC) Exploration Database contained 19 surface grain size analyses within the study area. Another 26 surface grain size analyses were performed on archived sediment samples from the GSC's marine sample collection for a total of 45 analyses that were used in this study. Silt is the predominant sediment type, distributed throughout most of Parry Channel. Clay-dominant sediment is observed mainly in eastern Lancaster Sound (leading to Baffin Bay) and in northwest Viscount Melville Sound (leading to M' Clure Strait). Smaller occurrences of clay are mapped where Peel Sound, Prince Regent Inlet, and Admiralty Inlet join Parry Channel. Sand and gravel dominant sediment is observed in close proximity to the islands of eastern Parry Channel. Sand and gravel may also be located near the islands of western Parry Channel; however more data are required to confirm this. Sand and gravel dominant sediment has been mapped in two large areas of Barrow Strait as well as in northern Viscount Melville Sound. The existing data set only provides sparse coverage of the surficial sediments of western Parry Channel resulting in interpolation between data points that are as much as ~150 km apart. Limited backscatter data is available in western Parry Channel but the data quality is poor. Additional high-quality backscatter and seabed sediment samples, especially in the near-shore, are required to improve resolution. Although data coverage is much better in eastern versus western Parry Channel, any additional sediment samples or high-quality backscatter would further refine the surficial sediment coverage.

PERFORMANCE OF AN ADVANCED HEAT RECOVERY VENTILATION SYSTEM IN THE CANADIAN ARCTIC

Berquist, Justin (1) (Presenter), C. Banister (1), and D. Krys (1)

(1) National Research Council Canada

A demonstration house was previously built and commissioned in Iqaluit, Nunavut, Canada. The purpose of the overall effort is to develop and integrate technologies and evaluate the performance of a high-performance building located in the Canadian Arctic, while considering the unique social, economic and logistical challenges associated with its remote location. Previous work consisted of monitoring and reporting on the energy use from heating between April 2016 and April 2017. The purpose of this next stage of research is to contribute experimental data of the prototype demand-controlled residential ventilation system in the extremely cold climate of Iqaluit, where the average annual outdoor temperature is approximately -9 °C. This paper outlines the development, implementation and monitoring of the carbon dioxide-based demand-controlled heat recovery ventilation system that took place between April 2017 and April 2019. The system was equipped with two electric preheaters to ensure that frost build-up did not occur in the heat recovery ventilator (HRV) and adequate ventilation could be maintained according to the demand. An electric heater was included after the HRV to control the supply air temperature. Between December 2018 and February 2019 the electricity consumption of the HRV, preheaters, and supply air heater were measured for the lowest ventilation rate of the system, 15.5 L/s. Pertinent temperatures in the ventilation system were also monitored to enable assessment of the system's performance. A comparison

of the sensible recovery efficiency (SRE) of the HRV and overall system is presented. Experiments displayed that, on average, the SRE of the HRV and system were 72% and 35%, respectively. The total energy use of the ventilation system was 390 kWh over the two months, which translates to 6.30 kWh/day, an energy use intensity of 0.27 kWh/m¬¬¬2/day, or 12.25 Wh/m3 of outdoor air supplied.

PERMAFROST COAST SENSITIVITY TO AIR TEMPERATURE AND STORM INFLUENCE ON PULLEN ISLAND, N.W.T.

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The ice-rich cliffs along the Canadian Beaufort Sea are subject to the rapid erosion characteristic of permafrost coasts. The Mackenzie Delta region experiences, on average, 1 m/yr coastal erosion, with rates in excess of 20 m/yr reported at some sites. Thaw-related erosion presents a unique problem to investigating the effects of changing weather trends on coastal dynamics; warming temperatures not only affect erosion indirectly by increasing energy to storms, but also have a direct influence on thaw rates. Two predominant failure mechanisms are identified for this study. Failure of intact frozen blocks, attributed to undercutting from wave action, is a dramatic and episodic process, characteristic of the permafrost cliffs along the Beaufort Sea coast. Slumping, a gravity driven movement of active layer sediments with the potential to form sprawling thaw complexes through rapid, retrogressive headwall retreat, is also present throughout the Mackenzie Delta region. Pullen Island, one of the outer islands of the Mackenzie Delta, exhibits both block failure and slumping along fairly constrained cliff sections, allowing the investigation of relationships between weather trends and erosion rates with regard to specific failure mechanisms. We use aerial imagery and ground survey data to show that mean erosion rates increased progressively from 0 + 4.8 m/a in 1947 to 12 + 0.3 m/a in 2018, accompanied by an increase in the variability of erosion rate across the study area. The increased heterogeneity of the cliff retreat rate is likely a result of different magnitudes of response to changing weather trends depending on erosive mechanism, and thus the morphological differences (such as cliff height and ground ice occurrence) which prescribe the mechanism. When compared to the summer air temperature and storm records, it was found that a correlation exists between mean erosion rate and both temperature and storm duration. However, when the study area is sub-divided based on erosive mechanism, the correlation with summer air temperature was stronger in areas where slumping was dominant than in block failure areas. Similarly, the correlation with storm duration was stronger in areas where block failure was the dominant mechanism compared to slumping areas. These data indicate that storm duration has the greatest impact on these ice-rich permafrost coasts and most acutely on areas undergoing block failures, whilst air temperature has a greater impact on slump-dominated areas than elsewhere along the coast. Coastal sites are typically assessed based on mean retreat rates for the entire surveyed section. Areas chosen for study because of a single erosive mechanism of interest are likely to show a fairly uniform change in erosion rate. However, the presence of multiple erosion mechanisms, with mixed response to the changing climate, can complicate projections of future coastal change. Based on observations at Pullen Island, we can expect coastal erosion rates across the Beaufort Sea area to increase and diversify in response to the current and projected climate trends.

MAPILLARY BASED PLANT DISTRIBUTIONS OF EDIBLE AND MEDICINAL PLANT BASED MIYAWAKIS.

Bheemaiah, Anil Kumar (Presenter)

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Mapillary is an open source code base for the use of GPU based Deep Learning for Semantic Segmentation of wild images. We propose the creation of an autonomous drone for the automated capture of scientific images of medicinal and edible plants to create geotagged maps of plants on Mapillary.com with additional tags on plant sizes, species and edible and medicinal value. This information is used in the planning of sponsored five or more level Miyawakis as social and academic forestry for edible and medicinal value. The same research is also useful in planning Miyawakis on Mars.
Keywords:Miyawakis, Mapillary, Seamless Segmentation, FPN, ResNet50, Redtail, Edible and Medicinal Plants, Geotag

RESPECTING ONTOLOGY: QUALITATIVE METHODS FOR DOCUMENTING INUIT KNOWLEDGE OF NUNATSIAVUT COASTAL OCEANOGRAPHY

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Climate change is having profound effects in the arctic environment, particularly in the ocean (i.e. changing sea ice thickness and timing, increasing water temperatures, and changing species distributions), which is increasingly impacting arctic and subarctic communities. This is evident in the Nunatsiavut region - where oceanographic research may be used in support of decision making and planning for future change. Under the land claims agreement, provisions outline the importance of including Inuit knowledge in decision making, and research projects in Nunatsiavut are increasingly looking to engage it alongside western science. Currently, oceanographic data derived from Inuit knowledge in Nunatsiavut is limited, as methods of documenting this knowledge are often shaped by western scientific paradigms, generating ontological tensions. This research explores the question: when recording Labrador Inuit knowledge of oceanographic features, what practices of documentation can be used to facilitate knowledge mobilization that respects the original ontological context? Group participatory mapping sessions were held in the Nunatsiavut communities of Rigolet and Hopedale, and guiding questions were designed so as to mimic how participants would interact with the marine environment. Follow-up semi-structured interviews were designed to capture a more detailed narrative associated with what had been marked on the maps, as well as to draw out more contextual information to accompany the data. In documenting Labrador Inuit knowledge of oceanographic features, this work identifies oceanographic trends and changes that Nunatsiavut communities are experiencing and provides a case study to identify practices that marine researchers can incorporate when documenting Labrador Inuit knowledge of the ocean. In addition to detailing the methods employed to document Inuit oceanographic knowledge, this research identifies the transformations that occur when knowledge is converted to data, and potential strategies to help preserve ontological context.

DOES THE COMMUNITY COMPOSITION OF ALGAE AND BACTERIA PREDICT LEVELS OF OMEGA-3 FATTY ACIDS IN SUBARCTIC POPULATIONS OF NORTHERN PIKE, ESOX LUCIUS?

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In the Canadian subarctic, many remote communities rely on country foods, including fish, to supplement more expensive store-bought options. At the request of community members in the Dehcho region of the Northwest Territories, a research project was initiated in 2012 to look at fish mercury concentrations in important subsistence lakes. Community members and leaders also requested that researchers quantify the level of beneficial fatty acids and micronutrients in subsistence fish species, to better understand both the risks and benefits of consuming fish. Fatty acid concentrations in the food fish Northern Pike (Esox lucius) were analysed from 8 lakes. Concentrations of total fatty acids, total polyunsaturated fatty acids, and essential omega-3 eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) were found to be significantly different among lakes. Many of the health benefits from fish come from omega-3 fatty acids. Essential omega-3 fatty acids can only be obtained from diet, and play a key role in the structure and function of the eyes and brain; they also decrease the risk of cardiovascular disease. In freshwater ecosystems, essential fatty acids are produced by algae and bacteria and then transferred up the food chain. However, the type and quality of fatty acids produced varies among primary producer taxa. Generally, algal plankton produce higher quality fatty acids than bacteria, which produce short-chained fatty acids and very few omega-3 fatty acids. As a result, fatty acid profiles in fish may vary among lakes due to variation in algal and bacterial community composition. This study examines whether among-lake differences in Northern Pike fatty acid profiles can be explained by the community composition of algae and bacteria. We used 16S and 18S rRNA analyses to determine the community composition of primary producers in the study lakes,

and then related community composition to fatty acid concentrations in fish muscle tissue. We also examined water chemistry, watershed land cover data, and other abiotic factors in each lake to determine whether these factors influence community composition of algae and bacteria, and therefore fish fatty acids. Understanding the factors that lead to variation in fish fatty acids will help us predict the nutritional value of food fish in other lakes, and will allow for better characterization of the risks (e.g., mercury exposure) and benefits of consuming fish.

INDICATORS OF THE QUALITY OF ARCTIC CHAR'S FLESH AND IT'S LINKS WITH FEEDING AND CULTURAL CONTRIBUTION TO INUIT IN NUNAVIK

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Country food plays an important role in Inuit culture as it promotes social cohesion and the well-being of communities. Moreover, country food consumption has beneficial impacts on Inuit health, as it is rich in omegas-3 and in other essential nutrients. However, during the last decades, a rapid socio-economic and environmental transition has affected northern regions, which negatively impacted the availability and the quality of country foods. Indeed, changes in Arctic char abundance and in the characteristics of its flesh, such as in the color, fat content, and taste are observed. Flesh properties might me due to the accumulation of pigments and fatty acids across marine food webs from the preys to the predator. As Arctic char is the second most consumed species across Nunavik, changes in its flesh characteristics can make it less attractive or tasty for consumption, which can disturb the precious relationship that Inuit have with their traditional feeding mode. This research project has a quantitative and a qualitative component. The quantitative component aims to compare the diet of Arctic char across Nunavik (N sites =12) and to understand how it affects its flesh composition. The diet will be determined by stable isotope 13C and 15N signature in the flesh and by DNA metabarcoding of prey in stomach contents. The diet will be put in relation with fat content, omegas-3 fatty acids, pigments concentrations and the flesh coloration. The qualitative component aims to document the feeding and cultural importance of Arctic char to Inuit in Nunavik. Interviews and focus groups will be led with Kangiqsualujjuammiut. The synergy between scientific and local knowledges will help to better understand the recent changes observed in Arctic char.

ENABLING PRECISE POSITIONING IN THE ARCTIC USING NATURAL RESOURCES CANADA'S PRECISE POINT POSITIONING SERVICE

Klatt, Calvin (1) and J. Bond (2) (presenter)

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The Canadian Spatial Reference System Precise Point Positioning Service (CSRS-PPP) enables geoscientists to obtain high quality position information anywhere in the world including remote regions with no local surveying infrastructure. Locations such as Arctic Canada, Greenland and Antarctica are therefore the areas where the service is most beneficial. Precise positioning and gravity information also contributes to research related to climate change impacts in the Arctic. Developed for Canada's surveying community, this free-to-user, post-processing service has been adopted by an expanding global geoscientific clientele. CSRS-PPP has computed cm-level positions at more than 300,000 unique locations in polar regions. Observations were conducted with high quality dual-frequency equipment monitoring GNSS signals from a few hours to 24 hours. Today, CSRS-PPP computes on average more than 1600 positions each day, most for geoscience purposes. The Canadian Geodetic Survey is examining how real-time precise positioning will be used in the future and would like your feedback on your ideal positioning services in the Arctic.

EPISHELF LAKE AND ICE SHELF IN MILNE FIORD

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Milne Ice Shelf (81.6°W, 82.5°N) is the last intact ice shelf in the Northern Hemisphere. This thick (mean ~50 m) mass of ice, situated at the mouth of Milne Fiord, restricts the flow of meltwater from the catchment to the ocean and thereby creates a perennial layer of freshwater on top of the seawater called an "epishelf lake". Milne Fiord epishelf lake is the last epishelf lake in the Arctic. Because it is connected to the ice shelf and the upfjord glacier, the study of Milne Fiord epishelf lake is also the study of the whole fjord and watershed system. The lake experiences an annual cycle of deepening and shoaling. During the summer, surface runoff from snow and ice melt increase the lake's depth. Meanwhile, water deeper than the minimum draft of the ice shelf flows to the ocean. When the melt season is over, surface runoff stops and the lake slowly shoals until summer. It is thought that most of the flow out of the epishelf lake is through a basal channel in the ice shelf. Hence, the minimum draft of the ice shelf and the dimensions of the channel control the outflow of the lake. In order to study the epishelf lake, a mooring was deployed in May 2011 and has been continuously recording since. The temperature and conductivity measurements from the mooring line from May 2011 to July 2019 are employed in the present study. In order to tie together this extensive dataset, we use a one-dimensional model based on the averaged scalar transport equation and formulate an inverse problem: we determine the unknown parameters of the model (mixing and outflow) using an iterative fitting method. The results from the inverse problem are presented. We find that the mixing happening in the upper water column of the fjord is episodic and higher in the fall. The strong halocline (~8 g/kg/m) acts as a barrier between the freshwater atop and the seawater bellow, minimizing heat fluxes out of the lake. Moreover, the outflow characteristics points toward a stable ice shelf with a minimum draft around 6.5 m.

HERD: LABRADOR INUIT VOICES ON CARIBOU

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Inuit in Labrador, Canada, share a deep and enduring relationship with caribou for millennia. In recent years, caribou herds have experienced population declines and changes in migration patterns. Compounding this, the Provincial Government issued a total hunting ban on caribou in 2013. This research examines: 1) the significance of caribou for Inuit; and 2) how changes in caribou management and populations have impacted this historic relationship and illustrating how this connection has and continues to persist through time. Through community-led, participatory audio-visual methods, this research represents a multi-year, audio-visual study that works in partnership with Nunatsiavut and NunatuKavut Inuit in Labrador, Canada to explore the ways in which changing caribou populations and hunting bans impact Inuit in Labrador. This research is led by a Steering Committee, with Indigenous and non-Indigenous members spanning disciplinary expertise, and knowledge systems (eight of 13 members are Inuit). A combination of qualitative and visual research methods - including participatory video, PhotoVoice, focus groups, and community engagement events - have been and will continue to be used to co-produce knowledge with Inuit about caribou. This research draws from 84 in-depth, conversational, filmed interviews conducted from January to April 2019 with Inuit in Labrador. Participating individuals were selected by both the Steering Committee and regional partners based on knowledge, hunting experience, and time spent on the land, with an aim to ensure a diversity of ages, experiences, and gender equity. This presentation will provide a summary of overarching findings, with particular emphasis on examining the ways in which changing access to caribou effect Inuit identity and existential realities, cultural continuity and intergenerational knowledge sharing, and long-term connections with caribou.

CALANUS GLACIALIS AND THE FEEDING SUCCESS OF YOUNG POLAR COD IN WARMING ARCTIC SEAS

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We investigated the relationships between diet composition and feeding success in 1797 polar cod (Boreogadus saida) larvae and juveniles 4.5 - 55.6 mm standard length (SL) collected in five Arctic seas from 1993 to 2014. Prey (n = 74498) were identified to species and developmental stages when possible, measured, and their carbon content was estimated using taxon-specific allometric equations. Feeding success was defined as the ratio of ingested carbon to fish weight. Carbon uptake in polar cod larvae < 15 mm was sourced primarily from calanoid copepods eggs and nauplii which were positively selected from the plankton. With increasing length, carbon sources shifted from eggs and nauplii to the copepodites of Calanus glacialis, C. hyperboreus and Pseudocalanus spp. C. glacialis copepodites were the main carbon source in polar cod > 15 mm and the only copepodite positively selected for. C. hyperboreus copepodites were captured primarily by post-metamorphosis juveniles > 35 mm. Pseudocalanus spp. copepodites became important replacement prey when C. glacialis left the epipelagic layer at the end of summer. Assuming that Calanus spp. nauplii prey were C. glacialis, C. glacialis was the preferred prey of polar cod, contributing from 23 to 84% of carbon uptake at any stage in the early development. Feeding success was determined by the number of prey captured in larvae < 13 mm and by the size of prey in juveniles > 25 mm. As Arctic seas warm, the progressive displacement of C. glacialis by the smallerC. finmarchicus could accelerate the replacement of polar cod, the dominant arctic forage fish, by boreal species.

FOXES (VULPES SPP.) AND LYNX (LYNX CANADENSIS) ARE GOOD INTERMEDIATE HOSTS FOR TOXOPLASMA GONDII IN NORTHERN CANADA

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In changing northern ecosystems, understanding the mechanisms of zoonotic pathogen transmission, including the coccidian parasite Toxoplasma gondii, is essential to protect vulnerable animal and human populations that live in these regions. As sentinel species, foxes and lynx give us a better idea of T. gondii distribution and help us understand how it persists in this ecosystem. Our research will generate baseline data on T. gondii amongst foxes and lynx across northern Canada, and help understanding trophic relationships between carnivores and their prey species. Red (Vulpes vulpes) and Arctic fox (Vulpes lagopus) (n=582), and lynx (Lynx canadensis) (n=162) carcasses were collected by local trappers and collaborators from Labrador, northern Québec, northern Manitoba, Nunavut, Northwest Territories, and Yukon during the winters of 2016-2019. We identified DNA from various coccidian species shed in lynx feces using real-time PCR and melting curve analysis, as lynx being the proposed definitive host of T. gondii in subarctic regions. We did not detect T. gondii in feces so far. Toxoplasma gondii genetic material was detected using magnetic capture PCR on brain and heart of all species. An indirect fluorescent antibody test and an enzyme-linked immunosorbent assay were also performed on heart fluid to detect evidence of previous exposure to the pathogen (antibodies). Finally, we are reconstituting the diet of Nunavik foxes for a year by measuring stable isotopes ratios of C and N in hair and muscle samples in order to link prey with status of infection. Thus far, the overall tissue prevalence is 21% (n=52/253, 95% CI:16-26) in foxes and 25% (n=15/60, 95% CI:16-37) in lynx, compared to a seroprevalence of 37% (n=46/126, 95% CI:29-45) and 35% (n=21/60, 95% CI:24-48) respectively. We found a difference in the tissue prevalence of T. gondii in foxes analyzed to date from eastern and western Nunavik: 8% (n=9/107; 95% CI:4-14) compared to 52% (n=12/23; 95% CI:33-71) respectively. Isotopic analyses to reconstitute the diet of foxes across these two ranges are currently underway and may help elucidate regional differences in T. gondii tissue prevalence. This study sheds new light on the current status of T. gondii in wildlife in northern Canada, informing future risk assessments and

predictive models to determine the potential human and animal health risks associated to T. gondii infection.

ARE SEALS FROM THE CANADIAN ARCTIC INGESTING AND RETAINING PLASTICS?

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Marine plastic pollution is recognized as a significant environmental concern, and plastics have now been found in nearly every ecosystem on Earth. Plastic debris has been shown to have deleterious effects on a wide range of animals through entanglement and ingestion, and over time, these encounters have become more frequent. Studying the ingestion of plastics by wildlife can be a useful tool to assist in understanding the extent of plastic pollution in the surrounding environment. Although seabirds have been used to monitor plastics in the environment through investigating the plastics they ingest, less is known about the ingestion and retention of plastics by marine mammals. Through a collaboration with Inuit hunters, we examined the stomach contents 142 seals hunted between 2007 and 2019 from different areas around Nunavut (Arviat, n = 39; Frobisher Bay, n = 20; Naujaat, n = 38; Sanikiluaq, n = 45) to assess whether seals in the Canadian Arctic are ingesting and retaining plastics in their stomachs. Since seals are hunted for subsistence by Arctic communities, and the stomachs can be easily kept for dissections, this project also aimed at determining whether seals could be used as effective monitoring species of regional plastic pollution. The seals in this study ranged from juveniles to around 30 years of age, and 55% of the seals were males. Around 40% of the seal stomachs were full of krill, 20% of the stomachs were empty, and the remaining stomachs contained fish, parasitic worms, rocks and kelp. No evidence of plastic pollution was found in any of the 142 seal stomachs suggesting that seals in Nunavut are not accumulating plastics in their stomachs. These data provide important baseline information for future plastic pollution monitoring programs in the Canadian Arctic.

PLASTICS A PROBLEM FOR POLAR BEARS?

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AC02 - Plastic Pollution in the Arctic: how big is the issue in the Canadian Arctic During recent polar bear meetings under the Inuvialuit-Inuit Polar Bear Agreement in the Southern Beaufort Sea managers were made aware of a new potential problem to polar bears. Recent work* examining the stomachs from polar bears harvested by hunters along the North Slope of Alaska found a high incidence of non-food items in their stomachs that included plastic bags and a towel. Analyses indicated 25% of the bears (n=51) had macroplastics in their stomachs and with the narrow pyloric sphincter out of the stomach it is very possible these large items would lead to gastric outlet obstruction. Two of the bears with significant amounts of non-food items were deemed aggressive and deterrent actions were ineffective. The North Slope Borough has initiated a plastic awareness campaign in their region. Inuvialuit are working to heighten public awareness of the problems with plastics and what individuals and communities can do about it. The Hamlet of Tuktoyaktuk had already banned the use of plastic grocery bags in their community. The Inuvialuit Game Council (IGC) and the Wildlife Management Advisory Council (NWT) have also initiated a program in cooperation with the hunters and the Government of the Northwest Territories, Department of Environment and Natural Resources to document the incidents of macroplastics in polar bear stomachs in the Canadian side of the Beaufort Sea and microplastics in fecal matter. The IGC and WMAC (NWT) are also raising the issue of properly managed landfills that keep garbage in and wildlife out. Increased documentation of the issue in a systematic way and work to raise public awareness is critical in working to change public perceptions and start real and meaningful change. * Raphaela Stimmelmayr, Billy Adams, Carla Kayotuk, Mike Pederson North Slope Borough Department of Wildlife Management (NSB-DWM), Utqiaġvik , Alaska

INTER-ANNUAL VARIABILITY OF NET ECOSYSTEM CO2 EXCHANGE AND IMPACT OF ENVIRONMENTAL VARIABILITY IN HIGH ARCTIC MESIC TUNDRA: 2008-2018

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Arctic tundra ecosystems are vulnerable to changes in climate, particularly given that Arctic air temperatures are rising at approximately twice the global rate. In response to changing environmental conditions, Arctic terrestrial carbon budgets have been observed to be shifting with respect to net ecosystem CO2 exchange (NEE), and its component fluxes; i.e., gross ecosystem CO2 exchange (GEE) and ecosystem respiration (ER). Determining whether Arctic ecosystems are behaving as net sinks or net sources is important as these scenarios are associated with various feedback mechanisms, either mitigating or enhancing atmospheric CO2 concentrations. Given the vast carbon stores in Arctic soils and permafrost, these processes can have significant impacts on atmospheric CO2 concentrations. This research analyzes how growing season NEE has varied from 2008 to 2018 at the Cape Bounty Arctic Watershed Observatory (CBAWO). Eddy covariance was used to make high-frequency measurements of NEE in mesic tundra during the growing season to see how NEE, GEE, and ER vary over a 10-year period. We also investigate the relative impact and functional relationships between environmental drivers, (i.e., photosynthetic active radiation - PAR, air temperature, precipitation, remote sensing vegetation indices) and CO2 fluxes over varying time scales. Preliminary results indicate significant inter-annual variability in NEE (range of -26 to 12 g CO2 m-2), with GEE (i.e., photosynthesis) primarily driving both inter- and intra-annual variability (range of -138 to -35 g CO2 m-2). Strong sink years (2012: -26.11 g CO2 m-2, 2014: -21.86 g CO2 m-2, and 2015: -25.28 g CO2 m-2) experienced varying environmental conditions which could suggest there is a temporal threshold associated with environmental controls on GEE (i.e., CO2 uptake). Long-term CO2 data sets are scarce and fragmented across high latitude environments. Our results provide a decadal-scale view of inter-annual variability in carbon exchange at a High Arctic site, and provide insights into the environmental controls on these fluxes at various scales.

FOOD-WEB STRUCTURE OF BENTHIC SOFT-BOTTOM COMMUNITIES EXPOSED TO A FRESHWATER INPUT GRADIENT IN A HIGH-ARCTIC FJORD (YOUNG SOUND, GREENLAND)

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Climate change induces a strong warming of air and surface seawater temperatures in the Arctic, at least two time higher than the global average. Among Arctic ecosystems, Arctic fjords appear to be one of the most sensitive habitats to these ongoing environmental changes notably due to their high exposition to terrestrial inputs of freshwater, sediment and terrestrial organic matter. Although numerous studies have highlighted the impact of these physical constraints on species distributions, their impacts on food web structures remain largely unknown. Here, we present results from a study conducted in a high Arctic fjord (Young Sound, Greenland) characterized by a long sea-ice cover (i.e. 9 months/year) and strong seasonal freshwater inputs. Spatial variability of benthic food-webs and community structure were studied along an inner/outer fjord gradient (i.e. reflecting a freshwater inputs exposition gradient) during both winter and summer. Isotopic values (δ13C and δ15N) and weight of benthic species were combined to determine the key species and main pathways involved in the carbon flow through the community. In parallel, several isotopic indices (e.g. isotopic functional richness and evenness indices) and community metrics (species and functional traits' diversity) were also compute in order to describe benthic community and food-web structures. Our results will aim to discuss: (1) to what extent freshwater inputs may impact the specific and functional diversity of benthic communities and (2) how

these variations in the benthic communities are reflected in the benthic food-web structure.

HOLOCENE SEDIMENTARY DYNAMICS OF THE BELCHER GLACIER (DEVON ICE CAP, NUNAVUT, CANADA)

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(3) GEOTOP

Located in the Canadian Arctic Archipelago, the Devon Ice Cap is among the largest ice caps in the world with a massive land ice volume (14 400 km2). Glacier mass-balance model have shown that over the next decades, climate change will melt the Devon Ice Cap by an amount of 2.2 ± 0.7 Gt.yr-1, a loss sufficient to raise the sea level in a significant way. Being responsible for 42% (0.17±0.03 Gt.yr-1) of total iceberg discharge, the Belcher Glacier is the largest contributor to overall ice mass loss from this ice cap. In order to place this reduction into perspective, sedimentological, physical, mineralogical, geochemical (elemental and isotopic) and magnetic signatures of sediment samples from a short (box core, ~43 cm) and long (piston core, ~7.05 m) sedimentary sequence sampled in the vicinity of the Belcher Glacier will be compared. The chronology was established by 210Pb dating for the box core and by radiocarbon (14C) dating in conjunction with paleomagnetic analysis for the piston core. The increase of sedimentation rates at the top of the box core and most of the detrital proxies, notably the concentration of plagioclase, magnetite, total clays, δ15N, Ti/K and Al/Ca, show an increase likely related to a greater retreat of the Belcher Glacier since the mid XIX century compared to the preindustrial period. Digital X-ray, detrital proxies and 14C dating on shells illustrate the transition from a deglacial to a postglacial regime in the piston core. The presence of laminated sediments at the base of the piston core (7.05-5.6-m) together with a high Al/Ca, low Ca/Fe and Zr/Al values, low concentration of dolomite and plagioclase and a fine grain size (fine silt) suggest that subglacial currents during permanent ice conditions dominated during the Younger Dryas Cold Event (~12.9-11.6 cal ka BP). The middle part of the core (5.0-4.4 m) is enriched in heterogeneous ice rafted debris with an increase of the concentration of sand, an increase of Ca/Fe and Zr/Al ratios, a decrease of the Ca/Al, and an increase of the concentration of plagioclase and dolomite, marking the melting phase of the Belcher Glacier which likely represents the transition to the Holocene Climatic Optimum (9-7 cal ka BP). Finally, the uppermost part of the sediment core (4.4-0 m) is characterized by homogeneous sediments with few variations in most of the detrital proxies, suggesting that the modern sedimentation regime in this marine-terminating glacier was established during the mid-Holocene. Those variations are synchronous with other regional records from Baffin Bay supporting the hypothesis that retreat observed in the Belcher Glacier could be driven by changes in the intensity of the West Greenland Current. Overall, the results from this study provide novel data to better understand the recent and potentially future retreat of the Belcher Glacier.

DEVELOPING INEXPENSIVE MOORED SENSOR ARRAYS FOR THE SEASONAL OBSERVATION OF GEOCHEMICAL PARAMETERS IN COASTAL-DRAINING RIVERS OF THE KITIKMEOT, NUNAVUT, CANADA

Brown, Kristina (1)(presenter), Peter Van Buren (1), Mike Dempsey (1), Donald McLennan (2), Adrian Schimnowski (3), Bill Williams (1)

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Arctic coastal systems are undergoing rapid change. Increased precipitation, river runoff, and permafrost thaw have contributed to an increased flux of freshwater and land-derived material to the ocean through coastal-draining rivers. Observation of local river systems is therefore a key component in understanding the impacts of terrestrial change on the Kitikmeot coastal marine system; however, our observational capabilities have been restricted to rivers in the vicinity of local communities or to single-point-in-time observations made from research vessel platforms, which provide access only in late summer. In this proof-of-concept study, we developed a series of inexpensive, in-situ sensor arrays to deploy in Kitikmeot rivers over the open water season. Using off-the-shelf loggers, these systems record high frequency observations of river water level, temperature, conductivity, dissolved oxygen, and optical properties for the duration of their deployment. We deployed these systems for the first time in July 2019 and recovered them 7-9 weeks later. Here we present the first time series of river geochemical observations from this pilot study and discuss some of the deployment challenges,

including remote site access and seasonal conditions. A long-term goal of this research is to develop cost-effective observational systems that can be deployed and recovered by community partners, informing community planning and future questions surrounding stewardship of Nunavut rivers and the coastal ocean.

ASSESSING TRACE ELEMENTS IN LAKE CATCHMENTS SURROUNDING IQALUIT, BAFFIN ISLAND

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The impacts of long-range transport of air pollutants on Arctic ecosystems have been widely documented. Trace elements, such as mercury (Hg), cadmium (Cd), lead (Pb) and arsenic (As) are a threat to environmental and human health due to their ability to bioaccumulate and biomagnify. This poses a particular risk to northern communities due to their reliance on traditional foods. As such, quantifying pollutant loadings to Arctic lake catchments will further our understanding of the fate of atmospheric trace elements, and the potential for human exposure. Monitoring abiotic and biotic ecosystem components can provide a comprehensive understanding of the degree of deposition within a region, illustrating their spatial patterns and highlighting areas of concern. One of the most common landscape components of Arctic ecosystems, are lakes and ponds, which are recognized as 'sentinels of change' owing to their ability to integrate landscape response to anthropogenic disturbances. Furthermore, bryophytes (mosses) are an effective biomonitor of atmospheric metal deposition. The objective of this study was to take a multi-media (surface soil, lake sediment, surface water and moss) approach and assess concentrations and the variability of trace elements in lake catchments (n=20) surrounding Iqaluit, Baffin Island. During September 2018, surface soil, lake sediment, surface water and moss (Hylocomium splendens) were collected from each catchment. Further, during August 2019, surface water and moss were re-sampled from the same catchments. The data generated from this study will provide baseline information and knowledge regarding the spatial extent and trends of trace elements in the region. Ultimately, enhancing our understanding of the impact that trace elements have on a landscape scale.

FINE-SCALE TEMPORAL CHANGES IN MERCURY ACCUMULATION IN LABRADOR RINGED SEALS (PUSA HISPIDA) USING LASER ABLATION TECHNOLOGY ON WHISKERS AND CLAWS: INFLUENCE OF A CHANGING ICE REGIME

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Ringed seals are particularly vulnerable to a changing Arctic due to their dependence on sea ice for reproduction, molting, resting and feeding. The Labrador coast is experiencing changing sea ice conditions, with 2010 having a below normal extent of ice coverage and earlier spring breakup. Recent studies have reported a shift in ringed seal (Pusa hispida) foraging and/or feeding ecology in response to unfavourable ice conditions. The change in foraging and feeding habits, in turn, might change the amount of mercury seals are exposed to in their diet as well as their environment. This may, in turn, impact mercury (Hg) accumulation in seals. The present study measures Hg concentrations using laser ablation inductively-coupled plasma mass spectrometry (LA-ICP-MS) and stable isotopes continuous flow ion ratio mass spectrometry (CFIR-MS) along both ringed seal whiskers (n=40) and claws (n=40), respectively and provides a history of diet and Hg exposure over varying climate conditions. Intra- and inter- annual variation in Hg levels and biological, ecological, and physical factors are being evaluated over a 20 year period. Results of this research will contribute to a better understanding of factors affecting geographic variation in Hg accumulation in seals, and to our understanding of the effects of climate change on ringed seal food web structure and contaminant exposure. This data will contribute meaningful information with respect to marine mammal toxicology which could be harnessed in wildlife management practices that employ non-lethal sampling methods.

SEROPREVALENCE OF FRANCISELLA TULARENSIS INFECTION IN AN ARCTIC FOX POPULATION (VULPES LAGOPUS) AT KARRAK LAKE, NUNAVUT

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The intracellular bacterium, Francisella tularensis, causes a serious vector-borne disease (tularemia) that infects a wide range of avian and mammalian hosts, including people. The disease transmits among infected hosts directly, or via vectors such as ticks and biting flies. Small mammals, such as rodents, rabbits, and hares, are major reservoirs, and large numbers often die during outbreaks. Small mammals dominate the diet of Arctic foxes (Vulpes lagopus), so we monitored seroconversion of foxes at Karrak Lake, Nunavut, as an indicator for circulating levels of tularemia. Serum samples from 119 live-trapped adult and juvenile Arctic foxes were collected from 2014 to 2018 and screened using a microagglutination test (MAT). Seroprevalence was high during the summers of 2016 (0.27; 95% CI [0.11, 0.52]) and 2018 (0.45; [0.32, 0.60]), and low during the summers of 2014 (0.03; [0.01, 0.16]), 2015 (0.04; [0.01, 0.20]), and 2017 (0.0). Furthermore, out of 23 juvenile foxes born in 2018, 39% had been exposed to the pathogen ([0.22, 0.59]). This study provides evidence that F. tularensis circulates in the Karrak Lake ecosystem and that Arctic foxes may be useful bio-indicators for tularemia. Further studies should investigate the role of rodents in the disease ecology of tularemia at Karrak Lake and the effect of this pathogen on Arctic fox survival and reproductive success in the Canadian Arctic.

INFLUENCE OF PERMAFROST DEGRADATION AND INCREASED TURBIDITY ON TRENDS OF CESIUM AND RUBIDIUM IN ARCTIC CHAR IN EAST AND WEST LAKE, MELVILLE ISLAND, NUNAVUT

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High Arctic lakes and landscapes are subject to direct and indirect climate-driven changes, including rising air temperatures, enhanced permafrost degradation (including thermal perturbation and physical disturbances), and altered precipitation patterns. Two physically similar lakes (East Lake and West Lake) in the Cape Bounty Arctic Watershed Observatory (CBAWO) on Melville Island, Nunavut, are experiencing the effects of climate change in different ways. This provides the unique opportunity to understand the potential impacts of permafrost degradation on Arctic char (Salvelinus alpinus), an important subsistence food source across the circum-Arctic. Episodes of internal subaqueous slumping in West Lake have resulted in a dramatic increase in turbidity in this lake, while turbidity in East Lake has been consistently low over the monitoring period. Previous work has indicated that the increase in turbidity in West Lake caused an increase in mercury (Hg) concentrations of Arctic char over the past 10 years, likely owing to shifting food webs and reduced food availability. Catchment wide permafrost thaw can also lead to increased inputs of solutes and trace elements in these lakes; thus, the objectives of this research are to: (1) Assess temporal trends of trace element concentrations in tissues of char from East Lake and West Lake, (2) Determine potential mechanisms driving temporal trends of bioaccumulative elements (e.g., Rb, Cs) in both lakes. Between 2008 and 2018, mean concentrations of Rb and Cs in Arctic char have increased in West Lake, but decreased in East lake during the same time period. While the specific mechanisms driving these changes are not yet clear, it is likely that they are related to the greater catchment inputs

to West Lake owing to enhanced permafrost degradation and increased lake turbidity from subaqueous slumps. A link between permafrost degradation and trace element concentrations in fish is concerning given the trajectory of climate change in the Arctic and importance of Arctic char as a country food.

CHANGING LANDSCAPE AND HYDROLOGIC PATTERNS' IMPACT ON MICROBIAL ACTIVITY: A COMPARISON OF HUMAN-INFLUENCED AND NATURAL ARCTIC WATERSHEDS

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The community of Baker Lake (Qamani'tuaq) is situated within a sensitive tundra ecosystem, where an increase in anthropogenic activities, in addition to climate change, has the potential to impact both aquatic and terrestrial ecosystems. Altered terrestrial biophysical environments may impact microbial activity and water quality within a community's fresh water supply, particularly community raw water collection sources. An initial step in identify potential changes and impacts is to establish baseline parameters and their seasonal patterns. In partnership with the Baker Lake Hunters and Trappers Organization (HTO) Water Monitoring Team two small watersheds were selected for monitoring. One watershed located adjacent to the community had minor anthropogenic activities, the second watershed was bisected by the Meadowbank Mine road, where concerns about road dust have been raised by the community. The HTO team measured a suite of hydrological (e.g., conductivity, pH, dissolved organic carbon, temperature) and microbial (e.g., E. coli and Coliforms) parameters through June and July 2019. In addition to the direct measures, landscape metrics were extracted from remotely sensed and topographic data. A comparison of the watersheds in relation to landscape and water quality was undertaken. Preliminary results indicate that increases in anthropological activity within the watersheds is directly impacting water quality.

HOLOCENE ICE WEDGE ACTIVITY IN THE EUREKA SOUND LOWLANDS, CANADIAN HIGH ARCTIC.

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Polygonal terrain underlain by ice-wedges are a widespread feature in continuous permafrost and make up 20-80%vol of the ground ice in the upper few meters of permafrost. Despite the numerous contemporary studies examining factors that control ice wedge cracking, their development and degradation, relatively few have explored ice wedge activity in relation with past climate and vegetation conditions. In the Eureka Sound region, ice wedge polygons dominate the permafrost terrain and their degradation has started to occur and is leading to growth of thaw slumps. The objective of the study is to determine the timing of ice wedge growth in the Eureka Sound region over the Holocene. This is reached by: 1) describing the cryostratigraphy of sedimentary units exposed in the headwall of the slump; 2) determining the moisture source of the ice wedges from measurements of δD-δ18O of the ice; 3) determining the age of the ice wedges from 14C measurements of the dissolved organic carbon. Preliminary results from three ice wedges show that DOC concentration in the ice range between 2-5 ppm with 14CDOC ages clustering during cold intervals in the Holocene. This contrast with ice wedge activity in central Yukon where ice wedge being active during the late Pleistocene and late Holocene.

TRACING ORIGINS OF EXPORT PRODUCTIVITY ACROSS THE NORTHERN LABRADOR SEA AND BAFFIN BAY USING AMINO ACID CARBON ISOTOPES IN CORE-TOP SEDIMENTS

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Compound-specific stable isotope analysis of amino acids is emerging as a powerful new tool for tracing biosynthetic origins of organic carbon in food webs. This approach has been mostly applied to tissues of living organisms. By contrast, relatively few investigations have been carried out on amino acid stable carbon isotopes (□13CAA) in detrital materials, particularly marine sediments. We examined □13CAA in core-top sediments

collected from the northern Labrador shelf, slope and basin, the west Greenland shelf, and Baffin Bay. These sampling sites span environmental gradients in water properties, proximity to land, and intensity of seasonal sea ice coverage. The core-top sediment 13CAA showed remarkably consistent patterns with those of field-collected and laboratory-cultured microalgae which represent a wide range of global ocean regions. Analysis of □13C of essential amino acids demonstrated that (eukaryotic) microalgae contributed to the dominant source of amino acid carbon in all samples, which indicated strong benthic-pelagic coupling across all the study sites. The between-site variability in □13C of total hydrolysable amino acids was only about 1‰, compared to up to 6‰ variation between individual amino acids. The significance of this variability with respect to proportional contributions of different types of marine producers will be discussed. Overall, our results highlight the potential for using □13CAA as a new approach to trace the origins of export productivit

LIFE IN THE DARK: CHARACTERIZING ISOTOPIC NICHE IN THE ARCTIC DEEP-SEA ACROSS A LATITUDINAL GRADIENT

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The deep-sea, defined as the area 200 m below the surface is facing emerging chemical, physical and biological stressors. Very little is understood about deep-sea food webs, particularly in the Arctic. Examination of isotopic niche across a latitudinal gradient will provide valuable inferences into spatial variation and ecological resources used by Arctic deep-sea species. Spatial variation in isotopic niche was quantified using d13C and d15N for seven deep-sea species on the east coast of Baffin Island, Nunavut (high to low latitude: Pond Inlet, Scott Inlet, Qikiqtarjuaq). Species were selected based on their functional role and foraging strategy. The Arctic deep-sea species selected include: benthopelagic predator: Greenland halibut [Reinhardtius hippoglossoides], keystone pelagic: Arctic cod [Boreogadus saida], bathyal demersal: Bigeye sculpin [Triglops nybelini], bathypelagic demersal: Atlantic poacher [Leptagonus decagonus], bathydemersal: Gelatinous snailfish [Liparis fabricii], and two shrimp, benthopelagic: Northern shrimp [Pandalus borealis] and unknown functional role: Sclerocrangon ferox. In Scott Inlet, high range in d15N for the five fish species (13.0 to 17.7 ‰) indicated prey diversity across trophic levels, while the d13C range (-22.0 to -18.3 ‰) indicated multiple basal signatures contributing to diet (i.e. sympagic, pelagic, benthic). Niche estimates (Bayesian standard ellipse areas) ranged from 0.13 ‰2 for Bigeye Sculpin to 1.05 ‰2 in Greenland Halibut, indicating species-specific variation in niche area linked to functional roles. Preliminary findings indicate niche overlap (6.45% to 100%) among the five fish species in Scott Inlet, the exception being Atlantic poacher. The Atlantic poacher had the highest d15N values, despite being a small-bodied demersal and bathypelagic fish. It is hypothesized that species will have smaller niches at lower latitudes (i.e. Qikiqtarjuaq) compared to higher latitudes (i.e. Pond Inlet) as a result of decreasing productivity and reduced biodiversity with increasing latitude. It is also hypothesized that niche area and overlap will be less at lower latitudes compared to higher latitudes, suggesting that environmental variables drive changes in available resources (i.e. prey reliant on sympagic vs. pelagic carbon), habitat utilization and energy pathways. Comparisons of isotopic niche size and overlap for the selected species will be presented across the three sites. This study provides baseline data for future ecosystem monitoring and will facilitate discussions towards an ecosystem-based approach for resource management through studying multiple species rather than a single species. In addition, by investigating multiple species and locations, it will address predictions for how emerging stressors, such as climate change, will impact Arctic food web diversity, energy dynamics and ecosystem structure. This research will also aid sustainable fishery development to help provide new opportunities to northern communities by studying three economically important species: Greenland halibut, Arctic cod and Northern shrimp.

MARINE COUNTRY FOOD IN NUNAVIK: TOWARD A BETTER UNDERSTANDING OF THE NUTRITIONAL PROPERTIES OF RINGED SEALS, BELUGAS AND WALRUSES

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Inuit communities have a strong relationship with the coastal ocean and the edible marine resources it provides. In Nunavik (Northern Quebec), the meat, organs, fat and/or skin of harvested beluga, ringed seal and walrus are consumed locally. This consumption is thought to provide important health benefits through the intake of essential elements such as polyunsaturated fatty acid (PUFA, including omega-3), selenium, selenoneine and vitamin A. PUFAs are considered essential for cardiovascular health, child development and brain function, whereas vitamin A plays a crucial role in vision, growth and reproduction. However, the consumption of some marine foods may also lead to methylmercury exposure, a potent neurotoxin, since some parts of marine mammals accumulate and biomagnifies methylmercury despite the absence of large industrial activities in the North. In this respect, the dietary intake of selenium and selenoneine is thought to play an important role in mitigating the toxic effect of methylmercury. As part of the BriGHT program, the present project aims to quantify the presence of essential elements and methylmercury in the tissues of belugas, ringed seals and walruses harvested in collaboration with Inuit hunters in communities of the Hudson Strait. Laboratory analysis for vitamin A, fatty acids, selenium/selenoneine, mercury and methylmercury are on-going. Differences in nutritional quality with respect to species, sampling site, population, sex or age will be evaluated. These results will help better understand the links between northern ecosystems, marine food nutrients and Inuit health and promote a safe consumption of these marine country foods in Nunavik.

ESTABLISHING A SUSTAINABLE ARCTIC FISHERY: POPULATION GENOMICS AND SHAPE VARIATION OF LAKE WHITEFISH IN A HYBRID SPECIES COMPLEX

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Northern regions have been disproportionately impacted by climate change causing shifts in the geographical ranges of some species. Along with myriad challenges, climate change may also create economic opportunities for northern peoples facilitating greater access to fishing areas in areas like the Lower Northwest Passage (LNWP). The Lake Whitefish (Coregonus clupeaformis) is one LNWP species that might be suitable for a commercial fishery as it has been eslewhere; however, its taxonomy presents challenges as there are multiple morphotypes/species. To develop a cogent, sustainable fisheries plan we must be able to identify these putatively distinct taxa. To this end, we examined individuals from three LNWP rivers that feed into Rasmussen basin: Legendary River, Back River, and Kaleet River. We surveyed variability in mitochondrial DNA sequence from the Cytochrome Oxidase I (600bp) and a genome-wide panel of single nucleotide polymorphisms (SNPs), and applied tools of geometric morphometrics to identify and describe the variation of morphotypes. We found some evidence for two genetic populations of lake whitefish with overlapping ranges in the region. Further, we found evidence of hybridization and introgression between lake whitefish and two other coregonid species (C. sardinella and C. autumnalis) evidenced by genetics. The shape analysis indicated that there are at least eight different morphotypes, which is consistent with genetic evidence of hybridization in the species complex. Admixture among these three species may elevate genetic variation within populations which may enhance the response to climatic variation and natural selection. However, this also makes setting sustainable catch limits for lake whitefish challenging, since fishing pressures will decrease the genetic diversity of each species. Our work aims to preserve biodiversity in the LNWP, by informing fishing practices in this region ultimately allowing lake whitefish to become a sustainable resource for the people of Nunavut. Through this work we have described a baseline of hybridization within this species complex - the management of this resource into the future of climate change, demands ongoing monitoring of these patterns as the response of this taxa to impeding climate change is unclear.

CEOTR GLIDER MISSIONS ACROSS CANADA

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The Coastal Environmental Observation Technology and Research (CEOTR) glider group operates both Slocum and wave gliders. Our fleet of autonomous ocean vehicles (Teledyne Webb Slocum glider & Liquid Robotics wave glider) has traversed more than 60 000 km supporting a variety of research projects in collaboration with investigators across Canada and the USA. A portion of the data collected has gone towards extending federal monitoring programs on the Scotian Shelf; validating models of ocean temperature and salinity; aiding in environmental assessments of the effects of the Maritime Link on snow crab behaviour; relating ocean conditions to salmon migration; and understanding the movements of marine mammals on the east and west coasts of Canada. In 2019 we performed our first mission as a service for the Nunatsiavut Government, supported by Oceans North and we have plans to perform additional missions in 2020 and 2021. This poster will share some information on the projects we've worked on and plans for the future.

IMPACTS OF CLIMATE CHANGE ON NAVIGATIONAL CHOKE POINTS FOR SHIPS OPERATING IN THE CANADIAN ARCTIC

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In the Canadian Arctic the recent reduction in sea ice extent and thickness, along with an increase in mobility of hazardous sea ice, creates navigational challenges for Arctic ship operations. The operational risks vary depending on the Ice Class (i.e. level of ice strengthening) of the vessel and on the extent to which dynamic and mobile sea ice is prevalent and changing in the regions where shipping operates. Locations where sea ice is frequently present throughout a shipping season, impeding travel along routes that are otherwise largely ice free, have been called 'choke points'. In this study we use a comprehensive temporal and spatial inventory of historic shipping traffic by Ice Class (1990-2018) to examine the location of choke points in the Canadian Arctic, how they're changing over time, and how the strength of ships navigating through these locations is evolving. Results reveal that since 1990 there has been a marked reduction in the voyages of highly strengthened Polar Class 3 ships, but large increases in the number of voyages of ships with medium ice strengthening (Polar Class 7) and little or no ice strengthening (Ice Class 1B). In addition, there are many more voyages by non-ice strengthened ship types occurring throughout the Northwest Passages in the 2010s than in the 1990s. This has occurred during a period when an analysis of historical sea ice charts indicates that ice navigability for vessels with medium or little ice strengthening has greatly eased. However, the increased mobility of sea ice, particularly areas of hazardous multi-year ice, promotes increased risks for poorly ice strengthened ships. The presence of choke points with limited infrastructure and support services will create additional risks for the region.

WESTERN HUDSON BAY BELUGA WHALE (DELPHINAPTERUS LEUCAS) PASSIVE ACOUSTIC TRIANGULATION AND REACTION TO VESSEL TRAFFIC IN THE CHURCHILL RIVER ESTUARY

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The Western Hudson Bay (WHB) is the most abundant known beluga whale population in the world. In the summer, this population forms large aggregations in the Churchill River estuary. This estuary is a hot spot for beluga whales for many reasons, including nursing; molting; feeding; and seeking shelter from predators. The thousands of belugas that occupy the estuary in early summer represent a high ecological, historical, and economical value for both the inhabitants of Churchill and the worldwide scientific community. In the last decades, the influence of anthropogenic activities on marine mammals has intensified, especially in the Arctic. This region is experiencing the most profound impacts of climate change, including a rapid decline in sea ice cover which will leave the Arctic ice-free and accessible to human activities for longer periods of time. Along with alterations in the sea ice habitat, the steep increase in maritime traffic and underwater resource exploitation happening in the Arctic has the potential to impact beluga whales. This pilot study aims to detect potential changes in the distribution, habitat use, and behavior of the WHB beluga population in the Churchill River estuary in response to vessel traffic using passive acoustics monitoring (PAM). The importance of the area for this type of study is determined by the presence of the only deep-water port in Canada that is re-opening after years of inactivity. A longer ice-free period in Hudson Bay will

enable an increased number of vessels to reach the port and will determine an extended shipping season in one of the most ecologically important areas for the WHB belugas. It is therefore crucial to determine the influence that such an increase in vessel traffic in the Churchill River estuary may have on its summer beluga population. To do this, an array of five new hydrophone prototypes was deployed in the estuary in July 2019, before the start of port activity since the shut-down. The hydrophones were moored in a double-triangular configuration and collected data continuously for a week. Different recording parameters were tested and CTD data were also collected. The hydrophone array will be used to triangulate beluga pod movements and for call detection, to potentially distinguish single individual positions using PAM automated software and personalized MATLAB scripts. Moreover, cameras were mounted on the moorings to test the possibility of monitoring beluga movements underwater. The acoustic data will be compared to the underwater camera visual observations and to some aerial footage collected simultaneously by colleagues using both a camera and a tethered drone mounted at the port. Collecting data before the beginning of the port activity will allow to record natural background noise and to study beluga movements relative to physical and biological parameters before the beginning of large vessel activity. The recordings are being processed for triangulation and the dataset will be compared to that of next year's campaign which will include vessel traffic noise. Ultimately, the comparison of acoustic and visual data will yield to more accurate results and will help designing a future array configuration able to cover the whole estuary year round.

SPATIAL AND TEMPORAL DISTRIBUTION OF POLYCYCLIC AROMATIC HYDROCARBONS IN SEDIMENTS FROM THE CANADIAN ARCTIC ARCHIPELAGO

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The Arctic is the region of the planet where the seafloor topography and composition are the least studied and understood. Indeed, the vast majority of the channels within the Canadian Arctic Archipelago (CAA), as well as the adjoining continental shelf and slopes, are characterized by a substantial knowledge gap of the seafloor sediment composition and associated contaminants. Therefore, a wider spatial coverage of sedimentary records across the marine CAA is essential to provide fundamental baseline information on the physical and geochemical sediment properties and also to forecast future dispersion of possible pollutants. In this context, a total of 115 surface sediment samples and 8 push-cores were subsampled from box cores collected over a large area covering the Canadian Beaufort Sea to the Baffin Bay. Sampling was performed during the 2016, 2017, 2018 and 2019 ArcticNet expeditions aboard the CCGS Amundsen to characterize the modern spatial distribution patterns and the temporal trends of polycyclic aromatic hydrocarbons (PAHs) within the CAA. The chronology of push-cores was established using 210Pb measurements (Letaïef, 2018). In order to document the depositional history of PAHs during the last century, only the top 10 cm of the push-cores were analyzed. Extractions were performed using a one-step accelerated solvent extraction and clean-up, followed by gas chromatography coupled to a mass spectrometer analysis. The sum concentrations of 23 PAHs in surface sediments ranged from 6 ng/g (dry weight basis) in the North Baffin Bay to 437 ng/g in the Canadian Beaufort Shelf, with a mean value of 67 ng/g. PAHs source characterization was investigated through diagnostic ratios: fluoranthene over the sum of fluoranthene and pyrene and benzo(a)anthracene over the sum of benzo(a)anthracene and chrysene. These tend to point a profile with mainly petrogenic sources (i.e., igneous rock-derived, petroleum or crude oil spill) for the majority of the stations. Some of them have a mixed profile with petrogenic sources and pyrogenic sources (i.e, incomplete combustion of either fossil fuel or biomass) that could indicate an anthropogenic input. As a first interpretation of the results, by considering previous studies in the Canadian Arctic, the inputs of PAHs to the surface sediments in CAA were relatively stable during the last years, but their sources are likely shifting from petrogenic to pyrogenic sources. This shift could be related to climate changes that modify the global atmospheric transport of PAHs, as recently suggested to explain the shift in the sources of PAHs associated with atmospheric particulates sampled at Alert (Yu et al., 2019). Taken as a whole, our study will provide a baseline of PAHs levels in surface sediments within the CAA before maritime transport increases in this area (notably within the Northwest Passage) as well as a better understanding on the sources and depositional history of PAHs in this Arctic region.

DEVELOPING SCIENCE COMMUNICATION STRATEGIES IN THE ARCTIC USING NATURAL HISTORY STORIES

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Social media platforms, such as Instagram, have revolutionized the way people communicate and share stories, allowing them to broadcast their stories across the world. These platforms provide a rich opportunity for researchers to engage in science communication - that is, to disseminate stories about natural history to multiple broad audiences. Using case studies, I discuss the impact of sharing Arctic natural history stories and research that appeals to an audience's values, and that humanizes science. I also present a framework for developing a social media strategy for in-the-field science communication with a focus on defining communication goals, evaluating impact, and audience building and retention.

SYSTEMATIC LITERATURE REVIEW OF FACILITATORS AND BARRIERS RELATED TO FOOD (IN)SECURITY STATUS IN INUIT NUNANGAT: PRELIMINARY RESULTS

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Food insecurity is an urgent public health issue shown to contribute to many negative health outcomes including heart disease, diabetes, obesity, depression and suicidal ideation. Some of the highest reported rates of food insecurity in Canada are experienced in the North, including Inuit Nunangat. Many large-scale and longstanding interventions have been implemented in Inuit Nunangat to address food insecurity, such as the Nutrition North Subsidy program and various hunter support programs. Despite these, and many other interventions, the most recent reports of food insecurity estimate that more than 50% of Inuit in Inuit Nunangat experienced food insecurity in 2012. Research projects and food insecurity interventions around the world often focus on one factor related to food insecurity thought to be critical, rather than considering multiple factors present in the system simultaneously. There is a long history of this approach leading to unintended consequences or ineffective action. One such example is the approach taken in an effort to protect declining fish stocks in Kiribati. As fishing and coconut harvesting were the two main sources of income on the island, coconut harvesting was incentivized to alleviate some of the pressure on the declining fish stocks. However, this strategy ended up increasing incomes, which allowed coconut harvesters to purchase better fishing equipment and afforded them more leisure time to fish, which ultimately contributed to a further decline in fish stocks. As evidenced in this and other examples of complex issues, in retrospect, it often becomes clear that more effective impact may be achieved if interventions were designed with a better understanding of the complexity of the system of factors that influence the issue. To begin exploring the system of factors that influence food (in)security status among Inuit in Inuit Nunangat, we conducted a systematic literature review, following PRISMA guidelines. We searched seven databases for white literature using keywords and subject headings that represented the concepts "food (in)security" and "Inuit Nunangat". After removing duplicates, two reviewers independently followed a two-step screening process. All titles and abstracts were screened for studies that analyzed a relationship between at least one barrier or facilitator and at least one element of food (in)security among Inuit in a community or region within Inuit Nunangat. Data were then systematically extracted and analyzed thematically to identify a list of facilitators and barriers reported to be associated with food (in)security status of Inuit in Inuit Nunangat. This systematic literature review is the basis of a Master's research project to statistically explore how multiple factors related to food insecurity status interact and how these interactions are related to the food (in) security status of individuals in Nunavik. The results of this project are expected to support a more comprehensive and inclusive consideration and development of new interventions to address food insecurity in the region.

SPATIAL AND TEMPORAL VARIABILITY OF BENTHIC COMMUNITIES IN THE BEAUFORT SEA

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Traditional surveys of large-scale patterns of marine benthos have been conducted in the Arctic using taxonomic diversity and biomass. However, much less attention has been given to the secondary production rates and the functional diversity of biota. Secondary production and functional traits analysis provide a more complete indicator of population structure and dynamics that influence ecosystems. Secondary production provides a synthesis of local mortality, growth rates, individual body mass, recruitment, population density and community biomass. Community functioning represent effects and responses of organisms on their environment. Therefore, secondary production and functioning both give a comprehensive representation of the success of a population and can be used to define functional importance at the community and ecosystem levels. Climate change, which will affect the distribution of species, will definitely modify secondary production and functioning in the Arctic. The objective is to model the spatial and temporal variability of benthic communities in the Beaufort Sea by (1) identifying sources of variability in benthic community structure, (2) estimating benthic secondary production and indices of functioning, and (3) identifying sources of variation with significant environmental variables. Extensive data on epifauna and infauna communities, and sedimentary habitat variables, were collected across the southern Beaufort Sea and in the Amundsen Gulf as part of BREA-MFP (2012-2014) and CBS-MEA (2017-2019). Results will demonstrate if spatial variability of benthic community structure is explained by habitat heterogeneity and biotic interactions at small-scale and by environmental gradients at larger scale. Our hypothesis is that benthic secondary production will closely match patterns of biomass while benthic functioning will be linked with species diversity and density. This study will allow for a better understanding of how benthic communities are distributed in relation to environmental parameters and what defines benthic secondary production and functioning hotspots in the Arctic.

USE OF STABLE (13C) AND RADIOCARBON (14C) ISOTOPES OF DISSOLVED INORGANIC CARBON (DIC) TO DESCRIBE THE INTERPLAY OF MINERAL WEATHERING AND ATMOSPHERIC EXCHANGE IN GLACIAL RIVERS

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A principal vector of climate-induced change in Canada's high Arctic involves shifts in glacier ice mass balances and hydrologic conditions of seasonal meltwater pulses to downgradient aquatic systems. Glacial rivers are biogeochemically dynamic conduits for meltwaters based largely on a complex interplay of mineral weathering and atmospheric exchange processes that evolve during transit. These processes are integral to the carbonate system and have been highlighted based on their likely impact to compartmental fluxes of carbon with projected future environmental change. Here we present a multi-year dataset spanning stark differences in hydrologic conditions (i.e. high vs low flow) for glacial rivers of the Lake Hazen watershed (2016 to 2019) for stable (13C) and radiocarbon (14C) isotopes of dissolved inorganic carbon (DIC). The goal herein is to deconvolute biogeochemical processes responsible for the behaviour of 13C and 14C signatures of DIC along glacial river transects. To support this work we have refined our interpretation of end-members for atmospheric CO2 (δ13C-CO2) and the particulate inorganic carbon phase (δ13C-PIC) of suspended sediments in these systems. The departure of actual measured δ13C-DIC values from those calculated assuming atmospheric equilibrium was compared along river transects spanning high to low flow years. Finally, kinetic isotopic fractionation factors associated with weathering of fine-grain glacial sediments were used to aid in the mechanistic breakdown of these riverine processes. Findings are poised to support future work where carbon balances of glaciated watersheds of the high Arctic are considered in the context of forecast changes to the magnitude and timing of glacier ice meltwater fluxes.

MASS AND HEAT BALANCE OF A PERENNIAL ICE PATCH IN THE ARCTIC POLAR DESERT (WARD HUNT ISLAND, CANADIAN HIGH ARCTIC)

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Ice patches (aniuvat in Inuktitut) represent the smallest, but also the most common in absolute number, perennial ice masses at the earth's surface. They are created by local accumulations of snow in favorable topographic sites, either by snow drifting or avalanching. The persistent snow masses gradually metamorphose into ice through complex thermo-physical processes, including the formation of superimposed ice and the regelation of soaked firn. Across the 72% of the Canadian Arctic Archipelago not covered by ice caps and glaciers, the ice patches are so widespread that they are expected to have a great implication in the landscape dynamic and hydrology. In the polar desert, ice patches represent a primary contributor to the hydrological cycle of small watersheds in sustaining meltwater flow throughout the summer. Their presence is associated with mass transfers on slopes, especially solifluction, and affects the surface heat budget, the ground thermal regime, and enhances geochemical and microbial activity. Due to their small volume, the ice patches are especially sensitive to climate fluctuations and are threatened by the current warming. In spite of their great environmental significance and their large number, scientists have paid hitherto little attention to ice patches. To fill this gap, we propose a first attempt to address the dynamics of polar ice patches and their climatic drivers. This study consists of a detailed investigation of processes that control the heat and mass balance of ice patches on Ward Hunt Island at the northern tip of the Canadian Arctic Archipelago. The dynamics of ice patches are controlled by their heat budget, which depends on meteorological conditions, but also on snow physical properties such as albedo and thermal conductivity. Snow and ice physical properties evolve dramatically from dry insulating snow with a high albedo to wet snow and subsequently ice with high thermal conductivity and a low albedo. These changes must be documented to quantify the mass evolution of ice patches over a season, to model their mass balance and to project future state and dynamics. Spatio-temporal patterns and properties of the seasonal snowpack are needed to understand the dynamic interaction between snow and the ground surface and to assess the formation processes of the ice patches as the seasonal snow feeds them in winter and controls their summer heat balance. The principal objectives of the study are: (i) determining the relative contribution of snow and ice accumulation and ablation processes in the mass balance of ice patches; (ii) understanding the control of the snow/ice properties on the heat balance of ice patches, and (iii) assessing what conditions are required to tip the balance towards the complete melt of the ice patches. The method relies on the estimation of the summer heat balance of the ice patch based on an automatic weather station (AWS) and thermistor cables, on the monitoring of the summer ablation rate based on high-resolution terrestrial laser scanning surveys and automatic time-lapse imagery, and on the measurement of snow and ice physical properties. This study is an essential prerequisite to model the response of the ice patches to climate change and assess how it will impact the hydrological cycle, geochemical cycle, slope processes, and permafrost dynamics. This is a vital issue given the regional physical and biological importance of ice patches in the polar desert evolution.

RECENT IMPACTS OF CLIMATE CHANGE ON VEGETATION DYNAMICS IN THE TORNGAT MOUNTAINS OF NORTHERN LABRADOR

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Across the circumpolar North, increases in the size, extent, and density of shrub species (termed 'shrubification') have occurred as a result of recent climate change, with widespread impacts on the structure and functioning of Subarctic and Arctic tundra ecosystems. The influence of climate change on tundra vegetation is context-dependent, however, with variability in local site properties and plant species characteristics altering outcomes at small spatial scales. This research aims to document changes in vegetation dynamics near Nakvak Brook located in the Torngat Mountains National Park, northern Labrador. Northern Labrador has undergone significant changes in climate and vegetation over the past 30 years (ca. 1.5°C increase in summer temperatures), but the precise magnitude and underlying mechanisms of the changes remain relatively understudied. Here, a mixed-methods approach is used to combine records of shrub growth, surveys of plant species composition, in-situ geophysics measurements, and changes in NDVI with historical climate data to develop a multifaceted understanding of recent ecological and abiotic changes in the area. Our preliminary results indicate that the area has experienced significant 'greening' over the past 30 years, and that shrub growth has increased in response to warming temperatures over this same period. Vegetation surveys indicate that recent (2010-2015) responses to climate change are complex and dependent on species identity and site context. Permafrost geophysics and

ground temperature analyses suggest that taller shrubs tend to be associated with thinner permafrost (if present) and warmer ground temperatures. Linking ecological records and ground surface measurements from the Torngat Mountains region with remotely sensed data provides information at scales appropriate for local management and for protected areas planning. The approach used in this research has wide applicability to northern environments elsewhere.

BIOAEROSOLS: CAN THE SETTLED DUST REPLACE AIR SAMPLES?

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Microorganisms are ubiquitous in occupied buildings as dwellings in the dust and in the air. Accurate air sampling is achieved using specific dedicated samplers and trained personnel that could limit the deployment of research protocols in remote locations such as northern environments. In some studies, settled dust sampling is used as a proxy since collection is easier to achieve. However, accuracy and correlation between both approaches needs to be validated for some microbial parameters such as application of molecular quantification of bacteria and molds and description of microbiota. In this context, the goal of the project was to assess microbial parameters in air and dust samples. To compare the microbial parameters in the air and in the dust, samples of dust and air were collected in 59 dwellings in Nunavik. Both samples were taken at the same time in a same dwelling. Dust samples were harvested in closed face cassettes with a polycarbonate filter (pores size 0.8 μM) using a micro-vacuum (ASTM D7144 method on 225 cm2) while a volume of 20 m3 of air was collected on filters using a Sass3100 air sampler with an airflow of 300 L/min. After the collection, the dust was weighed, the particles from the air and the dust samples were eluted, and DNA was extracted for further molecular analysis. Concentrations of total bacteria and Penicillium/Aspergillus were both quantified by qPCR and the biodiversity was assessed by high throughput sequencing targeting the fungal barcode ITS1 and the bacterial 16S rDNA. The median values for total bacteria concentrations were 4.01*103 copies/m3 in air samples and 5.13*104 copies/mg in dust samples. For Penicillium and Aspergillus concentrations, the median values were 1.45*101 copies/m3 and 5.07*101 copies/mg in air and dust samples respectively. There was no correlation between air and dust samples for the concentrations total bacteria and of Penicillium/Aspergillus. The results of bacterial biodiversity showed the predominance of the same genera Staphylococcus, Streptococcus, Corynebacterium, Propionibacterium, Micrococcus and Prevotella but the mean of Bray-Curtis index was 0.78 which suggested a difference of the global composition and abundance. The permdisp analysis on Bray-Curtis calculation did not confirm a statistical impact of the sample type on the global biodiversity. On the 9,131 OTUs found in all the samples, 545 were found in a different proportion in the two sample types. It seemed that some OTUs were specific to air or dust samples but for the majority were in present with a similar abundance regardless the sample type. The fungal biodiversity was only assessed in dust samples because the concentrations were low in air samples. There were 185±2 fungal OTUs in dust samples. Yeasts Cryptococcus, Malassezia, Candida and molds Aspergillus, Cladosporium, Penicillium, Alternaria represented the main fungal genera in household dust in investigated dwellings. In conclusion, the microbial parameters in dust and in the air were different, allowing to assessing different exposures of residents and shows complementarity in description microbial hygienic conditions in dwellings.

BENTHIC DIVERSITY IN THE LABRADOR SEA DEEP OCEAN

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Benthic surveys in northern Labrador have been mainly restricted to continental shelf and slope depths, with deeper areas being rarely or never surveyed. This study is part of the project "Integrated Studies and Ecosystem Characterization of the Labrador Sea Deep Ocean" (ISECOLD), lead by the Department of Fisheries and Oceans Canada (DFO), whose goals include the characterization of benthic communities in the deep Labrador Sea. As part of ISECOLD, 10-17 stations were bottom surveyed in June-July 2019, aboard CCGS Amundsen. A rock dredge (7 mm mesh net) was deployed to sample megafauna, while a box-core was used to sample sediment (i.e. organic matter, grain size) and macrofauna, and a drop camera system was used to video survey the study areas. Ten stations were surveyed in two parallel transect lines (ISECOLD-1: southernmost, and ISECOLD-2: northernmost) ~140 km apart, between Nain and Saglek Banks, at depth intervals of 500, 1000, 1500, 2000, and 2500 m. Another seven stations north of Saglek Bank were surveyed, encompassing depths ranging between 550-1830 m. Rock dredge and box-core samples were sieved aboard through a 2 mm and a 0.5 mm mesh, respectively. Species identification is still ongoing for most groups, but preliminary analysis of the dredge samples indicates that megafauna diversity at ISECOLD-2 and other northern stations was generally higher compared to ISECOLD-1. For instance, ten coral species were recovered in ISECOLD-2, versus only two in ISECOLD-1. However, video data from ISECOLD-1 indicates the presence of corals not recovered in the dredge. In terms of depth gradients, the preliminary dredge data indicate a decrease in species morphotypes with depth in ISECOLD-2, but a more unclear pattern at ISECOLD-1. This might indicate a potential for these communities to vary along both latitudinal and depth gradients, but further analyses are needed. Among the deep-water stations previously unsampled in the region, highlights include the presence of two species of stalked crinoids, which were only collected at stations >1800 m, the bamboo coral Acanella arbuscula sampled at two stations (1800 m and 2200 m), and the deep-water sea pen Protoptilum sp. (2200 m), rarely recovered in DFO scientific trawl surveys. Fish diversity based on the dredge was generally low, with a Grenadier (Family Macroudidae) and a Rockling (Family Lotidae) found at 500 m and 1800 m, respectively. Other fish include the Lanternfish Benthosema glaciale and bristlemouths (Gomostomatidae), which might have been recovered during the dredge's ascent and/or descent, rather than on bottom. Video data corroborate the presence of taxa sampled by the dredge, but also include taxa not sampled, such as black corals (Antipatharia), Asconema sp. sponges, crabs, and certain fish (e.g. skates, Blue Hake, Eelpout, Redfish), highlighting the complementarity of the two gear types for benthic surveys. Next steps include species identification at lower taxonomic levels, infauna species identification, analyses of sediment properties, and of drop camera video data. This combined dataset will allow for a more comprehensive assessment of the benthic diversity in the deep Labrador Sea, and therefore an improved interpretation of potential latitudinal, bathymetric, and environmental effects on the benthos.

IMPACT OF FRESHWATER ON THE COUPLED PELAGIC-SYMPAGIC HUDSON BAY BIOGEOCHEMICAL CYCLE

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There are many sources of freshwater input into the Arctic: river runoff, glacial melt and sea-ice melt. Freshwater input from rivers impacts the stratification of the upper water column and nutrient supply to the coastal waters. Rivers can be a large source of nutrients to the coastal ecosystems that they drain into by transporting entrained nutrients from the land to the ocean. However, runoff may also increase the stratification and dilution of the surface waters reducing the ability of nutrients from deeper layers to up well. Salinity also has an impact on the seawater freezing point and therefore on freezing and melting of sea-ice. All of these factors impact our understanding on how the nutrient supply and stratification will impact primary production. For the Arctic system the fundamental research question is how do the fresh water sources and their entrained nutrients impact the phytoplankton blooms in this system? The Hudson Bay Complex (HBC) is a subarctic system that experiences high levels of freshwater input, with over 65 rivers discharging into the bay and experiencing seasonal ice formation and melt, with high interannual variability of

environmental conditions. Understanding the amount of primary production that occurs within the sympagic (ice associated) and pelagic (oceanic) ecosystems is key to understanding the base of the food web of the system and how river runoff will impact higher trophic levels. It is particularly challenging to observe the Arctic and data collection is challenging due the difficulty of access to study sites for year-round observations. Numerical models can help to close these data gaps and provide a method to assess the Arctic and HBC. The BioGeoChemical Ice Incorporated Model (BiGCIIM) representing the carbon and nitrogen cycles within the pelagic and sympagic ecosystems has been coupled to the Arctic Northern Hemisphere Atlantic (ANHA4) configuration of the ocean circulation model NEMO v3.6 and the sea-ice model LIM2. The model will be used to try and simulate how the HBC primary production sources interact and the fate of the pelagic and sympagic primary producers and to quantify the relative contributions to the nutrient supply of the blooms.

MAPPING WILDLIFE HABITATS FOR CONSERVATION AND MANAGEMENT: A CASE STUDY AT CFS ALERT

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Managing species at risk and their critical habitats is challenging in situations where information is scarce, such as is often the case in the Arctic. Remote sensing provides a lot of information simply by the acquisition of images of the surface of the Earth. Recently, the increased efficiency of airborne and satellite sensors has facilitated the observation of precise biophysical attributes over large regions or in areas that were previously difficult to access. Here we present a multi-step process, based on satellite image analysis, that was used to create a map of polar desert vegetation at Canadian Forces Station Alert (82°30'N, 62°20'W), where we are working toward a Biodiversity Management Plan of the National Defence property. We combined plant field sampling, remote sensing and digital image analysis to distinguish vegetation-based habitat categories that we classified in broad physiognomic types: xeric habitats, mesic habitats, and wetlands. This vegetation map will be the most critical tool to develop our management plan. It will first serve as a background for wildlife habitat mapping. Then, identifying critical wildlife habitats will help target and prioritize research and management needed to protect species at risk. In the long-term, this map will provide a baseline for identifying and tracking environmental change and monitoring human-induced changes to the environment.

COMPOSITION AND RELATIVE ABUNDANCE OF FISH BYCATCH WITHIN OFFSHORE FISHERIES IN THE EASTERN CANADIAN ARCTIC

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Incidental capture of non-targeted species (bycatch) is a critical global issue for ocean conservation and fisheries management. The Baffin (Qikiqtaaluk) region in the Eastern Canadian Arctic supports some of the nation's most lucrative commercial fisheries, including large-scale fisheries for Greenland halibut and Northern shrimp, with some fisheries currently seeking sustainable fishing certifications. Both fisheries encounter a variety of bycatch species, including several deep-sea fishes with life history traits considered high-risk for overfishing. We present a preliminary analysis of bycatch species composition and relative abundance across gear types (bottom trawl, longline, gillnet) based on at-sea observer data collected onboard Greenland halibut and Northern shrimp fishing vessels operating in NAFO Division 0 from 2000-2017. Corrections to abundance data based on variable observer coverage were applied to explore the total cumulative bycatch numbers. Over 160 fish taxa were reported by at-sea observers, with the most common species across all gear types including Greenland halibut (Reinhardtius hippoglossoides), Greenland shark (Somniosus microcephalus), redfishes (Sebastes spp.), wolffishes (Anarhichas spp.), skates (Rajiidae spp.), Arctic cod (Boreogadus saida), and grenadiers (Macrouridae spp.). Of particular concern are Greenland sharks and skates, as these intrinsically vulnerable elasmobranchs are often encountered in all gear types used throughout the region. We also explore issues related to species identification by at-sea observers in Arctic waters, and present an overview of bycatch mitigation strategies and draw focus to current data limitations and avenues for future research. As changing sea ice in this region increases accessibility for shipping, tourism, and industry, fishing effort is also expected to rise, stressing the need for reliable and

rigorous bycatch assessments in emerging and existing Arctic fisheries.

OBSERVATIONAL STUDY ON THE REFREEZING OF SNOW MELTWATER WITHIN SUB-ARCTIC SEA ICE

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The refreezing of snow meltwater within the interstices of Arctic sea ice is believed to have an important control on the development of surface melt ponds in late spring and summer. However, only a few studies have investigated the development of this interposed ice preceding melt pond formation. Here, we present measurements of temperature, salinity and oxygen isotope ratio of sea ice that were sampled in conjunction with surface radiative energy balance observations during the early melt season in 2019 near the community of Sanikiluaq, Nunavut, in the sub-Arctic Hudson Bay. Based on the change in oxygen isotope ratio over the observational period, we found that interposed ice originating as snow meltwater replaced up to 40% of the pre-melt sea ice in the upper 10 cm of the ice cover. This was forced by the melt-freeze cycling associated with diurnal and synoptic-scale weather variability. The key of vertical percolation of snowmelt and interposed ice formation was the prolonged longwave induced warm up period combined with the latent heat released by the refreezing of the upper surface of melt ponds.

GEOPHYSICAL CHARACTERIZATION AND TEMPORAL COMPARISON OF DISCONTINUOUS PERMAFROST TERRAIN AT SCOTTY CREEK, NORTHWEST TERRITORIES.

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Canada's subarctic is experiencing significant land-cover transformations as a result of a warming climate. Permafrost thaw-induced land cover change in the sporadic discontinuous permafrost zone has driven changes to the hydraulic response of basins in this region. This study improves the understanding of the rates and patterns of permafrost change in this region and how such changes are transforming land covers. It has been well-documented that shifting land-cover and thaw rates are connected, however, it is unclear why these landscape wide changes occur at different rates. To better understand these changes, an isolated permafrost body was selected and intensively studied at Scotty Creek Research Station, Northwest Territories. This permafrost feature was last surveyed using geophysical methods in 2010 and is bounded by four unique terrain features, including a linear disturbance, a fen, a lake, and a bog. This research aims to: (1) Investigate how the permafrost body has changed since 2010; (2) Quantify the present size of the permafrost body; (3) Define its morphology, and (4) Compare the relative influence of the adjacent features on the changes this permafrost body has undergone over the last decade. To obtain a spatial understanding, remotely sensed images acquired between 1970 and 2019 were examined to map changes in land cover over time (Objective 1 & 2). This was complemented by ground-based measurements, including electrical resistivity tomography transects, active layer and talik measurements, near-surface soil moisture and temperature, all collected between March-September 2019 (Objective 3 &4). Results from remotely sensed imagery and geophysical surveys show the spatial extent of the permafrost body has receded both laterally and vertically with the majority of degradation located adjacent to the fen. This study provides valuable temporal and spatial understandings of how permafrost features within the discontinuous zone are changing; and offers imperative information to better predict the future trajectory of sporadic-discontinuous permafrost under a changing climate.

"THE SPIRIT OF THE NORTH:" CRUISE TOURISM IN THE CANADIAN HIGH ARCTIC AND ITS ENTANGLEMENTS WITH INDIGENEITY AND SETTLER COLONIAL PRAXIS

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My primary research question explores notions and practices of settler colonialism and the spaces and

praxis of decoloniality expressed through the mutually interdependent engagements of cruise ship tourism and Indigeneity in the Canadian High Arctic. Through a multi-method ethnographic study in Pond Inlet, Nunavut, Canada, my research aims to unpack the complexities of dwelling and place attachment in the Canadian High Arctic and its entanglements with the travel phenomenon of last chance tourism. The conceptual framework of my prospectus adopts a circular connection of decolonial theory, Ingold's dwelling perspective, and place attachment. Rooted in the notion of "uggianaqtuq," an Inuktitut word that refers to a friend behaving strangely, often used to describe the changes that Inuit are seeing and experiencing in their environment; my conceptual framework aims to highlight the dynamism and constant movement of the changing climate in the Arctic, the fluidity of Indigenous identity, and the deeply embedded settler colonial mentalities that shape Arctic travel. Crucial to understanding the theoretical framework is viewing it as a living entity in constant movement situated within the larger forces of settler colonialism. Positioned within an Indigenous research paradigm, my methodological approach is informed by a circular inseparability of ontology, epistemology, axiology, and methodology (Diab and Wilson 2008) and rooted in decolonial praxis and the recognition of the pervasiveness of colonial influence on Indigenous representation and voices in research (Smith 2012). Walking interviews will be the main method of data collection due to the ability to capture the embodied emotions and connections of person and place (Evans and Jones 2011). Additionally, my research will collect and use visual materials such as photographs, artwork, and craftwork to engage in discussions about place attachment and how and/or if cruise tourism transforms those bonds. My research aims to contribute to theoretical understandings of decolonial praxis and ways of knowing that further integrate Indigenous perspectives of the changing environment. Through capturing empirical forms of collaboration and resistance manifested through last chance tourism and cruise tourism in the Canadian High Arctic, it is my intention to reveal spaces of decolonial praxis while questioning how tourism influences peoples attachment to landscapes. Lastly, my research intends to contribute to larger conversations about Indigenous and non-Indigenous collaboration in contested spaces.

AVIAN BIODIVERSITY IN THE ARCTIC TUNDRA: WHAT IS THE ROLE OF PREDATION RISK?

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Every summer, millions of birds nest in the arctic tundra, but species abundance and distribution are highly heterogeneous. We expect that predation risk is one of the main mechanisms explaining this heterogeneity. Prey abundance and distribution can modulate predation risk through predator response, but landscape features can also modulate this risk and provide prey refuges (e.g. islands, cliffs, etc.). While some species can adapt to choose low risk habitat (refuges) to avoid predation, others fail to detect risk cues and can experience greater predation. Bylot island (NU) long term monitoring program represents a perfect opportunity to test the impact of predation risk variation on various prey species. In this system, Arctic fox is the main generalist predator, relying primarily on lemmings and snow goose eggs, but opportunistically consuming nests from almost all bird species. Predation risk is known to change in time and space following Arctic fox main preys' distribution and abundance. It decreases with lemming density and with distance to goose colony. To understand the importance this predation risk landscape on avian biodiversity, we tested the influence of distance to snow goose colony and lemming density on seabird, waterfowl, shorebird and passerine and raptor species occurrence in nesting territories and biodiversity transects. We did not find any evidence that distance to colony and lemming density affects occurrence of species that nest in refuges. However, we found evidence that distance to goose colony and lemming density positively affect probability of occurrence for two species nesting in riskier habitat. Species nesting

in refuges seem to experience less predation than species using riskier habitat. This finding reflects the potential role of landscape of predation risk on species distribution and abundance in the arctic tundra.

ESSENTIAL FATTY ACIDS IN A MULTIYEAR ICE ECOSYSTEM NEAR ALERT, NU.

Duerksen, Steve (1) (Presenter), Doreen Kohlbach (1), Anke Reppchen (1), Pascal Tremblay (1), Benjamin Lange (1), Joannie Charette (1), Ron ten Boer (2), Jana Hildebrand (2), Philipp Anhaus (2), Christian Katlein (2), Hauke Flores (2), Pierre Coupel (1), Karley Campbell (3), Christine Michel (1)

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Essential fatty acids (EFA) are critical for the survival and development of arctic marine zooplankton. They are utilized by copepods in the spring to help produce viable offspring, and are necessary for more mature copepods to successfully enter diapause. EFA are also very important for proper neurological development in fish. Old, multiyear sea ice (MYI) extent is rapidly decreasing, and little is understood about what effects its loss will have on the essential fatty acid supply of marine food webs. We investigated the essential fatty acid content in primary producers found in surface water, MYI and first year ice (FYI), as well as in sympagic and pelagic zooplankton during the 2018 Multidisciplinary Arctic Program Last Ice field season in the Lincoln Sea. We also investigated both stable and compound specific isotopes to help determine the food web structure. Surface water had lower proportions of EFA than both FYI and MYI. EFA levels were somewhat elevated in FYI compared to MYI, and could be indicative of more advanced algal growth. Ice associated amphipods Apherusa glacialis and Gammarus wilkitzkii generally had lower proportions of total EFA, and much lower levels of 22:6n-3, compared to pelagic zooplankton. Ctenophore fatty acid signatures had the highest proportion of 22:6n-3 but were extremely variable. Our results provide insight into the energetic contribution of multiyear sea ice to Arctic marine food webs during the spring, and will be critical in determining what the effects of continued ice loss could mean for these systems.

MODELLING BENTHIC COMMUNITIES IN THE KITIKMEOT SEA REGION, CANADIAN ARCHIPELAGO

Dumais, Philippe-Olivier (1) (Presenter); De Montety, Laure (1) ; Treau de Coeli, Lisa (1) ; Bluhm, Bodil (2) ; Archambault, Philippe (1)

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In the Arctic, sea ice loss has already transformed the dominant sources and periodicity of primary production in some areas, raising concerns over impacts of climate change on benthic communities. Benthic invertebrates play important roles in nutrient cycling, sediment oxygenation and decomposition and are very good indicators of changes. Nevertheless, the Canadian Archipelago megafauna is poorly studied compared to others in the Arctic region. This project aims to evaluate benthic diversity based on significant environmental drivers and then develop spatial predictive explanatory models of benthic communities to expand coverage between sampled stations across the Kitikmeot sea region and Parry Channel. Results from previously collected samples in that area propose that diversity is higher in that area compared to Beaufort and Baffin Seas, the two adjacent regions on the West and East respectively. That leads to the main hypothesis that (1) Kitikmeot sea region is an ecotone between the Beaufort Sea and the Baffin Sea. Other hypotheses are that (2) spatial distribution and community composition of benthic fauna differ spatially following a West-East gradient and that (3) Pacific Ocean water influence through the Canadian Archipelago can explain part of this gradient. To address these hypotheses, macrofaunal samples (infauna and epifauna) and environmental data were collected annually during summer from 2007 to 2019 and around Kitikmeot area (from Queen-Maud Gulf to Lancaster Sound). Hence Hierarchical Modelling of Species Communities (HMSC) will be performed to evaluate how communities react to environmental variations. Then, HMSC results and satellite imagery of environmental drivers (e.g. salinity, temperature, dissolved oxygen, etc...) are combined to develop spatial distribution models. Such models can be useful to target potential biodiversity hotspots and as baseline for eventual marine spatial planning purposes.

AERIAL OBSERVATIONS OF SEA ICE BREAK UP BY SHIP-INDUCED WAVES

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With the recent global warming, Arctic sea ice has seen both its extent and thickness decrease. A reduction in sea ice extent means more open water area and thus more fetch for wave generation. By creating conditions where more energetic waves can be generated, global warming thereby create room for stronger interactions between waves and sea ice. The marginal ice zone (MIZ), defined as the area of the sea ice cover impacted by waves, seems to play an increasingly important role in the evolution of the Arctic climate and needs to be better observed and modeled. Wave-induced ice break-up is certainly one of the most striking process that happens in the MIZ, but also one of the most difficult to observe in natural waters. In order to better understand this physical process, we carried two experiments where a drone was used to record the breakup of a large ice floe induced by waves generated by the CCGS Amundsen. The first experiment was held in the Gulf of St. Lawrence in February 2019 and in Kane Basin in August 2019. High temporal and spatial resolution footage were obtained, thus allowing an in depth study of the evolution of morphological properties of sea ice and of the timescales over which the breakup happens. Using photogrammetric methods, we extracted detailed information about the size, shape and orientation of ice floes resulting from the breakup. More precisely, the floe angle distribution displays an extremum at the wave's angle and the floe size distribution exhibits a mode at a size close to Mellor's criterion, which contradicts the break-up criterion based on the wavelength that is used in models. How this unique dataset help us understand the underlying physical mechanisms responsible for wave-induced ice break-up will be discussed.

THE RIGOLET INTERNET ASSESSMENT INITIATIVE: A COMMUNITY-BASED APPROACH TO QUANTIFYING THE CURRENT STATE OF TELECOMMUNICATIONS NETWORKS IN RIGOLET, NUNATSIAVUT

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The internet was once a niche technology reserved solely for military, academics, and research elites. Today it has become a general-purpose technology, without which, many aspects of modern society could not function. Digital systems which are often reliant on the Internet and other Information and Communication Technologies are significant catalysts in the accelerated innovation, healthcare, and economic and cultural development of a given community. With this in mind, it's no surprise that 84% of Canadians believe that access to high-speed internet is of importance to their livelihoods, and that the Canadian Radio-Television and Telecommunications Commission (CRTC) declared access to broadband internet of 50 Megabits per second (Mbps) download speed and 10 Mbps upload speed a fundamental human right. The CRTC has even publicly asserted that connecting communities via the Internet can provide many opportunities, particularly for more remote communities. Despite these claims, access to stable broadband internet is still variable for Canadian citizens, with approximately 14% without any access. This disparity between individuals with ready access to computers and telecommunication networks and those without is known as The Digital Divide. Unfortunately, there is a lack of publicly available data on the distribution of the divide, to say with certainty which regions, communities, and households are affected. However, it's clear that remote, Northern communities are largely affected due to sporadic internet connections, increased difficulty in erecting infrastructures, and scarce incentives and competition for Internet Service Providers. The remote community of Rigolet, Nunatsiavut, is one of many Inuit communities where residents are subject to inconsistent and slow internet connectivity. This in turn affects their ability to introduce new innovations, tools and services to the community that might require a stable network with viable speeds. The purpose of this research initiative is to collect and analyze data which will evaluate the quality of telecommunications in Rigolet, and which might also inform the development of alternative telecommunication networks in the community. Ten monitoring devices have been deployed into the households of community volunteers and have been collecting 72 datapoints daily relating to upload speed, download speed and round-trip delay time. Data has been collected and is being analyzed to answer questions such as; Does the average internet speed in the community match what is being reported by their local ISP? How stable is the local network? Does it increase or decrease based on time of day, week or season?

How does location within the community affect accessible internet speeds? Do environmental variables such as temperature, precipitation or wind affect broadband speeds? Ultimately, this research is a direct response to the need for stronger rural, community-based internet assessment initiatives in Canada, and the need for a stronger understanding of the state of internet accessibility in Rigolet, Nunatsiavut. It explores the design and development of the Rigolet Internet Assessment Initiative thus far, as well as what we've learned from our methods, our research results and recommendations for future community-based internet monitoring initiatives.

POST-FIRE SHRUB GROWTH IN HARVESTED BURNT WOODS OF COASTAL NUNATSIAVUT (LABRADOR)

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In the boreal forest, fire is the main natural disturbance driving ecosystem dynamics. This is especially true in the northern Labrador coastal forests, where other large disturbances such as insect outbreaks and forestry have a relatively minor importance. As ongoing climate change is expected to increase fire frequency, understanding how vegetation, including understory plants like shrubs, change after fire is crucial to predict the future of coastal environments, and local Inuit communities. This study examined the impact of forest fires on shrubs through Inuit knowledge interviews and ecological surveys at the sites of three recent fires near the communities of Nain (Webb Bay, Tikkoatokak Bay) and Postville (near Beaver River). The fires were 14-23 years-old and lightning generated. Community consultations were held in Nain and Postville prior to the beginning of the study. Semi-structured interviews were conducted to document Inuit knowledge and land use related to fires. These were followed by focus groups to discuss and corroborate preliminary analyses. Vegetation cover and maximum shrub height were assessed on 1mX1m plots along 40-80 m transects, extending from burned into unburned forest. Soil temperature and moisture, and organic layer depth were recorded in each plot. Locally dominant shrub species selected for dendrochronological analysis included tea-leaf willow (Salix planifolia), balsam willow (S. pyrifolia), grayleaf willow (S. glauca), dwarf birch (Betula glandulosa) and Labrador tea (Rhododendron groenlandicum). Samples were collected at ground level, above the root collar. The majority of shrub species were associated with burns, with Labrador tea the dominant species. Other species increasing post-fire included most berry-producing shrubs (such as blueberries and redberries - Vaccinium spp.) as well as dwarf birch, balsam willow and grayleaf willow. Alders (Alnus sp.), however, were mostly associated with the unburned forest. Post-fire recovery was, for some species, inconsistent across sites or locations. For example, blackberry (Emptrum nigrum) could be plentiful on burned shorelines, while negatively affected elsewhere in the burns. Soil temperature and organic layer depth significantly affected shrub communities in burns. Analyses of shrubs post-fire resprouting and growth patterns are still ongoing. Survey results and Inuit knowledge were often complementary in temporal and spatial scales. Overall, most fire-induced changes in vegetation, such as the abundance of Labrador tea and willows, were characteristic of circumboreal post-fire communities, but they were more persistent in the landscape. This has implications for the environment and the people relying on forest resources, such as potential long-term variations in berry availability or indirect impacts on game abundance in a changing fire regime.

UNDERSTANDING AND RESPONDING TO CHANGING WEATHER AND SEA ICE CONDITIONS IN NORTHERN COMMUNITIES

Eerkes-Medrano, Laura (1), Atkinson, David, (2) Tivy Adrienne (3), Hoeberechts Maia (4). Oversight Committee members and participants in the communities.

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Indigenous people in northern communities depend for their subsistence on food from the land. This means, constant travelling on the land and ice to reach hunting sites. Changes in weather and sea ice are making travel more dangerous as sea ice is freezing up later and breaking up earlier. The University of Victoria is partnering with the Canadian Ice Service and Ocean Networks Canada to work with residents from Ulukhaktok, Tuktoyaktuk and Sachs Harbour in the Inuvialuit region and in Gjoa Haven, Kugluktuk and Cambridge Bay in the Kitikmeot Region, to collaborate on a research project that aims to 1) identify inter-and intra regional similarities and differences to changes in sea ice and weather conditions based on

geographic location, sociocultural differences, and time of year when residents practice subsistence activities 2) identify how the users in these communities would benefit from additional/different format information from the Canadian Ice Services and the recommendations for CIS to modify products and 3) assess how having better CIS information could serve communities in their planning of activities e.g. how does it help people in general in their daily lives and as a community in general? Does having better information improve their ability to adapt to changing weather and sea ice conditions? what additional information would still be useful for them to have and in what format?

THE HYDROLOGICAL IMPACTS OF SEISMIC LINES ON PEATLAND IN A ZONE OF DISCONTINUOUS PERMAFROST

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Seismic lines, used for oil and gas exploration, are prevalent throughout the southern Northwest Territories. These linear disturbances are known to affect the hydrology of the discontinuous permafrost landscape, creating water drainage routes and preferential permafrost thaw. However, the impact of these features on the hydrology of individual bogs remains poorly understood. Therefore, this study examines the influence of a seismic line established in 1985, in the Scotty Creek watershed, Northwest Territories, Canada on three adjacent bogs of varying connection (connected, semi-connected, isolated) to the line. It can be difficult to identify connected bogs remotely due to tree coverage and subsurface connections. Bogs that appear to not be connected on the surface may have subsurface flow paths that form through the active layer and/or talik. These subsurface flow paths can evolve develop into surface channels as the ground surface subsides due to permafrost loss. As more bogs become hydrologically connected to the seismic line the remaining (hydrologically disconnected) portion of the land cover has less capacity to store water. Preferential permafrost thaw along and adjacent to seismic lines have transformed landscapes in the peatland dominated, discontinuous permafrost zone by reducing its ability to store water and increasing the proportion of hydrological inputs that contribute to runoff entering seismic lines from the adjacent terrain. It is hypothesized that this increased contribution of runoff is of two types: 1) transient runoff arising from the partial drainage of adjacent wetlands that develop hydrological connections with the seismic line, and 2) permanent connections that result from the expansion of the areas contributing runoff to the seismic line. This study found that when a bog is connected partially or fully the thawing of its active layer is delayed further into the season. So the bog remains impermeable to water runoff in the spring for an extended period of time.

STRATIFICATION IN HUDSON BAY DURING THE SPRING SEASON: WHY SHOULD WE CARE?

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Hudson Bay is the largest inland continental shelf sea in the world. It receives nearly one-third of Canada's river discharge and transitions from complete ice cover in winter to open water in summer. As a result, Hudson Bay receives a substantial amount of seasonal freshwater that potentially will lead to strong stratification. Such stratification is likely to cause vertical CO2 concentration gradients across the top few meters of the ocean, where the surface water pCO2 could be significantly different from waters sampled by shipboard underway systems at several meters below the sea surface. Here, we report the first spring observations of the impact of sea-ice melt and river runoff on stratification and air-sea CO2 fluxes in Hudson Bay. We collected dissolved inorganic carbon, total alkalinity, salinity, and oxygen water isotope samples within the upper meters of the ocean. We observed a distinct shallow stratified layer within the upper 2m of the ocean when close to the ice edge and coastal domain, signifying the high impact of sea-ice meltwater and river runoff in diluting the surface pCO2. We calculated an error of 30% in the sea-air CO2 fluxes based on the underway pCO2 system measurements, suggesting the influence of stratification on air-sea CO2 fluxes estimated by the shipboard underway pCO2 systems can no longer be ignored. However, we found a correction method that we can use to align the underway pCO2 measurements to the surface conditions and calculating the CO2 fluxes in a reliable way. A study of Hudson Bay during the spring-

ice melt-season may not only provide a good assessment about the impacts of stratification on CO2 fluxes, but also an insight into the expected widespread role of freshwater inputs to the Arctic.

ESTABLISHING AN IN VITRO COLLECTION OF NUNAVUT PLANTS FOR UNDERSTANDING OF PLANT CLIMATE CHANGE RESILIENCY

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Canada's climate is warming at twice the global rate. As the climate of Canada, and the climate of Inuit Nunangat warm, this will lead to significant changes in local ecosystems, including plant communities. Plants in this region are adapted to survive in one of the world's harshest environments and experience: limited water, short growing seasons, near to full 24 h light during these growing seasons and low temperatures, making these plants a unique and valuable subset of global biodiversity. In August 2019, we travelled to Resolute and Iqaluit, NU where we worked with Inuit guides to locate and collect a subset of local plant populations, and to identify plants species and priorities for further investigation. This survey included the collection of 83 Herbarium vouchers, 74 seed samples and 65 live tissue collections, which spanned more than 40 species, and 9 families. Several of these collections (e.g. Dryas, Saxifraga and Salix spp.) were identified as undergoing noticeable changes of interest to local communities. These collections serve an immediate conservation mandate as we will be submitting both seeds and vouchers to seedbanks and herbaria in Canada and globally. Additionally, we were able to identify several areas of unique change and composition in consultation with our local guide, which we will continue to work together to monitor on an ongoing basis. Plant adaptations to climate change require endogenous systems to perceive environmental changes and respond by redirecting growth, detoxifying stress metabolites and stabilizing physiological processes. We are currently working to establish an in vitro living germplasm collection of this collection which will allow us to investigate the mechanisms underlying some of the physiological phenomena which were identified as priorities by our Inuit collaborators. As we establish protocols for growth of these species, these germplasm and seed collections will be accessible to local communities for use in cultural and conservation projects. We also hope this collection will serve as a basis for fundamental science research to help understanding the mechanisms which determine climate change resiliency in plants.

SPATIAL AND TEMPORAL VARIATIONS IN MERCURY CONCENTRATIONS IN EDIBLE FISH IN THE NORTHWEST TERRITORIES; AN UPDATED ASSESSMENT

Evans, Marlene (1), Presenter, Derek Muir (2), Rosy Bjornson (3), Ray Griffith (4), George Low (5), Michael Low (5), Xinhua Zhu (6), Heidi Swanson (7), Daryl McGoldrick (8), Sean Backus (8), Jonathan Keating(1), and Xiaowa Wang (2)

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In the mid-1990s, researchers observed that mercury concentrations in predatory fish in several, remote lakes in the Northwest Territories exceeded commercial sale guidelines (>0.5 μg/g). This was confirmed by a series of studies conducted in lakes in the Sahtu and Deh Cho regions of the Mackenzie River Basin over 1996-2000 and the synthesis of the historical and largely unpublished record of mercury concentrations in fish. Since the late 1990s, the Northern Contaminant Program (NCP) has supported annual mercury trend monitoring of burbot at Fort Good Hope (Mackenzie River) and lake trout and burbot at Great Slave Lake and periodic mercury assessments at other lakes. Mercury concentrations in fish also have been measured as part of other programs including at Great Bear Lake and environmental impact assessment studies around mining and hydroelectric developments. These more recent data, in combination with older data, are forming the basis of an updated assessment of mercury in fish in the Northwest Territories.

Fish from more than 120 lakes, 17 rivers and two deltas have been investigated over 1971-2018 with the vast majority of sampling effort focussed on lakes. Lake whitefish, lake trout, northern pike and walleye have been the most commonly monitored species with average mercury concentrations approaching 0.5 μg/g; consumption advice for these fish populations has been issued by the Government of the Northwest Territories for several of the newer studies. Arctic char have been investigated as part of some stock assessment studies and typically have concentrations <0.1 μg/g. Suckers and lake whitefish have been less commonly monitored, most likely because of their low mercury concentrations; burbot (a benthic sedentary fish) and lake cisco (a smaller forage fish) also are not as commonly measured for mercury. Mercury concentrations increase with fish age, length, and predatory feeding but relationships differ between lakes and with time. Higher mercury concentrations tend to be associated with fish in smaller, shallower lakes and lakes with older fish populations. Most lakes have been sampled less than 5 times limiting the statistical ability to detect trends with small sample sizes (generally <10) in early studies further reducing statistical sensitivity. Age, an important predictor of fish mercury concentration, was not measured in most early studies. The best records for mercury trend assessments come from the NCP mercury trend monitoring programs and from periodic assessments at small lakes in the Deh Cho which have been commercially fished. These studies are showing that mercury concentrations are exhibiting a general trend of increase. A systematic program of periodic assessment of mercury concentrations in smaller to medium size lakes which are accessible to communities or important in sports fisheries may be timely and could be modelled on provincial programs. Such a program would complement NCP's and Environment Canada and Climate Change's trend monitoring at Great Slave Lake, Great Bear Lake, and Fort Good Hope.

THE ST. LAWRENCE ESTUARY'S SUSPENDED MATTER SIZE AND COMPOSITION IN WINTER

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The St. Lawrence Estuary in eastern Canada is a large coastal ecosystem of about 10,850 km2 that is affected by the presence of sea ice in winter. The suspended particulate matter (SPM) dynamics in this estuary are strongly influenced by winds, tides, river runoff, and coastal jets. One of the SPM properties is the particle size distribution (PSD) which may affect sinking rates, particle re-suspension and the distribution of pollutants. Although several studies have been done concerning the composition and the dynamic of the SPM in the St. Lawrence Estuary during the summer season, little is known for the winter months. In this context, this study will focus on the size and composition of SPMs collected along the estuary in winter 2019 during the Odyssée Saint-Laurent expedition aboard the CCGS Amundsen. Measurements of particles' size were made on discrete water samples using a LISST-100X together with measurements of the SPM and Chl-a concentrations. Combined with knowledge of the chemical and mineralogical composition of the SPM, the particles' dynamic and detrital sources will be documented for the winter of 2019 in the St. Lawrence Estuary. Preliminary results show that the upper estuary is characterized by relatively smaller size particles while the lower estuary is characterized by larger particle sizes in winter. Comparisons will be made with summer data from both the St. Lawrence and Hudson Bay to provide valuable information on suspended matter dynamics in sub-arctic environments.

BEARWATCH: MONITORING CLIMATE CHANGE IMPACTS ON POLAR BEARS USING GENOMICS AND INUIT KNOWLEDGE

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BEARWATCH is a multi-institutional collaborative research project focused on monitoring impacts of climate change on polar bear using genomics and Inuit knowledge in Nunavut and the Inuvialuit Settlement Region (ISR). A goal of BEARWATCH is to develop a non-invasive

biomarker toolkit for community-based monitoring that combines leading edge genomics with Inuit traditional ecological knowledge (TEK). This poster focuses on the community-based monitoring and TEK aspects of the project in the ISR. The research directly responds to recommended actions outlined in the Framework for Action for Management of Polar bears in the Inuvialuit Settlement Region, 2017. Specific objectives are: (1) document and describe the evolution of polar bear co-management in the ISR; (2) identify additional opportunities for Inuit TEK to inform monitoring and co-management; (3) review and critique current monitoring techniques for polar bear based on scientific, cultural, economic, management and ethical criteria; and (4) communicate information about genomics as a tool for non-invasive monitoring with communities in the ISR. The research will be conducted together with Inuvialuit, activities will be overseen by the Inuvialuit Game Council and results will be communicated with communities and co-managers in the ISR. The results are intended to enhance existing management of polar bears in the ISR in ways that better meet the needs and aspirations of Inuvialuit.

EMPOWERING SOCIALLY RESPONSIBLE AND ENVIRONMENTALLY SUSTAINABLE ECONOMIC DEVELOPMENT WITH A GIS FOR SUPPORTING MINERAL STRATEGY DEVELOPMENT (MSGIS)

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Mineral and resource development activities have and will continue to contribute to the development and growth of the economy of the Northwest Territories (NWT). In the projected future, Canada's territories are anticipated to have a substantial uptick in their economic growth due to investments in the mining industry. However, the NWT is struggling to keep up with the other Territories in this growth. This is due, in part, to the complex tiers of governance over land in the NWT. As outlined in the NWT Mineral Development Strategy (2013), the Government of the Northwest Territories affirms that with devolution NWT residents have inherited new control of the mineral industry. Increased clarity with land ownership and access should additionally allow achievements in growth in the medium-long term. However, the regulatory framework needed to support this heightened involvement in the management of NWT's natural resources continues to be developed and refined. For this strategy to work NWT communities will require tools and support systems to assist them in making more informed decisions on natural resource planning and development. Currently, a number of the Indigenous Communities of the North are asked to make crucial decisions based primarily on the information provided to them by the applicants/persons requesting them. This project, the GIS for Supporting Mineral Strategy Development (MSGIS), provides the decision-makers of these communities with vital independent information to support decision making concerning the development, implementation, and maintenance of mineral strategies. The MSGIS is a visual and interactive online tool which integrates GEM data on topography, geology, and permafrost with other culturally and environmentally significant datasets, as identified through stakeholder feedback. Since 2008, Natural Resources Canada's Geo-mapping for Energy and Mineral (GEM) program has aimed to modernize the geological picture of the North, and in doing so has produced more than 1000 maps and reports. By incorporating these geoscience data with culturally significant data (e.g., hunting areas, sacred and historic sites, animal migration paths, and birthing/calving areas) the MSGIS will support informed decision making through synthesizing data for general use in an observable manner. The MSGIS has built-in analysis capabilities which illustrate cumulative impacts on the land and environment. The querying, buffering, and overlay analysis tools aid in identifying critical areas for targeted development or conservation. The visualization tools facilitate the presentation of results in the form of maps, charts, and other visual aids that assist in effective information dissemination. Unique to the MSGIS is the creation of a Western Arctic specific high resolution, compressed basemap that fostered efficient functionality of the tool in areas of low internet connectivity. These capabilities will be utilized by regional governing groups such as Game Councils, Co-Management Boards, and Environmental Impact Review Boards. Vitally, the MSGIS will as well directly empower individual citizens and communities to access and interact with information in the first hand. This knowledge transfer and presentation will facilitate public engagement and building capacity, allowing for individuals to have an active voice in land and resource decision making.

MONITORING THE SOIL MICROBIOTIC COMMUNITIES OF FIVE DISTINCT TUNDRA HABITATS OF THE GREATER WAPUSK ECOSYSTEM IN THE HUDSON BAY LOWLANDS, MANITOBA, CANADA

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The permafrost active layer thickness (ALT) is expected to increase in Arctic regions as the climate warms and permafrost decays. Local factors such as vegetative cover and soil moisture may mediate the effects of rising temperature on ALT. Climate changes have necessitated a more in-depth look at ALT across the circumpolar Arctic as a way of monitoring the permafrost in these regions. While some predictive models relating ALT to surface level indicators do exist, there is a dearth of information on the characterization of soil microbiome in tundra habitats. Therefore the role soil bacteria may play in active modeling is unknown, particularly in areas likely to experience an increase in fires, and thus vegetative regeneration, such as Wapusk National Park in Manitoba, Canada. In this study, a selection of subarctic sites representing the five most common habitat types on the Hudson Bay coast were studied from 2014 to 2019. At each site, two parallel 50-m transects 10 meters apart were run and flags were placed at 2-m intervals. At each flag, ALT was measured twice using a steel probe, and categorical ground cover percentage estimates within 1 x 1m quadrat were recorded for all vegetation types. Also, at 2 randomly selected flags on each transect, more in-depth species-level percentages were recorded and soil microbial communities measured. Soil microbial 16S rRNA genes were amplified and sequenced using qPCR. Results indicate that tundra habitats are distinct in their composition of the five dominant groups of bacteria commonly researched: verrucomicrobia, bacteriodetes, actinobacteria, acidobacteria and alpha-proteobacteria. Additionally, the composition of each tundra habitat's microbiota is changing over time. Future research using next generation sequence analysis is needed to continue probing into the degree of change within each soil community. Digging deeper down the taxonomic tree to identify more specifically the structure and function of each group could provide more insight into the degree of vulnerability that exists for the disproportionately large carbon pool within arctic soils.

MARINE ECOSYSTEM SURVEYS IN THE PANGNIRTUNG REGION TO EXPLORE COMMUNITY-BASED FISHERIES OPTIONS AND CHARACTERIZE SPECIES AND HABITAT DISTRIBUTIONS.

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Increasingly, the expansion of fisheries in Canadian waters is regulated through scientific information and traditional knowledge of both the status of individual populations and an understanding of their roles and biological productivity within aquatic ecosystems. In Arctic marine waters, observe increases in accessibility to marine resources due to decreasing sea ice and expected large-scale redistribution of fisheries catch potential in response to forecasted future warming suggest the potential for increasing fisheries opportunities. Building upon the extensive Nunavut Coastal Resources Inventory for the Pangnirtung region, we developed a collaborative 10 day survey program aboard an inshore research vessel using whelk/shrimp pots, plankton sampling gear, and baited remote underwater video with the goals of: (1) consulting with Pangnirtung residents to identify priority survey areas and target species; (2) identifying potential resources for community-based fisheries, and expand the knowledge of species distributions and northern range limits for fishes and invertebrates by identifying the biomass of catch, including (but not necessarily limited to): Greenland halibut (Reinhardtius hippoglossoides), whelk, and shrimp, and; (3) collecting underwater video footage at the sea floor and near the surface in order to gain additional insight into marine species distributions and abundance, and bottom habitat characteristics. All three objectives were achieved in August 2019, yielding estimates of the distribution of shrimp, whelk, kelp, and Greenland sharks in the Cumberland Sound region. The catch rates of whelk are compared to those from southern fisheries and prior Nunavut fisheries ecosystem

surveys, while Greenland shark information is being used to calculate local abundances and characterize habitat features through non-extractive video methods. Data on the abundance and distribution of kelp among sampling depths was provided to ArcticNet project partners. These initial results illustrate the breadth and reach of fisheries ecosystem surveys to compliment and extend knowledge of nearshore fisheries resources in the Pangnirtung region.

DETECTING ICE ISLANDS USING POLARIMETRIC SAR IN THE CANADIAN ARCTIC

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Climate warming related calving of Arctic ice shelves and ice tongues over the past two decades has reduced their extent by ~1000 km2. These break-up events have created large tabular icebergs, known as ice islands, which can drift long distances over several years, occasionally calving smaller icebergs which pose a risk to marine traffic. While the Canadian Ice Service (CIS) tracks very large ice islands manually using RADARSAT-2 Synthetic Aperture Radar (SAR) imagery, often there is no easy way to distinguish them from other ice types. This is due, in part, to the unexplained variability in backscatter from ice islands in standard single- and dual-polarized imagery. This study uses several polarimetric SAR variables derived from Fine Quad-Polarization (FQ) RADARSAT-2 images to determine the optimal data to distinguish ice islands from their surroundings in SAR imagery. In this study, 43 individual SAR variables were computed for 14 unique ice islands in 213 FQ RADARSAT-2 scenes to evaluate which of them could best distinguish ice islands from backgrounds of first-year ice (FYI), multi-year ice (MYI), and open water. This study contains over double the number of ice islands, and close to triple the number of images as compared to our past studies on this topic. Ice islands were located within each SAR image using tracking beacon data collected between 2009 and 2017 and offer a variety of imaging geometries, geographical locations and times of year. All SAR variables were computed using SNAP software (European Space Agency). Initial results suggest that the Surface Scattering Band from the Cloude Decomposition is excellent at discerning water, FYI, and MYI from ice islands; however, there are instances where it is inherently difficult to differentiate ice islands and MYI. In these cases, the Lambda 1 or Lambda 2 bands from the H-A-Alpha quad-pol decomposition are quite useful in discerning ice islands and MYI. A drawback of these SAR variables is their apparent difficulty in differentiating water and FYI from ice islands. Further work on determining the most promising variables to delineate FYI, MYI, and water from ice islands is currently underway. Once fully tested, the most promising variables will be evaluated for inclusion in an automated ice island detection algorithm. This will be optimized for the Compact Polarimetry (CP) mode on Canada's newest satellites, the RADARSAT Constellation Mission (RCM). If successful, operational detection of ice islands will then leverage RCM's large swath width and high temporal resolution to efficiently track these navigational hazards.

A CASE STUDY OF POLAR BEAR CO-MANAGEMENT IN THE INUVIALUIT SETTLEMENT REGION

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Polar bears are a species of significance to Inuit culturally, spiritually, economically, and for subsistence. This makes including Inuit understandings of polar bear health under changing climatic conditions of great importance to the co-management of polar bears across the Canadian Arctic. In the Inuvialuit Settlement Region (ISR), Inuvialuit have outlined how they would like polar bear to be monitored and actions to ensure that Inuvialuit and their knowledge are included in polar bear co-management. Theirs is often considered a high-functioning co-management regime yet the documented experiences of Inuvialuit to date suggest persistent tension between Inuvialuit and scientific knowledge systems and consequently inconsistent inclusion of traditional

knowledge (TK) in decision-making processes. The aim of the proposed research is to examine how polar bear co-management is conducted in the ISR, with specific focus on the role and function of TK in decision-making, particularly around setting harvest quotas. Specific objectives include: (1) Functionally describing the current system of polar bear co-management in the ISR; (2) Reviewing the Inuvialuit and Nanuq: Polar Bear Traditional Knowledge Study and associated database to identify use for co-management; and (3) Identifying opportunities to make information from the study available to polar bear co-management partners. This research aligns with the ArcticNet Project "WM03 - Knowledge Mobilization for Wildlife Co-management in Inuit Nunangat".

WHAT ARE THEY EATING ALL AROUND THE ARCTIC? A CIRCUMPOLAR SCALE STUDY OF ARCTIC PREDATORS' DIET.

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Interspecific interactions within food webs affect the stability of populations and communities and potentially the species response to environmental changes. Adequate response of species to environmental changes can lie in how much their phenotype can be flexible. Yet we are limited in our ability to measure individual response translate into species interactions, such as predator-prey interactions. Prey switching is done seasonally by many predators and whether how much behavioral trait is plastic across scales is usually key to measure shift in species interactions. The goal of this study is to better understand how phenotypic plasticity is going to lead interactions strength by measuring prey switching plasticity in the predator's diet. We aggregated the published data quantifying the diet of arctic predators based on food remains (pellets and scats). This data synthesis synthesized 25 sites, spanning a circumpolar scale (Canada, Alaska, Greenland, Lapland, Alpin tundra and Iceland) and up to 70 years (1934 to 2015). The studied species include the most widespread and important arctic predators: the Rough-legged Hawk, the Snowy Owl, the Peregrine Falcon, the Gyrfalcon, the Long-tailed Skua, and the Arctic fox. The patterns of prey switching was relatively similar for non-lemming specialists across all sites irrespective of various species assemblages and abundance. Body-size was a potential driver for trophic interactions with the proportion of each prey type in the diet decreasing by about 25% as the predator/prey mass ratio increased by 2 orders of magnitude. This suggests that larger predators consumed preferentially smaller prey. Because this method is biased in favor of small prey in the diet, a study of the predator's diet with other methods (fatty acids, stable isotopes, bar-coding) is in progress to limit this bias. Furthermore, we started to study how predator-prey interactions strength may be modulated in the time depending on the behavioral traits.

THE PERMAFROST ARCHIVES SCIENCE (PACS) LABORATORY: AN INTERDISCIPLINARY RESEARCH FACILITY FOR PALEONVIRONMENTAL, BIOGEOCHEMICAL AND ENGINEERING RESEARCH ON FROZEN GROUND

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The Permafrost ArChives Science (PACS) laboratory is a permafrost core archive and research facility focused on the characterization and analysis of perennially frozen earth materials. It will serve a diverse user base from the earth sciences, biological sciences and engineering, including academic, community, industrial, and government users. PACS supports standardized and comprehensive physical, biogeochemical, and biological characterization and analyses of cores, with the aim to drive new insight into processes and impacts of climate and environmental change in permafrost regions. The new lab includes core storage for roughly 3 km of frozen core, including an existing collection of ~0.5 km, a large format industrial CT scanner, optical core scanner, analytical equipment (gas, water isotope, grain size and elemental compositions) and clean labs for biogeochemical and ancient DNA/microbial sampling of permafrost cores.

Outputs of the research will include the development of novel core characterization approaches that will inform responsible land use in permafrost regions; the development of paleoenvironmental records to improve understanding of past responses of permafrost regions to climate change; potential for novel genomics and drug discovery; and an understanding of the impacts of the biogeochemical cycling and permafrost fluxes of legacy nutrients and contaminants on local and downstream communities. In this poster, we describe progress in building the lab, access for users, and the nature of research projects that may be undertaken at the new facility starting in 2020.

MONITORING OF ICEBERGS AND ICE ISLANDS USING A LOW-COST, OPEN-SOURCE DRIFT TRACKING BEACON

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Icebergs and ice islands can present a significant hazard to marine vessels and infrastructure at a time when demand for access to Arctic waters is increasing. There is a growing demand for in-situ iceberg tracking data to monitor their drift trajectory, develop and enhance drift models used by researchers and operational stakeholders and improve iceberg detection algorithms in satellite imagery. Yet, the high cost of commercial tracking devices often prevents monitoring at optimal spatiotemporal resolutions. Here, we describe the design of the Cryologger, a low-cost, robust, and user-friendly iceberg and ice island drift tracking beacon based on the open-source electronics Arduino platform. Designed for extended deployments of one year or more, the Cryologger is capable of providing long term measurements of multiple parameters, including GPS position, temperature, pressure, pitch, roll, heading and battery voltage. Data is recorded hourly and transmitted over the Iridium satellite network at user-specified intervals. In August 2018, six Cryologgers were successfully deployed from the CCGS Amundsen on icebergs and ice islands along the coasts of Ellesmere and Baffin Island. One iceberg ran aground and broke up off the coast of Labrador in May, 2019, after having traveled over 4000 km. The remaining five beacons have achieved over 400 days of continuous operation, transmitting a total of 30,000 GPS positions and travelling a combined distance of 7000 km. Initial results have shown that the drift patterns and speeds differ significantly from iceberg to iceberg, with a maximum measured drift speed of 6.08 km/h and a mean drift speed for all six beacons of 0.34 km/h. In August 2019, an additional eight tracking beacons were deployed on icebergs and ice islands along the coasts of Greenland and Ellesmere Island. The success of the Cryologger tracking beacon deployments have demonstrated that inexpensive, open-source hardware and software can provide a reliable, and cost-effective method of monitoring icebergs and ice island drift patterns in the Canadian Arctic.

GPR SURVEYS IN SUPPORT OF LAND USE PLANNING IN PERMAFROST AREA: SALLUIT, HOW DEEP IS YOUR BEDROCK?

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The fast-growing population in the village of Salluit creates important housing and infrastructure needs that must be fulfilled in a secure manner. Difficult challenges are created due to difficult topographical constraints and ice-rich permafrost in silty marine sediments in the Salluit valley, where available space is limited for construction. Until now, most of the housing construction in Salluit was on stilts installed on thick gravel pads laid on either flat or gently sloping terrain, an overused design that led to the near exhaustion of granular resources in the community. Given those restrictions, implementation of the community land use development plan now calls for construction of the next residential sector at the southern fringe of the built area, on a sloping plateau with a discontinuous cover of glacial till. In outcrops, the bedrock appears highly fractured but nevertheless a solid foundation material. Among the foundation types considered are piles anchored in the bedrock and cut and fill of benches on the hilly terrain, where the general slope is about 8°. Both of these types of foundations would provide stable conditions that will avoid the impact of permafrost thawing in the future and ensure the stability of buildings while requiring minimal gravel resources. A critical, poorly known geotechnical factor, however, is the variable thickness of the till over the bedrock slope. Permafrost in till in Salluit is ice-rich with observed volumetric contents as much

as 50-70%. Excessive thickness may create difficulties for cut and fill work and bench stabilization. In addition, the disturbance during terrain preparation may pose a risk of thaw slumping in cut faces and thermo-erosion. Therefore, GPR (Ground penetrating radar) surveys were carried out in July 2019 to map the frozen till thickness over the bedrock. In total, 8.5 km long of surveys at the 100 Mhz frequency were run. The signal penetration with the applied time-window setting was about 8 m. It appears that over large areas of the hillslope, the till cover is sparse and very thin. On areas that were mapped as thick till cover (over 2 m depth and up to 6 to 8 m), the thickness turns out to be generally more about 3 m. This thickness of deposit makes it easy for piles to reach in the bedrock but may make slope stabilization tricky. A part of the sloping area has bedrock deeper than 8 m, which we consider as unsuitable for construction. The GPR interpretation data are being integrated as an information layer onto a high-resolution DEM. The next step will be to use this terrain model for siting housing projects with architects and planning civil engineering operations for construction. Shared into an online database using ArcGIS Online, all that information will be also easily accessible and understandable to the users. As the overall purpose of this project is to facilitate decision-making towards sustainable development, the sharing of data offers support to land use planning, construction and security assessments.

INVESTIGATING THE SENSITIVITY OF AN ARCTIC SEABIRD TO NOVEL PREDATION RISK FROM POLAR BEARS USING STRESS-INDUCED BEHAVIOURAL AND PHYSIOLOGICAL METRICS

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Arctic climate change is transforming ecosystems in many complex ways. One such instance is alterations to food-web dynamics, with prey being confronted by predators for which they have not encountered in their evolutionary past. In particular, earlier sea-ice breakup has created a shortened seal-hunting season for polar bears (Ursus maritimus), resulting in their recent terrestrial foraging on alternative diet items such as seabird eggs. To examine this phenomenon in detail, we are studying common eiders (Somateria mollissima) at East Bay Island, Nunavut, a large colony that has recently experienced an increase in polar bear nest predation as a consequence of the bear's climate-induced reduced winter diet. What is unknown is the degree eider hens perceive of the risk posed by polar bears and their concomitant predator-avoidance responses. Using trail camera videography and artificial-egg heart rate monitors, I quantified hen responsiveness - in terms of incubation behaviour (e.g., flight initiation distance) and underlying physiology (i.e., heart rate) - using a standardized threat-simulation protocol where I simulated an approach by predators that differ in familiarity: polar bear, arctic fox, and a control stimulus. This study will allow us to make inferences on whether responses to polar bear predation risk result in increased energetic expenditures of hens during incubation, and will provide insight on the fitness consequences eiders face as an indirect consequence of anthropogenic climate change.

FISH DIP: DAM IMPACTS ON PELAGIC FISH ECOLOGY IN A SUBARCTIC ESTUARY (LAKE MELVILLE, LABRADOR)

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By modifying the seasonal runoff pattern of the Churchill River, in Labrador, the operation of the Muskrat Falls hydroelectric dam could impact estuarine rainbow smelt, trout and salmon downstream. This research project seeks to understand how the operation of the Muskrat Falls dam will modify fish ecology in the 3,000 km2 Lake Melville subarctic estuary. Answering this question is critical to fully understand the impacts of this large-scale hydroelectric project on coastal communities in the region. It will also provide baseline information for science-based management of fisheries in Lake Melville, where five coastal communities rely heavily on food, social and ceremonial fisheries. We will conduct summer and winter acoustic surveys with a multifrequency echosounder to document changes prior to (2018-2019) and during (2020) the operation of the dam. Using an innovative combination of state-of-the-art technology

combining acoustics, net samples and environmental DNA (eDNA) we will (1) assess seasonal and interannual changes in the abundance, distribution and diet of fish upon operation of the hydroelectric dam; and (2) quantify potential changes in growth rate and survival of larval rainbow smelt, the most important prey for brook trout and seals in the estuary. This research will be conducted in collaboration with Wood Environment & Infrastructure Solutions, the Nunatsiavut Government, the NunatuKavut Community Council, and the Innu Nation to ensure that the new knowledge resulting from this project is used for monitoring program reviews and supports management objectives for sustainable harvesting of fish in Lake Melville. Ultimately, it will contribute to better predict the effects of future dam developments on fish populations in northern Canada.

MESOPELAGIC SOUND SCATTERING LAYERS OF THE HIGH ARCTIC: SEASONAL VARIATIONS IN BIOMASS, SPECIES ASSEMBLAGE, AND TROPHIC RELATIONSHIPS

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Mesopelagic sound scattering layers (SSL) are ubiquitous in all oceans. Pelagic organisms within the SSL play important roles as prey for higher trophic levels and in climate regulation through the biological carbon pump. Yet, the biomass and species composition of SSL in the Arctic Ocean remain poorly documented, particularly in winter. A multifrequency echosounder detected a SSL north of Svalbard, from 79.8°N to 81.4°N, in January 2016, August 2016, and January 2017. Midwater trawl sampling confirmed that the SSL comprised zooplankton and pelagic fish of boreal and Arctic origins. Juvenile beaked redfish dominated the fish assemblage in January and Arctic cod in August. The macrozooplankton community mainly comprised the medusa Cyanea capillata, the amphipod Themisto libellula, and the euphausiids Meganyctiphanes norvegica in August and Thysanoessa inermis in January. The SSL was located in the Atlantic water mass, between 200-700 m in August and between 50-500 m in January. In January, the SSL was shallower and weaker above the deeper basin, where less Atlantic water penetrated. The energy content available in the form of lipids within the SSL was significantly higher in summer than winter. The biomass within the SSL was >12-fold higher in summer, and the diversity of fish was slightly higher than in winter (12 vs. 9 species). We suggest that these differences are mainly related to life history and ontogenetic changes resulting in a descent towards the seafloor, outside the mesopelagic layer, in winter. In addition, some fish species of boreal origin, such as the spotted barracudina, did not seem to survive the polar night when advected from the Atlantic into the Arctic. Others, mainly juvenile beaked redfish, were abundant in both summer and winter, implying that the species can survive the polar night and possibly extend its range into the high Arctic. Fatty-acid trophic markers revealed that Arctic cod mainly fed on calanoid copepods while juvenile beaked redfish targeted krill (Thysanoessa spp.). The relatively high biomass of Arctic cod in August and of redfish in January thus suggests a shift within the SSL, from a Calanus-based food web in summer to a krill-based food web during winter.

INTEGRATION OF RENEWABLE RESOURCES WITH VARIABLE SPEED GENERATORS

Giles, Patrick (1) and Jason Zrum

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Despite increasing development and implementation of renewable resources in the north, diesel remains a critical component of remote systems as they transition to greater levels of renewable penetration. As renewables such as solar and wind are not fixed processes, they alone cannot be relied upon to provide consistent power in remote communities. Conventional fixed-speed generators (FSGs) experience reduced efficiency and mechanical issues when operated at low loadings. This determines how the FSGs are operated and how , and how much, renewable, or intermittent, resources can be integrated into

remote communities. Variable speed generators (VSGs) are expected to be capable of low loading operation as well as having improved efficiency over FSGs. Consequently, VSGs may improve the ability of a remote power system to integrate a higher penetration of renewables. Further, the volatility of diesel prices and transportation costs, as well as environmental issues like fuel spills or air pollution, are all motivating factors for increased renewable penetration in remote communities. While the proposed increased efficiency in VSGs is alone a significant upside; combined with the potential of greater renewable penetration, widespread adoption of VSGs has tremendous potential benefits for remote communities. In addition, several communities' generators across the territories are reaching the end of their lifespan. Utility operators are considering replacing aging FSG technology with VSGs, to improve the overall flexibility of their power system and increase their capacity for integrating renewable resources. At present, there is only one VSG being operated as a pilot project in Aklavik, NWT by North West Territories Power Corporation. Our research team has been conducting an analysis on the efficiency of this generator to gauge the technology's potential for wider deployment throughout the territories. This presentation will outline the basic mechanics and differences between a variable speed generator and a traditional fixed speed generator, with a focus on the implications for a remote system seeking to integrate an array of renewable resources. We will also speak to our analysis of a year's worth of data collected from the pilot project VSG in Aklavik, NWT, to assess the generator's performance and overall efficiency during low-loading scenarios with a high penetration of renewable resources. Our results indicated that VSGs are a promising technology for generating power with a high-penetration of renewables, although a greater resolution of data will be necessary to effectively assess the generator's low-loading efficiency. In addition, some discrepancies between our own data analysis and that of the generator's engine control unit were apparent. Future work on this project will require communicating with the generator's manufacturer regarding this discrepancy, in addition to collecting a higher resolution of low-load data to assess a wider host of high-penetration scenarios.

REMOTE SENSING OF FRESHWATER ICE PHENOLOGY IN CANADA'S NORTH IN THE ERA OF ABUNDANT OPEN-ACCESS SATELLITE IMAGERY

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Given the abundance of lakes in Canada's North, the phenology of freshwater ice heavily influences both environmental (e.g. climate, ecology, hydrology) and socio-economic systems (e.g. access to traditional harvest territories). Throughout the Northern Hemisphere, climate-induced shifts have resulted in earlier spring break-ups and later autumn freeze-ups. Monitoring rapid and dynamic changes in ice cover over vast regions is particularly challenging, but can provide important tools for travelling in remote areas for activities ranging from subsistence harvesting and hunting to transportation and shipping operations. Detailed ice maps are especially helpful for these applications but they require high-resolution satellite imagery which can present several obstacles, such as the high cost of purchasing imagery, the large temporal gaps in the capture of high-resolution imagery by individual satellites, and the computational requirements for analyzing large datasets. In this study, we present an algorithm developed in Google Earth Engine (GEE) that combines open-access imagery from multiple satellite sensors into a coherent time series of freshwater ice phenology observations over all of Canada at a 30-metre resolution for the spring seasons of 2014 to 2018. Using both optical (Sentinel 2 and Landsat 8) and radar (Sentinel 1) imagery, we build reference datasets from lakes across Canada to optimize classification trees using machine learning to discriminate ice and water. We then run a change detection algorithm on the time series of ice/water classifications to estimate the date a pixel transitioned from ice to water. We test the accuracy of our maps using the Canadian Ice Service's database of weekly ice cover estimates for over 100 lakes in Canada. Capitalizing on GEE's powerful cloud computing platform and the abundance of free open-access satellite imagery, our analysis overcomes financial and computational barriers to producing usable and useful high-resolution maps and tools to understand and adapt to changing ice phenology.

SEAWATER MICROBIAL RESPONSE TO AGED PERMAFROST CARBON IN THE GULF OF ALASKA

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Permafrost contains the worlds largest reservoir of carbon, and accounts for 34% of the worlds coasts. Currently, Arctic warming resulting in longer open water seasons and sea level rise are leading to increased rates of coastline degradation from 1 meter to as high as 20 meters per year. As a result, permafrost coastline erosion is delivering large amounts of aged organic carbon and nutrients into nearshore marine environments, abruptly, and irreversibly. The annual release of terrestrial organic carbon from degrading coastal permafrost has large uncertainties (~14.0 - 44.0 Tg C) but may be the same order of magnitude as riverine inputs from thawing permafrost. Yedoma permafrost aged 18 Kya, 27 Kya, and 33 Kya from the Fox permafrost tunnel in Fairbanks, Alaska was added to surface seawater (~2 m) from the Gulf of Alaska and microbial activity immediately measured (oxygen consumption) aboard the R/V Sikuliaq in July 2019. Oxygen consumption was found to be driven primarily by seawater microbial communities rather than permafrost communities, with the highest consumption observed in the most aged permafrost samples (33 Kya), indicating that aged permafrost carbon may be more relatively labile than previously thought. Our work investigates how variations in seawater nutrients, and environmental parameters such as light and temperature impact the quantity and composition of evolved gases as a result of permafrost erosion into nearshore marine environments.

POPULATION GENETIC STRUCTURE OF AN ARCTIC BREEDER, THE SNOWY OWL

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An understanding of genetic diversity and population structure is critical for developing conservation strategies for species of concern, especially important during times of fast environmental changes. The maintenance of genetic variation is often regarded as a critical target for wildlife management as it is linked to mechanisms of adaptation and population stability. With the fast-changing Arctic climate, there is an even more important need to measure how arctic species are structured or whether they reach threshold levels of genetic variation. The snowy owl, an arctic breeder and critical predator of the tundra ecosystem, is considered vulnerable and in decline by the IUCN red list yet we have no information on his genetic arrangement. Our study will help decipher the population structure of North America snowy owl by using the winter site localization of individuals from Nova Scotia to British-Colombia (n=160) and powerful and precise genetic markers (SNPs). Genetic variation will be measure and link with environmental factors to verify if isolation by environment pattern is present in North America snowy owl. Our results will give possible multiple conservation targets for the species.

HOW EFFICIENT ARE EARLY CAREER SCIENTISTS IN PEER-REVIEW ACTIVITIES?

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In our collective endeavour towards global sustainability, there is now a broad appreciation that producing scientifically robust knowledge requires new forms of engagement between scientists, stakeholders and society. But what is the role of Early Career Scientists (ECS) in these processes that are closing the gap between science and policy? Because opportunities to interact with more experienced peers through science refereeing are scarce, the role of ECS in the peer-review process remains minor despite ECS possessing strong academic credentials. Such engagement in the peer-review process represents a valuable opportunity for ECS and the scientific community as a whole. This opportunity provides a robust platform for ECS to understand the overall review process and editorial activities related to high-credibility publications such as those conducted by the Intergovernmental Panel on Climate Change (IPCC). During May/November 2018, 174 ECS on behalf of the Association of Polar Early Career Scientists (APECS) reviewed the first and second-order drafts of the IPCC "Special Report on Ocean and Cryosphere and in a Changing Climate (SROCC)". Here, we present the methodology, results, and lessons learned from these group reviews. Altogether, data from participant surveys on their experience and their comments catalog illustrate ECS as competent reviewers, comparable to more experienced researchers. The diverse disciplines and geographic perspectives, fostered through APECS and its partners, are currently being mobilized in the First Order Draft of the Working Groups I and II of the Assessment Report 6 of the IPCC, and will continue during the second round of reviews of these reports in early 2020. Information gathered during these ongoing reviews will add to the findings obtained during the review of the SROCC.

GROUND SUBSIDENCE AND HEAVE OVER PERMAFROST: HOURLY TIME SERIES REVEAL INTER-ANNUAL, SEASONAL AND SHORTER-TERM MOVEMENT CAUSED BY FREEZING, THAWING AND WATER MOVEMENT

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Heave and subsidence of the ground surface can offer insight into processes of heat and mass transfer in freezing and thawing soils. Additionally, subsidence is an important metric for monitoring and understanding the transformation of permafrost landscapes under climate change. Corresponding ground observations, however, are sparse and episodic. A simple tilt-arm apparatus with logging inclinometer has been developed to measure heave and subsidence of the ground surface with hourly resolution and millimetre-accuracy. This presentation reports data from the first two winters and the first full summer, measured at three sites with contrasting organic, and frost-susceptible soils in warm permafrost. The patterns of surface movement differ significantly between sites and from a prediction based on the Stefan equation and observed ground temperature. The data is rich in features of heave and subsidence that are several days to several weeks long and that may help elucidate processes in the ground. For example, late-winter heave followed by thawing and subsidence, as reported in earlier literature and hypothesised to be caused by infiltration and refreezing of water into permeable frozen ground, has been detected. An early-winter peak in heave, followed by brief subsidence, is discernible in a previous publication but so far has not been interpreted. An effect of precipitation on changes in surface elevation can be inferred with confidence. These results highlight the potential of ground-based observation of subsidence and heave as an enabler of progress in process understanding, modeling and interpretation of remotely sensed data.

NUNARISK PROJECT: EARLY WARNING SYSTEM FOR DRINKING WATER MANAGEMENT AND MONITORING IN NUNAVIK

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Drinking water quality is mainly influenced by the variability of source water quality, which is in turn affected by meteorological and climate factors. Contrary to the systems of medium and large municipalities, small water systems (SWS) supplying northern villages in Nunavik, do not have appropriate infrastructure to face important variations of raw water quality and do not possess enough data on the impact of these alterations. In Nunavik, most SWS are supplied by surface water, and the treatment process generally consists of a double disinfection (UV treatment and chlorination). These SWS are highly vulnerable to variability in source water quality. According to projections, climate warming at high latitudes, and especially in Nunavik, will be more pronounced than warming anticipated at low latitudes, inducing most notably an increase in rainfall. Recent studies observed correlations between meteorological events like heavy rainfall events with water quality degradation, chemically and physically (increase of concentrations of chemicals and suspended solids) and biologically (pathogen occurrence). For example, natural organic matter in surface water can increase by a factor of 4 to 5 during heavy rains and snowmelt, affecting the effectiveness of the water treatment. Moreover, the main consequence of water quality degradation induced by global climate disruption concerns SWS supplied by surface water, the larger systems being more resilient to source water quality variations. In Nunavik, some northern villages are already facing water supply challenges in terms of quantity, due to freezing and drying of their water resources. Because Nunavik communities have small surface water systems that are vulnerable to climate change, careful management of these systems is important so as to ensure a reliable, safe and sustainable drinking water supply. In order to achieve this goal, new strategies of data analysis, diagnosis, predictive modeling, and early warning can be used to anticipate and better manage environmental crises in such SWS. It has been shown that using trend analysis for indirect measurements of water quality and of operating conditions, it is possible to forecast water quality variability. If early warnings of water quality changes are obtained in a timely manner, it will be possible to undertake proactive actions to reduce the impacts of those changes. Thus, an efficient monitoring and control system could improve water treatment management to ensure high quality water for consumers at a relatively low operating cost. Significant advances have been made in recent years in technologies for better real-time monitoring of water systems and drinking water quality, opening the possibility for proactive management. The objective of this project is to develop a tool for adaptation to climate change dedicated to Nunavik water operators for early warning of drinking water quality. The tool will take into account meteorological and source water variability and will optimize water treatment in order to reduce the risks to the population associated with drinking water consumption. The project will be implemented in Kangiqsualujjuaq, as a proof-of-concept, thanks to a strong collaboration with local and regional authorities. This poster will illustrate the methodology and objectives of this collaborative project and present preliminary field works realized in September 2019.

HIGH-LATITUDE AQUIFER-OCEAN EXCHANGE IN A CHANGING CLIMATE

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Hydrogeological processes in the Arctic and subarctic are rapidly changing due to accelerated atmospheric warming. Along coastlines, changes in hydrogeology and groundwater-surface water exchange can impact conditions on land and in the ocean. Groundwater discharge to the coastal ocean can alter the biogeochemistry of coastal water bodies, while landward migration of seawater results in salinization of coastal freshwater resources. However, coastal high-latitude hydrogeological processes and groundwater-surface water exchange are understudied compared to terrestrial systems, and the mechanisms mediating aquifer-ocean exchange are not well understood. This knowledge gap limits our capacity to predict exchange under changing hydrologic and climatic conditions and the resulting impacts on marine resources and coastal aquifer quality. This poster will serve as a platform for discussion about

changing high-latitude coastal hydrogeological processes and the feedback mechanisms between climate change and aquifer-ocean exchange. Whereas we hypothesize that increased connectivity and longer/deeper groundwater flow paths due to permafrost thaw will increase delivery of terrestrially based water and solutes to the coastal ocean through groundwater pathways, alternative hypotheses suggest that flow through less permeable sediment and alterations in the hydraulic gradient due to permafrost thaw will decrease aquifer-ocean exchange. Additionally, we hypothesize that sea-level rise and decreased terrestrial heads due to permafrost thaw will increase saltwater intrusion through landward migration of the freshwater-saltwater interface. Enhanced understanding of changes in groundwater flow and aquifer-ocean connectivity due to permafrost thaw is critical as changes will have profound impacts on high-latitude coastal zones, including marine and freshwater resources.

SEASONAL FRESHWATER AND NUTRIENT DYNAMICS OF COASTAL REGIONS OF NORTHEAST JAMES BAY AND SOUTHEAST HUDSON BAY

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In Arctic marine environments, the renewal of nutrient stocks through physical and microbial recycling processes during the winter is an important process that supports primary production in the spring, when ice-cover begins to melt and light availability increases. However, the introduction of river water during winter, and associated changes in the sea ice cycle, may impact these physical processes, with unknown implications for nutrient recharge in the Arctic. Winter nutrient data from Arctic areas are extremely scarce; this study is attempting to fill this gap, focusing on the coastal regions of northeast James Bay and southeast Hudson Bay. Hudson Bay and James Bay collectively make up the largest inland sea in the global North. In recent decades, these areas have experienced atypical ice conditions, along with an overall shortening of the sea-ice season. The northeast coast of James Bay has also experienced increased winter river outflows due to hydroelectric development on the La Grande River, which now peaks during the winter, as opposed to a typical spring peak. In this study, we present new nutrient and freshwater tracer data for water samples collected during both ice-covered and open-water conditions from sites along the northeast coast of James Bay, northward into coastal southeast Hudson Bay, and the Belcher Islands. Using oxygen isotope ratios in conjunction with salinity, we calculated the fractions of freshwater components (river runoff and sea-ice melt) of samples. The relationships between these components and nutrient concentrations were examined, and further, nutrient inventories for each region were estimated. In winter, the La Grande River plume in northeast James Bay is nitrate-rich relative to the surrounding coastal waters. The Hudson Bay source marine waters that circulate into northeast James Bay in winter have higher phosphate but lower nitrate than the river-sourced water. In southeast Hudson Bay, the Great Whale River is one of the major riverine sources in the region, however it provides less of a freshwater influence on the surrounding waters in winter compared to the far-reaching impacts of the La Grande. Recharge, in southeast Hudson Bay, however, produces higher nutrient concentrations than in northeast James Bay. Winter nutrient maxima are much lower than the concentrations observed in Hudson Bay below the winter mixed layer suggesting generally poor winter nutrient recharge in northeast James Bay waters. Fieldwork was conducted in partnership with the Arctic Eider Society and through a community-driven research network.

CLIMATE CHANGE AND HEALTH IN RESOURCE-DEPENDENT COMMUNITIES: EXPLORING FRAMEWORKS AND PERSPECTIVES FOR NORTHERN BRITISH COLUMBIA

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The impacts of climate change and resource development on ecosystems and human populations are of increasing concern around the globe. However, a current understanding of the interface of climate change and health in resource-dependent communities remains unknown, particularly in northern British Columbia. The present study, conducted in collaboration with the Environment, Community, and Health Observatory Network and the Climate Change Communication and Engagement in Canada's Provincial Norths: A Collaborative Place-based Approach study, sought to determine what insights can be gained about climate change and health interconnections

in northern British Columbia's resource-dependent communities to inform conceptual and practical action. A targeted narrative review of contemporary climate change and health conceptual frameworks, published between 2013-2018, was conducted to identify their relevance to northern British Columbia resource communities. Pre-collected interview data from 2018 was analyzed using thematic content analysis to determine how the current literature on climate change and health frameworks relates to perceptions of climate change from community experts in northern British Columbia. Combined analysis of the current literature and interview data informed options for a refined framework to better depict the dynamics of climate change, resource development and health in northern British Columbia. The study findings highlight a gap in the contextualization of global climate change and health frameworks at the local level to promote climate action. There is a need for collaborative, interdisciplinary climate change and health action in northern BC that attends to local political, social, economic and cultural contexts to facilitate communicating the complex interrelationships between climate change and health in resource-dependent communities, contextualized to the realities in northern British Columbia.

ENVIRONMENTAL INFLUENCES ON SKIN-ASSOCIATED MICROBIAL COMMUNITIES OF ARCTIC CHAR AND WHITEFISH ON AND SURROUNDING KING WILLIAM ISLAND

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The Towards a Sustainable Fishery for Nunavummiut Project is partnered with the Nunavut community of Gjoa Haven on King William Island. Together with the community we have endeavored to integrate Inuit traditional knowledge and practices with genomic and microbial analyses to assess the long-term sustainability and health of the Arctic char (Salvelinus alpinus) and whitefish (Coregonus species complex) fisheries. In this region, the salmonids, Arctic char and whitefish can be anadromous, migrating annually from the ocean to freshwater rivers and lakes in order to escape sub-zero temperatures. It is not known how microbial communities change while their wild Arctic salmonid hosts migrate, and how this affects fish health. It is also unknown how climate change will impact the dynamic interactions between microbes and hosts. Skin-associated bacterial communities were sampled from 406 Arctic char and 241 whitefish at different times in their migration cycle and from the ocean, freshwater lakes, and rivers on and adjacent to King William Island. Microbial communities were assessed by high-throughput sequencing of bacterial 16S ribosomal RNA gene amplicons. The microbiota changed depending on whether fish were sampled from freshwater or saline water sites, and also showed significant differences between sampling seasons. Moreover, when fished from the same waters in the same season, there were microbial community differences between the two salmonids. At sites where water was also sampled, skin-associated bacterial communities did not simply reflect the microbiota of the surrounding aquatic environment. Additional analyses indicate that 'healthy' Arctic char and whitefish, characterized as wild-caught fish in fair to excellent condition (condition factor, $K > 1.2$), possess unique core bacterial communities (taxa present across 70-80% of the fish sampled). Core microbiota across species was dominated by psychrophilic bacteria belonging to the genera Psychrobacter in Arctic char and Acinetobacter in whitefish, as well as nitrogen-fixing bacteria belonging to the genera Synechococcus in both species. Such core microbiota likely provides essential services to the fish, such as possibly interacting with the fish immune system to maintain fish health. Our analysis has also raised concerns over the impact of climate change on the health of these salmonids that in turn, are important for food security for the Nunavummiut. Acknowledgements: We thank the Gjoa Haven, NU community residents, the Hunters and Trappers Association (HTA), and all of the associated supporters of the Towards a Sustainable Fishery for Nunavummiut Project. We would like to thank all sampling personnel that provided invaluable help in the field, and particularly the Gjoa Haven fishermen who were integral to the fish sampling efforts. This work was funded by the Government of Canada through Genome Canada and the Ontario Genomics Institute (OGI-096). We also acknowledge funding from the Natural Sciences and Engineering Research Council (Canada), the Ontario Ministry of Research and Innovation, CanNor, the Government of Nunavut, and the Northern Scientific Training Program (Polar Knowledge Canada).

AUTOMATED OBJECT DETECTION FOR THE IDENTIFICATION OF BELUGA WHALES AND BOAT TYPES IN UAV VIDEOS

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Researchers interested in the health and population characteristics of marine mammals often use aerial imagery to study animal behaviour, group dynamics and identify individuals. Population metrics such as age and individual health can be determined from aerial imagery knowing the length, colour and other biological markers of individuals. Aerial imagery (in comparison to video) is beneficial in this field due to the relatively low data size and processing requirements, however imagery provides a static observation of a population, limiting the array of results which can be derived from this data type. In comparison, video can capture interactions between individuals, their environment and human influences (ie. shipping vessels), making it the data type of interest in this study. Conventional methods of aerial image analysis require researchers to manually identify and count mammals, expending countless hours which could otherwise be applied to the interpretation and analysis of results. Methods of deep learning automated object detection/identification in imagery and video have been extensively developed in response to the rise of self-driving cars, facial recognition and event crowd metrics. However, the application of these high-end programs to the analysis of marine ecological data is limited. Automated detection programs can reduce human-time spent identifying features, and can output quantitative measures of relative position, movement and speed of all features within a scene. This presentation will provide a first look at the implementation of existing object identification frameworks (i.e. R-CNN, YOLO) to beluga whale identification in the Churchill estuary from oblique UAV video. The effectiveness of each object identification framework in identifying motorized boats, kayaks and beluga whales will be examined, taking into consideration the strengths and weaknesses of each method.

BOON OR BANE? ARCTIC COD ECOLOGY IN A CHANGING CANADIAN ARCTIC

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Arctic cod (Boreogadus saida) is the dominant pelagic fish species in marine ecosystems of the Canadian Arctic and is responsible for most of the energy transferred between zooplankton and higher trophic levels. Variations in the population dynamics of Arctic cod impact the rest of the Arctic ecosystem and could result in entire regime shifts in the marine food web. Recent research has shown that warmer sea surface temperatures and earlier ice melt result in cascading effects leading to a greater abundance of age-0 Arctic cod and age-0 fish achieving larger prewinter sizes. Despite the increase in recruitment with the relaxation of extreme Arctic conditions, models have suggested an eventual decline in the abundance of Arctic cod, most likely due to a decrease in suitable habitat. Therefore, while climate change has already begun to affect Arctic cod populations, the future magnitude of its effects is unclear. A more comprehensive understanding of Arctic cod abundance, distribution and migratory behavior is needed to predict the future effects of climate change on its ecology. This study will rely on a 15 year time-series of acoustic-trawl data to 1) assess if increased larval survival results in higher recruitment of mature individuals in Beaufort Sea and Baffin Bay; 2) Identify pelagic hotspots of zooplankton in Baffin Bay and relate these to the abundance and distribution of Arctic cod and its predators (mainly turbot, Reinhardtius hippoglossoides). Lastly, we will use otolith microchemistry to document movement and population connectivity of Arctic cod across the Northwest Passage. As the Arctic Ocean continues to warm, having a more holistic understanding of the ecology of Arctic cod will help inform management decisions for Arctic marine ecosystems.

ARCTIC COMMUNITY FISHERS: FROM PROJECT PROPOSAL TO MOBILIZING NORTHERN RESEARCH PARTNERSHIPS

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Inuit communities use and depend on the marine ecosystem year-round, and in doing so they hold an intimate wealth of knowledge of the local environment. This knowledge and activity, when combined effectively with instrument-based monitoring and scientific methods, can be utilised by communities and researchers to inform decisions and expand data coverage. Ocean Networks Canada (ONC) has contributed to the oceanographical technological aspect of spatial and temporal monitoring by the installation of fixed cabled ocean observatories and mobile monitoring programs in the Inuit Nunangat region. Since the installation of the underwater observatory in Cambridge Bay, NU in 2012, ONC's presence and work in the Arctic has expanded. This includes a secondary smaller observatory in Gascoyne Inlet, NU and automated identification systems (AIS) in Cambridge Bay, NU and Kugluktuk, NU. The placement of such instrument platforms has furthered ONC's relationships with Arctic communities and led to an ONC accredited training course at the Nunavut Arctic College to provide post-secondary training opportunities for work with oceanographic instruments. ONC also collaborates with community educators in the Youth Science Ambassador program in Kugluktuk, Cambridge Bay, Gjoa Haven, and Iqaluit, NU to provide opportunities for youth to youth mentoring in ocean science and its relationship with Inuit Qaujimajatuqangit (IQ). Recently, ONC has partnered with several communities to implement a citizen science water property monitoring program called "Community Fishers". This program is now active in Iqaluit, NU and is being considered in Cambridge Bay, NU, and the Nunatsiavut region in collaboration with the Nunatsiavut Government and Transport Canada. Similar data collection is occurring through the Canadian Rangers Ocean Watch (CROW) program in collaboration with Fisheries and Oceans Canada. The Community Fishers program is built on the successful implementation of citizen science projects with Indigenous communities on the Pacific coast of Canada. Here, we will present the project outline for the Iqaluit "Community Fishers" citizen science program, from the initial proposal to research mobilization. ONC's role has been to support communities with funding applications, co-create appropriate sampling plans, provide accredited training to community members and support instrument maintenance, data management, and reporting. Minimally, a conductivity-temperature-depth (CTD) instrument, including additional sensors, is provided, which transmits data wirelessly to a rugged tablet. A user-friendly mobile application has been developed to import and display the data and allow users to make time-stamped/georeferenced annotations. In this presentation we shall detail some of the challenges that were faced during the initiation phases of the Iqaluit Community Fishers, how they have been resolved and what ONC has learned in our launch and ongoing support of citizen science. While the Community Fishers program demonstrates a sustainable model that builds capacity in communities which has potential to improve ocean monitoring, it is still in its infancy in the Arctic thus should be considered an opportunity for communities, ONC and Arctic partners to learn and improve, so that together we can ensure that this type of community-based monitoring program reaches its full potential and remains beneficial for all parties involved.

MINING-INDUCED FLOODING AND USE OF DETERRENTS FOR MITIGATING IMPACTS ON ARCTIC-NESTING BIRDS

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Agnico Eagle Mines Ltd. has proposed the Whale Tail Project, approximately 130km North of Baker Lake, NU. The project involves the construction of a dyke within Whale Tail Lake that will divert water from the proposed mining pit into the surrounding lakes and tributaries. Flooding will result in the elevation of water levels by 4 m above current levels over two years, causing approximately 157 ha of tundra to become flooded during the time of birds' nest initiation. The Migratory Birds Convention Act (1994) prohibits the harm of migratory birds and the disturbance or destruction of nests and eggs. The research project intends to explore mitigation options for the proposed flooding during the construction of the Whale Tail Pit and to assess the degree of risk posed to migratory birds by mining-induced flooding during the nesting period. The study looks to determine the impact of mining-induced flooding on nest loss, success and dispersal of arctic-nesting birds, by outlining the timing, distribution and nest success of arctic-nesting birds relative to the schedule and distribution of the flooding. The study also seeks to explore mitigation options for deterring arctic-nesting birds from nesting in potential flood zones by determining the degree to which bird behaviour changes with treatment intensity. Mitigation options seek to prevent birds from nesting in high-risk areas so we may minimize impacts from mining-induced flooding or other localized disturbances. Through the experimentation of deterrent

use, we can add to the understanding of mitigation and conservation of at-risk species.

A WEB-BASED DATA PORTAL FOR NORTHERN COMMUNITIES AND DECISION-MAKERS: THE WINTER ROAD/TRAIL NETWORKS ACROSS CANADA'S TERRITORIAL NORTH

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Climate change is one of the major threats to transportation systems in the Canadian North. One area in which remote indigenous communities are particularly at risk to the impacts of climate change is with regards to their reliance on winter roads and trails. The winter road/trail networks in Canada's Territorial North encompass seasonal roads and trails, including on sea ice expanses, that are usable only during the winter. Winter road users rely on them for their yearly supply of fuel, construction material and other bulk commodities that are too expensive for air transportation. The public and private sectors rely on these roads for their operations. The winter road/trail networks also play an important socio-economic role within remote northern communities, as it affords to link between the communities and subsistence activities (e.g., fishing, hunting, and gathering), and impacts the economic development potential of those communities. It also integrates with other transportation modes - for instance, the unexpected closure of a winter road has an impact on air transportation in particular. The importance of the annual construction of seasonal roads to the communities and industries who rely on the networks cannot be understood. Unlike all-season roads, nature controls the state of a winter road/trail's foundation - natural ground and ice surfaces - that need to be trafficable and able to support the vehicles' weight. Every year, construction and maintenance operations are highly vulnerable to the changes of climate behavior, although the extent and consequences of that vulnerability have yet to be assessed. Moreover, a number of traditional winter trail routes such as a network of the Pan Inuit trails in Inuit Nunangat and the Tlicho traditional trails in the Northwest Territories are directly affected by climate variability and extremes. Currently, there is no comprehensive map of the winter surface transportation network, (i.e., roads, sea ice, and trails), either in print or online, that can house available data (from transport operational data to environmental conditions data) for the three territories, to support future work by governments, consultants, and researchers. The goal of this project is to develop a user-friendly web-based portal that will synthesize and centralize critical information in one comprehensive database; information that includes transportation network topologies, climate data and simulations, logistical and transportation operations data, physical, socio-economic and cultural aspects of winter road/trail networks. This tool will combine an interactive database with map visualization, and this will guide effective decision-making and policy prioritization on the management of winter roads, access roads, and trails in Canada's Territorial North. This project is in its initial stages and we are seeking a broad feedback and input on our project.

POTENTIAL FOR ANAEROBIC HYDROCARBON BIO DEGRADATION COUPLED TO SULFATE REDUCTION IN ARCTIC MARINE SURFACE SEDIMENTS

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Increases in maritime traffic in the Arctic as a consequence of decreasing ice cover has heightened oil spill risks in this permanently cold and vulnerable ecosystem. Oil spills in other parts of the world have revealed that crude oil releases can result in oil accumulating on the sea floor. This increases microbial respiration, resulting in rapid depletion of any oxygen in the porewater of surface sediment layers. This anoxia is toxic to benthic populations, and also means that any subsequent remediation by microorganisms would have be to catalysed by anaerobic populations. To assess the potential for anaerobic hydrocarbon biodegradation in anoxic, permanently cold marine surface sediments, microcosms were established using sediment from Smeerenburgfjorden located at 79□ North in NW Svalbard. Sediment was sampled from 0-2 and 10-12 cm depth horizons by subsampling intact seabed samples obtained using a Haps corer deployed from a 15-metre

long research vessel, MS Farm. To simulate an input of hydrocarbons, these microcosms were amended with naphtha (0.2% v/v) or diesel at 3 concentrations (0.01, 0.1 & 1% v/v). Synthetic seawater medium contained 20 mM sulfate to stimulate sulfate reduction, the predominant anaerobic respiratory process in anoxic coastal sediment. Microcosms were incubated at 4□C. Monitoring sulfate concentration revealed rates of depletion were higher in 0-2 cm microcosms compared to parallel incubations using deeper 10-12 cm sediment. After 3 years of incubation, it remained ambiguous whether sulfate was being depleted from microcosms with the deeper sediment; 35S radiotracer was added to these incubations and confirmed rates of sulfate reduction of 1.4 to 1.9 nmol cm-3 d-1 in microcosms amended with diesel, and similar rates of sulfate reduction in unamended controls. Rates were lower, 0.5 nmol cm-3 d-1, in microcosms amended with naphtha, suggesting possible toxicity effects from the low-molecular weight hydrocarbons present in this mixture. 16S rRNA amplicon sequencing of 0-2 cm sediment microcosms suggested diesel-driven community profiles with putative sulfate-reducing bacterial activity due mostly to members of the family Desulfobacteraceae. A significant ($p<0.05$) correlation was observed between the relative sequence abundance of certain RNA OTUs and sulfate concentration, such as Desulfoconvexum (R2 - 0.612) which increased in relative sequence abundance in the cDNA libraries that correspond to lower sulfate concentrations, suggesting a possible role in sulfate reduction in the presence of diesel. Overall, these results show the potential for slow sulfate reduction at low temperature in the presence of diesel. Further testing of samples before and after incubation using GC-MS will reveal whether anaerobic biodegradation of hydrocarbons in diesel- or naphtha-amended incubations took place.

IN SITU NON-GROWING SOIL RESPIRATION MEASUREMENTS IN HIGH ARCTIC ENVIRONMENTS

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Climate warming and changing precipitation patterns are affecting the magnitude of carbon dioxide release in Arctic regions. The Arctic stores more than half of the global soil carbon pool up to three meters, and continued warming threatens the release of this carbon to the atmosphere. While there are several examples of growing-season measurements of carbon exchange in the High Arctic, there are far fewer examples of non-growing season soil respiration. Techniques like forced diffusion allows for continuous in situ measurements of year-round surface and belowground CO2 flux measurements that can provide insight into the patterns and drivers of high latitude carbon cycling. In this study, we deployed a forced diffusion station in High Arctic mesic tundra at the Cape Bounty Arctic Watershed Observatory, Melville Island, Nunavut to investigate the impact of temperature and moisture on soil CO2 efflux throughout the entire year. Surface chambers measured continuous CO2 release using a gradient method, while chambers buried at 10, 25, and 50 cm belowground measured concentrations of soil CO2 flux throughout the year. Preliminary results gathered from the surface and depth chambers at the peak and end of the growing season in 2018 show strong links between CO2 production and soil temperature fluctuations during this time. Respiration rates were highest in the transient layer of permafrost around 25 cm depth, and these higher fluxes persisted later into the growing season than fluxes from shallower depths. Rates of respiration were greater in the growing season than in the non-growing season, but when considered on an annual timescale, the CO2 released in the non-growing season was double that released during the summer. These initial results highlight the importance of non-growing season respiration as a significant contributor to the annual soil carbon efflux. Coupled with continued environmental measurements at this site, will lead to the development of improved models to predict changes to the carbon cycle in response to changes in climate.

RINGED SEAL DIET IN THE INUVIALUIT SETTLEMENT REGION, EASTERN BEAUFORT SEA

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Basic information on species diet is important for understanding life history and ecology and central to

conservation and management actions. But these data also serve a broader function as environmental indicators (especially higher trophic levels) and for northern food security issues, and as we experience unprecedented environmental changes that are particularly intense in the Arctic, these secondary aspects are increasing important. Since 2014 we have collected diet and condition data opportunistically from locally harvested ringed seals (Pusa hispida) in three communities (Paulatuk, Sachs Harbour, and Ulukhaktok, NT) using strict collection protocols. Stomach samples have been processed and prey identified using basic screen sifting methods. Results indicate a number of consistently important prey species including sandlance (Mallotus villosus), Arctic cod (Boreogadus saida), capelin (Ammodytes americanus), sculpins (Cottidae), and invertebrates, particularly amphipods (Themisto libellula). The data fill an important gap in our knowledge of ringed seal diet for this region; the only other records for this region are from Smith (1987). A comparison with these earlier records indicates that the marine system has moved from an Arctic to a sub-Arctic marine ecosystem.

IMPACT OF THE ATMOSPHERE AND OCEAN HEAT FLUX ON THE SEA ICE THICKNESS OVER THE HUDSON BAY COMPLEX

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The Hudson Bay Complex (HBC), comprised of Hudson Bay (HB), Hudson Strait (HS) and Foxe Basin (FB) is a subarctic shallow inland sea, which is fully ice-covered during cold seasons in contrast to other water masses at the same latitude (e.g., Labrador Sea, Baffin Bay). In this study, the monthly cycle of sea ice thickness variability in the Hudson Bay Complex is examined using the NEMO (Nucleus for European Modelling of the Ocean) numerical framework and its ice component, the Louvain-la-neuve Ice Model version 2 (LIM2) from 2002 to 2009. Examining the sea ice energy budget it is shown that that the atmospheric energy flux governs ice thickness changes, with secondary contributions from ocean heat flux in fall. In winter larger heat flux release in northwest HB, north of FB and around the coastlines of HS provides a signature of open water and polynya formation and maintenance due to prevailing winds and therefore the sources of escaping sensible heat flux. Sensible and longwave heat fluxes are also shown to have the most impact on the total surface heat flux in winter.

A DETAILED ANALYSIS OF POLAR BEAR (URSUS MARITIMUS) TERRESTRIAL FORAGING BEHAVIOURS IN A LARGE SEADUCK COLONY

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Behavioural shifts are generally the first responses exhibited by animals in a changing environment, and it is becoming critical to evaluate the adaptiveness of these behaviours to determine whether a population will persist in a new environment. Polar bears (Ursus maritimus) are ice-dependent predators that mainly feed on seals throughout their range. In recent years, changes in sea-ice phenology have advanced the arrival of polar bears onto nearshore terrestrial environments and they are now coinciding with the breeding schedules of many avian species, including the common eider (Somateria mollissima). As a result, bears are taking advantage of this phenological mismatch and are foraging on bird eggs in lieu of missed seal-hunting opportunities. Using unmanned aerial vehicles (UAVs), we filmed polar bears foraging on common eider eggs on Mitivik Island, Nunavut, in northern Hudson Bay. We analysed these direct behavioural observations and applied a descriptive approach guided by classical optimality models and previous empirical research to explore foraging strategies of consuming eggs during a restricted time period. We examined whether polar bears adjusted their 'choosiness' in nest selection, reduced their area-restricted searching as a cost-saving strategy, or, alternatively, wasted energy visiting already-empty nests as the resource diminished. We also recorded whether the use of a visual cue (flushing hens) results in polar bears locating (and consuming) a

greater number of eggs. Information on the underlying behavioural mechanisms governing the foraging process provides more fine-scaled information on the adaptiveness of polar bear novel diets and the sustainability of these interactions.

NATSIQ - RINGED SEAL EDUCATION AND MONITORING PROGRAM IN NUNAVIK

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Ringed seals (natsiq) have been harvested for thousands of years by Inuit, and remain important culturally and as a subsistence food. Nunavik hunters have reported several concerns regarding ringed seals, including declines in numbers in some areas and increases in signs of illness. Additionally, for such a widespread and important species, ringed seals are underrepresented in the scientific literature, with very few studies conducted in Nunavik. Importantly, Nunavimmiut expressed concerns for the health of people consuming seals and stressed the need for more research in their region. Given the broad concerns and lack of data, the Nunavik Marine Region Wildlife Board (NMRWB) in collaboration with the Nunavik Research Center initiated a ringed seal monitoring program to document and assess changes in seal health, distribution, and habitats in three Nunavik communities. This community-based project engages experienced hunters and youth in a transdisciplinary approach combining tissues sampling of landed seals, mapping exercises and surveys of harvesting information, and student activities such as in-class stomach content analysis and field-based educational activities. In addition to providing training opportunities to allow Nunavik Inuit to develop interest and capacity in wildlife research and management, this project contributes important baseline information on seal health, abundance and distribution in the Nunavik Marine Region (NMR). The knowledge collected will also inform wildlife management in the NMR, and contribute in developing a robust model for other communities to direct and commence addressing wildlife related concerns locally.

BIOTIC INTERACTIONS GOVERN THE DISTRIBUTION OF COEXISTING UNGULATES IN THE ARCTIC ARCHIPELAGO - A CASE FOR CONSERVATION PLANNING

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Coupled with climate change, the mounting loss of biological diversity and wildlife habitat amplify the need for robust conservation planning, even in the most remote areas of the world. In the Arctic, where a warming climate has heightened interest in both marine and terrestrial resources, protected areas may be insufficient (in size and location) to safeguard important habitat of wide-ranging species. At such broad scales, species distribution models (SDMs) can help identify critical habitat for reserve selection and the conservation of biological diversity. In keeping with the Eltonian Noise Hypothesis (ENH) these models are often based on physical variables alone, overlooking fundamental biotic interactions (e.g. herbivory, competition) that might shape a species range. To test the ENH, we estimated the late-winter distribution of two key Arctic ungulates, Peary caribou and muskoxen, whose interactions, although a longstanding concern, remain unresolved. To do so, we applied a maximum entropy modelling algorithm (MaxEnt) using extensive location data - 541 observations of caribou and 1536 observations of muskoxen - sampled from 65 islands and 800,000 km2 in the Canadian Arctic Archipelago. By fitting models using two sets of predictor variables - (1) abiotic only (i.e. topographic, climatic) and (2) abiotic + biotic (i.e. vegetation communities, distance-to-heterospecifics) - we estimated and mapped the habitat suitability for each species and evaluated model performance. We found both sets of models had good predictive ability, although model performance was improved by incorporating biotic variables, specifically, vegetation cover. The strong and positive relationship between late-winter habitat suitability and proportions of grass-lichen-moss and barren-lichen-moss communities suggested that forage resources were a critical limiting

factor for both species - signaling herbivory as the likely driver. Although niche overlap was high based on habitat suitability predictions for each species, areas with high suitability scores were separated spatially and occurred largely outside (~ 85%) protected areas. Importantly, we reject the ENH and demonstrate that biotic predictors can strength the performance of SDMs while sharpening spatial predictions of habitat suitability to include areas of critical resources. For Peary caribou and muskoxen, our findings underscore both similarities and differences in niche characteristics, and a protected areas system that falls short of protecting their critical late-winter habitat.

CANADIAN ARCTIC SAR RESPONSE AND THE ANTICIPATION OF REMOTE TECHNOLOGY: RISK DIMENSIONS AND RISK-PREVENTION MEASURES

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Due to climate change, the number of ship voyages to the Canadian Arctic has increased more than double for the last 10 years including voyages by cargo ships, fishing vessels, and cruise ships. Furthermore, there were over 6,000 cruise passengers in 2016, and the year 2017 alone saw about 400 visits by vessels to the Arctic including 32 transits through Northwest Passage (NWP). Coupled with the increase of ship traffic in the Canadian Arctic, the region experienced precursors of disasters in the near future such as the Clipper Adventurer incident with 128 passengers on board in 2010 and the Akademik Ioffe with 126 passengers in 2018. The huge Canadian Arctic territories and narrow corridors along the archipelago, and the complicated Northwest Passage lead to a search and rescue response time of approximately 10 hours under average ice conditions. This poses a serious deficiency to emergency situations in the region. Demands for search and rescue services have increased, but capacity building has encountered inherent limitations including a shortage of trained personnel, a lack of sufficient search rescue centres, budgetary burdens, and the affected life quality of indigenous people. Under the Arctic SAR Agreement of 2011, Canada has committed to ensuring safety, environmental protection and sovereign presence in the area by maintaining joint SAR centers. However, the harsh and remote environment in the region, combined with complicated coastlines and many poorly charted traffic routes makes SAR response in the region exceptionally challenging, leading to various safety gaps. This presentation aims at a proactive risk exploration of a concept of remotely operated search and rescue (SAR) assets in the Canadian Arctic. The concept includes drones, remotely operated ships, and remote controllers. Apart from outlining SAR response in the Canadian Arctic, remotely operated unmanned ships for SAR response are introduced, and insights in their opportunities, risk dimensions, governance implications, and risk-prevention measures are given.

USING DENDROCHRONOLOGY TO RECONSTRUCT HISTORIC POPULATION TRENDS IN THE TORNGAT MOUNTAINS CARIBOU

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Caribou are important cultural and subsistence species for Inuit inhabiting Northern Labrador and Quebec. Users of this resource have long been aware that the Torngat Mountains Caribou population (TMC) is distinct from the migratory George River herd, but this distinction has only recently been recognized by federal and provincial governments. Therefore, limited long-term TMC specific population data are available, though existing population data and Inuit knowledge suggest that the TMC experienced a significant population decline and remains low. For this reason, they were assessed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2016. To better understand the status of this population, we are studying historical TMC population trends using established dendrochronological methods to ask the following questions: 1) What are the historic TMC sizes? 2) How has this population varied through time? and 3) What can data on historical population size contribute to management and recovery targets? To answer these questions, we collected shrub stem and root samples along caribou trails having visible scarring caused by hoof damage to the bark of roots and shrubs. Samples were thin sectioned and examined to determine the year and frequency of scars. These data

allow us to quantify historic caribou activity levels as a proxy for herd size. Preliminary data from 419 samples were collected at 3 sites in the Torngat Mountains during the summer of 2018, and additional samples from across Labrador will be collected in the summer of 2020. This information, in combination with existing population surveys and traditional knowledge, will be used to describe historic population trends and inform management planning for the TMC.

EMPHASIZING CONNECTIONS: VISUALIZING INORGANIC CARBON CYCLING USING AN ANNUAL CYCLE WHEEL

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Inorganic carbon cycling in the coastal ocean is influenced by light and nutrient availability, sea ice presence and characteristics, river discharge, and lateral connectivity to adjacent seas. Thus, seasonal variations in these factors will impact the carbon cycle and may alter the dominant processes and pathways. This poster is inspired by Indigenous Ways of Knowing and presents an inorganic carbon cycle timeline in the form of an annual cycle wheel. A wheel is an effective tool for visualizing how the elements of the inorganic carbon cycle work together and in identifying which processes are expected to emerge as dominant at different times of year. This example includes information about present-day inorganic carbon cycling in the connected Greiner Lake - Freshwater Creek - Cambridge Bay coastal ocean system in Iqaluktuuttiaq (Cambridge Bay), Nunavut. In addition to communicating baseline conditions across the terrestrial - marine transition, visualizing the relative timing of key events on the wheel, such as spring melt or the onset of fall freeze-up, is helpful in discerning how the effects of change may propagate into subsequent seasons and years. In this way, the wheel can be used to identify potential feedbacks and vulnerabilities associated with continued climate change in the region.

SEABED MAPPING IN UNCHARTED AREAS TO SUPPORT OCEAN MODELLING: COMBINING CLIMATE CHANGE RESEARCH AND CROWDSOURCED BATHYMETRY

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The velocity and dynamics of tidewater glaciers are highly influenced by the submarine morphology near their terminus. Water depths at the glacier front and fjord bathymetry determine the circulation and stratification of ocean water within a fjord, and exchange of water across the continental shelf. These processes can have a significant effect on submarine melt rates, retreat of glacier termini, calving of icebergs, and thus the contribution of tidewater glaciers to global sea level rise. Unfortunately, existing bathymetric data in the Canadian Arctic has large gaps, with the majority of glacial fjords completely uncharted, preventing numerical ocean models from accurately characterizing ocean circulation and the influence of the ocean on the mass balance of marine-terminating glaciers. In order to increase the spatial resolution of the bathymetry in uncharted fjords, there is a need to develop new mapping programs in the High Arctic, using acoustics or optics methods. To this day, large survey vessels (e.g. CCG Amundsen) with deep drafts are not well suited for safe navigation in shallow uncharted near-shore areas, whereas satellite remote sensing technique provide coarser resolution bathymetric data. This study presents nearly 300 nm of multibeam echosounder data collected from the polar sailboat Vagabond in 2019 on the Eastern coast of Ellesmere Island during a dedicated seabed mapping cruise. This innovative research program has been made possible through collaboration between academic researchers, R2Sonic LLC, and the Canadian Hydrographic Service. The results highlight the major role played by marine geomatics in climate change research. Moreover, the research data shared with federal authorities will allow for the updating of Arctic bathymetric charts, in a context of increased marine traffic and tourism in glacial fjords of the Canadian Arctic.

RUSSIAN ENVIRONMENTAL POLICY IN THE ARCTIC

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With the acceleration of the global warming process, the Arctic region attracts the attention of many countries, especially Russia. As a historical power, Russia is a dominant force in the North Pole. On the one hand, this is due to the huge potential (minerals, logistics capabilities, biological resources) found in the Russian part of the Arctic. On the other hand, the Arctic is an energy, ecological and civilizational reserve of mankind, a virtually untouched part of the planet that requires a reverent and thoughtful attitude to itself. It is important to pay special attention, because the environmental problems of the Arctic threaten to grow from a regional scale to a global one. On 11 March, 2019 Russia's Natural Resources and Environment Ministry forwarded the list of 118 potential Arctic projects to the government. The main measures for the implementation of the state policy in the sphere of environmental safety in the Arctic zone of Russia is the establishment of special regimes of nature use and environmental protection, including monitoring of its pollution, reclamation of natural landscapes and disposal of toxic industrial waste. In view of the specific nature of the Arctic, the organization of activities in this region requires the development of environmental policy based on interdisciplinary scientific and international cooperation.

TWO YEARS OF COMMUNITY-BASED SEA ICE AND OCEAN RESEARCH IN THE CONTRASTING COASTAL DOMAINS OF HUDSON BAY

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The coastal domain of Hudson Bay is characterized by a seasonal landfast ice fringe, flaw-lead polynyas driven by strong tides, large freshwater inputs from rivers even during winter due to hydroelectric regulation, and notable climate-driven changes. This coastal domain is of key importance not only for physical and chemical processes that couple the terrestrial and marine environments, the buoyancy-driven contiguous coastal boundary current, but it is also importance for wildlife and human use. In northwest Hudson Bay, there is little or no freshwater runoff from land during much of the year, with the exception of freshwater supply from Baker Lake through Chesterfield Inlet. In contrast, the southern portion of Hudson Bay receives large amounts of freshwater through both river runoff and sea ice melt. In recent years, communities around Hudson Bay who rely on the coastal domain for travel and traditional subsistence harvesting of country food have witnessed changes to their environment. Of particular concern are climate change, altered river regimes from upstream hydroelectric projects, and industrial activities such as shipping. To develop a better understanding of the sea ice and winter oceanographic baseline conditions and processes, particularly during the winter period, in the two contrasting coastal domains of Hudson Bay (Northwest and Southeast), bi-weekly CTD profiles and water and ice samples were collected February to June 2018-19. This data was collected in collaboration with the Arviq, Aqigiq, and Sanikiluaq Hunters and Trappers Associations and the Arctic Eider Society. Here, we present on the success of this collaboration and compare findings from community-led bi-weekly CTD profiles and ice core- and seawater sampling program from the coastal environment near the communities of Naujaat, Chesterfield Inlet and Sanikiluaq, Nunavut.

CHANGES OBSERVED IN THERMOKARST LAKES ALONG THE INUVIK-TUKTOYAKTUK HIGHWAY (ITH) CORRIDOR (1950 - PRESENT)

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Arctic warming has attributed to a multitude of changes across the tundra landscape. One hydrological process particularly important in driving physical and ecological changes is the thawing of ice-rich permafrost. Thermokarst lakes are waterbodies that form within a depression in the landscape due to the thawing of ice-rich permafrost. By tracking changes in thermokarst lakes, it is possible to track changes occurring within ice-rich permafrost. Monitoring these lakes is important as they are a source of freshwater, biogeochemical processes, wildlife habitat, could potentially pose a risk to the newly opened Inuvik-Tuktoyaktuk Highway, and are of cultural importance to local communities. A 3000 square-kilometer

area South of the Beaufort Sea, East of the Mackenzie River Delta, West of Husky Lakes, and North of Inuvik in Northwest Territories, Canada was used to study over 1000 thermokarst lakes. Primarily using air photos and ArcGIS software, it is possible to delineate lake shorelines during the late summer period for different years. Large visible changes were observed at approximately 40 lakes. Observable changes include lakes merging together, splitting apart, disappearing, and drying. Most changing lakes demonstrate either drying or splitting into 2 or more smaller-sized lakes. There are no new lakes found to be forming. The majority of visible change is occurring at lakes underlain with rolling moraine soils. Lake changes were verified with photos taken by helicopter, inspecting lakes at ground-level, and flying a drone above lakes for finer resolution imagery. While ground-truthing, it became evident that the influence of beaver dams cannot be underestimated. Beaver dams provide a false sense of stability to lakes by having the lake outlet dammed. Overall, observed lake change is scarce. However, this is likely a combination of beaver dams, and due to thermokarst lakes being situated in depressions across the landscape. Water levels are fluctuating, yet this is difficult to observe from above-ground imagery. Further analysis will evaluate climate records for each year prior to imagery acquisition. Drone imagery will also be compared to lake level from in-situ water level recorders, in order to demonstrate that lake water level fluctuations are difficult to observe.

ROLE OF MEAN SEA LEVEL PRESSURE, ZONAL WINDS AND SEA-ICE CONDITIONS IN DRIVING SEA ICE DRIFT SPEEDS AND PATTERNS

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Sea-ice is a highly dynamic and rapid changing environment. Arctic has experienced drastic sea-ice decline over the past several decades. The rapidly changing Arctic cryosphere has been linked to various factors including an increase in ice drift and wind speeds, thinning/weakening of the ice cover, decrease in sea-ice concentration, and fluctuations in the pressure patterns. Based on this, we have analyzed the key parameters that affect the sea ice drift speeds and patterns. Our interest in ice drift/motion pertains to its correspondence with 1) Mean Sea Level Pressure (MSLP), 2) Zonal winds and 3) Sea-ice concentration (SIC). In this study, we examine sea ice drift speeds and patterns for each winter from 2006-2017 and present the preliminary results of their spatiotemporal correspondence with MSLP, zonal winds and sea ice concentration for three anomalous years to understand their role in driving Arctic sea ice dynamics.

SPRING FLOODING RISK, RECURRING EVACUATIONS, AND VULNERABILITY AND RESILIENCE OF REMOTE INDIGENOUS PEOPLES: THE CASE OF KASHECHEWAN FIRST NATION, NORTHERN ONTARIO, CANADA.

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This article examines how Kashechewan First Nation, located in the flood-prone southwestern James Bay region of northern Ontario, Canada, is affected by the frequent risk of spring flooding. Kashechewan is an isolated and remote Indigenous community (in Treaty 9) located on the North Channel of the Albany River, which is the second-largest river (982-km-long) in Ontario. It consists of the three sub-rivers, the Mammamattawa, Ogoki, and Kengogami. The First Nation has been evacuated 13 times to 20 different host communities across the Ontario province since 2004 (consecutively from 2012-2019) because of actual flooding events or flooding risk and the potential failure of the 5.3 kilometers long and 3.5 meters high ring-shaped dyke wall. Through a collaboration with the First Nation, qualitative semi-structured interviews were conducted with 41 participants. In recent years, spring flood risk has significantly increased the community's physical and socio-cognitive vulnerability. Spring flooding frequently impacts the community infrastructure, traditional spring hunting and harvesting, and the local economy. Results indicate that dealing with the regular flooding risk during spring and recurring emergency experiences have helped to

improve the community's disaster preparedness and coping capacity, but residents' experiences during the evacuations are negatively affecting their well-being during and after the evacuations.

DOWNSTREAM ROUTING OF RETROGRESSIVE THAW SLUMP IMPACTS THROUGH HYDROLOGICAL NETWORKS ACROSS NORTHWESTERN CANADA

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Retrogressive thaw slumping is affecting large areas of northwestern Canada. Warmer and wetter conditions have increased the frequency and magnitude of thaw-driven mass wasting which has been shown to significantly alter hydrological, geochemical and sedimentary regimes of northern aquatic ecosystems. Knowledge of thaw slump impacts on hydrological networks has been limited to catchment studies, whereas basin-scale impacts have been typically inferred through the analysis of geochemical trends in larger Arctic rivers. The goal of this project was to develop and implement a method to inventory the effects of slope thermokarst on hydrological systems and to project the routing of downstream effects. An inventory of thaw slump affected lakes, streams and coastal areas was generated for a drainage area covering over 990,000 km2 of northwestern Canada by identifying impacted hydrological segments on the 1:50,000 National Hydro Network (NHN) dataset using georeferenced SPOT 4/5 (2004-2010) and Sentinel 2 (2017) imagery. The thermokarst impacted hydrological features database represents a composite for these two time-periods and includes over 2000 mapped features. All digitized inventories were re-examined by an expert mapper for the entire study domain and edits were implemented for quality control. Downstream routing of thaw slump effects were assessed using a river network processing tool (RivEx 10.25) and ArcMap 10.6.1. Hydrological segments that comprise the NHN dataset were classified as being directly affected, or indirectly affected by thermokarst if the segment was downstream of an impacted feature. Flow accumulation analysis enabled routing and the relative magnitude of effects to be projected across basins of northwestern Canada, and the locations of flux convergence within watersheds, lakes and coastlines to be identified. Summary by Strahler stream order enabled the distribution, and length of direct and indirect effects within a watershed to be assessed within four sub basins. Low ordered streams represented the highest proportion of streams directly impacted by thermokarst and as a result, high ordered streams embodied the highest proportion of streams indirectly impacted. Results from this project demonstrate that the mapping framework can be used to visualize change in the distribution of thermokarst effects over time, and may provide more quantitative assessments of impact accumulation where the magnitude of disturbance has been determined.

CHARACTERIZATION OF DISSOLVED CARBON AND SUSPENDED MATERIAL IN MELTWATER ACROSS GLACIATED AND UNGLACIATED HIGH ARCTIC BASINS

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Snow and glacier ice meltwater runoff serve as important conduits for delivering dissolved carbon and suspended material downstream. The sources and processes controlling carbon dynamics and composition in the High Arctic are often unknown and understudied. This study seeks to characterize the concentration of dissolved carbon and suspended material across both snowmelt and glacial melt dominated watersheds in the Canadian High Arctic. Multiple meltwater samples will be taken from locations within the Wolf Creek Basin and the Expedition River Basin on Axel Heiberg Island, Nunavut, Canada (79° 24' 55" N, 90° 42' 35 W). Meltwater sources from Wolf Creek Basin are predominantly from snowmelt and the small (<5 km^2) Crown Glacier. Meltwater sources from Expedition River Basin are glacier melt from White Glacier and Thompson Glacier. Sampling of the Wolf River Basin was conducted during the 2019 field (summer melt) season and will be continued into the 2020 field season, and will be expanded to include the Expedition River catchment. Sampling locations will be chosen based on source input of meltwater, geologic setting, and varying land cover. Snow water equivalence (SWE) from snowmelt will be assessed using ground penetrating radar (GPR) and in situ snowpit analysis. Glacier melt will be assessed using a variety of regional melt models validated by in situ measurements on White Glacier. It is hypothesized

that glacier meltwater will contain a greater amount of weathering derived carbon and less organic carbon while unglaciated meltwater will contain a greater amount of organic carbon and less weathering derived carbon. Overall, a warming climate in the Arctic is expected to increase meltwater discharge and chemical weathering at the glacier bed, thus increasing weathering derived solutes. In order to gain a better understanding of dynamics in the High Arctic and outputs to the Arctic Ocean, it is essential to study the biogeochemical implications of terrestrial freshwater inputs.

PREY SELECTIVITY EXHIBITED BY NINESPINE STICKLEBACK (PUNGITIUS PUNGITIUS) IN ARCTIC STREAMS OF THE GREINER LAKE WATERSHED

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This project aims to determine prey selection exhibited by ninespine stickleback (Pungitius pungitius) on aquatic macroinvertebrates in Arctic streams of the Greiner Lake watershed in Nunavut. Ninespine stickleback are highly abundant in the Arctic. It is understood they are generalists and feed primarily on aquatic invertebrates, but their ecological role within Arctic food-webs is not well defined. This is important information, given that climate change will affect benthic invertebrate community structure, and that ninespine stickleback are an important trophic link to Arctic Char. Canadian Aquatic Biomonitoring Network (CABIN) protocol kick-net sampling was used to determine benthic macroinvertebrate community structure and abundance in stream reaches. Gut content analysis as well as DNA meta-barcoding analysis will be used to determine the benthic macroinvertebrate taxa present in ninespine stickleback guts. For sites selected for gut content analysis, I will compare differences in relative abundances of macroinvertebrates collected from streams to the head capsules of various invertebrate taxa collected and identified from ninespine stickleback guts to determine if they are selecting for specific prey found within the streams. DNA meta-barcoding will be used for the remainder of sites to simply determine presence/absence of taxonomic groups. Comparisons between stream and gut invertebrate communities will then be made based on taxonomic differences, as well as differences in macroinvertebrate traits such as body size, shape, hardness, movement frequency, and burrowing/swimming tendency. Arctic char gut contents will also be analyzed to determine trophic linkages to benthic macroinvertebrates and ninespine stickleback in this watershed. Statistical methods such as selectivity indices, stable isotope bivariate analysis, as well as principle component analysis will be used to determine if diet is associated with specific benthic macroinvertebrate taxa and/or traits. Preliminary results from last year's samples show that Chironomidae make up 70% of the benthic macroinvertebrate community for all but 3 study sites. The research proposed here is part of a multi-thematic study with the aim of developing a multi-trophic understanding of food-webs in the Greiner Lake watershed.

FIRST FINDINGS FROM AN ACADEMIC CONSORTIUM STUDYING THE EELGRASS ECOSYSTEM ALONG THE EASTERN COAST OF JAMES BAY

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Eelgrass (Zostera marina) is an underwater flowering plant that provides important ecosystem services and habitat for a diversity of marine organisms. Until about twenty years ago, eelgrass beds were very extensive (250 km2) along the eastern coast of James Bay and productive hunting grounds for Canada Geese, Brant and other migratory birds important to coastal Cree. During the 1990s, a major decline in the eelgrass beds was witnessed by Cree hunters and documented by the environmental monitoring implemented by Hydro-Québec. Today, there is a widespread agreement that the eelgrass has not recovered in terms of abundance, shoot length or distribution. To improve understanding of the coastal ecology of Eeyou Istchee marine region and particularly the eelgrass ecosystem, an academic consortium was formed with fieldwork activities beginning in the fall of

2017. The multi-disciplinary research consortium includes faculty, post-doctoral researchers, students and research staff from six universities. In addition to focusing work on the properties of the coastal ocean (i.e., the area that can be accessed from the landfast ice platform and/or freighter canoe), researchers are also seeking to understand what rivers deliver to the coastal waters and studying the ecology, distribution and physiological properties of the eelgrass. Researchers are also collecting data to assess the use of the coastal habitat by Canada Geese (various populations). By working together closely on the different aspects of the science, the consortium aims to rapidly advance understanding of this complex coastal ecosystem and synthesize the results to address the central questions of interest to the Steering Committee that oversees the research. This committee has representation from coastal Cree communities, regional Cree organizations, the Canadian Wildlife Service and Hydro-Québec. Another important aspect of the project is to connect Cree Traditional Ecological Knowledge with the scientific research results to achieve an enhanced understanding. All the researchers work closely with Cree land-users for fieldwork activities and a project is underway to address gaps in the documentation of Cree Traditional Ecological Knowledge. In this talk, I will present some first results emerging from the research consortium following completion of at least one field season by all of the scientific teams. The emphasis is on the potential for new insights to be generated by connecting an unusually broad set of specialists (oceanography, goose ecology, ocean optics, remote sensing, eelgrass ecology and physiology) and working alongside Cree land users. Identifying causes of change in the coastal habitat of James Bay is a very complex challenge that will require us to find ways to connect all available knowledge to arrive at a common understanding.

TIMING OF BREEDING SITE AVAILABILITY DRIVES MIGRATION SCHEDULE IN A LONG DISTANCE TRANS-HEMISPHERIC MIGRANT.

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Long-distance migrants are under strong selection to arrive on their breeding grounds and initiate reproduction at the time that maximizes fitness. Many arctic birds start nesting as soon as snow recedes from their breeding sites but timing of snowmelt can vary substantially over the distribution range of a species. Using geolocators, we studied migratory paths of 31 American Golden Plovers (pluvialis dominica) nesting across the North American Arctic. American Golden Plovers show high breeding site fidelity, and mix freely on their non-breeding ground located mostly in Southern South America. They share the same general wintering area and main spring stopover area in Mid-Western USA before moving towards their respective breeding ground. We looked at relationships

between individual migration schedule and timing of snowmelt at the nesting site. Timing of snowmelt was highly correlated to the timing of breeding. The departure date from the last shared stopover area was positively related to the average snow-free date at the individual breeding site. This relation could not be explained by the remaining distance to reach the breeding ground nor by the duration of the stay of the individual at the shared stopover site. This suggests that plovers adjust their migration according to the breeding site availability and that departure from Mid-Western USA has a population-specific optimum that is controlled endogenously. Climate change is likely to impact timing of snowmelt differently across the breeding range of species, and this is likely to have population-specific effects.

CROSS-SCALE APPROACH FOR UNDERSTANDING CLIMATE CHANGE IMPACTS ON RADIAL GROWTH AND PRODUCTIVITY OF DOMINANT SHRUBS SPECIES IN LABRADOR, CANADA

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Climate change is altering ecological drivers that shape plant communities and landscapes. In particular, Arctic regions are experiencing significant changes to plant communities, including increased growth rates and overall increases in productivity of shrubs (henceforth referred to as 'shrubification'). However, there is tremendous variability in shrubification across the Arctic both at regional and local scales. In the summer of 2019, we conducted research at two sites in southern and northern Labrador, Canada, to investigate the impacts of climate change on the radial growth and productivity of the dominant shrubs (Alnus viridis and Betula glandulosa). The growth rates of these shrubs can be limited by various factors such as temperature, precipitation, and nutrient availability - all of which are being altered by climate change. Therefore, determining the variability of growth rates and productivity of shrubs at the site level can help understand and interpret patterns of shrubification across Labrador. We used Normalized Difference Vegetation Index (NDVI) trend maps (1984-2012) to select random points in areas experiencing rapid greening, greening, and no change. We sampled 26 shrubs, 6 from greening, 8 from no change and 12 from rapid greening in northern Labrador and 11 shrubs in southern Labrador, taking cross-sections of stems at 10 cm intervals to analyse radial growth patterns, and determine if and when shrubification began. This research demonstrates the value of connecting small scale in situ field data with coarser remote sensing products to gain a better understanding of shrubification in sensitive northern environments. This type of research can also be used to further examine which areas are most at risk of climate change impacts.

ICE DYNAMICS OF THE COLD/TEMPERATE ICE TRANSITION ZONE OF WHITE GLACIER TERMINUS.

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The Canadian Arctic Archipelago hosts the largest glaciated area in the world after the Antarctic and Greenland ice sheets. White Glacier on Axel Heiberg Island, Nunavut (~79°N, 90°W) has been monitored for 60 years and acts as one of four reference glaciers to the World Glacier Monitoring Service for Arctic Canada. With mass balance measurements and series of aerial photographs spanning six decades, White Glacier presents an opportunity to use historic and modern data to study ice structure change on a time scale well-suited to observe changes in ice thickness and velocities. White Glacier is polythermal, indicating that it contains both temperate ice close to 0 °C, alongside cold ice, well-below 0 °C that is frozen to the underlying bed material. In regions where ice thickness allows for a temperate base, a polythermal glacier's displacement has components of basal sliding and deformation due to pressure and frictional heating. Thinning ice near the glacier terminus and seasonal changes in sub-glacial hydrologic channels produce complex flow patterns that are expressed as ice surface structures. To better understand these flow patterns, this study will compare the ice surface in the 1960s to that of the current decade. First, an updated version of a 1962 topographic map of the White Glacier terminus area with a corresponding surface model will be produced using Structure from Motion. Next, the current terminus model will be compared to those produced from aerial surveys of previous years and inferred ice processes will be validated with field measurements. To produce the modern map and

model of White Glacier's terminus, 230 high-resolution aerial photos were taken in the summer 2019 field season. Ten ground control points were collected from stable ground around the glacier in 2019 using a portable dual-frequency GPS to georeference and validate the model. To observe the evolution of White Glacier's terminus, the 2019 surface model will be compared with those produced from previous photo surveys, and the digitized 1962 map. Transverse profiles of bed depth were taken along the glacier terminus in the spring of 2017 using ground-penetrating radar, and total station measurements of a stake network drilled into the ice, indicating strain rate, were taken over ten days in July of 2019. These measurements will be used to explain the local ice dynamics and observed surface feature evolution. Here, we present the digitized 1962 White Glacier terminus map and elevation model, and comparison to the models produced from scanned historic air photos. We also discuss the development of the modern Structure from Motion model and interpret the resulting structural evolution of the glacier's thermal transition zone between the two eras. White Glacier is currently retreating, but little is known about how the cold/temperate ice transition zone will change given the current increase in observed melt. Based on a preliminary review of the collected data, it appears that some of the major ice surface features currently observed are relics of a more dynamic glacial history, though their origin is still unknown. Considering the number of similar glaciers found in the Arctic, understanding how ice structures are changing on the White Glacier terminus could help predict their potential effect on melt feedbacks on a regional scale.

INITIAL ESTIMATES OF GREENLAND HALIBUT SURVIVAL: APPLYING ACOUSTIC TELEMETRY MARK-RECAPTURE TO SUPPORT FISHERIES MANAGEMENT

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Emerging Arctic fisheries have the potential to provide socio-economic opportunities to the indigenous communities of the Arctic. Sustainable management of these fisheries, however, is required if beneficial outcomes such as, improved food security, and greater self-determination are to be achieved. Evidence-based sustainable management is underpinned by the accurate estimation of demographic parameters: natural mortality, survival, and abundance. Mark-recapture studies are a popular and well understood method used to estimate these parameters; however, recapturing marked individuals is logistically demanding, and models can perform poorly if the encounter rate of the marked individuals is low. Remote data collection via passive acoustic telemetry has the potential to address some of these limitations, and improve the precision of parameter estimates. The temporal resolution of acoustic telemetry data also provides an opportunity to directly link behaviour to demographic parameters, in a way that can truly inform spatial fisheries management. Quarterly survival probabilities for a deep-sea flatfish, Greenland halibut (Reinhardtius hippoglossoides) were estimated using multiple years of acoustic telemetry data from Cumberland Sound, the location of an established community fishery. A series of open population models were used to explore constant and time-varying survival and detection probabilities. Survival probabilities were high regardless of the model used, with the best fit model supporting time-varying detection probabilities. These initial survival estimates of inshore Greenland halibut can be used to inform forthcoming stock assessments and will support the sustainable growth of this fishery. Further advances of these mark-recapture models to investigate if movement of Greenland halibut between inshore and offshore environments can affect survival estimates will be presented.

FURTHER EVALUATION OF AN EXPLOITED DEMERSAL FISH ASSEMBLAGE: VARIATIONS AND TRENDS IN WEST GREENLAND

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It has long been recognized that single-species-based fisheries management approaches should be complemented by multispecies and/or ecosystem-based approaches in order to provide a broader context of the ecosystem (environmental, ecological, and socioeconomic) for species management. In addition, the abundance and distribution of marine fishes are quickly changing during the last decades due to climate change and overfishing.

For this purpose, we evaluate the status of an important exploited marine ecosystem for one of the largest fisheries in Greenland, Greenland halibut in west Greenland offshore. We use bottom trawl data survey from 1997 to 2019, in West Greenland (NAFO 1CD survey), from 400 to 1500m depth, and we examine how the mean trophic level and three diversity indicators (species evenness, species diversity, and species richness) have changed through time. Furthermore, we also analyse their relationship with climate (bottom temperature and NAO) and effect of fishing (fishing effort). This research has the aim to demonstrate the importance of taking into account ecological indicators and the convenience of estimating the indices for spatial and temporal correlations under different climate conditions and fishing pressure to provide a further understanding of the ecosystem status.

USING ICE AND SEDIMENT CORES TO QUANTIFY CLIMATE-WARMING INDUCED INPUTS OF LEGACY MERCURY TO LAKE HAZEN, NUNAVUT

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Mercury (Hg) emitted from anthropogenic sources can undergo long-range atmospheric transport to the Arctic where it may cause health concerns for Arctic wildlife and indigenous people. Many sediment records do not show a clear decline in Hg deposition despite estimates that Hg emissions from anthropogenic sources have recently stabilized or declined, suggesting that Hg is being remobilized in catchments and delaying the recovery of lakes following emission reductions. To date there is little data on whether the input of legacy Hg increases Hg accumulation in lakes. We hypothesize that the climate-warming induced melting of glaciers may be remobilizing legacy Hg from glaciated watersheds into downstream lakes, providing an important subsidy of Hg in addition to modern Hg inputs. To test this hypothesis, we will compare Hg accumulation rates through time measured in an ice core and sediments cores collected from the Lake Hazen watershed, Nunavut, Canada. By comparing ice and sediment core data, we can determine how post-depositional processes in the watershed controls delivery of legacy and modern Hg into Lake Hazen and whether legacy Hg inputs are increasing the rate of Hg accumulation in the lake. The temporal trends in atmospheric Hg deposition will be compared to known changes in anthropogenic production and/or emission of Hg. Our research will elucidate whether climate change may delay the benefit of decreasing Hg emissions in glaciated and Arctic watersheds, and help improve models of global Hg cycling, develop policies on Hg management, and better manage contaminant exposure for Arctic people and wildlife.

HOW TO BEST PROMOTE COUNTRY FOOD WHILE AVOIDING CONTAMINANTS DURING PREGNANCY? THE NUTARATSALIIT QANUINGISIARNINGIT NIQITUINNANUT - PREGNANCY WELLNESS WITH COUNTRY FOODS (NQN) PROJECT CONSULTATION WITH HEALTH PROFESSIONALS AND NUNAVIMMIUT

Lemire, M (1,3) (Presenter), E. Gagné (1), M. Pontual (1), P. Ayotte (1,2,3), K. Gordon (4), L. Grey (5), MJ. Gauthier (4),S. Ricard (4) and M. Brisson (4)

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Inuit are exposed to a wide range of environmental contaminants through their diet, which includes significant amounts of fish and sea mammals. Conversely, these country foods are of optimal nutritional quality and important for healthy pregnancies and children. During the past 30 years, our team has monitored the exposure of Nunavik's Inuit population to persistent organic pollutants (POPs), metals and country food nutrients. In this period, for most legacy POPs, a decreasing trend in exposure was confirmed in wildlife and circumpolar Inuit. Conversely, some more recent POPs like long-chain perfluoroalkyl and polyfluoroalkyl substances (PFASs) are increasing and biomonitoring remain critical to provide scientific evidence for international actions. For mercury (Hg) and lead (Pb), decreasing trends are observed and can be explained by a diminution in country foods consumption,

and in the case of lead, to the transition towards the use of steel shots. However, still up 23% and 5% of pregnant women presented blood levels above recommended guidelines in 2016-2017. For many years, we have worked on multiple related projects to assess local sources of Hg, Pb and nutrients in Nunavik, to understand their effects on pregnancy outcomes and child development and how to best communicate this information and reduce their exposure. Together with the Nunavik Regional Board of Health and Social Services (NRBHSS), we now propose to integrate Hg and Pb exposure assessment and counselling into pregnancy clinical follow-up across Nunavik. We may also include other contaminants and nutrients biomonitoring in these activities. In order to carefully plan these new joint clinical and research activities, we realised a series of consultation and information sessions with Nunavik health professionals and Nunavimmiut about the NQN project in Kuujjuaq, Inukjuaq, Puvirnituq and Salluit to: 1. Identify their information needs and offer information sessions with respect to Hg and Pb exposures and related health outcomes; 2. Document their views on the feasibility, tools and linkages needed to integrate Hg and Pb exposure assessment and counselling into clinical activities for pregnancy follow-up; 3. Evaluate the feasibility of integrating research objectives (i.e. clinical intervention effectiveness, biomonitoring for Hg, Pb, other contaminants and nutrients) into the proposed clinical activities. Previous NQN project findings and these consultations are critical to carefully plan and implement the joint clinical and research activities proposed here over the coming years for successful pregnant women counselling and contaminant biomonitoring for healthy pregnancies and children in Nunavik. Key outcomes will be presented during the poster session. The project is focused in Nunavik, however has potential applicability in other Arctic regions and also at the international scale.

THE CAFF-CBMP STATE OF ARCTIC FRESHWATER BIODIVERSITY REPORT: HIGHLIGHTS OF CIRCUMPOLAR TRENDS IN ALPHA AND BETA DIVERSITY OF FRESHWATER BIOTA

Levenstein, Brianna (1)(Presenter), J. Lento (1), J. Culp (2), W. Goedkoop (3), T. Christensen (4), K. S. Christoffersen (5), E. Fefilova (6), K.F. Lárusson (7), P. Liljaniemi (8), J.S. Ólafsson (9), S. Sandøy (10), C. Zimmerman (11)

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The freshwater group of the Circumpolar Biodiversity Monitoring Plan (Arctic Council: Conservation of Arctic Flora and Fauna) has completed circumpolar assessments of freshwater flora and fauna to determine the state of Arctic freshwaters. This evaluation included examination of data from both historical (paleolimnological data and records from 1800 to 1950) and contemporary (post-1950) time scales. Assessments compared and contrasted the regional state of Arctic freshwater ecosystems in North America, Iceland, Greenland, Fenno-Scandia, and Russia. In addition, circumpolar assessments for specific focal ecosystem components, namely fish, benthic invertebrates, benthic algae, macrophytes and plankton, provided novel analyses of how climate change and associated environmental drivers affect these biological components. We highlight patterns of alpha and beta diversity across Arctic freshwaters, with specific links to climate change and its potential impacts in these unique ecosystems. This group of studies represents the first circumpolar assessment of trends in Arctic freshwater biodiversity.

LONG-TERM EVOLUTION OF ECOLOGICALLY AND CULTURALLY SIGNIFICANT (SUB)-ARCTIC POLYNYAS: FROM NORTHERN BAFFIN BAY TO HUDSON BAY

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Polynyas (i.e. open-water area surrounded by sea ice) support multiple ecosystem services that are of tremendous importance to northern communities. Yet, their intrinsic link to sea ice makes them particularly sensitive to global climate changes and variability, and the recent rapid changes in the Arctic icescape raise important questions regarding their future. Although multi-decadal observations show a strong inter-annual variability in the extent, duration and biological productivity of polynyas, only little information about the multi-centennial and millennial evolution of most polynyas located in the Canadian Arctic is currently available. This lack of data limits our ability to predict the future evolution of key polynya components, including primary production. Here, we present the results from a suite of micropaleontological (diatoms and dinoflagellate cysts), geochemical and sea-ice biomarker (IP25 and triene) analyses applied on sediment cores spanning the mid-to-late Holocene and collected from the region of the North Water polynya in northern Baffin Bay. We also present preliminary data from recurrent polynyas forming around Southampton Island in northern Hudson Bay. Our results highlight the complexity of the interplay between polynya dynamics and climate variables and demonstrate the necessity of applying a multi-proxy approach to assess the long-term natural history of Arctic polynyas.

SLOPE STABILITY ANALYSIS OF SEDIMENTS IN THE SOUTHWIND FJORD, BAFFIN ISLAND, CANADA

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A predominantly coastal population, high seismicity and competing demands for seabed usage have driven the need to better understand marine geohazards in Baffin Bay, in particular slope stability. Submarine slope failures have the potential to generate tsunami waves that can cause severe damage to coastal communities. In a rapidly changing environment, coupled with glacial ice melt and high seismitcity, it is imperative to create a predictive framework to understand the geohazard risks associated to coastal communities and offshore instrastructure. The Baffin coastline is characterized by fjords, which are known to be environments where slope failures generate. Recent studies show that glaciated fjords, such as those in Baffin Island, are more likely to tsunamigenic landslides. Therefore, in the summer of 2018, the Geological Survey of Canada collected several piston cores (<7 m) inside Southwind fjord, near Qikiqtarjuaq, in efforts to understand slope stability. A comprehensive geotechnical testing program using cores from inside and outside the failure scars evaluated the: 1) lithostratigraphy, 2) bulk density at 1 cm intervals, 3) laboratory mini-vane undrained shear strength, 4) Atterberg limits, 5) consolidation stress history, and 6) the Mohr-Coulomb shear strength parameters. The results were combined into geotechnical profiles to define distinct geotechnical units within the sediment column. Initial results classify the sediments as lean to fat silts, normal to slightly overconsolidated, friction angles between 31˚ and 37 ˚, and cohesion values of 0 kPa. This presentation will provide an overview of preliminary results on the stability of surficial sediments using the limit equilibrium analysis under static and seismic loading conditions.

ASSESSING THE VULNERABILITY OF NORTHERN SALMONID SPECIES TO COMBINED METAL CONTAMINATION AND HIGH TEMPERATURE STRESSORS

Martyniuk, Mackenzie A. C. (1) (Presenter) and P. Couture (1)

(1) Université du Québec Institut nationale de la recherche scientifique - Centre eau terre et environnement

This research will assess the impact of metal contamination and mining infrastructure on northern salmonid species (e.g. Brook charr (Salvelinus fontinalis) and Arctic charr (Salvelinus alpinus)) and habitat in association with increased risks posed by anticipated climate warming in Northern Québec. This is currently a significant knowledge gap, considering this area of research has typically been restricted to fish in temperate

regions. The vulnerability of these species to combined metal contamination and high temperature stressors will be assessed through both field and laboratory studies. The study's field component will include the collection of fish muscle, liver, kidney, gill, and pyloric caeca tissue samples from mining impacted zones, as well as reference sites, to quantify gradients of metal contamination and provide insight into metal uptake and elemental tissue affinity in these species. Additionally, muscle and liver tissues will be also be utilized to further our understanding of ecotoxicological impacts on fish health using biomarkers and collected sediment, invertebrate, and water samples will be used to further assess the impact of mining operations on fish habitat. Laboratory studies will focus on determining critical thresholds of metal contamination as a result of variation in temperature in juveniles. This will be accomplished through exposure of fish to metals at a range of realistic, current, and anticipated temperatures to quantify mortality rate as well as the impact of metal contamination on metabolic and antioxidant capacities, aerobic swimming capacity, and oxygen consumption via metabolic performance experiments. Finally, collected data will be evaluated in association with modeled surface warming predictions to determine critical scenarios for the assessed salmonid species. All research will be performed with emphasis on relationships with Indigenous stakeholders. Continual meetings will be held with local communities to ensure traditional knowledge is incorporated, as well as to discuss project objectives, progress, results, and local concerns associated with mining development.

MEOPAR COAST AND OCEAN RISK COMMUNICATION COMMUNITY OF PRACTICE: WELCOMING NORTHERN PERSPECTIVES ON COASTAL HAZARDS AND RISK COMMUNICATION

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This poster will outline the vision and goals of the Coast and Ocean Risk Communication Community of Practice (CORC CoP), describe how the CoP brings people together to exchange knowledge, share resources and connect with others across Canada and internationally through our events and activities, and share outcomes of our activities over the past year, since our inception in 2018. A community of practice (CoP) is "a group of people who share a concern or passion for something they do, and learn how to do it better as they interact regularly1". The changing climate and increasing industrial development in northern regions are affecting coastal communities in many ways. Identifying existing and emerging risks for communities, from all perspectives, and communicating effectively about them, could be helpful to maintain or build community resilience and social capacity. Mechanisms like communities of practice, that bring people with diverse perspectives together - community members or groups, researchers, and others who live or work in the north - provide an opportunity for people to interact, connect, and collaborate on projects or initiatives, as well as share knowledge and information resources. The Coast and Ocean Risk Communication CoP brings together people with varying perspectives (e.g., local and indigenous communities, researchers, emergency planners, policy-makers; marine industries, and others), to exchange knowledge and experience, and to learn about approaches and best practices for communicating risks relating to marine and coastal hazards affecting people in coastal environments (such as marine pollution, extreme weather events, sea level change, coastal flooding, storm surge, sea-ice change, or others). CORC CoP is sponsored by the Marine Environmental Observation, Prediction and Response Network (MEOPAR), a federally-funded Network of Centres of Excellence (NCE). CORC CoP is led by Dr. Joel Finnis (Memorial University), Dr. Ronald Pelot (Dalhouise University), and Dr. Amber Silver (University at Albany) and Community Coordinator, Cindy Marven (Victoria, BC). The CoP offer webinars, identifies and produces resources for members, invites people to participate in informal discussions or presentations and to share ideas to address challenges, or identify challenges in need of solutions. Our activities and events occur mainly online through our website (corccop.com), online forum (network.futureearth.org/corccop), newsletters, and webinars (2019: Navigating the Changing Communication Landscape: Social Media For Risk and Crisis Communication; 2019: Communicating disaster risk? An evaluation of publicly accessible flood maps in Canada; 2018: Our Incredible Shrinking Island: Climate Science Public Outreach on Prince Edward Island; 2018: What's That Sound? Public and Official Perceptions of the January 2018 Tsunami Warning and Evacuation in the Alberni Valley). We have held two in-person events: 2018 CMOS Town Hall Session: Risk Communication at the Local Level: Towards Meaningful Community Collaborations on Environmental Hazards; and Coastal Hazards and Risk Communication Forum, MEOPAR ASM 2019). MEOPAR CORC CoP invites people living, working, or studying in northern coastal regions to connect with the CORC

community to spark conversations about the concerns of northern communities, and exchange knowledge about coastal hazards and risk communication. /1 (Wenger, McDermott, &Snyder, 2002).

MICROBIAL N-LIMITATION IN TUNDRA SOILS ALONG ENVIRONMENTAL GRADIENT: INTRA-SEASONAL VARIATION AND EFFECTS OF RISING TEMPERATURE

Maslov, Mikhail (1) (Presenter) and O. Maslova (1)

(1) Lomonosov Moscow State University

The availability of nitrogen (N) sources is one of the main factors limiting both primary productivity and decomposition throughout much of the Arctic alpine tundra active growing season and determines the ability of ecosystems to store carbon from the atmosphere. It is believed that the alpine tundra soils are poor accessible nitrogen. However, the tundra landscape is not homogenous and consists of a mosaic of vegetation types which differ greatly in soil fertility. Increasing temperature in the Arctic may potentially stimulate microbial activities, which could have long-term effects on ecosystems. We studied two contrasting N availability mountain tundra soils under dwarf-shrub heaths and grass-forbs meadows in the Khibiny (67°64□ N 33°64□ E), Russia. We conducted a series of laboratory incubations with soils collected at the beginning, peak and finishing of the growing season to understand intra-seasonal variation in the controls of N limitation on soil microbial activity. Soil samples were incubated at + 12 and + 22 °C with nitrogen (NH_4NO_3) added at three times the maximum concentration for the season and without (added DI water). We determined the effect of N on the respiration activity of microorganisms (daily during the week), the content of microbial biomass carbon and nitrogen, extractable nutrients, as well as the activity of extra-cellular enzymes. The effect of increased nitrogen availability on the microbial activity at the beginning and middle of the active season is the same: nitrogen addition stimulates mineralization of soil organic matter (SOM) in nitrogen-poor dwarf-shrub heaths soil and does not affect in the nitrogen-rich grass-forbs meadows soil. These findings suggest that other factors (for instance, temperature and carbon availability) limit microbial activities in alpine meadow soils at these time. In contrast, raised nitrogen availability at the end of the growing season (sampling in September during leaf fall) significantly increases microbial activity in both heath and meadow soils. This is due to the entry into the soil of a large amount of organic matter from the aboveground and belowground plant detritus. The increase in incubation temperature stimulates respiration of microorganisms both in the soils of the dwarf-shrub heath and the meadow. At the same time, the temperature sensitivity of the SOM mineralization (Q10) in the heath is higher than in the meadow and generally does not depend on the period of the growing season. Increase availability of nitrogen reduces the temperature sensitivity of the SOM mineralization in the heath but rises it for meadow soil. Thus, despite the proximity of the heaths and meadows, the activity of soil microorganisms in them is limited by various factors. Dwarf-shrub heaths soil microorganisms are limited by nitrogen throughout the growing season, while meadows soil is limited only during the period of increased availability of organic matter. Our results showed that growing availability of nitrogen in tundra soils under climate change (due to increased mineralization and nitrogen fixation, as well as atmospheric depositions) can decrease the temperature sensitivity of SOM mineralization in the dwarf-shrub heaths that accumulate the largest reserves of organic carbon and are widely represented in the tundra zone. This work was supported by the grant of President of the Russian Federation (project no. MK-207.2019.5).

FROM RESEARCHER-DRIVEN TO COMMUNITY-BASED: MUSKOX AND CARIBOU HEALTH SURVEILLANCE IN ULUKHAKTOK, NORTHWEST TERRITORIES

Mavrot, Fabien (1) (Presenter), B. Inuktalik (2), G. Okheena (2) (Co-presenter), T. Davison (3), H. Fenton (3), J. Di Francesco (1), X. Fernandez Aguilar (1), J. Mosbacher (1), J. L. Rothenburger (4), S. Kutz (1) and the Olokhaktomiut Hunter's and Trapper's Committee

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Monitoring of wildlife in the Arctic is associated with many challenges. For researchers and governmental biologists, the huge costs and logistic difficulties of traveling and maintaining a presence in one of the most remote regions of the globe often impair the quantity, quality and temporal distribution of samples and data collected. For Arctic community-members, although great

progress has been made in the past decades regarding co-management and inclusion of traditional knowledge in mainstream science, there are still situations when their expertise is being by-passed in the monitoring/ decision-making process and where they feel left as observers, their voices inadequately represented in conservation and management efforts. Here we detail how the collaborative muskox and caribou health monitoring in Ulukhaktok, Northwest Territories, is addressing some of those difficulties. The program started in 2016 as a university-based initiative aiming at improving the timely detection of changes in the local muskox population. Since then, it has transitioned to a community-based monitoring program for muskox and caribou surveillance, led by the Olokhaktomiut Hunter's and Trapper's Committee and funded by the Indigenous Community-Based Climate Monitoring Program (Crown-Indigenous Relations and Northern Affairs Canada). The monitoring program has successfully brought together the community of Ulukhaktok, governmental agencies and academic researchers to guide the monitoring effort and enhance the flow of information and knowledge between all parties. It has also built capacity in the community through the training of community-members championing the program and through the engagement of youth in scientific monitoring. Through a harvester-based sampling scheme, 75 sample kits have been collected since 2016. The program has already identified several health issues in muskoxen such as an increase in incisor tooth breakage and exposure to the bacterium Erysipelothrix rhusiopathiae. The program has also enhanced the reporting of abnormalities in harvested animals and documented an increase in the exposure to Brucella spp in muskoxen, a bacterium that can be transmitted to people when handling or consuming raw/undercooked meat. Finally, lab results will be combined with analyses of sample kit questionnaires and annual harvester interviews to better capture trends in muskox and caribou populations and health. This transdisciplinary approach will help tailor future monitoring efforts and contextualize the obtained results. It will also serve as a baseline for future monitoring efforts. The insight gained through the monitoring program is shared between all project partners and with the community of Ulukhaktok and with management organizations such as the Inuvialuit Game Council and the Wildlife Management Advisory Council. Although still in its early stage, we believe that the current program in Ulukhaktok provides the framework for a long-lasting, multi-partner, community-driven muskox and caribou health surveillance network in the Canadian Arctic.

SOCIAL ORGANIZATION AND DISTRIBUTION PATTERNS OF THE EASTERN BEAUFORT SEA (NWT) BELUGA POPULATION IDENTIFIED FROM AERIAL PHOTOS

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The Eastern Beaufort Sea (ESB) is home to one of the largest belugas whale population in the Western Canadian Arctic region. During their summer migration, belugas travel from the Bering Sea to the Beaufort Sea and Amundsen Gulf. They form large aggregations in the shallow waters of the Mackenzie Estuary as soon as the area is ice free. The estuary is thought to provide an important calving area and offer environmental advantages (e.g. shallow depth, warm and fresh waters). It is here that Inuvialuit have a long history of harvesting beluga for subsistence. Partnership efforts with communities of the Inuvialuit Settlement Region have led to long lasting successful EBS beluga population monitoring programs, using technology and traditional ecological knowledge (TEK). Recently, knowledge gaps have been identified both by scientists and communities about beluga population distribution and structure. The aim of the research is to describe the social organization and the distribution patterns of the EBS beluga population while in their summering region. During mid July 2019, an aerial survey was conducted in the Eastern Beaufort Sea, Mackenzie Delta and Amundsen Gulf to estimate the beluga population size. The data obtained from marine mammal observers during the survey and the georeferenced aerial photos will be used to describe group composition, swimming direction and distance between individuals and between groups. Recognizing the knowledge held by Inuvialuit, we will co-interpret the activities of belugas in the photos together with community knowledge holders. These observations could be compared with data from previous surveys (1992, 2007-2009) to assess changes over time. The expected findings are intended to improve our understanding of beluga social organization and distribution under environmental changes and contribute to co-management decision making. This research aligns with the ArcticNet Project "WM03 -

Knowledge Mobilization for Wildlife Co-management in Inuit Nunangat".

IMAPPIVUT EXPEDITION 2019: SCIENCE AND COMMUNITY ENGAGEMENT IN COASTAL NUNATSIAVUT WATERS

de Moura Neves, Bárbara (1), P. McCarney (2) (Presenter), A. Vance (3), R. Rangeley (3), R. Lang (2), M. Denniston (2), A. Murphy (1), B. Brown (2), D. Coté (1)

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Imappivut ("Our Oceans") is a marine planning initiative of the Nunatsiavut Government (NG) to represent Labrador Inuit interests in identifying research and decision-making priorities in the coastal and marine areas of Nunatsiavut, which have had considerably fewer scientific surveys than offshore areas. To help inform Imappivut and fill these research gaps, the NG, Oceana Canada and the Department of Fisheries and Oceans Canada (DFO) partnered on a scientific expedition to generate data that can inform decision-making in northern Labrador. Here we describe outcomes of the expedition, which was fully collaborative and had both scientific and community engagement objectives, involving ecological and social-cultural considerations. Three main sites that had cultural and ecological significance were surveyed: Hebron fiord, Okak Bay, and island complexes around Nain, Nunatsiavut. The expedition took place in August 2019 aboard the R/V Odyssey, and included scientists and outreach professionals from partner organizations, as well as NG staff and daily community visitors. The science objectives involved seabed video surveys to characterize benthic habitats and quantify biodiversity across different depth zones in coastal Labrador. Video surveys were conducted using a benthic sled, deployed as a drop camera, and a baited camera. Benthic sled deployments consisted of snapshots of the seafloor at 3-5 stations per site. Baited cameras were deployed using squid as the bait, at depths of 24-240 m, with soaking times of 2-4.5 hours. At Hebron fiord (50-235 m), dense fields of cerianthids, ophiuroids, and polychaete tubes were common in soft bottom areas, while in rockier areas ophiuroids and sea urchins dominated. At Okak Bay (29-176 m), ophiuroids densely covered the seafloor at soft bottom areas, while rockier areas (shallower) were dominated by coralline algae, cerianthids, and ophiuroids. Near Nain (19-75 m), one of the surveyed sites is located inside of a rattle (polynya), where benthic diversity was high, including the sea squirt Boltenia sp., Cucumaria frondosa sea cucumbers, scallops, and soft coral fields (Gersemia rubiformis). The baited camera video data indicate a relatively depauperate fish community relative to benthic epifauna, with sculpins (Family Cotidae) as the most commonly observed fish, with other fish species infrequently visiting the camera. During the Nain portion of the project, community members boarded the vessel for a closer view of scientific operations and had discussions with scientists, crew members, and communication personnel on scientific objectives, methodology, rationale for the choice of sites and gear, and provided local knowledge to guide collections and inform future studies. Following the expedition, the project team organized a community event at the J.S. Community Center in Nain to display videos and interviews conducted during the project. The results from this expedition will contribute to ongoing work to define the Ecologically and Biologically Significant Areas (EBSAs) within and adjacent to the Nunatsiavut Zone, raise awareness of important ecosystem components, and provide a foundation for further collaborative efforts that involve a range of partners. We also argue that the elements of scientific rigor and meaningful community engagement are mutually supportive and enhance the likelihood that data that will be relevant to both community members and governments in decision-making.

THE ARCTIC COASTAL BIODIVERSITY MONITORING PLAN - AN INTERNATIONAL APPROACH TO CO-GENERATE KNOWLEDGE TO MONITOR IMPORTANT TRENDS AND CHANGES IN CIRCUMPOLAR ARCTIC COASTAL BIODIVERSITY.

T. Jones (1), Behe, C. (2), McLennan, Donald. (3) (Presenter), Arvnes, M. (4), Wegeberg, S. (5), Sergienko, L. (6), Harris, C. (7), Harcharek, Q. (8), Christensen, T. (5), Fletcher, S. (10), Nichols, S. (11)

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Circumpolar Arctic human settlements are largely coastal, and include the homelands of many Indigenous groups. Indigenous People hold a close relationship to this environment, and rely on coastal species for the many aspects of food security; health and well-being, culture, economics, stability, as well as wildlife accessibility and availability. Recognizing humans as a part of the ecosystem, the Arctic Coastal Biodiversity Monitoring Plan acknowledges the interdependence of human coastal communities and the coastal ecosystems they rely on. The Arctic Coastal Biodiversity Monitoring Plan (the 'Coastal Plan') was recently approved by the Senior Arctic Officials of the Arctic Council in May 2019 (https://www.caff.is/coastal/coastal-monitoring-publications). The Coastal Plan is an agreement across Arctic States to compile, harmonize and assess results from existing coastal biodiversity and ecosystem monitoring efforts, to identify gaps, and comprehensively monitor and report Arctic coastal ecosystem changes. The Coastal Plan is the Arctic Council's first initiative to develop a platform that will support a co-production of knowledge approach, and is an important step towards bringing together Indigenous Knowledge (IK) and science into the assessment, planning and management of Arctic biodiversity. The co-production of knowledge approach specifically includes involving Arctic peoples and their knowledge in the monitoring and analysis of Arctic biodiversity. Arctic coasts can be viewed as a series of social-ecological systems that include components of marine, freshwater and terrestrial realms that interact with each other, and with the people that live there. Within this nexus, coastal social-ecological systems meet and interact in complex ways that significantly influence their composition, and their capacity to support a wide range of Arctic coastal biodiversity. Arctic coastal biodiversity is threatened by multiple interacting environmental drivers and anthropogenic stressors. The difficulty in understanding these complex processes and interactions underscores the need for comprehensive and sustained monitoring of coastal ecosystems. To begin addressing these issues, the Coastal Plan proposes to bring together an ecosystematic science approach and an Indigenous Knowledge holistic approach to co-produce knowledge of coastal ecosystems. This co-generated knowledge cooperatively produces evidence-based information that will inform proactive and adaptive decisions and policies needed to help maintain the biodiversity and sustainability of Arctic coastal social-ecological systems. The next, and most difficult stage in this process, is the coordinated implementation of the Coastal Plan across the Arctic nations. Implementation requires flexibility, as each nation will have its own unique set of social-ecological settings, issues and approaches. Through a series of international workshops involving both IK experts and science experts, the Coastal Plan proposes a prioritized set of Focal Ecosystem Components (monitoring indicator species) that will allow an international synthesis of monitoring results across the circumpolar areas of the Arctic coastline. This presentation will outline the structure of the Coastal Plan, and invite coastal communities and Indigenous organizations, national government and non-government entities, academics, and individuals to participate and contribute to its implementation in the Canadian Arctic.

DOES SCIENTIFIC ENGAGEMENT INCREASE POLAR AWARENESS? EXAMPLES FROM THE EXPEDITION SHIP OPERATOR HURTIGRUTEN.

Meraldi, Verena (1) (Presenter), Morgan, Tudor (1) (Presenter), Chardine, John (1) (Presenter), Lowther, Andrew (2), Cusick, Allison (3), Damsgård, Børge (4)

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Hurtigruten, a leading member within the International Association of Antarctic Tour Operators (IAATO) and the Association of Arctic Expedition Cruise Operators (AECO), has been visiting the West Antarctic Peninsula and the Arctic for almost two decades, ample time to witness the effects of climate change in these vulnerable environments. We have always believed we have the responsibility to invest in the understanding and conservation of the areas we visit. We have therefore supported the scientific community by transporting researchers and their equipment to and from their study areas in both polar regions. As a result, we have established collaborations with numerous scientific institutions, such as the University Centre in Svalbard (UNIS), the Norwegian Polar Institute, the Institute for Marine Research and the SCRIPPS Institution of Oceanography, as well as charities such as ORCA and Oceanites. Scientific data collection in the polar regions is challenging due to remoteness, a harsh environment and high operational costs. At the same time, tourism and the

number of ships travelling to polar regions has increased considerably. Well aware of the potential for impacting the environment, but without compromising our growth, we launched the first electric/fuel hybrid expedition ship in July 2019. A second hybrid ship will be launched in April 2020. Both ships have been equipped with state-of-the-art Science Centers that not only allow guests to have greater exposure to scientific research conducted within polar regions, but are also ideal for collaborating scientists to perform preliminary examination of specimens and analysis of data. Engaging directly in science enhances our guests Darn!!experience, and this has increased their awareness of the planet's most fragile environments. We present results of such collaborations as examples of what can be developed in the future with other scientific institutions. Our resources, used in combination with our lecture programmes and hosting projects from scientific institutions, support our guests' education as well as scientific research in the polar regions and citizen science programmes.

MARINE ECOLOGICAL CONSERVATION IN THE CANADIAN EASTERN ARCTIC (MECCEA): A PROJECT TO IDENTIFY PRIORITY AREAS FOR CONSERVATION (PACS)

Martine Giangioppi (1), John Roff (1), Adrian Gerhartz-Abraham (1), Will Merritt (1,2)(Presenter), Erin Keegan (1,2), and Tim James (1,2)

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(3) Marine Affairs Program, Dalhousie University, Halifax, Nova Scotia
(4) Department of Geography and Planning, Queen's University, Kingston, Ontario

WWF- Canada initiated a project intended to inform the development by the Government of Canada of a network of Marine Protected Areas (MPAs); specifically, to address a current gap in MPA Network planning in the eastern Arctic. Priority Conservations Areas (PACs), based on ecological principles that rely on both scientific and indigenous knowledge, have been identified. The PACs are integrated into the wider landscape and seascape by patterns of connectivity, thus permitting the establishment of a true Network of Arctic marine protected areas. The scope of the project includes the Arctic Basin, Arctic Archipelago, Eastern Arctic and Hudson Bay Complex marine bioregions. The outcomes of MECCEA can be used to inform future MPA Network planning in the Arctic, the establishment of individual marine conservation areas, and planning and management decisions outside of MPAs, including Ecosystem-Based Management, Marine Spatial Planning, Strategic Environmental Assessments, etc. This work will also contribute towards international efforts to support the development of a Pan Arctic Marine Protected Areas Network (PAMPAN).

INDIGENOUS MENTAL HEALTH IN A CHANGING CLIMATE: A SYSTEMATIC SCOPING REVIEW OF THE GLOBAL LITERATURE

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Indigenous peoples globally are among those who most acutely experience the mental health impacts of climate change, as many Indigenous peoples continue to rely on the environment to support their livelihoods, relationships, and wellbeing. Little is known, however, about the ways in which Indigenous peoples globally experience climate-sensitive mental health impacts and outcomes, and how these experiences may vary depending on local socio-cultural contexts, geographical location, and regional variations in climate change. Thus, the goal of this study was to examine the published research investigating the ways in which global Indigenous mental health is impacted by meteorological, seasonal, and climatic changes, and characterize Circumpolar research within the international Indigenous scholarship. Following a systematic scoping review protocol, three electronic databases were searched. To be included, articles had to: be empirical research published since 2007 (i.e. since the Intergovernmental Panel on Climate Change's Fourth Assessment Report); explicitly discuss Indigenous peoples or communities; and describe factors related to climatic variables and mental health. Descriptive data from relevant articles were extracted, and the articles were thematically analyzed. Forty-nine articles were included for full review. Most primary research articles described research with Indigenous peoples in Circumpolar countries (>50%), including: Canada (40.4%), United States of America

(10.6%), Russia (4.1%), and Sweden (2.0%). The number of articles increased over time, and they documented mental health outcomes such as strong emotional responses, suicide, depression, and anxiety that were linked to changes in meteorological factors, seasonality, and exposure to both acute and chronic weather events. The literature also reported on the ways in which the emotional and psychological impacts of climate change? were connected to changing place attachment, disrupted cultural continuity, altered food security and systems, forced human mobility, and intangible loss and damages. This review highlights the less visible and inequitable harms of climate change that are only beginning to be recognized by international scientific bodies, and identifies pathways to support Indigenous-driven initiatives and decision-making to enhance mental wellness in a changing climate.

TWO-EYED SEEING COMPARATIVE POLICY RESEARCH: POLICY PROFESSIONAL AND INUIT COMMUNITY NARRATIVES ABOUT FRESHWATER AND WASTEWATER IN NUNAVUT, CANADA

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The following is a comparative study proposal between two Nunavut communities that centralizes freshwater and wastewater policy strengths and challenges from two perspectives. The perspectives, gained through interviews and tables talks, will be recruited from Inuit community members and policy professionals. Using a two-eyed seeing research approach that is Indigenous and non-Indigenous, the study gathers Inuit intergenerational knowledge from two age cohorts (born before 1950 and born after 1970). Two community sites will serve as the basis to gather policy narratives to observe how policy beliefs are narrated using physical, localized watersheds in Nunavut. With a community based design in mind and an existing community mentorship model, the project's research question and subquestions seek to explore: How does a two-eyed seeing comparative approach help us better understand water governance challenges in Nunavut? Sub-questions: What are the policy beliefs and narratives related to freshwater and wastewater in Nunavut communities? Are the freshwater and wastewater policy challenges experienced differently or shared across Nunavut communities? What intergenerational Inuit knowledge is evident in policy narratives related to freshwater and wastewater? How can it be sustained or advanced? What are the Indigenous and non-Indigenous policy beliefs and narratives related to freshwater and wastewater in Nunavut? What are the implications for water governance and policy? About 8 Inuit will be invited to complete interview and table talk dimensions of the study in each community, a total of 16 Inuit study participants. Professionals across 4 levels of government will be invited to complete the interview dimension of the study: local, regional, territorial, and federal are targeted as study participants for the policy dimension of the study (n=20). A third dimension of the study includes content analysis of dominant policy documents. Data analysis and validation will be sought from the community mentors in each community on environmental sustainability values. Narratives will help explore how Inuit and non-Inuit perspectives are integrated into Nunavut's policy process. The two-eyed seeing approach outlines details about the comparative analysis. In one sense, research compares differing values, those from Indigenous and non-Indigenous perspectives through the different groups of study participants. Community level freshwater and wastewater policy beliefs are not often compared in research. Therefore, the two-eyed seeing approach deepens the context of policy research in Nunavut.

COASTAL SEDIMENT DYNAMICS IN EASTERN JAMES BAY (QUEBEC, CANADA) UNRAVELED BY MINERALOGICAL AND GEOCHEMICAL ANALYSIS

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James Bay is a shallow rectangular basin located in the southeastern part of the Hudson Bay. The eastern coast of the bay includes very dynamic environments from a sedimentary point of view. Indeed, the sediment transport and deposition in this area are influenced by strong seasonal fluctuations in sea ice cover and runoff from several dammed rivers, as well as by tidal- and wind-driven currents. This area is also characterized by the presence the eelgrass beds (Zostera marina), considered important for sediment stabilization and enhanced biodiversity. During the last decades, the eelgrass

distributions along the eastern coast of James Bay have shown decreased extension. However, little is known on how seabed composition and sediment dynamics affect eelgrass distribution in this subarctic region. In this context and in the framework of the COAST-JB (Coastal oceanography of the eastern James Bay) project financed by Niskamoon Corporation, the mineralogical and elemental geochemical signatures of 70 surface sediment samples (including <2 mm and <63 μm fractions) from eastern James Bay were investigated to (1) characterize the spatial distribution of the surface sediments, (2) define the potential sediment sources and transport processes, and (3) explore how differences in sediment composition influence the coastal eelgrass habitats. To better constrain the provenance of sediments, analyses were also performed on 8 river bank sediment samples from the main rivers that drain into eastern James Bay (La Grande, Castor, Maquatua, Vieux Comptoir, Conn, Eastmain, Jolicoeur, and Pontax rivers). The mineralogical composition of the sediments from the <2 mm and <63 μm fractions are dominated by plagioclase, quartz and K-feldspar, with minor proportions of dolomite, amphibole, chlorite+biotite and illite. All sediments are classified as wacke, suggesting that detrital material in this area contains higher proportions of rock flour derived from glacial erosion of the Precambrian granite-greenstone terrains of the Canadian Shield. The spatial distributions of mineralogical ratios (illites/total feldspars and quartz/total feldspars), elemental ratios (Si/Al, Ca/Al, Fe/Al, K/Fe, Zr/Zn), and detrital carbonate concentrations indicate higher contents of plagioclase, K-feldspar, and Fe-K-Zr in the northern coast (53.1°N - 54.1°N) and higher contents of illites, quartz, detrital carbonates and Ca-Si-Zn in the southern coast (52.3°N - 53.1°N). This north-south mineralogical trend reflects the underlying geology, as quartz monzonite and monzodiorite rocks are outcropping on the northern coast, while granodiorite and tonalite gneiss, as well as metasedimentary rocks, are outcropping on the southern coast. The compositional sediment difference between the north and south coasts suggests that the (1) longshore currents do not have a significant role in mixing and homogenizing detrital sediments along the eastern coast of James Bay, and/or (2) fine-grained sediments discharged by rivers are transported in suspension relatively rapidly offshore and they influence coastal sediments only regionally. Additional surface sediment samples will be analyzed to improve our understanding of coastal sediment transport and to determine the influence of sediment river discharge on the eelgrass habitats along the eastern coast of James Bay.

UNRAVELING REGIONAL VARIATIONS IN SURFACE SEDIMENT MINERALOGY IN THE CANADIAN ARCTIC ARCHIPELAGO USING MULTIVARIATE STATISTICAL ANALYSIS

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During recent decades, research efforts to assess the seafloor mineralogical and geochemical composition of the Canadian Arctic sediments have been carried out in limited areas. Indeed, substantial knowledge gaps regarding regional-scale seafloor mineralogical and geochemical composition exist within the vast majority of the Canadian Arctic Archipelago (CAA), as well as the adjoining continental shelf and slopes. To a large degree, this lack of information reflects the challenges of collecting seafloor sediment samples in areas where sea ice presents a major limitation on sampling operations. Overall, a wider spatial coverage of sedimentary records across the marine CAA is essential to provide fundamental baseline information on the main accumulation and erosion areas, sediment transport pathways and physical and geochemical sediment properties in this Arctic region. In this context, a total of 115 surface sediment samples were subsampled from box cores collected over a large area covering the Canadian Beaufort Sea to the Baffin Bay to unravel modern regional variations in sediment mineral composition in the CAA. Sampling was performed in 2016, 2017, 2018 and 2019 aboard the CCGS Amundsen as part of the ArcticNet program. The weight percentages of minerals in the <2 mm sediment fraction were determined by quantitative X-ray diffraction. Cluster, classification decision tree and principal component analysis are used to highlight mineral associations with similar relative variation patterns and identify statistically significant mineral clusters or provinces. Our results, combined with spatial analysis, reveal that the CAA can be separated into three mineral provinces: (1) the Mackenzie Trough-Canadian Beaufort Shelf, characterized by high clay contents (notably illite, chlorite, muscovite, smectite, and kaolinite) which are derived mainly from inputs of the Mackenzie River; (2) the Queen Maud Gulf, distinguished by the association of quartz, feldspars, amphibole and vermiculite resulting from inputs of the North American Arctic rivers flowing into the gulf; and (3) Banks/Victoria/Prince of Wales Islands, Barrow Strait and Lancaster Sound, characterized by high dolomite and intermediate clay contents mainly supplied from coastal cliff erosion of Pleistocene carbonate-rich glacial tills, as well as clastic sedimentary

rocks outcropping on these islands. Classification decision tree and principal component analysis corroborate that illite, feldspars and dolomite can be used to track changes in detrital sediment provenance in the CAA during the late Quaternary. Taken as a whole, our approach provides new constraints on the sedimentary processes controlling the seafloor composition within the CAA.

MAPPING SEA ICE HABITABILITY FOR POLAR BEARS IN THE HUDSON BAY USING DEEP LEARNING , RADARSAT-2 SATELLITE IMAGERY AND COLLAR DATA.

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Monitoring wildlife and its habitat is key to assess biodiversity issues and improve species at risk recovery strategies. Traditional methods are great at tracking species located within a specific region and monitoring its interactions with its local habitat. In remote areas, traditional methods become very challenging and sometimes impossible, especially if there are no continuous tracking method of the studied area like many locations in the Canadian Arctic. For species like polar bears, an added challenge is that they can travel many kilometers in a day and are often alone, meaning it is easy to miss the animal within a given area and time. Remote sensing has proven to be a valuable tool to indirectly monitor wildlife by mapping landscapes properties favorable to specific species. Common methods consist of using optical remote sensing to extract landscape features and select areas to study with the most favorable habitat conditions. These methods are difficult to use in Arctic environments since they require sunlight which is absent during polar winter and requires cloud free days which can be rare. It is also possible that the identified favorable landscape properties may vary for a given species that needs to respond quickly under fast changing environmental conditions to survive. One way to reduce the limitation of such methods using remote sensing data is to use synthetic aperture radar (SAR) which possesses its own radiation source (i.e. does not use sunlight) and has the ability to see through clouds making it a key satellite sensor to monitor the Arctic landscape. Nonetheless, using SAR data to map large areas in an automated and efficient way can prove to be complex and difficult. In this study, we propose to use a deep learning algorithm on SAR imagery around known polar bear locations from collar data and train this algorithm to recognize the sea ice features surrounding the bears and identify where these conditions are in the Hudson Bay. Current results show that deep learning algorithms can identify specific sea ice features with an accuracy of 90%. Results from the algorithm from data acquired between 2010 and 2017 will be presented and explained to enable wildlife researchers to use the results but also potentially adapt this method to wildlife studies other than for polar bears. This method is a novel approach at wildlife monitoring and it also removes most human assumptions of landscape properties favorable to polar bears. It could also provide insight on changing wildlife behaviors and improve large scale species at risk recovery strategies.

DIRECT DATING OF GOLD-ASSOCIATED GEOLOGICAL FAULTS IN THE ARCTIC CANADIAN CORDILLERA, YUKON TERRITORY.

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The tectonic and metallogenic (resource) framework of Arctic regions is poorly understood because of limited infrastructure, climate considerations and the high cost of exploration. However, knowledge of Arctic geology is vital for responsible resource identification and management and ensuring economic opportunities for northern communities. Economic metals can concentrate in fluids and magmas within the Earth's crust. For example, interaction between magmatic intrusions, fluids and the surrounding rocks causes enrichment of metals such as copper, gold and molybdenum in 'porphyry style' deposits. In these settings, the metals are intimately associated with veins containing minerals such as quartz and calcite. In order to develop predictive models for mineralised systems it is imperative to understand the timing of emplacement of these veins. Dating of hydrothermal veins, however, has proved challenging due to lack of suitable 'datable'

material. Here we aim to use the newly-developed U-Pb calcite dating technique to test the capabilities of calcite dating for providing robust and critical timing constraints for ore-deposit models. The Dawson Range in the central Yukon is locally enriched in gold, copper, molybdenum and other metals largely association with magma bodies (porphyry, epithermal and skarn type deposits) hosted in large continental-scale strike-slip fault zone systems, such as the Big Creek Fault (BCF) system. Here, we use in-situ laser ablation U-Pb calcite dating to directly-date mineralised carbonate veins from the Late Cretaceous porphyry deposits associated with ther BCF. Initial results indicate two unambiguous carbonate veining events, one during the Late Cretaceous (~73 Ma) and a second during the Paleocene (~55-60 Ma). This suggests that there were distinct pulses of mineralisation associated with granitoid emplacement and faulting on the BCF. Our results represent a significant contribution to tectonic and mineralisation models for the region and explore the role of major faults, such as the BCF for hosting and facilitating deposition of economic Cu-Au deposits. Furthermore, our results demonstrate the potential for calcite U-Pb dating to provide timing constraints for hydrothermal mineralisation processes in a variety of deposit-type settings.

ECOLOGICAL CHARACTERIZATION OF COASTAL AND OFFSHORE BENTHIC HABITATS OF THE LABRADOR SEA USING BAITED REMOTE UNDERWATER VIDEO (BRUV)

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The Labrador Sea is the gateway to the Arctic and the unique oceanography of this region makes it a focal point for climate change. Therefore, benthic and demersal communities in this region may be particularly sensitive to ongoing environmental changes and useful in identifying and foretelling oncoming changes to other northern ecosystems. Baited remote underwater video (BRUV) is a useful and versatile, low-impact technique for characterizing biotic communities and can be applied to a variety of habitats and depths. In 2017 and 2019, baited cameras were deployed as part of the Integrated Studies and Ecosystem Characterization of the Labrador Sea Deep Ocean (ISECOLD) project in coastal and offshore areas of the Labrador Sea to characterize these largely unstudied ecosystems. Sets ranged in depth from 600 - 3,015 m in 2017 and 25 - 1,750m in 2019. Observed fish communities were depth-specific and this pattern was consistent across the latitudinal gradients examined. In deep water, fish species such as abyssal grenadier (Coryphaenoides armatus), blue hake (Antimora rostrata), hagfish (Family Myxinidae) and slatjaw cutthroat eel (Synaphobranchus kaupi) were most common and there were also observations of invertebrates such as deepwater corals, sponges, echinoderms and sea anemones. In coastal waters, the prevalence of epibenthic fauna relative to fish was noteworthy and in opposition to deeper stations. Common epibenthic fauna included echinoderms, polychaetes, ascidians, and sea snails whereas observed fish were largely restricted to sculpins (Family Cottidae), and rock cod (Gadus ogac). The biotic communities observed are being examined with respect to abiotic drivers and in the context of other similar habitats beyond the Labrador Sea.

THE GEOGRAPHIC EXPANSION OF BEAVERS IN NUNAVIK

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New species of wildlife that are appearing, expanding, and establishing in northern regions are of concern to local communities because of their potential impacts on local ecosystems, traditional food species, food security, and wellness. In Nunavik, community members are concerned about the expansion of several species, including the North American beaver. Increased habitat suitability caused by global warming is thought to have facilitated North American beaver colonization of tundra, and they, in turn, alter the hydraulic environment. This poster presents the expansion and contemporary distribution of beaver populations in Nunavik and a few of their potential social and ecological impacts. Understanding the impacts of climate change on local ecosystems through both empirical data and local knowledge is a priority for local communities; this knowledge helps them prepare mitigation and adaptation strategies.

BUILDING KNOWLEDGE ON ENVIRONMENTAL DRIVERS DETERMINING BELUGA HABITAT IN THE MACKENZIE ESTUARY (INUVIALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES)

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For centuries, beluga whales (Delphinapterus leucas) or qilalugaq have been and remain an important resource for cultural and nutritional needs of the communities in the Inuvialuit Settlement Region (ISR). Through the Inuvialuit Final Agreement, the Inuvialuit co-manage beluga together with Fisheries and Oceans Canada (DFO) that incorporates both Inuit Knowledge (IK) and Western Science (WS). During the Beluga Summit in 2016, knowledge gaps such as understanding environmental drivers altering beluga habitat and the subsequent use of habitat, especially in the context of climate changes, were identified by communities and scientists. The Eastern Beaufort Sea beluga form large summering aggregations in the Mackenzie Estuary, where the Tarium Niryutait Marine Protected Area (TN MPA) was designated. Major changes in the physical environment are impacting this habitat, with clear demonstration this summer where break-up of land-fast ice occurred three weeks early (relatively to the 30-year average break-up date). Powerful storms are occurring more frequently, generating waves and surges that damage and reshape ice-bonded unlithified coasts, exposing the once concealed permafrost and inducing coastal change and thawing. The coastal erosion of the region (actual rates are from >2 m/yr up to 30 m/yr) has accelerated and even doubled in the past two decades. Given the rapid change of core beluga habitat, the goal of this research, under the project "Knowledge co-production on Beluga movement ecology in the Eastern Beaufort Sea", is to co-develop a better understanding of physical changes occurring in this habitat and how those impact beluga habitat use of the Mackenzie Estuary using both IK and WS. IK will be gathered from knowledge holders using participating mapping, individual and group interviews, together with local observations and literature. Satellite-based remote sensing will be used to extrapolate turbidity and sea surface temperature to investigate changes in these potential key drivers. Aircraft-based imageries (aerial surveys from 1985, 1992 and 2019) and metrics available from in-situ observations and measurements will be used to define beluga use of the area. Through knowledge co-production, we hope to create an inshore diachronic analysis of beluga habitat use, evaluate changes over a decadal scale and consider future consequences of a changing system. This information could help the co-management of beluga by predicting trends in terms of beluga use of the Mackenzie Estuary a core aggregating habitat and traditional harvest location.

FRESHWATER BENTHOS IN THE CANADIAN ARCTIC: USING DNA BARCODING TO ASSESS BIODIVERSITY, PHYLOGEOGRAPHY, AND ECOLOGICAL FACTORS

Nowosad, Danielle S.J.(1) (Presenter) , I. Hogg, A. Borisenko, S. J. Adamowicz

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The freshwater biodiversity of the Canadian Arctic Archipelago and its post-glacial recolonization history have received considerable attention from researchers, but much of their work pre-dates the introduction of time- and cost-efficient molecular genomic approaches. As a result, gaps remain in our understanding of the taxonomy, phylogeographic patterns, and distribution of many aquatic organisms. At local scales, there is limited information available on the site-specific composition of benthic communities and their responses to biotic and abiotic factors, such as geochemistry of water bodies, seasonal and phenological patterns, and long-term climatic changes. This study aims to employ DNA barcoding to collect local-scale baseline biodiversity genomic data on freshwater benthos at sites in the Canadian middle arctic as part of the larger Arctic BIOSCAN project. During the summers of 2018 and 2019, water bodies of different sizes were surveyed in the vicinity of the Canadian High Arctic Research Station (CHARS), Victoria Is., Nunavut, using D-nets and plankton tows. In the 2019 season a total of 53 samples were collected, representing 11 orders, predominantly from arthropods. Molecular analysis is currently underway. A comparison with available reference data from other areas in the Arctic and Boreal zones of the Holarctic will provide insights into phylogeographic connectivity of Victoria Is. with other regions and enable a comparative analysis of the structure of benthic

communities at different geographic scales. Advancements in molecular methods for DNA analysis have been crucial in studies of biodiversity and phylogeography. Through generating novel DNA sequence data from freshwater benthos collected on Victoria Island, Nunavut, and comparing genetic similarity with publicly available data from other localities across the northern Holarctic, we are investigating biodiversity, post-glacial colonization pathways, and phylogenetic community similarity. The 2020 summer seasons efforts will include a detailed study of the biotic and abiotic characteristics of the surveyed water bodies to assess which environmental factors affect community composition and habitat occupancy by benthic invertebrate species, in the context of the region's post-glacial history and on-going environmental changes.

SYSTEMATIC LITERATURE REVIEW OF FACILITATORS AND BARRIERS RELATED TO SENIORS FOOD (IN)SECURITY STATUS IN INUIT NUNANGAT: PRELIMINARY RESULTS

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High food insecurity levels documented among Indigenous peoples in Canada relative to national levels are cause for significant public health concern. This is particularly important for Canada's northern Indigenous populations who are reported to experience the highest levels of food insecurity in the country. For example, national household food insecurity levels documented in 2014 were 12.8% compared to 59.3% in Nunatsiavut, a self-governing Inuit region of Northern Canada, with significant disparity reported between communities within the region. Significant research has taken place on many of the factors influencing food insecurity and associated health outcomes. Food insecurity has been associated with nutritional deficiencies, obesity, higher prevalence of chronic diseases, neurological disorders, and stress. However, little is known about factors specific to Indigenous communities located in food systems shaped by unique environmental, socio-economic and cultural values and contexts. Even less is known about the status of this issue among sub-groups within Indigenous populations or communities that are likely to be more vulnerable to food insecurity. It is important to understand population-specific factors and sub-group vulnerability in order to effectively develop evidence-based intervention strategies to address food insecurity. To begin exploring the group of factors that influence food (in)security status among a vulnerable group, such as Inuit Seniors in Inuit Nunangat, we conducted a systematic literature review following PRISMA guidelines. We searched seven databases for white literature using keywords and subject headings that represented the concepts "food (in)security" and "Inuit Nunangat". After removing duplicates, two reviewers independently followed a two-step screening process. All titles and abstracts were screened for studies that analyzed a relationship between at least one barrier or facilitator and at least one element of food (in)security specific to Seniors in Inuit Nunangat. Data were then systematically extracted and analyzed thematically to identify a list of facilitators and barriers reported to be associated with the food (in) security status of Inuit Seniors. This literature review is the first of three phases in an explanatory sequential mixed methods study. The study is conducted in partnership with the Nunatsiavut Government, which identified Seniors to be vulnerable to food insecurity in that region. Key-factors identified in the literature review are being considered in phase 2 of the study, which involves user-directed multivariable analyses of an existing dataset on the food security status of Seniors in two Nunatsiavut communities. Results from the statistical analysis will be further examined in phase 3 through key-informant interviews with local health and community representatives to help explain the results obtained. It is anticipated that results will enhance understanding of the vulnerabilities to food insecurity experienced among Inuit Seniors. Results will also inform the development of a regional food security strategy being led by the Nunatsiavut Government inclusive of interventions to address Seniors' food insecurity.

COMMUNITY-BASED OBSERVING OF THE COASTAL OCEAN IN NUNATSIAVUT

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The ocean along coastal Labrador is rapidly changing yet is poorly observed, particularly in winter and at more northerly latitudes. Nunatsiavut, in northern Labrador, has seen substantial air temperature warming and sea ice loss in recent decades, and locals have recently reported an increasing number of incidents of people breaking through sea ice while travelling in winter. This has led to great uncertainty around the safety of traditional travel routes as well as the sustainability of traditional wintertime hunting and fishing activities. Therefore, there is great need to improve our wintertime ocean observations in this region and to do so in cooperation with local communities. The region lies in the critical transition zone between the Atlantic and Arctic Oceans and adjacent to areas of deep convection in the Labrador Sea, which are important for global climate dynamics and biogeochemical cycling. This region is home to the Labrador Current, which flows out of the high-latitude regions and into the productive fishing grounds off Atlantic Canada. The region also exhibits significant natural climate variability, linked to the Atlantic Multidecadal Oscillation, leading to strong swings in temperature and precipitation from decade to decade. The dynamics of the connectivity between the oceanography, freshwater content and nutrients in the coastal zone, and both the terrestrial freshwater systems and the offshore oceanographic systems is relatively unknown. The degree to which these systems are changing is important, and would have significant impacts on local coastal ecosystems and fisheries. The Community-based Observing of the coastal Nunatsiavut Ocean in Winter (CONOW) pilot project has partnered with the Nunatsiavut Government and community members in Nain, Nunatsiavut to perform observations of the coastal ocean in Spring, under the sea-ice, as well as again in Fall, during the ice-free season. In 2019 measurements of temperature and salinity were taken along a freshwater-saltwater gradient following the axis of the Fraser River / Nain Bay / Strathcona Run area north of Nain. Measurements were taken with an easy-to-use handheld CTD, that includes the ability to transfer data by wifi and log position by GPS. We will present the methods, the data, successes, failures, lessons learned, and stories arising from this project. Plans for expansion of the observing system to include other communities, techniques, and variables will also be presented. The data will be made freely available and should prove useful to community and governments plans for marine management and climate change adaptation, improve estimates of future ocean change in the region, and be available for model validation and data assimilation systems.

TUKTOYAKTUK ISLAND - GEOTECHNICAL CONSIDERATIONS FOR AN IMPORTANT ERODING ARCTIC ISLAND

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The community of Tuktoyaktuk faces severe threat from the rising ocean and eroding permafrost. Located along the Beaufort Sea coast in the western Canadian Arctic within the Inuvialuit Settlement Region, Tuktoyaktuk has faced the challenges of dealing with coastal erosion for many decades. Climate driven change has accelerated the coastal erosion problem to pose a real threat to coastal areas which have inadequate, or lack, of erosion protection measures. One such area is Tuktoyaktuk Island, found just east of the Hamlet of Tuktoyaktuk, which acts as a natural barrier protecting the harbour from the impact of waves. The island and community of Tuktoyaktuk are greatly affected by ongoing climate change due to longer warmer summers lengthening the open water season in the region resulting in a greater number of storms, which in turn impact the sensitive permafrost rich coastlines. Arctic warming also leads to permafrost thawing, weakening the soil, increasing susceptibility to settlement and erosion, and impacting overlying buildings and roads. Tuktoyaktuk Island is composed of five (5) distinct lithological units, from top to bottom: organic silt, laminated sand, non-visible well-bonded clayey silt, sharp ice and clay contact, and well-bonded clayey silt with visible stratified ice - all underlain by massive ice exposed in some areas along the north face of the island. Erosion on Tuktoyaktuk Island is a cycle of mechanical and thermal processes. Wave action exposes massive ice and leads to thawing from thermal abrasions which undercut the 12 m high north cliff face triggering mass wasting of overlying sediment. This material accumulates at the base of the cliff, covering and insulating the exposed massive ice and ice-rich permafrost sediment against thawing. Further storms repeat this cycle of erosion. Tuktoyaktuk Island is currently eroding at a rate of ~2 m/yr and may be breached within the next 15 years, allowing for increased erosion along the shores of the harbour. As such, it is of immediate importance to understand how the geotechnical soil properties of Tuktoyaktuk Island permafrost influences

coastal erosion, and the implications to potential future shoreline protection measures. The focus of this study is to investigate the geotechnical properties of permafrost and soils from Tuktoyaktuk Island's beach and nearshore region. Using grab samples taken from the receding north face of the island, the soil strata will be characterized by determining particle size distribution and plasticity limits, and permafrost strength behaviour during thaw will be assessed through thaw consolidation and strength testing of reconstructed samples in a laboratory-controlled setting. In addition, frozen cores collected from the top and nearshore of the island by the Geological Survey of Canada in March 2018 may be available for thaw consolidation and strength testing and will be used to validate the lithology of the cliff face. Understanding the settlement and strength behaviour of permafrost in this rapidly changing climate will address some of the community's public safety concerns regarding the stability, safety and future of local infrastructure.

THE ALASKA BELUGA MONITORING PARTNERSHIP: A NEW CITIZEN SCIENCE MONITORING EFFORT EXPLORING ENDANGERED BELUGA HABITAT USE IN ALASKA'S COOK INLET

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Five populations of beluga whales (Delphinapterus leucus) inhabit the waters of Alaska's coasts, including the Cook Inlet beluga, a small geographically isolated population that resides exclusively within Alaska's Cook Inlet. Following a 75% decline in abundance, the Cook Inlet beluga was listed as endangered in 2008 and has since exhibited no signs of recovery. Although extensive scientific research has sought to understand beluga ecology and conservation in Cook Inlet over recent decades, to date, important baseline data on beluga habitat use and disturbance at key foraging sites is lacking. Contrary to other beluga populations in the state, Cook Inlet belugas inhabit the waters surrounding Alaska's largest human population center and can be observed from a variety of public sites, including highway pullouts, boat launches, and city docks. These characteristics make the Cook Inlet beluga population a prime target for citizen science monitoring, wherein trained members of the public record important data on their beluga sightings and submit this data to the scientists and resource managers facilitating Cook Inlet beluga recovery. Launched in 2019, the Alaska Beluga Monitoring Partnership (AKBMP) is a citizen science monitoring program supported by federal agency, non-profit, and university partners. The AKBMP is based in Anchorage, Alaska and trains members of the public to conduct beluga monitoring across five known foraging sites in Cook Inlet, during which they collect data on beluga presence, age class, behavior, and disturbance. Since our season commenced on August 15, 2019, over 100 members of the public have undergone our citizen science training and now conduct regular beluga monitoring sessions. This presentation provides an overview of this partnership and monitoring program and presents preliminary findings from our first collaborative field season. Although the AKBMP remains in the early stages of its development, this program has already facilitated valuable cross-boundary collaboration between researchers and the public and provides a compelling example of how citizens can collect important baseline ecological data that directly contributes to endangered species conservation and recovery efforts.

RECENT RAPID DRAINAGE OF GLACIER DAMMED DONJEK LAKE, YUKON

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Donjek Glacier, located in the St Elias Mountains, Yukon, is a surge-type glacier with a repeat surge interval of approximately 12 years since the 1930s. Donjek River runs perpendicular to the terminus of the glacier from its headwaters on the Kluane Glacier and surrounding ice bodies. Past surges have at times caused the terminus to advance enough to block the river, leading to the formation of an ice dammed lake. The glacier most recently surged in 2014, and since then Donjek Lake has experienced annual filling and draining episodes. The most recent drainage event occurred in mid-July 2019, when the ~1.6 km2 lake drained in less than two days and created a canyon through the glacier terminus. Time-lapse cameras, satellite imagery and a water pressure logger provide details of the drainage event. A dense series of air photos were also taken before

and after the lake drained (in May, July and September 2019), from which high resolution digital elevation models have been produced using the Structure from Motion technique. These data provide information concerning the amount of glacier ice lost through the formation of the canyon, as well as the volume of water lost during the drainage event. These data provide new insights into glacier dammed lake dynamics, the mechanisms of flood release, and downstream hazards caused by the floods.

PATTERNS AND BIASES IN AN ARCTIC HERBARIUM SPECIMEN COLLECTION: IMPLICATIONS FOR PHENOLOGICAL RESEARCH

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Plant collections in the form of herbarium specimens (dried, pressed plants) are increasingly being used for phenological studies. Plants are most often collected in flower or fruit for identification purposes and thus provide a time series of flowering and fruiting times of plant species over the last century or more. Herbarium specimens can therefore be used to relate phenological patterns with time, geography, climate, and species traits. However, herbarium specimens have generally been collected for taxonomical and biogeographical purposes, without phenological studies in mind. Furthermore, remoteness restricts herbarium specimen collection in the Arctic. The Canadian Arctic territory of Nunavut is 2.1million km square, with just 25 small communities, none of which are accessible by road. Sea ice restricts boat access to Nunavut to two months towards the end of summer. Thus, vast areas of Nunavut are difficult to access, and organised expeditions by boat or plane have been the most common means of collecting herbarium specimens. In addition, due to the very short snow-free season, the majority of Arctic field work for herbarium specimen collection takes place in July. These limitations may result in spatial, temporal, collector, taxonomic and plant trait biases that should be taken into account when interpreting phenological information in herbarium records. We assessed the presence of biases in an Arctic herbarium specimen collection and identified the impacts these biases could have on Arctic phenology studies. We analysed the Nunavut herbarium specimens accessioned at the National Herbarium of Canada (CAN) to determine the following: distribution of the collection across years; proportion of specimens collected in relation to distance from easy points of access; proportion of specimens collected at different phenological stages; proportion of specimens collected at start, peak or end of flowering; and number of specimens collected per collector, taxonomic group, flower colour, growth habit and plant size. We found periods of high and low collection across the 170 years of collection; specimens have only been collected from 0.63% of Nunavut's landmass; a preference to collect closer to easy points of access; 24% of the collectors collected 90% of the collection; and there were preferences to collect certain taxonomic groups, flower colours, growth habits and plant sizes that were disproportionate to the actual plant trait proportions. Arctic plant collection biases may be accentuated by factors related to the challenges of Arctic travel (e.g., emphasis on July collecting, lower number of institutions and individuals participating in Arctic field work, fewer collections possible per unit effort / investment and low density of collections across a large geographical area). We found that there is a tendency for plants to be collected in flower and at peak flower irrespective of the dominant population phenology stage at the time of collection which could impact Arctic plant phenology findings. We recommend conducting a simple assessment, as we presented here, to assess the biases and limitations of natural history collections used in a phenology study to support a more insightful and accurate interpretation of the results.

OBSERVED LONG-TERM VARIABILITY OF STABLE ISOTOPES IN PRECIPITATION AT TIKSI, RUSSIA

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Stable isotope in precipitation is a useful tracer to estimate the origin of water in hydrological and meteorological studies and to validate atmospheric water

cycle simulated by climate models. Precipitation sampling has conducted from 1998 to examine changes in water cycle at a tundra site, Tiksi where climate warming is significant. It was selected 934 and 551 samples among 1,500 precipitation samples for the analysis of δ2H and δ18O, respectively, by means of quality check that used d-excess values and relationship between temperature and isotopic compositions. The analyzed values of δ2H, δ18O, and d-excess were ranged from -320.0 to -79.2 ‰, from -40.48 to -9.08 ‰, and from -9.9 to 26.7 ‰, respectively. There is no temporal trend for δ2H and δ18O, while d-excess indicates significant decrease since 2008 when air temperature was warmed. The fitted Local Meteoric Water Line (LMWL) was δ2H = 7.65×δ18O – 3.0 (r2=0.98), which is compared with δ2H = 7.83×δ18O – 3.0 at Yakutsk, provided by the Global Network for Isotopes in Precipitation. Air temperature significantly affected the temporal variability of δ2H (r2=0.56) and δ18O (r2=0.55). The Isotopes-incorporated Global Spectral Model (IsoGSM) simulated the variability of the isotopic compositions in precipitation for the study period in Tiksi, and the simulated monthly mean values weighted by precipitation amount were compared with the observed values, which indicated higher correlations for δ2H and δ18O. It suggests that the model simulations are probably able to access changes in the terrestrial isotopic compositions that is linked to the declining Arctic sea ice.

MARITIME SEARCH AND RESCUE (SAR) - EFFICIENCY AND EFFECTIVENESS

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A Maritime Search and Rescue system is a very expensive and complex program. In Canada, it involves a coordinated effort between the Canadian Coast Guard (CCG) and the Department of National Defence (DND), with assistance from many other entities (such as volunteer organizations). Given this, and the dangerous and volatile operating environment during rescues, system modelling can help inform strategic, tactical and operational planning to achieve the best mix of response assets in the right place at the right time, in a cost-effective manner. This is particularly applicable in the Canadian Arctic, given the vast expanse, relatively harsh environment, remoteness, and sparse response assets. We have developed such a model as a decision aid on the composition and location-allocation of maritime SAR vessels which incorporates a number of features: coverage area for each vessel; multiple coverage capacity for a given location (i.e. backup coverage); mean access time to incidents based on expected transit speed; gaps in coverage. This multi-objective model can be used to examine: trade-offs between total fleet cost and mean access time to incidents; the implications of using a variety of response vessels with diverse ranges and speeds; the impacts of relocating vessels on a seasonal basis to more effectively respond to changes in demand patterns; the possible repositioning of response vessels to accommodate out-of-service ships; the best mix of vessel types in the fleet to optimize coverage. The results provide a range of trade-off solutions, improving the service level obtained compared to the current fleet composition and arrangement of SAR resources with respect to several decision criteria. This can help mitigate shipping risks, and improve the safety and environmental impacts of northern navigation. Current and future work on enhancing the model includes: developing asset effectiveness measures to best match response capability with incident characteristics; incorporation of factors that are particular to Canada's North, and incorporation of other response assets (especially aircraft, and vessels of opportunity) to assess the aggregate system performance.

INVESTIGATING THE ROLE OF VEGETATION COMMUNITY TYPE AND PERMAFROST DISTURBANCES ON THE TOTAL DISSOLVED CARBON FLUX AND COMPOSITION IN HIGH ARCTIC STREAMS

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Projected climate change in the Arctic is expected to have an extensive impact on permafrost stability and hydrology, influencing watershed biogeochemistry. Increased permafrost thaw and physical disturbance enhance biogeochemical cycling, mobilization, and export of previously frozen nutrients, inorganic solutes (dissolved inorganic carbon), and dissolved and particulate organic matter in surface waters. Subsurface pathways or surface flow through disturbed sediments are important channels for dissolved inorganic carbon (DIC) derived from weathering and/or mineralization of dissolved organic matter (DOM). Permafrost soils contain a large reservoir

of dormant organic carbon that, upon warming may partly degrade to carbon dioxide or may be leached DOC carried by streams as DOC that can be mineralized and released as carbon dioxide. Permafrost thaw and disturbance can also enhance chemical weathering reactions that can consume carbon dioxide (derived from the atmosphere, or from mineralization of organic matter) due to exposure or thaw of mineral soils, which can potentially counterbalance the release of carbon dioxide by the mineralization of DOC release. In the High Arctic, there is a limited understanding of how changes in permafrost and hydrology may affect watershed carbon dynamics. Therefore, the purpose of this research project is to investigate how climate-driven changes in hydrological regimes and permafrost disturbances will alter the fluxes of organic carbon and inorganic carbon in High Arctic watersheds and how their proportions vary seasonally and in different land cover types (vegetation community types and disturbance). This study investigates seasonal carbon fluxes across three head water catchments dominated by various land cover types (e.g., wet sedge meadow, mesic tundra vegetation, and permafrost disturbance). Stream discharge was monitored, and water samples were collected daily and analyzed for total particulate carbon, particulate organic carbon, dissolved inorganic carbon, and dissolved organic carbon to calculate the total amount of carbon emanating from the three headwater catchments at the Cape Bounty Arctic Watershed Observatory (74°54'N, 109°35'W). We hypothesize that the carbon flux in streams influenced by permafrost disturbance or thaw where surface or subsurface flow is in contact with freshly exposed or thawed mineral soils will be dominated by bicarbonate flux (from elevated weathering-mediated carbon dioxide sequestration) as opposed to streams dominated by surface flow through vegetated surface soils, where the carbon flux will likely be dominated by organic carbon fluxes. Results from the study will be used to investigate the sources and loads of carbon in High Arctic surface waters and to contribute to the development of watershed scale models to evaluate how contributions from different land cover types influence carbon chemistry.

MARINE MOVEMENTS AND HABITAT USE OF ARCTIC CHAR IN NUNATSIAVUT WATERS

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Acoustic tagging of Arctic char has been underway in Nain Bay and in Saglek Fjord of Nunatsiavut since 2018 to inform marine spatial planning associated with the Nunatsiavut Government's Imappivut initiative. Specifically, the joint DFO and Nunatsiavut Government project, aims to track movement patterns of tagged char using fixed receiver arrays to establish important habitats (e.g. feeding and staging areas) and capture information regarding the timing of migration events. These data will be integrated with genetic studies to further understanding of the extent of stock mixing in these areas. These data will also provide a foundation for additional studies that will help to determine they key habitat characteristics that attract char in the marine environment. Thirty-nine acoustic receivers situated in estuaries and movement corridors across the two water bodies monitored the presence of an initial group of 95 acoustically tagged char. Detections occurred predominantly in close proximity to freshwater habitat (river mouths and estuaries), while only a few individuals were detected at the seaward limits of our arrays. As expected, char activity in oceanic habitats was restricted to warmer months from June to September, outside of which no fish were detected, despite frequent detections on receivers positioned in river mouths throughout the year. These data underscore the importance of estuaries to char as feeding and overwintering habitat. Further analysis will provide an understanding of migration timing and habitat use in fjord/coastal marine environments, and subsequently provide information on life history patterns of local char populations that can be used to develop effective conservation and management strategies for these fish.

ENVIRONMENT AND CLIMATE CHANGE CANADA'S LONG-TERM WATER QUALITY MONITORING NETWORK ACROSS CANADA'S NORTH

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Environment and Climate Change Canada (ECCC) have maintained a long-term water quality monitoring network in Canada's North since 1960. This network contributes to the fulfillment of ECCC's mandate of ensuring a clean, safe and sustainable environment for present and future generations. ECCC's monitoring in the North provides for the collection, interpretation

and dissemination of high-quality surface water data and information in support of related work completed by various levels of government as well as community groups, researchers and private citizens. This network depends on partnerships and collaborations that have been developed over many years. The challenges and successes of maintaining an extensive network over a vast and exceptionally remote geographical area will be discussed. Additionally, reporting products for which this northern network is critical will be reviewed, and importantly, how the data can be accessed and used by local governments and other interested parties will be described.

KNOWLEDGE INTERSECTION AND INTEGRATION: A CASE STUDY OF INUIT AND SCIENTIFIC OBSERVATIONS AND KNOWLEDGE OF ENVIRONMENTAL INFLUENCES ON ARCTIC CHAR

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In recent years, the notion of integrating knowledge systems as playing an integral role in helping to better understand various aspects and changes of the environment has gained an increase in attention. However, there are multiple aspects to such a process including how and where one can draw on multiple knowledge bases, such as the use of multiple methods. Application of different methods can increase confidence in observations of the same phenomena being studied, broaden the scope of information available regarding climate variability and change, and contribute to understandings of the mechanisms of change. While significant research has taken place quantifying climate change effects and documenting Inuit knowledge and observations of climate change, there is little work to date exploring the interface between these two knowledge bases. Using the case study of environmental influences on Arctic char growth and condition, as observed through ecological measurements and Inuit knowledge, the purpose of this study is to explore the intersections of these knowledge systems and potential reasons for their convergence and divergence to inform future efforts to enhance knowledge gathering and understanding on complex environmental phenomena. Utilizing existing ecological data and Inuit knowledge narrative pertaining to the environmental influences on Arctic char growth in the Canadian Arctic, this study will explore questions of knowledge interaction and intersection. Results will provide a more comprehensive understanding of the potential role of key environmental factors on Arctic char growth as well as contribute to the regional, national and international discourse on the opportunities for knowledge intersection and integration between the environmental sciences and Indigenous knowledge. This contribution is particularly important in light of the challenges to our evolving understanding of rapidly changing ecosystems, such as those in the Arctic, in association with climate change and variability.

EARLY SUMMER MACROZOOPLANKTON COMMUNITIES OF HUDSON BAY

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Subarctic Hudson Bay completes a full cryogenic cycle every year, transitioning from completely ice covered in winter to completely ice free in summer. The ice-free season is lengthening due to an increasingly early melt and increasingly late freezing in response to climate warming. Recent studies in the High Arctic have shown how the overall summer production of the ecosystem, from microalgae to juvenile fish, is dictated by the ice breakup date. The baseline against which future change in plankton and fish production should be measured is generally undetermined for Hudson Bay. Macrozooplankton (zooplankton > 2 mm) effect the transfer from primary and/or secondary producers to the higher trophic levels (fish, marine birds, marine mammals) that underpin much of the ecosystem services provided by the sea. Here we describe the spatial structure of the springtime macrozooplankton communities of Hudson Bay. Macrozooplankton were sampled with a double 1-m2 aperture sampler carrying 500 μm mesh nets deployed from the icebreaker CCGS Amundsen in a double oblique tow from the surface to 90 m (or 10 m above the bottom at shallower stations) and back to the surface at a speed of two knots. Based on a cluster analysis using the Bray-Curtis dissimilarity index on relative abundance, four distinct springtime taxonomic assemblages associated with specific oceanographic conditions were identified in the Hudson Bay system. In the deep waters of Hudson Strait and the North part of the bay, a first community dominated by the copepod Calanus glacialis also included Calanus finmarchicus, Calanus hyperboreus and Metridia longa. In the shallow coastal waters of the west side of the bay,

a second community presented a high relative abundance of Themisto libellula juveniles. In shallow waters further away from the coast, a third community presented low relative abundances of Calanus glacialis and high relative abundances of the chaetognath Parasagitta elegans and the jellyfish Aglantha digitale. Finally, in the Nelson River estuary, a fourth community potentially representative of Hudson Bay's estuaries showed a completely different taxonomic composition with very low proportions of copepods and high proportions of cnidarians (Aeginopsis laurentii and Bougainvillia principis principally) and decapod larvae. As expected, depth was the principal determinant of zooplankton distribution and community differentiation in the Hudson Bay system.

EXPOSURE TO MERCURY AND CONSUMPTION OF COUNTRY FOODS IN NUNAVIK: TEMPORAL TRENDS AMONG PREGNANT WOMEN

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In the Arctic, indigenous populations living off marine mammals and fish consumption may be exposed to high concentrations of methylmercury (MeHg). Furthermore, since their availability varies over months, there is every reason to believe that exposure to MeHg also varies from month to month. There are still significant knowledge gaps with respect to temporal variations in MeHg exposure and about country foods responsible for MeHg exposure, particularly for pregnant women in Nunavik. Several findings from the Nunavik Child Development Study highlight that fetal life is a critical moment to prevent MeHg exposure in order to avoid neurodevelopmental outcomes later in childhood. The aim of the present study was to characterize the temporal variation in MeHg exposure among Inuit women during pregnancy and to better identify country foods responsible for these variations. In total, 97 pregnant women from the 13 Nunavik communities participated in this cross-sectional study. Blood and hair samples were collected. An interview-administered questionnaire was used to gather information on pregnancy and country food frequencies of consumption by season. Blood total Hg was measured using Inductively coupled plasma mass spectrometry (ICP-MS). Hair total Hg was measured by centimeter as a surrogate for monthly exposure using Cold vapor atomic absorption spectrometry (CV-AAS). Multiple regressions analyses were done to assess the seasonal variation of mercury (Hg) levels. A latent class growth analysis was conducted to identify pregnant women with similar monthly trajectories in hair Hg levels over time. Up to 23% of participants had blood Hg levels above the Health Canada guideline ($\geq 8\ \mu g/L$) at the recruitment time (Oct 2016 - March 2017). Sequential Hg hair analyses showed important monthly variations in Hg exposure over the past year as Hg hair concentrations were significantly higher in summer ($p<0.05$) and lower in winter ($p<0.001$). Three latent classes (groups) of pregnant women with similar trajectories of Hg hair monthly variations were identified: high variation (n=20, 22%), moderate variation (n=38, 41%) and low variation over time (n=35, 38%). Beluga meat was the country food generally contributing to most of daily MeHg intake within each group of pregnant women for all seasons, but primarily in the summer. Increasing beluga meat intake was also the only country food associated to the odd of being classified into moderate and high hair Hg monthly variations groups (OR = 1.19 [1.01-1.39] for moderate versus low; OR = 1.25 [1.04 -1.50] for high versus low). Our study show a high MeHg exposure among Nunavik pregnant women, particularly in the summer, and highlight the importance of documenting the seasonality in country foods consumption before conducting biomonitoring studies in order to more adequately assess MeHg exposure on an annual basis. Beluga meat was identified as the primary source of MeHg exposure for pregnant women in Nunavik. Considering the central role of country foods in Inuit culture and community wellbeing, the nutritional benefits of country foods as well as the important prevalence of food insecurity in Nunavik, this emphasized the need for joint efforts with communities and local caregivers to promote

local country foods while minimizing exposure to MeHg for healthy pregnancies and children in Nunavik.

TUKTOYAKTUK GEOPHYSICAL DATA RELEASE

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Located in the southeastern Beaufort Sea, Tuktoyaktuk Harbour is a valuable natural harbour, providing a staging and over-wintering area for the offshore oil and gas industry since the early 1970s. The community depends on the safe passage of ships through the confined channel leading into the harbour situated at the east end of Tuktoyaktuk Island where minimum water depths range are ~4 m, but can increase up to 8 m in the dredged channel leading into the harbour. The shallow seismic reflection data were collected during the 2012, 2014 and 2015 field programs (3.5 kHz sub bottom, StrataBox 10 kHz sub bottom and sidescan sonar) in and around Tuktoyaktuk Harbour, in water depths of 2-5 m outside the harbour and up to 30 m depth inside the harbour. Sub- bottom data clearly image structures up to 25 m below the seabed. The resulting data were analyzed using visualization tools created by the Geological Survey of Canada, and reside within a larger collection of legacy Geological Survey marine geophysical data that have been converted to digital formats from analog paper records, as part of NRCan's Open Data policy. The newly released digital data (in SEG-Y format) were collected in support of coastal dynamics research in the region, but will also have applications to land-use planners, stakeholders and decision makers.

TOWARDS CONTEXT-SPECIFIC TOURISM MANAGEMENT RECOMMENDATIONS FOR THE WRECKS OF HMS EREBUS AND HMS TERROR NATIONAL HISTORIC SITE

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Over the last 25 years, climate change-induced increases in open water have made space for a dramatic transformation in the Canadian Arctic's social landscape (Dawson, Pizzolato et al., 2018; Johnston, Viken, & Dawson, 2012). Despite increased interannual variability in sea-ice conditions and hazards, increasing numbers of tourists now venture farther into Canada's Arctic waterways seeking natural and cultural experiences aboard cruise ships and private yachts (Stewart & Draper, 2008; Stewart et al., 2007). While tourism growth presents important opportunities for the region, it is not void of challenges. This poster examines Nunavut marine tourism and shipwreck tourism management concerns in relation to the recent discovery of the Franklin shipwrecks in shallow waters of the Northwest Passage. It is anticipated that the wrecks will become a popular tourism destination, leading to the need to explore context-specific management recommendations for the Wrecks of HMS Erebus and HMS Terror National Historic Site (WET NHS). This poster describes the nature of tourism management concerns, outlines industry "best" practices, and presents feedback on proposals from key management stakeholders. Key management issues covered in the poster include: which site(s) should be open to various visitor types; how the sites should be monitored; and, how and where interpretation facilities should be developed. Together, they help inform the context-specific management of the WET NHS for its protection and enjoyment by future generations and benefit of local Inuit communities.

ANALYSIS OF COMPETING AQUATIC INVERTEBRATES IN SUB-ARCTIC LAKES WITH WATERSHEDS AFFECTED BY FOREST FIRE

Pretty, Tom (1) (Presenter) and D.Gray (1)

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Fires represent a major natural disturbance in the Boreal region, and their frequency is increasing in response to climate change. In 2014, severe megafires spread throughout the organic and mineral-rich turbic crysol soil lands of the Taiga Plains in Canada's Northwest Territories (NWT), denuding watersheds for hundreds of small lakes. Lakes found in burned areas often experience large increases in nutrients and metals (including methyl-mercury) which can have impacts on aquatic communities. To examine the impact of the 2014 fires on lakes in the NWT, I collected and enumerated biological data of benthic invertebrates using a 500μm mesh D-net (identified and separated into functional feeding groups), zooplankton using a 64μm mesh net (identified to genus),

chlorophyll-a, and vascular macrophytes using frequency analysis. Water chemistry, surface sediment (≤5cm depth), surrounding soil organic composition, burn severity, and physical attributes (surface area, watershed area, etc.), were used to model the interrelationships between the physiochemical environment and invertebrate communities affected by burned watersheds and unburned watersheds. Sampling was conducted on nine lakes with > 68% burned watersheds, and ten unburned (<4% burned watersheds) reference lakes during August 2018 and August 2019. Analysis indicates a shift towards less filter feeders, gathering collectors, and reduced Ephemeroptera, Plecoptera, and Trichoptera (EPT) abundance and richness when watersheds are scorched. Such shifts in ecosystems may result in subsequent changes in fish abundance. Understanding the response of aquatic habitats to a burned landscape will become increasingly important for local communities and environmental managers. Analysis of methyl-mercury will be available at the time of presentation.

ASSESSING THE IMPACTS OF OIL-RELATED CONTAMINANTS IN NORTHERN MARINE ECOSYSTEMS WITH COMMUNITIES IN RESPONSE TO A REGIONAL STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT

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Currently in the Canadian Arctic there are low levels of shipping and oil exploration related activities as compared to many other regions. As offshore oil and gas activities might proceed in Baffin Bay and Davis Strait, there is a need to assess the current levels of oil-related contaminants exposure in marine species, and the potential effects. The communities in the region are working with the Nunavut Impact Review Board (NIRB), the Qikitani Inuit Association (QIA), the Government of Nunavut (GN), and Crown and Indigenous Relations and Northern Affairs Canada (CIRNAC) to assess information gaps in the region directly relating to the concerns of the communities with a Strategic Environmental Assessment in the Baffin Bay-Davis Strait. This process will consider possible types of oil and gas related development activities that could one day be proposed within the Canadian waters of Baffin Bay and Davis Strait outside of the Nunavut Settlement Area, and will focus specifically on the gaps identified via community discussions. To address knowledge gaps around seabird exposure to oil and gas this project was developed from a request from the Hunter and Trapper Association in Qikiqtarjuaq. In 2018 hunters and researchers collected 4 species of bird and 1 species of mussel around the bird colonies in the region. All birds were then dissected by students at the Nunavut Arctic College in Iqaluit, and the birds and mussels were tested for chemicals known to be associated with oil. For each bird and mussel a fresh tissue sample was collected and stored at -80°C in order to preserve the genetic material. In the lab these tissues will be analysed for a range of oil-related contaminants and gene expression known to be associated with pollution. For two bird species a tool (called a ToxChip) has been developed that will target parts of the genes that are known to be sensitive to exposure to oil-related contaminants. Levels of gene activity will be compared to the oil-related contaminant concentrations. This information will be used to assess how different species may be affected by oil-related contaminants, if at all, well before acute effects are visible. Early results from the project suggest the birds examined are exposed to low levels of contaminants from natural oil and gas sources in the region.

WHO'S OUT? TRACKING GJOA HAVEN HUNTER HARVESTS, OBSERVATIONS, AND LOCATIONS IN REAL TIME

Puqiqnak, B (1). and Gee, J. (1) (Presenters), J. Takkiruq (2), J. Qitsualik (3), J. Chapman (4), A. Hayes (5) and S. Schott (6)

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The Gjoa Haven harvest study started in 2017 with the goal of understanding harvest rates, the spatial harvest

distribution by season, the cost of hunting, and how food is distributed in the community. The study uses satellite tracking devices, surveys, and online Atlases to collect and display the data. As study facilitators, our job is to administer the study by handing out the tracking devices to registered participants that are going hunting, and have them fill out surveys on their expenses and harvests when they return from their trip. This summer, a new "Whose Out" Atlas was created that shows in real time where the harvesters are on the land and any observations they submit on the device using our specially designed "forms" application. A new screen was installed in the Gjoa Haven Hunters and Trappers Association building so that the community can see the "Whose Out" Atlas and follow the hunters on the land. This poster highlights our new Atlas, how it works, and the benefits and challenges of having a real-time display of where hunters are out on the land.

SIMULATING THE SEA ICE CARBON PUMP IN THE BEAUFORT GYRE

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The Arctic Ocean is undersaturated in CO2, and currently acts as a carbon sink. Carbon fluxes in the Arctic are not only impacted by the presence or absence of sea ice, but also by its melting and freezing. During sea ice formation carbon-rich, dense brine is rejected, while ice melt dilutes surface water and reduces CO2 concentration. This combination of processes should lead to a net uptake of atmospheric CO2. The magnitude of the resulting uptake is determined by how much of the brine sinks below the mixed layer. This carbon export mechanism is referred to as the Sea Ice Carbon Pump (SICP). Since the Arctic is rapidly warming, multi-year and seasonal sea ice are declining. This decline is more prominent for the annual sea ice minimum in summer than the annual maximum in winter, leading to an overall increase in the seasonal growth and melt of sea ice, and potentially the SICP. Yet, its importance and impact on carbon fluxes in the Arctic Ocean remain an open question. Here we look at how to best parametrize this process in numerical ocean models and at quantifying its importance. To do so, we are using a 1D version of the biogeochemical model PISCES constrained by mooring observations of physical, carbonate and ice properties in the Beaufort Gyre. The validated model is then used in sensitivity studies to investigate how the change of ice characteristics due to the replacement of multi-year by first-year ice, such as bulk salinity and DIC to alkalinity ratios, might impact the efficiency of the SICP.

WHEN RUN-OFF MEETS PERMAFROST: THERMAL EROSION CHANGES ARCTIC BIOGEOCHEMICAL CYCLES

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Permafrost in high latitude environments plays a major role in the long-term storage of organic carbon and nutrients. A disturbance of these fragile environments is expected to trigger several feedbacks to the global climate system by altering biogeochemical cycles. Thermal erosion gullying is one of the most rapid permafrost degradation processes currently occurring in the Arctic, and significantly alters material exports from terrestrial environments to the surrounding aquatic systems. As frozen ground is eroded and transported out of gullies, changes in hydrological dynamics arise. Water quality is substantially affected by the release of previously frozen sediments, carbon and nutrients but the magnitude of this disturbance remains poorly known. This study provides a first continuous fine scale analyse of mass transfer by rapid permafrost degradation, and aims to quantify the spatial and temporal variations in global discharge, organic carbon, nutrient and suspended sediment fluxes throughout a hydrological season. To investigate those variations, daily water sampling, discharge measurement, active layer thickness measurement and mapping of thermal erosion gullies of different development stages was conducted during two summer field campaigns (2017-2018), on the Arctic ice wedges polygon field of Qarlikturvik Valley, Bylot Island (Nunavut). Results highlight significant differences in the chemistry of the water flowing through the gully systems, expose the critical role of snowmelt and show the major contribution of rainfall events to soil erosion and mass transfer to downstream aquatic systems. As is the case for most watersheds situated in permafrost environments, high concentrations of dissolved organic carbon (DOC) were recorded at the gully outlet during

the snowmelt period (6.5 mg/L to 8.6 mg/L). However, higher peaks of DOC (7.3 mg/L to 11.2 mg/L) have been observed later in the summer, as the active layer deepened, the gully extended into the landscape and late precipitation events remobilized materials exposed to erosion. As the frequency of abrupt permafrost disturbances increases, this study aims to provide a more complete portrait of the consequences of rapid permafrost degradation on global biogeochemical cycles.

METAPROTEOMIC INVESTIGATIONS INTO GLACIER MELT - PHYTOPLANKTON INTERACTIONS

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Retreating glaciers deliver water and ice containing dissolved and particulate material into the ocean. The interaction of this glacial discharge with the ocean environment and its impact on primary productivity is understudied and can have both positive and negative effects. For example, nutrients from glacial discharge can increase plankton growth, while the glacially-derived sediment plume can limit light penetration and therefore limit phytoplankton growth. Though the Canadian Arctic Archipelago (CAA) has a high density of marine-terminating glaciers, very few studies have examined the relationship between glacial output and primary productivity. Here we examine these relationships in Jones Sound as well as Nares Strait, Kane Basin and Kennedy Channel. Our samples were collected aboard the CCGS Amundsen and a private polar research sailboat, the Vagabond in July-Aug 2019. Sites extended from the glacier termini, through plumes and into open water to gain a picture of the extent of glacial influence. To examine phytoplankton responses to glacial melt, we have designed a quantitative, targeted proteomics approach to study the composition of the phytoplankton community, their abundance, and possible nutrient stress. For example, we use peptides specific to Rubisco (RBCL1) which is present in all Eukaryotic phytoplankton, and an Actin peptide specific to diatoms (dACT1) that, when quantified, describe the size of the eukaryotic phytoplankton community and the diatom contribution. We will pair this data with chlorophyll a concentrations, temperature, turbidity, salinity and nutrient concentrations to form a more robust understanding of the extent of the possible influence of glacial input on primary productivity. Results from this study help fill a knowledge gap on glacier-ocean interactions in the CAA, and in particular, add context to local knowledge of the increased productivity around glacier termini, as described by Inuit of Grise Fiord in Jones Sound.

ASSESSING "SHRUBIFICATION" PATTERNS IN SUBARCTIC TUNDRA AND ASSOCIATED CHANGES IN CONDITIONS, INCLUDING DECOMPOSITION AND NUTRIENT RELEASE RATES FOR BETULA GLANDULOSA AND CAREX AQUATILIS

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Widespread shrub encroachment has been reported in tundra ecosystems of the circumpolar north. This project examines patterns of shrubification in a portion of the Hudson Bay Lowlands underlain by continuous permafrost, and assesses the impacts of increased shrubiness on long term decomposition rates, nutrient cycling, and soil microbial community. The study site is along the southwestern shore of the Hudson Bay, near the community of Churchill, MB. The objectives of the project were to (1) assess patterns of shrub encroachment near Churchill, Manitoba, (2) compare decomposition and nutrient release rates over a period of 10 years for Betula glandulosa (shrubs) and Carex aquatilis (sedges) in a fen affected by shrub encroachment; (3) characterize the soil chemical environment, microbial community, and potential GHG production in areas dominated by shrubs and sedges in this fen. To assess patterns of shrub encroachment, vegetation surveys in the field were used to train and evaluate a supervised land cover classification

of multispectral imagery collected via a Remotely Piloted Aerial System (RPAS) at 6 sites. These classified images were in turn used to produce datasets to train and evaluate a supervised classifications of land cover in a sequence of Landsat images spanning 1980 to 2019. Rates of decomposition were assessed using a litter bag decomposition experiment, where 200 nylon bags filled with 10 g of either Carex aqualitis litter (100 bags) or Betula glandulosa leaves (100 bags) were installed on the ground surface in 2009 in a wet sedge medow and in an adjacent area with dwarf shrubs. Every summer for the first 5 years, 10 bags were collected in each vegetation type, then again in summer 2018, in spring 2019, and the remainder of the bags were collected in fall 2019. Total carbon, nitrogen and sulfur in soil chemical environments were characterized through combustion analysis, and bioavailable nitrogen, phosphorous, and other base cations were determined through acid-digest techniques. DNA was extracted from samples to characterize soil microbial community through Illumina-MiSeq sequencing of 16s rRNA, and green house gas production potential was assessed using jar incubations at 4 and 14 °C. Preliminary results indicate slower rates of decomposition for shrub litter, with k values of 0.078 (R2 = 0.75) and 0.11 (R2 = 0.69) for B. glandulosa and C. aquatilis respectively. These first results suggest that climate-induced shifts in vegetation structure may be associated with a negative feedback to climatic warming, as more carbon is stored in plant litter in areas with shrubby vegetation.

ASSESSING THE VULNERABILITY OF TUNDRA ECOSYSTEMS TO CLIMATE CHANGE: A FOODWEB APPROACH FRAMEWORK FOR CONSERVATION PLANNING

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Protected area networks are our most valuable resource for in situ conservation of biodiversity. With increasing pressures from climate change and industrial development, northern regions would benefit from an integrated conservation planning. To account for future ecosystemic changes however, conservation initiatives in these regions and elsewhere need to focus not only on species but also on ecosystems. Species in ecosystems are interlinked by biotic interactions, forming ecological networks. These interactions can modify the effects of disturbances such as climate change, and impacts on one group of organisms can be transferred to distant groups. Thus, including a measure of ecosystems' vulnerability is crucial to account for future climate change impacts. Using climate change scenarios, climate niche modeling and trophic network reconstruction, we thus propose a framework to assess the vulnerability of northern ecosystems to climate change. We then apply this framework to evaluate the vulnerability of a network of conservation areas in the tundra of Northern Quebec, Canada. The vulnerability index we propose is based on the "exposition + sensibility = vulnerability" paradigm, where exposure reflects the magnitude of projected climate change, sensitivity reflects the geographical distribution of species during the reference period and the trophic relationships between them, and vulnerability expresses both the potential shifts of species' ranges and the potential rearrangement of trophic links that these movements may cause. We assume that the more climate change is projected to remodel trophic linkages in an ecosystem, the more vulnerable that ecosystem is to climate change. The vulnerability index (V) varies from 0 to 1. V = 0 indicates that exactly the same trophic interactions are found between the reference and the future period, and V = 1 indicates that none of the trophic links that existed during the reference period are present in the future period. We calculated the vulnerability index for each 10 x 10 km cell of northern Quebec's tundra biome for two climate change scenarios (RCP 4.5 and RCP 8.5), for the 2071-2100 period. High values of V were found for the whole region and for both RCPs. These results are consistent with the high species turnover projected for the region (80-90% for RCP 8.5), but also with the projected changes in the relative proportions of functional groups and in the number of trophic links. We found a geographical coherence in spatial patterns within a given RCP but not across RCPs, meaning that adjacent regions have similar vulnerability indices but the most vulnerable regions tend to change across RCPs. This indicates complex relationships between the intensity of climate change and the potential reorganization of food webs. Our index gives an insight of how much change is projected to occur in northern Quebec in terms of trophic network structure. As we stated, more changes (or dissimilarities) between baseline and future trophic networks translates into more

vulnerability to climate change in the 21st century. Should conservation practitioners concentrate their efforts in more or less vulnerable regions remains an open debate, but our approach remains an important step further in the comprehension of climate change impacts. Although our index should be interpreted sparingly, it remains one of the most advanced tools available to insert climate change issues into conservation planning.

REDUCTION OF TIDES DUE TO SEA ICE IN COMPLEX ARCTIC CHANNELS

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We examine the tides in the Kitikmeot Sea using year-long time-series from moored instrumentation in Dease Strait, and a 3D barotropic numerical tidal model of the region. The in-situ data show strong tidal damping during wintertime seasonal sea-ice cover, with a 50-60% reduction in tidal elevation and 65% reduction in tidal velocities at the sea-ice maximum. We hypothesize the damping largely occurs in Victoria Strait, the eastern gateway of the Kitikmeot Sea, where tidal-induced ridging causes thick, rough ice to accumulate over its shallow sill. Using the numerical model, we independently vary sea-ice friction and sea-ice thickness, and show that the observed wintertime tidal damping likely requires both very rough ice and a partial sea-ice blockage in the sill region. Analysis of the model shows different dynamics and dissipation of the dominant M2 and K1 tides. Both M2 and K1 are dominated by the Atlantic tides entering through Victoria Strait. Arctic tides, entering from the west, have a minor, but significant, contribution to the M2. Overall, the K1 tide, after 19% dissipation in Victoria Strait and 24% in adjoining bays, propagates far into the region and behaves as a Helmholtz resonator in Dease Strait and Coronation Gulf. In contrast, 92% of the M2 tidal energy does not reach Dease Strait because, in addition to dissipation in Victoria Strait (29%), it is significantly diverted into adjoining bays and around an amphidrome in eastern Queen Maud Gulf. The K1 tide, with double the wavelength of the M2 tide, is less diverted.

WILFRID LAURIER UNIVERSITY: PAST, PRESENT, AND FUTURE RESEARCH IN THE NWT

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For decades, researchers from Wilfrid Laurier University (WLU) have worked in the Northwest Territories, studying various aspects of the environment from multiple disciplines and perspectives. WLU research is closely aligned with government and community priorities and has contributed to the development of evidence-based policy and practical management decisions for both environmental integrity and human health in the territory. Officially established in 2010, Laurier's longstanding partnership with the Government of the Northwest Territories (GNWT) aims to expand the Territories' capacity to conduct environmental research and monitoring, and to assist in developing the next leaders needed to manage the NWT's natural resources for future generations. WLU's network of established field sites throughout the NWT, each representing a widely occurring biophysical environment, support field studies that focus on the impacts of a warming climate and human activities on aquatic and terrestrial ecosystems, water resources, food security and communities. To further assist in enhancing and broadening this partnership and to support our growing capacity for research needs in the NWT, WLU established a research office in downtown Yellowknife in 2017. The goal of Laurier's physical presence in the region is to work more effectively with all GNWT departments, agencies, and communities throughout the NWT in supporting their present and future research needs. The core WLU Yellowknife team includes personnel working on climate, hydrological, permafrost, water quality, and environmental change research with partners across the NWT. Looking forward, WLU northern research is focused on delivering risk-management solutions to manage water resources throughout Canada where climate change is altering landscapes, ecosystems, and fresh water aquatic and marine environments. This poster presentation includes an overview of the past, present, and future of Laurier research in the NWT, and an introduction to the people who are involved.

USING AN UNMANNED AERIAL SYSTEM TO MONITOR A THREATENED BELUGA WHALE POPULATION IN CUMBERLAND SOUND, NUNAVUT

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Photographic identification is a valuable tool in the monitoring and management of at-risk marine mammal populations, providing insights into their movements, site fidelity, social structure, and reproductive history. Using unmanned aerial systems (UAS) to collect these photographic data allows for the monitoring of evasive populations in otherwise inaccessible locations. In this study, we used UAS to establish a photographic identification catalog of an isolated and threatened beluga whale population in Cumberland Sound, Baffin Island, Nunavut. This population was commercially exploited for several decades until the 1960s, reduced from over 8,000 whales to its current size of approximately 1,400 whales. It is still harvested by the local Inuit community Pangnirtung at a rate of 41 whales landed per year. The objective of our study was to develop a catalog for future analyses, including a capture-mark-recapture technique to estimate population abundance. Photographs of beluga whales were taken in August 2017, 2018, and 2019 using a DJI Phantom 4 drone and supplemented with boat-based photographs in 2018 and 2019. Group sizes ranged from 1-16 whales with an average group size of 3.7 whales. Approximately 70% of the population were classified as adults, 16% as juveniles, 7% as calves, and the remainder were unknown; these classifications were made based on colour, size, and proximity to adults. Individual whales were identified using scars from natural sources and from hunting wounds. In 2017 at least 43 whales were photographed with markings that appeared to be unique and likely to persist over long periods of time, and analyses of the 2017 and 2018 images indicate that approximately 40% of the population is marked. Four whales were photographed and identified in both 2017 and 2018. Creating a photographic identification catalog for this population will allow us to infer life-history characteristics (e.g. calving rate and survival) which is needed for understanding population growth and for monitoring the population. In addition, gaining a better understanding of the Cumberland Sound beluga whale population demography will allow for the development of more effective conservation and management strategies.

SOIL CHEMISTRY, NOT AGE, IS THE PRIMARY DRIVING FACTOR CORRELATED TO DIFFERENCES IN PLEISTOCENE AND HOLOCENE AGED PERMAFROST MICROBIOMES

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Despite the presence of well-documented signals of change in vegetation and faunal community structure at the Pleistocene-Holocene transition, it is still unknown whether these signals have been preserved at the soil microbial level. Activity and composition of temperate soil microorganisms are directly influenced by both local biogeochemical and climate parameters. However, recent studies of permafrost microbial community structure in ancient permafrost samples do not show a clear connection between soil parameters and community structure; rather, microbial communities tend to cluster based on the age of the permafrost alone. Such an age effect may preclude permafrost microbiome-climate studies since these microbial community structures might have only responded to the stresses in the permafrost and not climate change. However, the lack of correlation between soil chemistry and soil microbiology in permafrost may be due to insufficient resolution of both characteristics. In our study, we used accurately dated permafrost segments and subsampled in close proximity to the well-preserved Pleistocene-Holocene transition zone under strict sterile conditions developed for ancient DNA studies. Our ordination analyses of microbial community composition based on 16S RNA genes and chemical composition of the soil samples resulted into two distinct clusters based on epoch, while samples within an epoch were not differentiable by age. A distinctive set of chemical parameter characterized all samples for each epoch and were not found in samples from the other. In addition, a many generalized linear model and network analysis showed that the samples from the two different epochs had different microbial and soil chemical composition, but

within each epoch no statistically significant changes at microbial and chemical levels were demonstrated. Thus, it appears that both soil chemical and microbial parameters are fairly stable until a "tipping point" is reached during climate change, after which there is a shift to a new set of chemical and microbial parameters. Modern anthropogenic climate change may lead to a similar shift in the state for the soil biogeochemical system if the shift is large enough to reach a similar tipping point.

UNDERSTANDING THE ROLE OF INUIT YOUTH ENGAGEMENT IN SCIENTIFIC RESEARCH IN NUNAVUT

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There is a growing movement for researchers to be more inclusive of local interests, organizations, and individuals in Northern scientific research. As this inclusion becomes more common place and researchers seek partnerships with knowledgeable, skilled community members, opportunities for employment and education in research also increase for local Inuit. Experienced harvesters are often hired by researchers, as they possess the resources and land-based knowledge necessary to accommodate environmental research, frequently spending time on the land participating in hunting, fishing, gathering, and trapping activities. However, opportunities for Inuit youth to engage in similar research relationships are limited. Given that Northern scientific research may generate unrecognized opportunities and benefit from greater youth engagement and benefit-sharing, we will present the results of a two-year project, with partners in Pond Inlet, Nunavut, that explored i) pathways for Inuit youth to develop scientific literacy through land-based activities linked to environmental research ii) the role of researchers in enhancing scientific literacy, and iii) the potential outcomes of Inuit youth engagement in environmental research. Nunavummiut believe that researchers have the responsibility to include Inuit youth in environmental research and enhance their scientific literacy through research engagement. It was found that youth engagement in environmental research may be enhanced by factors such as access to research mentors and a balance of town-based and land-based opportunities to participate. In addition, researchers may play an important role in supporting upcoming generations of Inuit environmental researchers and resources managers in Inuit Nunangat. It was also found that youth may be able to make important contributions to environmental, land-based research.

TOWARDS A FRAMEWORK FOR CUMULATIVE RISK ASSESSMENT FOR MARINE SHIPPING

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The thriving utilization of the Arctic ocean due to the shortening of the sea ice in the summer season has posed several risks to Inuit communities and the Arctic environment (Arctic Council, 2009). Among those risks, there are marine shipping risks, which rank as a major concern to marine and federal authorities due to the exhaustive list of potential environmental issues that can emerge from it, such as oil spills, noise pollution, air emissions, marine mammal strikes, among others. (Walker et al., 2017). One way to examine these risks is through a cumulative effect assessment (CEA), which provides a means to combine different stressors into one single impact measure (Halpern et al., 2008). The proposed CRA framework is an adaptation from CEA and combines spatial and modelling methods, along with other supporting methods, such as Traditional Knowledge (TK) and expert surveys. Spatial methods were used to map location and characteristics of the stressors and receptors through ArcGIS tools from ArcMAP version 10.5 software, and modelling methods applied to calculate each element in the CRA equation. The determinants of risk included in this assessment are more than just the probability of adverse effects from stressors on receptors, as it also includes the receptors' exposure and their sensitivity to stressors (Rados-Derr et al., 2014). Thus, the contribution of each stressor to the overall risk score is accounted for. An illustrative case study in the Kitikmeot region was conducted for the shipping season (June 1st to October 14th), with the selection of the stressors and receptors based on local communities' concerns as documented by Carter et al. (2018). As for shipping stressors, ship-source oil spills and noise pollution are considered to be two of the threats of greatest concern among the Northern communities. As for receptors, Beluga, Bowhead and Narwhals were included because Inuit communities rely

on them for their food security through their traditional subsistence hunting and also their cultural importance to these communities. This study demonstrates how risky areas are identified in a more systematic approach than just purely accounting for the overlap between the Northern Marine Transportation Corridors and the marine mammals. The resulting hot spot maps from this CRA can be used to indicate areas where the cumulative risk of the two selected shipping stressors have the most potential to harm these three Arctic endemic marine mammals. Among the findings, it can be concluded that the shipping season overlaps with the period of time where these mammals are present in Kitikmeot region, with the season Ukiaqsaaq (September 15th to October 14th) being the one when these animals are at highest risk from noise or spills. Due to time and data constraints, this proposed method was only applied to a selected number of stressors and receptors, but it can be extended to other types of shipping stressors (for instance, invasive species carriage and air emissions), requiring further research.

INVESTIGATION OF SUBMARINE LANDSLIDES AND ASSESSMENT OF THE RELATED RISK IN PANGNIRTUNG FJORD, EASTERN BAFFIN ISLAND, NUNAVUT

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Recent research efforts have highlighted that current climate warming is reducing the thickness and extent of glaciers, is affecting permafrost stability and is increasing river runoff in high-latitude regions. The influence of climate change on Arctic submarine environments and their associated geological hazards are still debated. This project aims to assess the recurrence of past geohazards such as submarine landslides, floods and tsunamis in Pangnirtung Fjord, eastern Baffin Island to test the hypothesis that the cumulative effects of climate change increases the frequency of such hazardous events across the Arctic Archipelago. A nine-day research cruise on the R/V Nuliajuk with the Geological Survey of Canada was used to collect sub-bottom profiles, multibeam bathymetric data, sediment cores, and topographic data of the flanks of the fjords to address the factors responsible for sediment transport processes and margin instability in high latitude fjords. Multibeam bathymetry and 3.5kHz sub-bottom profiler data will be used to investigate seabed sediments and to identify submarine landslide deposits while Unmanned Aerial Vehicle (UAV) data of the high-relief fjord sidewalls will help determine possible subaerial areas of failure. This analysis will aid in identifying potential trigger mechanisms of landslide generation in the fjord. Surficial sediment cores will be collected to quantify the age of the landslides and estimate the stability of the seafloor through geotechnical analyses. The results of this first year of the project will also be used to drive future field investigations aimed to collect new sediment cores in lagoons and low-lying environments along the fjord deltas to assess the tsunamigenic potential of these hazards. This second acquisition campaign will aim at reconstructing the history of past tsunami events that can be correlated with landslide deposits discovered offshore. Coastal coring sites will also be selected based on the results of numerical modeling simulations of tsunami waves propagation generated by the submarine landslides. In addition to addressing the frequency of hazardous events, this study aims to produce the first record of tsunami events for the Arctic, to identify active marine geohazards for the area and to aid local communities by providing geohazard maps.

FACTORS INFLUENCING SPATIAL PATTERNS OF TUNDRA VEGETATION PRODUCTIVITY IN THE BEAUFORT DELTA REGION

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Widespread changes in remotely sensed vegetation indices such as the Enhanced Vegetation Index (EVI) indicate that climate warming is altering the productivity and structure of Arctic ecosystems. Spatial heterogeneity in these indices suggest that tundra vegetation change is being mediated by broad-scale variation in biophysical factors. In this research project, we investigate how local environmental variation influences landscape-scale vegetation productivity in the Yukon and Tuktoyaktuk Coastal Plains. We calculated per-pixel EVI trends using data from 1984 to 2016 and used random forest models to identify biophysical predictors of changes in EVI across our study area. Biophysical variables include surficial geology, land cover type, and several parameters derived from the high resolution ArcticDEM (elevation, slope, aspect, topographic wetness, and solar insolation). In the summer of 2019, we also collected plot-scale field data on vegetation composition and structure, and soil and

permafrost conditions. Preliminary results from random forest modelling suggest that variables including elevation and topographic wetness are key determinants of trends in vegetation productivity. Ongoing analysis of our field data explores how vegetation structure and community composition vary with the magnitude of greening. Our study area in the Beaufort Delta Region supports a number of culturally and ecologically important species (caribou, muskox, moose, and others) that will be impacted by changes in vegetation. Tundra vegetation change will also influence physical conditions like albedo, snow pack and ground temperature. An improved understanding of the factors mediating tundra vegetation change will contribute to local and regional planning and decision-making.

CONTAMINANTS IN NORTHERN TRADITIONAL FOODS: EXAMINING THE RELATIONSHIP BETWEEN RISK PERCEPTION, AWARENESS AND HEALTH BEHAVIOURS AMONG NORTHERN INDIGENOUS PEOPLES

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Traditional food consumption is an integral part of health, wellness and food security in Indigenous communities. A diet rich in traditional foods is associated with lower risk for cardiovascular disease and diabetes and an excellent nutritional source of micro and macronutrients. The consumption of some traditional food items has been associated with increased exposure to environmental contaminants. Many of the contaminants in traditional foods have been associated with chronic health risks after prolonged dietary exposure, compromising confidence in traditional food safety for many northern Indigenous communities. Previous approaches to risk communication about environmental contaminants and traditional food safety have proven to be limiting, and even potentially disruptive to balanced health and diet decision making. While significant research has taken place on the issue of environmental contaminants in traditional foods to date, comparatively little attention has been paid to processes of risk communication with Indigenous communities and the examination of methods of transmitting the most important information in effective ways to influence informed health decisions related to traditional foods and contaminant exposure. Significantly little is known about Indigenous specific perceptions, concerns, and reactions to risk communication messages related to contaminants in traditional foods, particularly among vulnerable, yet critically important, subgroups. Providing locally contextualized and balanced information on both risks and benefits is argued to be critical to support individuals in empowering them to make informed health decisions and food choices. The purpose of this research project is to enhance our understanding of the underlying factors influencing perception of traditional food risks and benefits in northern Indigenous communities and residents' reception and use of information received on these topics from biomonitoring research projects. Through the use of both surveys and semi-directed interviews before and after individual's participation in a contaminant biomonitoring study, this project will explore individuals' awareness and comprehension of current health messages about traditional foods and contaminants and their intention to change health behaviour based on this knowledge at two time points. Study results will provide an improved understanding of the factors that influence Indigenous perception, reception, awareness and response to environmental health risk communication messages on contaminants in traditional foods in the Canadian Arctic. Findings will inform the communication of other environmental and public health risk issues, as well as contribute to regionally specific efforts to create health risk communication tools that support the consumption of traditional foods while still protecting the health of Indigenous residents.

SOCIAL DETERMINANTS OF HEALTH FRAMEWORK APPROACH IN ADDRESSING TUBERCULOSIS IN NUNATSIAVUT

Shea, Jennifer(1) (Presenter); Tina Buckle (2) (co-Presenter); Sylvia Doody(2) (co-Presenter); Kayla Chubbs(1); and Michele Wood(2).

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In 2017, the Government of Canada established a taskforce encompassing each of the four Inuit Nunangat regions to develop an action plan to eliminate TB across Inuit Nunangat by 2030, with reduction of at least 50% of active TB by 2025 (ITK, 2018). In collaboration with the Nunatsiavut Government Department Health & Social Development (NG DHSD), this research project was designed to inform this gap in knowledge: how do social determinants of health influence the transmission and prevalence of TB in the Nunatsiavut communities of Nain

and Hopedale? We have applied the social determinants outlined by ITK (2013) with a specific focus on how the communities of Nain and Hopedale perceive food security and nutrition, availability of health services, mental wellness, and housing as contributing to TB prevalence. While there are commonalities throughout Inuit Nunangat, specific regional analysis is necessary to develop an effective TB Action Plan, as the influence of each of the social determinants of health may vary from community to community depending on location and resources available. Thus far, NG DHSD has addressed TB regionally through the NG TB Campaign which was informed through community consultation (NG, 2017a). The knowledge gained through this project adds a rich perspective and understanding of TB and social determinants of health, which can help to further inform NG's region-specific plan for TB eradication. Nain and Hopedale were selected for this study in consultation with NG DHSD, as arguably these communities have recently faced the highest rates of TB within Nunatsiavut. 38 participants (19 in each community) participated in sharing circle discussions. All sharing circles had an NG DHSD nurse present to help facilitate and to answer participant questions. In both communities, there were three main themes: 1) Contributors to TB, 2) Barriers to care, and 3) TB Management Suggestions. There was variation in both communities related to the corresponding sub-themes. Our presentation will review findings and outline recommendations for next steps as NG DHSD works toward TB eradication. Finally, we discuss knowledge mobilization and how findings can contribute to program development and delivery.

IMPACTS OF SALINE INCURSION ON PLANT AND SHOREBIRD COMMUNITIES IN THE OUTER MACKENZIE DELTA, NWT

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In the Western Arctic, reduced sea ice cover, coastal erosion, and more intense storms are increasing the frequency and magnitude of coastal inundation. The loss of vegetation resulting from saline incursion along the coast is likely impacting arctic shorebird populations that use these critical areas as migrating, breeding, and nesting habitats. In 1999, a severe storm caused widespread and persistent vegetation kill in the outer Mackenzie Delta. In this project, we used remote sensing and field surveys to investigate how shorebird diversity is affected by heterogeneous vegetation recovery following the storm. Landsat imagery (1986-2017) was used to calculate the Normalized Difference Vegetation Index (NDVI) to: 1) identify areas of vegetation that were affected by the storm, and 2) track recovery. Specifically, we used maps of NDVI change to establish 20 plots in 3 site types (control/unaffected, recovering, unrecovered). Shorebird diversity surveys conducted in June 2019 were used to assess habitat use by migratory and breeding birds. Twenty years after the storm, large areas of the outer Delta remain unvegetated. Preliminary analysis shows that shorebird populations differ significantly among site types. Ongoing analyses focus on the importance of vegetation and the presence of standing water as determinants of habitat suitability for shorebirds. With increases in storm surge frequency, it is paramount to understand the rate of ecosystem recovery and to determine if compounding effects from subsequent storms could result in cumulative habitat loss. By characterizing the impacts of vegetation kill on shorebird communities, this study will contribute to regional planning and decision-making in the midst of rapid change.

REMOTE SENSING AND COMMUNITY-BASED MONITORING TO ASSESS HYDROLOGICAL AND BIOGEOCHEMICAL CHANGE IN A LARGE SUB-ARCTIC RIVER BASIN (GEORGE RIVER, NUNAVIK, CANADA)

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Arctic rivers, such as the George River, are among the least understood and studied hydrological systems.

Northern rivers drain vast regions where hydrological and biogeochemical data are sparse and scientific understanding limited. Here we present the results of a research program that seeks to integrate scientific approaches and traditional knowledge to advance our understanding of environment and climate change in Arctic freshwater ecosystems. Our study focuses on the George River watershed (565 km length, 41 700 km^2), located in Nunavik, the sub-arctic region of Northern Québec (Canada). The George River basin is home to the Inuit of Kangisuallujuaq who value the river and its watershed as the basis of their livelihood, culture and well-being. Adjusting to climate change and the significant pressure to exploit natural resources within the river basin has become a major concern for the community and for researchers. To address this concern, a Science Land Camp program involving Youth, Elders and local experts was co-initiated by the community of Kangiqsualujjuaq and University researchers, to undertake a long-term biomonitoring program of the George River watershed. Field campaigns to obtain water quality measurements were conducted during the summers 2016-2018, and timed with data acquisition from space-borne remote sensing systems. Our sampling efforts seek to establish the predictive relationships between in-situ measurements and data obtained through remote sensing platforms, that will subsequently allow us to gain insight into hydrological and geochemical changes taking place across this vast watershed. Measurements taken along a 50 km stretch of the river included: (i) aquatic productivity (chlorophyll-A); (ii) turbidity, suspended sediment concentration (SSC); (iii) water color; and (iv) water depth. Field data are compared to the relatively fine scale (10 to 30 m spatial resolution) remote sensing multispectral information obtained from two distinct optical imaging satellites (i.e., Sentinel-2A's Multispectral Instrument, and Landsat-8 Operational Land Imager). The insights gained through field measurements and remote sensing will be integrated with Kangiqsualujjuamiut knowledge to facilitate understanding of the impact of climate warming and land-use changes within this sub-arctic watershed.

HOUSING SHORTAGE AND DEMOGRAPHIC PRESSURES IN INUIT NUNANGAT

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To explain the extent of the current housing crisis in Inuit Nunangat, public authorities often refer to the "high population growth" or the "peculiar demographic profile" of Inuit population. With a high fertility rate - close to 3 children per woman on average - Inuit population is growing much faster than the rest of Canada, and this growth is said to put more pressure on the housing stock. Against what public authorities seem to suggest, a rapid population growth does not automatically imply an equivalent increase of households and dwellings, because household formation also depends on population age structure and marital behaviors. Yet, these two crucial components of household formation are never considered when discussing housing and demographic pressures in Northern Canada. Such a lack of research and interest appears as a major limitation to a better understanding of the consequences of demographic changes on the current housing shortage in Inuit Nunangat. The study we wish to present fills these gaps by providing a portrait of the demographic changes that may have increased pressures on housing in Nunavut, Nunavik, Nunatsiavut and Inuvialuit region. Using Canadian census microdata files from 1996 to 2016, we show that new housing construction outpaced population growth in all areas of Inuit Nunangat between 1996 and 2016. Yet, in the meantime, Inuit population age structure evolved, and the number of adults grew much faster than the whole population. The rise of divorce and changes in marital behaviors led as well to a diversification of family configurations and a rising number of single parents. In Nunavut and Nunavik especially, the housing stock did not apparently adjust to these new realities, judging by the major drop of the percentage of young Inuit (18-29 years old) living in independent households. These results as well as their implication for future housing policy in Inuit Nunangat will be discussed during our presentation.

INUIT KNOWLEDGE AND EXPERIENCE TRANSFORMING INUIT NUNANGAT SEARCH AND RESCUE

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Imagine, being lost and injured in Inuit Nunangat. Search and rescue agencies located thousands of miles to the south have been alerted. Rescue, if it comes at all, could take more than twenty-four hours and essential

medical services may not be readily available at the nearest community. Search and rescue and health care challenges are realities of Inuit Nunangat residents, workers, and visitors alike. Climate change impacts are adding additional pressures to Inuit Nunangat search and rescue and health care systems that are already significantly stressed . Greater access to Inuit Nunangat resulting from climate change has increased the likelihood of a major disaster or emergency. This research represents a novel approach serving to encourage meaningful discussion among key stakeholders with the aim of making Inuit Nunangat Search and Rescue more effective. The solution to effective Inuit Nunangat Search and Rescue may well be found within Inuit knowledge and experience. Traditional skills of tracking, hunting, and survival on the land are key factors in Inuit Nunangat Search and Rescue. Using these skills and taking control of Inuit Nunangat search and rescue, the Inuit would be asserting their knowledge and lived experiences while at the same time helping their communities. Inuit controlled search and rescue has the potential to positively impact the health care system while demonstrating inherent resilience in the face of climate change. This research is about understanding, embracing, and promoting Inuit knowledge, experience, and leadership of search and rescue in Inuit Nunangat - After all they are the experts.

LEARNING FROM AND ENHANCING COMMUNITY CAPACITY FOR CLIMATE CHANGE AND FOOD SECURITY (C4FS) ACTION IN THE NWT

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In Canada's Northwest Territories (NWT), understanding adaptation to climate change impacts is critical, since livelihoods, food systems, Indigenous health, and long-term community sustainability are tightly linked with the health of the environment. This presentation highlights a newly formed and funded, collaborative research project developed through an iterative process of open communication and relationship-building, involving research partners from multiple NWT communities, academic institutions, and both territorial and regional Indigenous organizations/governments. Together, we aim to identify, develop, and implement community-defined and -driven initiatives to enhance local capacity to plan for and address food security issues in the face of climate change. Our approach, centered on the core principles of fostering community leadership, involvement and engagement, also highlights a way forward for health-related research in the NWT. Our collaborative research uses Participatory Action Research (PAR) methodology, an approach grounded in stakeholder participation and action to address the needs of partner communities. This project evolved from many years of collaborative work and relationship-building among academic, community and policy partners in different parts of the NWT. This overarching project brings these multiple partners together to support community-driven adaptation planning, and fosters knowledge-sharing within and among communities across different land claim regions. The research co-development process involved a grant development workshop hosted by the academic co-leads in Waterloo, Ontario, on March 25-26, 2019. The 32 participants included community members and government decision-makers from across the NWT, as well as researchers and students from five universities. Team members worked together to share knowledge and to identify core areas of research focus, potential case studies, and overall goals of the proposed project, while ensuring alignment with community needs. The workshop process reinforced the importance of taking a holistic approach to addressing food systems; of working across scales, while emphasizing place-based and community-level approaches; and of linking community-based action to health and well-being outcomes. Furthermore, participants identified four cross-cutting themes to consider throughout all aspects of the research, namely: Traditional Knowledge, governance, youth and gender. These themes and their relationship to food procurement, food security, and climate change are thus central to the project. Here, we highlight work that led to the establishment of this project, including current and ongoing projects on food security and climate change in the NWT that are led by project partners. We also discuss plans to roll out the project across communities and regions, and address the sharing of information to promote scaling up and out of local initiatives to regional and territorial levels.

KNOWLEDGE CO-PRODUCTION OF ARCTIC CHAR (SALVELINUS ALPINUS) IN A CHANGING ENVIRONMENT

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Inuit in the Western Canadian Arctic have identified a need to better understand the health and movement of key marine species in relation to a changing environment. In particular, Inuit in Ulukhaktok, NT, have observed rapid changes in the health and movement of Arctic char (Salvelinus alpinus). The proposed research will draw upon Inuit traditional ecological knowledge (TEK) and western science to co-produce knowledge about this fundamental subsistence species. Specific objectives include: (1) document TEK and observations of Arctic char health and movement; (2) use telemetry and TEK data as a venue to bring together knowledge holders for co-production; and (3) identify opportunities to inform fisheries co-management. TEK will be recorded through participatory mapping and interviews with key knowledge holders in Ulukhaktok. Concurrently, quantitative data on individual fish movement patterns will be collected using telemetry. The approach is informed by a pilot study conducted in February 2019 with Inuit knowledge holders that used photographs of tagged fish and maps to share TEK. The expected results are intended to improve our understanding of the dynamics of movement ecology and the health of Arctic char and provide valuable information for the co-management of a significant species for Inuit food security.

BIOMETRICS OF POLAR BEARS IN A CHANGING WORLD: ASSESSING BODY CONDITION NON-INVASIVELY NEAR CHURCHILL, MANITOBA

Smith, A.(2) (Presenter), J. Michaud(2) (Presenter), C. Lisakowski(2) (Presenter), M. Burke(3), E. Holmes(5), Q. Ritual(4), S. Temesvari(2), D.Labun(2), J. Larkin(3), J. Forslund(4), G. Spieser(5), JM Waterman(1), J.D. Roth(1)

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The body condition of polar bears may be an important indicator of changing climate, as the time when the sea ice is frozen has declined with rising temperatures. Polar bears consume large amounts of seal blubber, which must sustain them during the ice-free period until the ocean freezes again. Recent studies indicate that polar bears in Western Hudson Bay are coming off the sea ice in poorer body condition as the annual ice-free period has increased, but these data required the capture of bears on land. Using a body condition index (BCI) developed using photos taken from field research, and facial recognition software (Whiskerprint) developed to identify individuals, we monitored annual variation in polar bear body condition over the past 25 years non-invasively. We also investigated the relationship between body condition and the date sea ice breakup. Our body condition index differed significantly between males and females, so our analysis used sex as a fixed factor. Our data show a pattern of a decrease in body condition in both sexes over the past 25 years, similar to the pattern found in live-captured polar bears earlier in the season. Our non-invasive methods complement the use of more invasive methods to estimate body condition, but they can be used in periods when invasive estimates are not possible, such as during times of peak tourism or in conditions not conducive to direct estimates.

IMPROVEMENTS IN MODELING THE SPRING SNOW DISTRIBUTION AT IQALUIT, NUNAVUT

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Snowmelt is the largest component of the annual water budget in Arctic watersheds, and hydrological studies require accurate estimates of spring snow water equivalent (SWE). Unfortunately, baseline SWE records are lacking for most of Nunavut, including the territorial capital, Iqaluit. Due to wind-induced precipitation gauge bias and extensive midwinter redistribution and sublimation, snowfall estimates from meteorological stations should be benchmarked against spatially representative field measurements. To support ongoing hydrologic research in the Niaqunguk (Apex) River Watershed (NRW) near Iqaluit, extensive field surveys have been conducted each spring by Carleton University researchers and Nunavut Arctic College students. In this study, researchers have focused on computer modeling techniques to reduce surveying requirements and improve the transferability of estimation methods. The software employed is SnowModel (Liston et al., 2007) - a spatially-distributed, physically-based snow modeling program, driven using local topographic and meteorological data. In past years, SnowModel has effectively simulated overall patterns of snow depth in the NRW. However, the model has consistently overestimated total spring SWE. This poor performance could be attributed to one of three main shortcomings: (1) flawed meteorological inputs from the 2014-15 winter at Iqaluit airport, which is tested by including more years in the current study, (2) poor selection of model parameters, which is tested by use of a data assimilation routine that can re-tune parameters during a run, or (3) SnowModel could be fundamentally unsuitable for the rugged terrain of southern Baffin Island, likely due to a limited wind model or unsuitable handling of non-equilibrium transport conditions. The model's performance during 4 simulations (ending in the springs of 2015-2018) will be discussed, and each of these areas examined in detail.

TOWARDS A REGIONAL OCEAN MODEL FOR THE LABRADOR COAST AND SHELF

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The Labrador region is located in the northwestern North Atlantic ocean, forming the western boundary of the subpolar gyre. For centuries it has been the homeland for the Labrador Inuit, who have a close relationship with the ocean, sea ice and coastal islands. Northern Canada is warming twice as fast as the global rate and this is exerting a significant influence on the coastal ocean in Labrador. Changes are evident in the decreasing sea ice coverage and increasing sea surface temperature. Thus, the landfast ice, so important for hunting and to give fishing access to the ocean, has been changing in thickness and seasonal timing in consequence of this new climate scenario. The waters over the Labrador continental shelf, seasonally covered in ice, include the Labrador Current as the main circulation feature, which acts to transport freshwater from the Arctic to the interior North Atlantic subpolar gyre. A number of important processes in this region are not well understood, including freshwater transport pathways, the connectivity between inshore-offshore waters and interannual-to-decadal variability. To answer these questions, we will examine both available observational data (drifters, gliders, ship-based CTD casts, ADCPs, satellite images, etc) to characterize the ocean state and its dynamics and use a high-resolution numerical ocean model to target specific questions in detail. The proposed modelling framework is to use ROMS for the physical oceanographic process and CICE for the sea-ice model component. The model domain will cover the entire Labrador coast and offshore to just off the shelf edge. In the first instance, a hindcast covering the period since 1993 will be performed and complemented with a set of process studies to examine specific research questions on freshwater transport, connectivity, and interannual-to-decadal variability.

WHERE ARE MY HOUSING RIGHTS? THE ROLE OF LAW IN NUNAVUT'S HOUSING INSECURITY CRISIS

Song, Gloria

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Discussions on Nunavut's housing crisis often focus on the shortage of available housing, and how to build more houses in a timely manner to keep up with growing demand and overcrowding problems. One angle that is often overlooked in housing strategy discussions is the legal dimension, such as the legal rights and obligations involved in housing. By examining case law jurisprudence from the Nunavut Court of Justice, supplemented by the presenter's experience as a former housing lawyer in Nunavut, this presentation will examine the role played by the legal system in Nunavut with respect to the territory's housing crisis. What legal issues arise? Where does the legal system fall short in providing housing solutions? What law reforms are needed to adequately protect the housing rights of Nunavummiut? After all, sustainable

housing should also mean being able to remain in your home - legally, safely, and securely.

USE OF AUTOMATED SYSTEMS FOR THE STUDY OF OCEANIC DIMETHYLSULFIDE (DMS) DYNAMICS IN ICE-COVERED AND ICE-FREE WATERS OF THE ARCTIC

St-Onge, Joanie (1)(Presenter), M. Lizotte (1), G. Massé (1), J-É. Tremblay (1), M. Levasseur (1), M. Gosselin (2), P. Massicotte (1)

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The sources and strength of oceanic dimethylsulfide (DMS) emissions, a climate-active biogenic gas, could increase in the Arctic as a result of the reduction in snow cover, sea ice extent, and thickness. Understanding the impacts of climate change on DMS dynamics is crucial since DMS-derived sulfate aerosols lead to cloud formation and contribute to moderate solar energy input in the Arctic and influence the Earth's radiative balance. The purpose of this study was to investigate the spatial distribution of DMS concentrations in relation to biological and physicochemical parameters as well as sea ice dynamics. Using a high frequency automated instrument (ACT-MIMS), DMS samples were collected in the Arctic ocean and the Canadian Arctic Archipelago during the summers of 2017 (July-August) and 2018 (July) aboard the Canadian Coast Guard Ship Amundsen. More than 3500 DMS observations were collected alongside continuous measurements of sea surface salinity, sea surface temperature, fluorescence (proxy for Chl a), solar irradiance and discrete measurements of dimethylsulfoniopropionate (DMSP). DMS concentrations were measured over a wide range of marine environments from coastal to open ocean, ice-free waters, as well as under-ice waters. DMS concentrations were extremely variable ranging from ca. 0.2 to 43.0 nmol L-1 in 2017 and from ca. 1.6 to 55.0 nmol L-1 in 2018. These values are comparable to previous studies conducted in the Canadian Arctic Archipelago during the summers of 2015 and 2016, using similar high-frequency measuring systems and challenge the representativeness of the existing DMS climatology by showing that average summer surface DMS concentrations may be twice as high in this part of the Arctic at this time of year. DMS hotspots (> 10 nmol L-1) were observed in high productivity coastal waters and at the ice edge of ponded first-year ice (FYI) following the breakup of the ice. The results of this study strengthen the belief that marine DMS cycling in the Arctic is intimately linked to sea ice dynamics, the origin of water masses and hydrographic frontal structures. As such, future changes in the seasonality of the Arctic cryosphere will likely play a crucial role in shaping DMS emissions. The rapid turnover time of DMS and the presence of localized hotspots demonstrate the potential of using an automated high-resolution instrument in order to fully apprehend the future of DMS emissions in the Arctic.

PLIOCENE LANDSCAPE EVOLUTION INFERRED FROM THE IPERK SEQUENCE, OFFSHORE BANKS ISLAND, NWT

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During the Pliocene (5.3-2.6 Ma), global mean surface temperatures were approximately 2□C warmer than present. However, Arctic Pliocene local mean annual temperatures were at least 22□C warmer than today, due to a shallower latitudinal temperature gradient. We hypothesize that a thick Miocene-Pliocene regolith was readily available for erosion during global cooling in the Piacenzian, which lead to a Pan-Arctic mobilization and deposition of quartz-rich sand. The mostly Pliocene Beaufort Formation (BFm) provides a well-preserved record of dramatic landscape change during that subtle (2°C) global cooling. Today the BFm outcrops along the western Canadian Arctic Archipelago where fluvial deposits formed a contiguous coastal plain and westward thickening (up to 3 km) clastic wedge across the continental shelf and into the Canada Basin. The Miocene-Holocene Iperk Sequence (IpS), interpreted in seismic data and identified in marine petroleum exploration cores from the Beaufort Sea shelf, contains some fluvial and marine sediments that may be coeval with the BFm. Quantifying how these northern landscapes respond to large-scale climate deterioration is critical to understanding the first-order controls on sediment flux and regional marine alkalinity. For the first time, a lithostratigraphic correlation of the onshore-offshore stratigraphy has been achieved

using newly available climatological and chronological constraints to help evaluate the scale of landscape response to the Piacenzian climate change. Distinct geophysical facies and unconformities observed in high resolution marine seismic reflection data from ION Geophysical Technologies form the basis for subdividing the IpS into five Pliocene sub-units and a Pleistocene-Holocene sequence. The sub-unit volume changes appear to scale with contemporaneous onshore catchment-wide average erosion rates observed in BFm and equivalent onshore units. Our results also indicate that Pliocene shorelines lie between 30 and 90 km offshore from Banks Island. Furthermore, there is no evidence of coastline-parallel faulting in M'Clure Strait which supports the hypothesis that at least some waterways of the Northwest Passage may have been climatogenic (owing to fluvial and glacial incision) instead of tectonogenic grabens. We discuss the implications of these data in relation to major transgressive sequences and landscape evolution during a period of significant climate change.

WHAT ARE SMALL MODULAR (NUCLEAR) REACTORS? AND WHY IS HEALTH CANADA INTERESTED IN THEM?

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A number of countries are doing research into developing Small Modular nuclear Reactors (SMR) for electrical power generation, including Canada. These types of reactors could be used to power remote locations, for heavy industry applications, and for on-grid applications. One of the possible uses for a SMR is to provide power to remote Arctic communities. Small nuclear reactors are not a new concept. The Americans constructed small nuclear reactors for remote areas in the 1960s, under the U.S. Nuclear Power Program, where they built and ran 4 reactors in remote regions: in Alaska, in Greenland, in Antarctica, and in the Panama Canal Zone on a barge. More recently the Russians have put two nuclear reactors on a barge and plan to send it to a remote Arctic community to replace diesel power generation. Health Canada plays a role in human health risk assessment for major resource and infrastructure projects in Canada and is therefore interested in the history of SMRs and the potential radio-ecological consequences of future projects in terms of radiation dose received by humans. This presentation will provide a brief overview of SMRs in general and will describe some early thoughts on potential challenges for human health risk. For example, in doing assessments for nuclear reactors, often an environmental transport model is used which is dependent on transfer factors which are determined from measurements. These transfer factors most likely will change in the Arctic environment.

ESTIMATING RISK-BASED SHIP TRANSIT TIMES IN ICE USING POLARIS

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Maritime traffic in the arctic is expected to increase in coming years as northern communities grow, tourism increases, and large resource development projects enter operation. Potentially accelerating this growth is evidence of a decline in ice coverage in the arctic which is expected to increase accessibility in the region over time. As activity increases, the number of vessels exposed to the navigational risks in the arctic region will rise. It is rather self-explanatory fact that the vulnerability of a vessel to these risks depends heavily on the type and class of the ship, the training and experience of the crew, and access to high quality information to support effective decision making, both during the planning and execution phase of an operation. This poster provides a visual overview of the Polar Operational Limitations Assessment Risk Indexing System (POLARIS) and showcases its use with open-access ice information to support strategic and operational decision making in polar waters. A method to estimate risk-based ship transit times in ice using POLARIS is also presented.

KEY SUMMER FORAGING HABITATS FOR EASTERN BEAUFORT SEA BELUGA WHALES IDENTIFIED FROM TELEMETRY DATA

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The Beaufort Sea is an important summer foraging ground for one of the largest populations of beluga whales (Delphinapterus leucas); the Eastern Beaufort Sea (EBS) population. Recent effects of climate change including a decrease in total sea ice extent, and alterations to the date of sea ice freeze-up and break-up may have direct and indirect effects on the movement patterns and migration timing of this population; whilst declines in body condition have been associated with a climate-induced shift in the prey assemblage. Predicted continuation of these patterns as well as the increase in shipping traffic associated with the opening up of the Northwest Passage may pose significant threats to this population. This necessitates a greater understanding of the key foraging habitats and foraging behaviour of EBS beluga whales. Improvements in the technology of satellite-linked transmitters now enable questions on cetacean behaviour and ecology to be answered over greater time scales and to a higher accuracy than was previously possible. In July 2018 satellite tags were deployed on 10 beluga whales in the Mackenzie Estuary, Northwest Territories. Tags were programmed to record depth data every 75 s, and Fastloc-GPS locations each time the whale surfaced. Such data facilitates the application of more sophisticated models for inferring animal behaviour than in traditional hotspot analysis or state-space models. Here a discrete-time hidden Markov model (HMM) is being implemented using the R package "momentuHMM". The HMM uses step-length, turning angle, and number of dives to specific depth bins to fit three states (transiting, resting and foraging) to the animal track. Covariate data including bathymetry and sea-ice concentration are also included in the model to explore how behaviour varies under different environmental conditions. Viscount Melville Sound and the Amundsen Gulf, both part of the Northwest Passage, were identified as critical foraging habitats between mid-July and mid-August. Preliminary analyses on the role of bathymetry suggest that foraging occurred most frequently in water depths between 400-500 m. Whales continued to make occasional deep foraging-type dives even when transiting between more productive foraging grounds. The findings from this study will be essential in informing management decisions in these areas of the Beaufort Sea, Amundsen Gulf and Northwest Passage, and will also build into later bioenergetic studies to better predict the response of this population to climate change.

DEVELOPMENT OF ON-SITE SOIL TREATMENT PROCESS BASED ON CHEMICAL OXIDATION AND ADAPTED TO THE CONTEXT OF NUNAVIK'S NORTHERN VILLAGES

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Development of on-site soil treatment process based on chemical oxidation and adapted to the context of Nunavik's Northern Villages At a global scale, there is a considerable amount of sites where ground or groundwater is affected by organic contamination, and especially by hydrophobic organic compounds (HOC). The problem of contaminated sites is a major issue for municipalities and land developers in all industrialized and developing countries, as well as for the various ministries and responsible agencies. In the Canadian Arctic region, this problem is well known and has been declared serious by the governments of Canada and Russia (Yang et al., 2009, Chuvilin et al., 2000). Although there are many technologies available in the southern part of the province, the remote cold region context makes most of these technologies difficult or impossible to implement and operate. In fact, local resources are limited, transport costs are high, and interventions must occur on-site. Finally, the operating conditions are very difficult because of the climatic context, the field constraints and the high concentrations of organic matter and iron in natural soils (Sherwood and Cassidy, 2014). In too many cases, soils are simply excavated, bagged and sent by boat and at great expense to landfills located in the south. The main objective of the project is to develop an innovative process able to treat soil contaminated by heating oil and located beneath the buildings of the Nunavik's Northern Villages. An in-situ chemical oxidation technology will be developed in laboratory and tested on a pilot scale in the Northern Village of Inukjuak, Nunavik, Qc. This research project is carried out in collaboration with the Kativik Regional Government (KRG), the Kativik Municipal Housing Bureau (KMHB) and the Métox Inc. company and will allow the testing of an innovative technology at a pilot scale. The technology is planned to be marketed within 2 years after the project. The poster presents the general problematic, based on the example of the three most populous Nunavik's Northern villages, the methodology followed for the development of the oxidation process and its in-situ implementation, the

preliminary results obtained to date and a conclusion. Yang, S.-Z., et al. (2009). "Bioremediation of Oil Spills in Cold Environments: A Review." Pedosphere 19(3): 371-381. Chuvilin, E., et al. (2000). The use of permafrost for the storage of oil and oil products and the burial of toxic industrial wastes in the Arctic. Polar Record,36(198), 211-214. doi:10.1017/S0032247400016478. Sherwood, M. K. and D. P. Cassidy (2014). "Modified Fenton oxidation of diesel fuel in arctic soils rich in organic matter and iron." Chemosphere 113(Supplement C): 56-61.

THE CHANGING LANDSCAPES OF LABRADOR

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Climate change and natural climate variability are impacting northern communities and landscapes. Across Labrador and northern Québec (including Nunavik, Nunatsiavut and NunatuKavut), rapid regional warming observed over the past several decades has significantly affected the quality of life for Indigenous Peoples and Northerners by reducing access to traditional lands and the availability of resources, including firewood and wildlife. Satellite and field-based data have shown that regional shrub growth has accelerated due to warming summer air temperatures with coastal Labrador and Nunavik having the fastest greening trends in North America. Our research asks the following question: How do changing snow and permafrost conditions affect plant biodiversity and ecosystem function, especially with respect to culturally important plant species? Using a multi-scale approach which integrates field data collection, remote sensed data, and advanced modelling techniques, we will be able to understand and predict how these landscapes will respond to future change. In the summer of 2019, we established sites near Nain and Red Bay, Labrador. At each site, we set-up four 2 x 2m permanent plots, recording plant and lichen/moss diversity at forested, high and low shrub tundra, and open tundra plots. We also established snow monitoring stations at each plot using light sensors to record snow depth and photogrammetry to document the distribution of snow across the landscape. Across the Circumpolar Arctic, the improved understanding of linkages between snow, trees, plants, lichens/moss, and permafrost is highly transferable and will give other communities access to conservation and planning tools needed to better manage changing northern landscapes due to climate change.

MONITORING WATER QUALITY IN LA ROMAINE ESTUARY, THREE YEARS AFTER IMPOUNDMENT OF ROMAINE RESERVOIRS

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Hydro-Quebec is one of the largest electric power companies in North America and one of the world's leading producer of hydropower. Hydro-Québec decided to develop a series of four dams, four reservoirs and four generating stations (GS) along the entire lower 500-km portion of the Romaine River, which composes the actual Romaine Complex. Construction started in 2009 and the flooding of the first reservoir was in 2014. Local communities were concerns by Romaine River freshwater flow modification with the project and the possible implication on the Romaine estuary. Comprehensive studies dealing with the impact of hydropower on coastal environments are scarce. In order to better describe the environmental changes, Hydro-Quebec conducted an exhaustive follow-up of some physical, chemical and biological parameters in the Mingan Channel. A monitoring program was carried out over 5 months of the 2013, 2015 and 2017 summers, involving the installation of two fixed instrumented buoys which continuously record water salinity, temperature, oxygen, chlorophyll, nitrates, turbidity and dissolved carbon dioxide. The instrumented buoy data set was completed with results from several sampling campaigns (nutrients, phytoplankton, zooplankton) and by the realisation of more than 900 water quality vertical profiles at different tidal cycles. The results presented focus on the variation in salinity and planktonic production before and after the commissioning of the Romaine Complex. According to the Environmental Impact Assessment predictions, changing the river discharge could change the intensity and the time of occurrence of the water movements dynamic. Hence, our results show that the modification of Romaine

River freshwater discharge does not seem to influence much the salinity in the estuary. It is rather the marine water coming from the open sea Jacques-Cartier Strait, which determines the salinity of the study area and also the planktonic production. The upcoming environmental follow-up planned over the next few years will allow the confirmation or not of these general trends.

USING BIG DATA TO UNDERSTAND ARCTIC SURFACE WATER CHANGE

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Globally, we are rapidly adapting to the widespread availability of geospatial data and adopting to accessible cloud-based computational resources for processing it. Surface water distribution in Arctic regions is ripe for these new techniques in terms of data synthesis. Water is highly prevalent in these regions, often due to the presence of permafrost which limits infiltration into the subsurface and stores large amounts of frozen water as ice. Dynamics in these regions often exhibit strong seasonality where nival characteristics can often dominate where snowmelt is the largest annual hydrological event. Other areas like rivers can also be strongly influenced by glaciers in the headwater areas. Differentiating how variability affects surface water over time strongly benefits from these new techniques to standardize processing these characteristics over large spatial scales (i.e. country, hemisphere and global). This presentation outlines current strategies for successfully accomplishing these types of analysis over 35 years in all areas with permafrost in the northern hemisphere. The first step was to utilize the Global Surface Water dataset available on Google Earth Engine to harness a co-located monthly dataset of surface water presence co-located in a computing environment capable of robust, repeatable data analysis. The second was to use existing datasets on water type characteristics including lakes and rivers and modify them from representing average conditions at a specific time period to areas of high connectivity. Third, computational efficiencies in terms of zonal analysis and summation were developed in order to further reducing analysis time. This approach offers novel and robust methods for improving standardization and synthesis of surface water in Arctic regions which can be readily extrapolated to other areas of analysis. It can be easily updated as new data is available over time. These techniques make it possible for this type of data to readily inform policy and planning in these regions.

AN AUTONOMOUS, LOW COST, INTEGRATED MULTI-SENSORS FLOATING PLATFORM FOR REAL-TIME MONITORING OF SELECTED ENVIRONMENTAL PARAMETERS

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This poster presents the development of a low cost integrated floating platform that can be equipped with a diversity of sensors for real-time monitoring of environmental parameters on practically any body of water. The platform also includes a bidirectional satellite link for control download and data upload to a remote command station. For development and testing purposes, the first prototype platform unit includes atmospheric pressure, temperature, ambient light and GPS location sensors. The body of the platform is composed of a spherical base that maintains orientation along the vertical axis for optimal antenna position and skyward measurements, such as ambient light. An independent GPS antenna and module support several positioning protocols, allowing continuous operation and tracking in either Lagragian or Eulerian deployment. The top housing is made of clear plastic, allowing the transmission of light for illumination measurement and solar energy harvesting, which will be included in the next development units. The platform will support a cluster of sensors for diverse applications, such as gas monitoring, water analysis and atmospheric parameters measurement. Different subsets or ensembles of such additional sensors will be included in future versions of the platform. For this first development phase, we demonstrate the feasibility and test the prototype on a small lake, in the province of Quebec in Canada and we present recently obtained data. Further versions of the platform will be tested in the Canadian Arctic during the 2020 summer.

HYDROECOLOGICAL RESPONSES OF A DRAINED THERMOKARST LAKE TO 12 YEARS OF DRASTIC CATCHMENT CHANGE

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Lake-rich landscapes provide immense ecosystem services and resources for northern communities. However, widespread and variable changes in the surface area of lakes have been observed across high latitudes, which alter lake ecological conditions. Research presented here was carried out in Old Crow Flats (OCF), Yukon where community members have observed landscape changes during recent decades including drastically changing water levels. The most substantial and rapid transformations occurring here and other lake-rich permafrost landscapes are catastrophic lake drainage events. The frequency of these events is increasing across OCF, which underscores the importance of developing techniques to monitor the response of the catchments, hydrology and biogeochemistry following drainage. Here we showcase the utility of coupling water isotope and chemistry records, water level, snow water equivalent data and multiscale remote sensing techniques to identify lake hydroecological responses. The study focusses on Zelma Lake in OCF, which drained over 80% of its volume during June 2007. The modified normalized difference water index (MNDWI) was used to calculate the spatial extents of Zelma Lake for all Landsat Thematic Mapper (TM 5) and Landsat Operational Land Imager (OLI 8) scenes collected during 2006 - 2018 ice-free seasons. Water level data collected during 2009 and 2018 showed strong correspondence with surface area fluctuations, which was not the case for four other non-drained lakes that have steeper shorelines. Changes in deuterium-excess (d-excess), calculated using d18O and d2H water isotope values, corresponded with Zelma Lake water level and surface area fluctuations indicating that lowering values into the mid-ice-free season were in response to evaporation in addition to drainage from the outlet formed during catastrophic drainage in 2007. Snow survey results and d-excess monitoring since drainage indicates that the willow shrub vegetation that encroached 21% (3.3 km2) of the catchment (on the former lakebed) has enhanced snowpack and melt input to the lake. This has also altered the concentrations of other biogeochemical properties. Findings here highlight the utility and limitations of using Landsat data for estimating past hydrological changes. Furthermore, this work provides a valuable reference for predicting the hydroecological response of lakes to shrub vegetation proliferation, which is widespread across northern regions.

HEAVY FUEL OIL USE IN CANADIAN ARCTIC SHIPPING FROM 2010 - 2018

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The rapid increase of shipping propelled by climate change poses significant threats to the Arctic region, specifically, the wellbeing of Inuit communities. In response to the increase in shipping activity, the Canadian government has proposed the creation of Low Impact Shipping Corridors as an adaptation strategy to support coastal resilience - to minimize the negative impacts and increase the safety of shipping in the Arctic. While a large amount of data have been used to generate these corridors, traditional knowledge from Arctic communities has yet to be considered in much detail. Thus, the corridors as they are currently prioritized, lack fundamental local perspectives among the people who know the area best. This paper focuses on five communities located along the Northwest Passage (Pond Inlet, Resolute, Gjoa Haven, Cambridge Bay, and Ulukhaktok). The purpose of this paper is to contribute knowledge from the perspectives of these five Inuit communities to consider how increased shipping is impacting subsistence hunting and how the low-impact shipping corridors framework could operate as a risk mitigation strategy to support coastal resilience. The findings show that these communities are concerned about the current and potential impacts increased shipping has and might have on subsistence hunting and their livelihoods. In this paper, we present these concerns under three main themes linked to impacts of shipping: Marine pollution; Disruption of travel; and Disturbance of marine wildlife, which all contribute to affecting subsistence hunting and food security. The proposed low-impact shipping corridors could present a risk mitigation strategy for Inuit communities to support coastal and community resilience in response to climate change and increased shipping. However, for this to be used as a tool in this manner, Inuit perspectives need to be understood and considered in the development and management of the corridors framework.

REFLECTIONS ON THE IMPACT OF CERTIFICATION AND TRACEABILITY IN THE NUNAVUT SEAL MARKET: IMPLICATIONS FOR INUIT RIGHTS

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As recognized in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), which Canada has signed, Inuit have the right to food, culture, and economic opportunities. Seal harvesting has sustained countless generations of Inuit, and is therefore at the centre of these Inuit rights. However, anti-sealing campaigns targeting the commercial seal hunt in Newfoundland have resulted in international bans that have collapsed the market for sealskins and imposed hardships on communities across Inuit Nunangat (the collective Inuit regions in Canada). In an effort to improve market access for Inuit seal products, the Canadian Government established the Certification and Market Access Program for Seals (CMAPS), which is creating certification and tracking systems for Inuit seal products in European Union markets. In 2015, the Government of Nunavut became an Attestation Body under the EU Indigenous Communities Exemption, which enables the Government to certify Nunavut seal products for export into EU markets. As such, this research will explore the suitability of certifications and traceability in supporting the Nunavut seal market and Inuit rights. Through an analysis of Fur Tracking System data and focus group discussions with value chain actors in Iqaluit and Qikiqtarjuaq, this research will: a) document and analyze barriers, bottlenecks and challenges in the seal value chain, and b) identify credence qualities of the Inuit seal harvest that should be considered in the development of certification and traceability systems. Collectively, these findings seek to better inform the Government of Nunavut on best measures for supporting the Nunavut seal market in the context of Inuit rights.

EXPLORING THE VARIABILITY OF METHANE ACCUMULATION IN ARCTIC LAKES

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Methane (CH4) is a potent greenhouse gas with a warming potential 30 times greater than that of carbon dioxide (CO2). Past efforts have attempted to estimate the contribution of methane from lakes to the global methane budget, however information from Arctic lakes is lacking. Previous studies show there is potential for methane to accumulate in lakes which undergo annual freeze-thaw cycles, due to thermal stratification. Certain lake characteristics have been associated with high methane concentrations in lakes, however the most prominent factor in determining these concentrations remains unknown. This study was conducted in the Canadian Arctic Archipelago during May of 2019, one month prior to lake ice breakup and the highest predicted dissolved methane concentrations. This field study used freshwater samples to measure dissolved methane, dissolved inorganic carbon (DIC), dissolved oxygen (DO), total alkalinity (TA), conductivity, nutrients (PO43- and NO3-+NO2-) pH, temperature and δO18. Additional lake characteristics, such as lake depth, lake area, ice thickness and snow depth were recorded. Lake selection utilized aerial imagery, where lakes with varying area and their proximity to features such as topology and other water bodies were chosen. Using known lake depths from the Greiner Lake watershed, lakes with a depth < 2m were not included, as the average ice thickness was 1.93m. Using measured values of DIC and TA, pCO2 values will be calculated to determine if these lakes are acting as sources or sinks of CO2. Preliminary results show high alkalinity and dissolved inorganic carbon across lakes of varying character, with dissolved oxygen values ranging from 1-111%. With this breadth of data, the variable which has the strongest influence on methane concentrations in these lakes will be identified. This exploratory research has the potential to substantially improve our understanding of the contribution Arctic lakes have to the Arctic methane budget.

AFTER THE ICE AGE: STUDYING THE EFFECTS OF FEDERAL MEDIA POLICY CHANGES ON NORTHERN SCIENCE COMMUNICATION AND THE CANADIAN SCIENCE-TO-POLICY INTERFACE DURING THE HARPER ERA.

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The Arctic is changing. A rise in global temperatures over the past forty years, in tandem with polar amplification means that the Arctic is warming at a rate three times that the rest of the earth; this is occurring with major implications for the landscapes, populations, and political entities within the region. The consequences of climate change will not be limited to the environment, nor will they be isolated within the region. A reduction in the seasonal extent of Arctic sea-ice and the changing timing of freeze-up and break-up will drastically alter the accessibility of the region-opening Northern landscapes and communities to a host of new and expanding interests, actors and risks. These implications are accompanied by a need for government leadership in managing change within the region through the use of strong scientific research to inform adaptive governance and policy initiatives. From 2006-2015, the Canadian government, led by Prime Minister Stephen Harper, frequently asserted the importance of the Arctic, speaking to the environmental challenges facing the region. Consistent with this, the Government of Canada invested substantial In early 2008, journalist Margaret Munro wrote the first story on what would become a decade-long fixture in the Canadian news media: the muzzling of Canada's federal scientists by the Conservative government under the leadership of Prime Minister Stephen Harper. Her article, Environment Canada 'muzzles' scientists' dealings with media, came on the heels of changes to Environment Canada's media policy, governing how federal scientists are contacted and communicate with journalists. The implications of these changes on scientists and other actors operating at the science-to-policy interface have not been studied and a significant gap in our understanding of the effects of this era remains. As a period of significant scientific and political consequence for Canada and the Canadian North, it warrants examination. The objective of this study is to answer the following research question: How did the changes to the federal departmental media policies affect the communication of Northern science and the actors operating within this space, and how did it shape the science-to-policy interface in Canada from 2006 to 2015? This research identifies key groups of actors and illuminates their roles during this time and more broadly within the science-to-policy interface through the use of semi-structured qualitative interviews. The research question is answered through the analyses of qualitative data and fulfills three focuses. First, it outlines the relevance of Northern science and the audiences of Northern science and media. Second, it explains the challenges and barriers to the successful communication of Northern scientific research to non-scientific audiences, including the effects of the changes to departmental media policies from 2006-2015. And third, it documents how Northern Scientists and Northern Federal Scientists, perceive and define their role in the science communication and policy creation processes. In its entirety, this paper aims to highlight the importance of science communication in Canada; better prepare Northern scientists to participate in and contribute to Northern policymaking and public discourse through the communication of their research; and provide policymakers with an increased capacity to reflect on and include Northern science in Northern and federal policy.

KEY RECOMMENDATIONS AND MISCONCEPTIONS CONCERNING THE INCORPORATION OF INDIGENOUS KNOWLEDGE WITH SCIENCE TO PROVIDE EVIDENCE FOR POLICY AND DECISION-MAKING FOR ENVIRONMENTAL STEWARDSHIP

Wheeler, Helen C. (1) (Presenter), N. Mukhergee (2), F. Danielsen (3), M. Fidel (4), T. Horstkotte (5), N. Johnson (6), V. Hausner (7), O. Lee (8) + additional authors to be added

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There is increasing recognition and understanding of both the need and the potential scientific and social benefits to incorporating Indigenous Knowledge into evidence synthesis for environmental stewardship. As increasing numbers of researchers and policy makers seek to work with knowledge holders to expand the evidence-base for policy- and decision-making, it is important to reflect on insights from Indigenous organisations and knowledge holders regarding best practice for use of Indigenous Knowledge. Here we use the Delphi technique to address three key questions relevant to the better use of Indigenous Knowledge with science to inform decision-making, Specifically we address the key drivers

of progress and limitations in the use of Indigenous knowledge with science to inform decision-making relating to wildlife, reindeer herding and the environment and common misconceptions of scientists regarding Indigenous Knowledge. We summarise compiled insights on these themes from representatives of Indigenous organisations, Indigenous Knowledge holders and those working closely with Indigenous Knowledge from across the Arctic.

MAKING AND BREAKING STRATIFICATION IN THE CANADIAN ARCTIC ARCHIPELAGO'S KITIKMEOT SEA: BIOLOGICAL AND GEOCHEMICAL CONSEQUENCES

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The Kitikmeot Sea Science Study (K3S) was initiated in 2014 to provide the Canadian High Arctic Research Station a scientific basis for long-term ecological monitoring and research. The Kitikmeot Sea - which includes Coronation Gulf, Bathurst Inlet, Queen Maud Gulf and Chantrey Inlet in the Canadian Arctic Archipelago - is unique in the pan-Arctic system due to its massive freshwater input relative to the sea's area, and its shallow (<30 m) bounding sills to the north and west. Because of this, three foci guide the study: the Pacific-origin estuarine through-flow, which is limited by the shallow sills and sets the oceanographic structure of the region; the origin and pathways of freshwater components, which influence nutrient balances and stratification; and the tidally influenced biological communities whose structure and functioning differ between shallow sills / narrow constrictions and away from those. We apply a suite of oceanographic tools and seasonal and year-round moorings deployed from the R/V Martin Bergmann to investigate these themes. Our results show that the Kitikmeot Sea is characterized by two-layer estuarine flow, with surface outflows and sub-surface inflows across the primary bounding sills at Victoria and Dolphin-Union straits. River inputs along the southern boundary deliver freshwater, terrestrially derived nutrients, and carbon to the riverine-coastal domain, which subsequently spreads throughout the system. Strong tidal currents over shallow sills and through narrow passages enhance vertical heat and nutrient flux to maintain thin ice conditions in winter and tight pelagic-benthic coupling in summer. These sites are characterized by a predominance of hard bottom substrate with high proportions of suspension feeders, while away from these constricted flow regions, soft sediments inhabited by deposit feeders are prominent. This analysis reveals a dynamic ecosystem characterized by pelagic-benthic coupling forced by the physical flow field and external inputs of nutrients and freshwater. New observations and analysis of the regional tides, river-to-estuary flow, tidal straits and wintertime conditions are expanding and quantifying our conceptual model of the region.

MOBILIZING SIKUMIUT'S INUIT QAUJIMAJATUQANGIT FOR SEA-ICE TRAVEL SAFETY IN MITTIMATALIK, NUNAVUT

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Sikumiut means "people of the sea ice" in Inuktitut and is the self-titled name of the Inuit management committee in Mittimatalik (Pond Inlet, Nunavut) that governs the SmartICE community-based sea-ice monitoring program (smartice.org). Sikumiut was concerned with the low levels of sea-ice knowledge of younger generations and wanted to document and share their Inuit Qaujimajatuqangit (IQ) to improve safe sea-ice travel for youth. Under Sikumiut's governance, Katherine Wilson has been working to address their research needs and build Inuit youth capacity as part of her PhD. One of Sikumiut's goals is to have training opportunities for youth to capture, learn and mobilize Sikumiut's sea-ice IQ. Between October 2018 and June 2019, a total of five workshops and meetings took place to document Sikumiut's sea-ice IQ. After the first workshop, we observed that not all of the IQ shared could be captured as an individual term or as a discrete feature on a map. Jamesie Itulu, a local Inuit youth artist, joined the research team to specifically explore how IQ could be shared in

creative ways when the written word or map features could not effectively convey appropriate meaning. This poster will show the artistic and graphic illustrations developed to communicate and mobilize Sikumiut's sea-ice IQ to improve sea-ice travel safety in Mittimatalik.

TOWARDS WATER CO-GOVERNANCE? INSIGHTS FROM MODERN LAND CLAIM AGREEMENTS IN YUKON

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There exist few examples of functioning water co-governance systems in which Indigenous and colonial states work together to share authority for water on a nation-to-nation basis. In Canada, many questions remain about how to realize co-governance in practice given issues of overlapping and conflicting jurisdiction and authority. Through community-based research conducted in partnership with four Yukon First Nations (Carcross/Tagish, Kluane, Tr'ondëk Hwëch'in, and White River First Nations), this presentation explores the co-governance of water in Yukon Territory, Canada where Modern Land Claim agreements uniquely acknowledge Indigenous water rights and implement these authorities through the creation of co-management institutions. While debates around shared decision-making in the Canadian North have frequently been framed in terms of "co-management," this work engages a systems-level approach to include multiple governance institutions, actors, and processes. This analysis reveals that water governance in the territory remains highly contested despite the significant increase in Yukon First Nations' ability to influence decision-making about water resulting from these agreements. I conclude that water co-governance could be better achieved by expanding acknowledgement of First Nation jurisdiction in relation to water, developing a governance system that better reflects Indigenous ontologies (ways of being), epistemologies (ways of knowing) and forms of governance, and addressing barriers to implementing the agreements including issues of capacity and distrust.

"BIGGER THAN TB ITSELF": A QUALITATIVE STUDY OF PATIENT AND COMMUNITY PERSPECTIVES ON TUBERCULOSIS CARE IN NUNATSIAVUT

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Background: Inuit experience disproportionately high rates of tuberculosis compared to non-Indigenous populations in Canada. TB prevention is a leading public health priority in Inuit regions, though historically, approaches to treatment and prevention have been traumatic. The objective of this study was to explore patient and community members' perspectives on tuberculosis care and prevention. Methods: We conducted a community-based, qualitative study in Nunatsiavut, Newfoundland and Labrador. We used semi-structured interviews to collect data from community members and patients who were involved in TB-related health care in the region. Thematic analysis was used to identify themes and strategies for improving TB-related care and prevention. Results: We interviewed twenty-nine participants who described four themes. Participants reported fear and stigma related to taking part in tuberculosis-related care, and explained that there is a need for more community information sharing. Participants identified overlapping barriers to accessing treatment which was complicated by the historical context of tuberculosis care and by challenges related to social determinants such as housing and food insecurity. Strategies for improving TB prevention and access to services were identified. Interpretation: Community and patient experiences and perspectives provided a broader understanding of the context of TB screening, diagnosis, and treatment in Nunatsiavut, and identified key strategies for improving access to care and prevention.

FALL DEVELOPMENT OF FLIGHT MUSCLES IN JUVENILE RUDDY TURNSTONES (ARENARIA INTERPRES), END OF GROWTH, COLD ENDURANCE OR PREPARATION FOR MIGRATION?

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At the end of the short summer breeding season, Arctic breeding shorebirds are faced with the energetic challenge of decreasing temperatures with the onset of winter and the anticipated cost of Southward long distance migration. Young birds that continue to incur metabolic costs associated with development may be especially susceptible to a selective 'trap' wherein dropping temperatures force them to increase energy expenditure to thermoregulate. Increased energy expenditure in the pre-migratory phase of a birds' life may limit, or stop entirely, the mass gain required to complete long duration flights to their wintering areas. Here we present results from capture data of young Ruddy Turnstones (Arenaria interpres) caught in late summer 2019 at the Canadian Forces Station Alert (82°N). We collected basic morphometric data, echography measurements of pectoral muscle thickness, and basal metabolic rates of turnstones caught from July 29 - September 1st 2019. Preliminary results indicate that later caught birds do not have greater mass but do have greater pectoral thickness and are structurally smaller than birds caught earlier. These structurally smaller birds may be late-born birds or trading off growth for increased muscle size to cope with colder temperatures and long-distance flight costs in late summer.

THE POTENTIAL IMPACT OF CHANGES IN THE BREAK-UP AND FREEZE-UP OF SEA ICE IN THE CANADIAN ARCTIC

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Ice conditions are changing in the Canadian Arctic with trends showing earlier break-up and later freeze-up of the ice cover resulting in a longer open water season. The changes in ice conditions are leading to an increase in shipping activity over a longer period which in turn has the potential to affect ice conditions and the use of the ice cover by northern communities.

TUNNGAVIA: FOUNDATIONS FOR DEVELOPMENT (FIRST ANNUAL NUNAVUT SOCIO-ECONOMIC MONITORING REPORT)

Zell, Erika (1) (presenter) and E. Taylor (1)

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In 2018 and 2019, the Government of Nunavut (GN) produced the first and second annual Nunavut Socio-Economic Monitoring Report (NSEMR), Tunngavia: Foundations for Development. The GN plays a lead role in monitoring socio-economic impacts and benefits associated with mineral development within the Nunavut Settlement Area. Historically, the GN has tracked socio-economic impacts and benefits through the mining lifecycle via: (1) participation in Nunavut Impact Review Board (NIRB) processes as an intervenor; (2) facilitation of annual regional Socio-Economic Monitoring Committee (SEMC) meetings in each of the territory's three regions; and (3) ongoing collaboration with project proponents to develop and track valued socio-economic components in project-specific Socio-Economic Monitoring Programs. The NSEMR enhances existing reporting by establishing and tracking a comprehensive set of socio-economic indicators to assess the cumulative impacts and benefits of mining across the territory. It integrates the monitoring of the three regions and their projects into a single monitoring framework, resulting in a consistent set of socio-economic indicators and data being applied for the first time across the territory. Having a common monitoring framework and report allows consideration of cumulative impacts and streamlines development of monitoring reports. Development of the NSEMR was a multi-year initiative involving preliminary consultations with stakeholders and extensive background research followed by iterative development of the NSEMR. A team of GN staff worked closely to develop a technical framework for the NSEMR. The framework provides the necessary technical details for EDT staff to develop future NSEMR reports themselves. Development of the NSEMR involved careful checking of data accuracy and consistency. The NSEMR contains monitoring indicators for the following nine Valued Socio-Economic Components (VSECs): Demographics; Health and Well-Being; Food Security; Education and Training; Housing; Economic Activity; Employment and

Income; Inuit Language; and Traditional Activities and Skills. Detailed statistical information and data for selected VSECs and related indicators will be provided in the poster, providing a detailed snapshot of Nunavut and its relationship to the mineral development industry in 2019.

EFFECT OF ENVIRONMENT AND TIME ON TERRESTRIAL ARTHROPOD COMMUNITIES ON AXEL HEIBERG ISLAND, IN HIGH ARCTIC CANADA

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The Arctic climate is warming at a faster rate than in any other place on Earth. The effect of this relatively rapid warming on ecosystems in the Arctic is not fully understood, because we lack a complete understanding on how Arctic ecosystems function. Terrestrial arthropods are the most abundant animal life in the High Arctic, which makes them ideal model organisms for studying these ecosystems. One of the largest and northernmost members of the Canadian Arctic Archipelago, Axel Heiberg Island in Nunavut may yield valuable information on how High Arctic ecosystems function; however, no ecological study on terrestrial arthropod communities has been conducted for this huge landmass. During summer fieldwork in 2018, I sampled over 37,000 terrestrial arthropods from four sites over six sampling periods in the Expedition Fiord region of western-central Axel Heiberg Island, while climate data was collected concurrently from a local Campbell Scientific meteorological station. Using Principle Component Analysis, I am looking for relationships that reveal how arthropod communities on Axel Heiberg Island were affected by environment and time over the summer. This study will aid in our understanding of how High Arctic ecosystems function, which in turn will help us to understand the impact that rapid climate change is having on these ecosystems. This ecological study of High Arctic arthropods lays the foundations for proposed future entomological work on understudied Axel Heiberg Island, including a possible longer-term ecological monitoring program. Please note that results are forthcoming and will be ready by the time of the conference.