ArcticNet

2018 Annual Scientific Meeting
Réunion scientifique annuelle
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December 10 - 14 · Shaw Centre · Ottawa, ON

PROCEEDINGS

2018 ARCTICNET ANNUAL SCIENTIFIC MEETING

A conference focusing on the challenges
and opportunities arising from climate change
and modernization in the North

ArcticNet
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Oral Presentations

POST-GLACIAL CLIMATIC AND ENVIRONMENTAL CHANGES IN THE FURY AND HECLA STRAIT REGION BASED ON BIOLOGICAL AND GEOCHEMICAL PROXIES

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Located between the Melville Peninsula and northwestern Baffin Island in the Canadian Arctic, the Fury and Hecla Strait region has experienced major environmental shifts since the end of the last ice age followed by glacial retreat (7000 cal. BP approx.). Triggered by post-glacial processes (including marine inundation and glacio-isostatic uplift), geomorphological changes and climatic fluctuations (that shaped the region throughout the Holocene) have been recorded in marine and lake sediments. By analyzing sediment cores of different lakes in the region using a multi-proxy approach, our study provides a high-resolution reconstruction of the region's paleoclimates and paleoenvironments and their evolution over time. We use sedimentological (grain-size analysis, LOI and magnetic susceptibility), geochemical (elemental geochemistry) and biological (marine and freshwater diatoms) methods in order to understand and recreate post-glacial conditions and dynamics at different stages during the Holocene, including past oceanographic and limnologic conditions. Various radiometric dating methods (210Pb, 137Cs and 14C) were used to establish a detailed chronology for the inferred changes. All data combined will help us gain more detailed insights into post-glacial environmental dynamics in northwestern Foxe Basin and enable us to predict Arctic ecosystem responses to global warming.

TRACE ELEMENTS IN SELECTED PERMAFROST-AFFECTED SOILS OF NEAR-NATURAL AND ANTHROPOGENICALLY-AFFECTED SITES OF YAMAL REGION

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Soil is an important component of polar ecosystems and plays a key role in their functioning. Soils implement significant role in processes of accumulation, mobilization, redistribution of chemical, and especially, trace elements in landscapes and ecosystems. Both anthropogenic impact and climate change may affect biogeochemistry of soils in permafrost-affected landscapes, which are considered as highly sensitive to climate change and anthropogenic forcing. Involvement of additional portions of trace elements into the soils due to permafrost degradation and thawing is considered as one the main risk factors for natural environments in polar regions. This investigation is devoted to evaluation trace elements contents in soils of urban areas (Kharsaim, Aksarka, Salekhard, Harp and Labytnangi) and natural environments of Yamal region (Ust'Uribey and Beliy island) were investigated. Soil samples from Kharp settlement showed the highest content for Cu, Pb, Zn, Ni. It is connected with existing galvanizing plant "Kongor-chrome". Kharsaim and Kharp settlements were characterized by the highest values for Pb. The highest values for Pb were found in soil samples from Aksarka and Labytnangi key plots. Soils from Kharsaim and Kharp key plots were characterized by the highest median values for Zn. Analysis of trace elements content showed poorly manifested eluvial-illuvial differentiation of soil profiles in near-natural environments. The highest content for most of the studied trace elements has been revealed in topsoil horizons. Trace elements content in soil samples collected from urban environments ranged significantly high due to difference in functional zones of the sites and predominant anthropogenic source of trace elements additions. The results of statistical analysis show that statistically significant differences in Ni and Cu content in soils were found only between Kharp settlement and each of natural sites – Ust'-Uribey and Beliy Island.

Almost all studied urban soils showed significant differences in Pb, Zn, As and Fe content between natural sites. In general terms, obtained Geo-accumulation indices (Igeo) values in all samples were under or slightly above the 0 level, indicating low to moderate pollution of the studied soils. However, considerable Igeo values of Zn, Pb and Ni were revealed in several samples, suggesting different soil pollution levels, namely: Zn Igeo in Harsaim soil sample of 2.22 – moderate polluted to highly polluted soil; Pb Igeo in Aksarka soil sample of 4.04 – highly polluted to extremely polluted soil; Ni Igeo in Harp soil sample of 4.34 - highly polluted to extremely polluted soil. Almost all samples exceeded the maximal permissible concentrations (MPCs, established by the Russian environmental legislation) for As in soils (2 mg•kg-1). Concentrations of Ni in several soil samples taken in Harp were 19 times higher than recommended level (20 mg•kg-1). Moderate excess in Zn, Pb and Cu was also noted. Data obtained will be used in further environmental researches and environmental management purposes in this key oil and gas exploration region. This study was supported by grant of Saint Petersburg State University "Urbanized ecosystems of the Russian Arctic: dynamics, state and sustainable development".

THERMAL TOLERANCE AND LOCAL ADAPTATION TO FREEZING TEMPERATURES IN A KEY NEMATODE OF ARCTIC UNGULATES: THE CASE OF MARSHALLAGIA MARSHALLI

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The survival and development of free-living stages of parasitic nematodes are intrinsically tied to environmental factors such as temperature. As a consequence, climate change is changing population dynamics and spatial distribution nematodes across the Arctic. Marshallagia marshalli is a key, but relatively unknown, nematode from the behaviourHolarctic region that infects all the endemic ungulate species inhabiting the Arctic and sub-Arctic ecosystems. Recently, it has been associated with reduced fitness in Dall's sheep and Svalbard reindeer. Marshallagia has a direct life cycle in which eggs are passed in host feces and develop through three larval stages (L1, L2, and L3) on pasture. Eggs normally hatch as L1 but can hatch as L3 under certain conditions. Since freezing temperatures are a common feature of Arctic ecosystems understanding the effect of below zero temperature on survival and differential behavior is key to evaluate and predict the impact of climate change on Marshallagia dynamics, and thus host and overall ecosystem health. The objective of this study was threefold: i) to determine differences in freeze tolerance among free-living stages of M. marshalli, ii) to determine if hatching as L3 improves survival of early larva stages (L1) under freezing conditions, and iii) to explore local thermal adaptation in freeze tolerance among eggs of M. marshalli from different locations. First, the survival of eggs, L1 and L3 of M. marshalli from Alberta, Canada, was compared after up to 60 days of exposure to -8, -20, and -40°C. Second, we compared the survival of larvated eggs (L1 inside the egg) and free-living L1 after their exposure to the same days/temperature protocol than in the first experiment. Finally, we compared the survival of eggs sourced from four different locations in North America after being exposed to the same days/temperature protocol than in the first experiment. Survival of eggs, L1, and L3 of M. marshalli decreased with increasing freezing duration and decreasing temperature. The survival of eggs and L3 was in general higher than the survival of L1, particularly at -20°C. Hatching as L3 seemed to deliver a fitness advantage for M. marshalli in extreme conditions as survival of larvated eggs was higher compared to the survival of free-living L1, although in both cases mortality increased with time of exposure and decreasing temperature. The survival of eggs from different locations was similar at -8°C and -20°C in all the time exposures but slightly higher in eggs from southern Yukon at -40°C. These results improve our understanding of the thermal tolerance and thermal adaptation in a key Arctic parasite and it can help predict spatial shifts in the fundamental niche of parasites under climate change.

EXPLORING THE EFFECTS OF ARCTIC FOX ECOLOGY ON RABIES EPIDEMIOLOGY IN NORTHERN QUEBEC USING A SPATIALLY-EXPLICIT INDIVIDUAL-BASED MODEL

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Arctic fox rabies is an ongoing health threat to human populations and domestic animals in northern polar areas. Arctic rabies persists in its main reservoir species, the Arctic fox (Vulpes lagopus), despite its lower population density than required for red foxes to maintain this disease further south. The incidence of rabies in the Canadian Arctic varies in space and time, such as periodicity in case cyclicity. Our understanding of the dynamics of rabies epidemiology remains limited, in part, due to the difficulty of obtaining ecological and surveillance data from remote and expansive regions. Simulation models help study ecological complexity of host-pathogen systems. A non-spatial model of arctic fox rabies ecology (Simon et al. in press) was not able to maintain rabies using known arctic fox densities. This may be because two main northern ecotypes (inland, coastal) influence fox density, movement and interaction in a manner that enables rabies persistence. Inland foxes feed primarily on lemming populations which provide a multi-year cyclical resource. Coastal foxes feed mainly on marine resources (e.g. coastal birds, marine animal carcasses) and this provides a more constant resource. Here we use a spatially-explicit model to test how the spatial and temporal structures of the inland and coastal ecotypes affect rabies dynamics given their influence of arctic fox density, movement and interactions. Results indicate that metapopulation disease dynamics develop with varying intensities depending on the space-time structures of resources. Our modelling approach provides theoretical evidence for characteristics of arctic fox ecology that can maintain rabies under current ecological conditions and provides a basis for exploring future rabies dynamics under climate change.

INUVIALUIT SETTLEMENT REGION BELUGA TAGGING PROGRAM: A COMMUNITY AND CO-MANAGEMENT DRIVEN SUCCESS STORY

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The Inuvialuit Final Agreement has provided the Inuvialuit and Government a robust and adaptive co-management framework for wildlife management and research for over 30 years. The Inuvialuit co-management system provides various and ongoing participation for communities and Inuvialuit boards to meaningfully engage in research in the Inuvialuit Settlement Region (ISR). This presentation will look at how community and Inuvialuit boards like the Inuvialuit Game Council (IGC), Fisheries Joint Management Committee (FJMC) and the various community Hunters and Trappers Committees (HTC), as well as the Inuvialuit-Inupiat Beluga Management Committee participated in the co-design and implementation of the current Beaufort Sea Beluga Tagging project. The results of this project will be used to inform the Inuvialuit strategize on how to best conserve beluga habitat and migration routes, as well as gain a better understanding of how beluga are utilizing the Beaufort Sea in light of a changing climate and shifts in prey species movements. This research project is an example of how community involvement is pivotal in ensuring the success of a project, especially around a highly valued and respected resource like beluga whales. This presentation will review the range of strategies use by the co-management system for Inuvialuit to provide direction and their traditional knowledge in a respectful and culturally empowered manner. It will look at the nature of involvement on the community and co-management board level in co-designing the project in general and in specific components like the animal care protocols and design of the tagging tools. The project also provided opportunities for Inuvialuit to be involved in the decision-making, as well as the implementation of the research project itself. Inuvialuit were also part of the advisory committee to provide input back to the FJMC, IGC and Department of Fisheries and Oceans throughout the development and implementation of this project. Clear and open communication has been essential in building support on community level and a respectful and informed dialogue between community and researchers.This presentation will review the various communication tools used to provide the Inuvialuit a platform for sharing ideas, concerns and questions to address the sensitivities Inuvialuit have around tagging and handling of beluga whales. It will also look at the communication strategies utilized within the co-management process the ensure alignment of priorities and objectives around this project. The presentation will end with a look at some of the challenges and lessons learned through this process, as well as some of the possible next steps to continue the involvement of Inuvialuit in this project and in the interpretation of the data.

IMPROVING DRINKING WATER IN POND INLET: INUIT RESEARCHERS ADVANCING MONITORING CAPACITY FOR WATER SOURCES AND SUPPLY SYSTEM

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Environmental changes linked to climate change can affect water quantity and quality and can easily impact community source water if they occur within a source water watershed. These source water issues can also negatively impact other steps along supply water systems (from source to tap). This work builds on a previous 4-year youth-based water monitoring project in Mittimatalik (Pond Inlet) piloted by Tim Anaviapik Soucie and supported by academic and non-profit mentors. More recently, we pursued the monitoring of local water sources and expanded our activities for the monitoring of the local water supply system. From mid-June to mid-September 2018, we monitored 5 streams and 2 lakes for physical parameters (pH, dissolved oxygen, conductivity and temperature), hydrological parameters (water level and flow), and microbial content (fecal coliforms indicators and DNA markers). In May 2018, we surveyed the 4 components of the local water supply system (source, pumping station, water truck, house water tank and tap) and determined the biological safety of the water using bacteria detection methods, DNA sequencing, and ATP formation (a measure of overall biomass). We measured chemical parameters including pH, conductivity, dissolved oxygen, temperature, turbidity, and dissolved organic carbon at each station. We also measured the concentration of metals (lead, iron, manganese, and others). In addition to this general sampling program, since May 2018, 2 water tanks have been monitored on a monthly basis in order to quantify the rate of biofilm formation in the tank and any impacts that this might have water quality at the tap. Finally, we established a lead sampling program where we monthly sample tap water in 10 households of the community. Lead is a metal that has been associated with negative health outcomes in children and infants, and past studies have indicated the presence of lead levels above recommended values in a number of homes in Pond Inlet. Recommendations for source water consumption, tank cleaning methods and frequency, and lead prevention and management will be developed collaboratively between our team, local and territorial water authorities and the community members. With this work we continue our commitment to listen to, and follow up by documenting local concerns and observation with regards to issues related to source water and to the local water supply system. This guides our research, and we provide general advice as requested.

UNDERWATER VIDEOGRAPHY AS A WINDOW INTO THE HEALTH OF JAMES BAY EELGRASS

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Northwestern Québec's coastal James Bay had one of the largest expanses of eelgrass observed in North America. Over the past four decades the indigenous Cree have observed a reduction in the range and growth of eelgrass, which they believe is related to hydropower development. Additional factors such as forestry, mining, and climate change may also have negatively affected eelgrass health. In situ observation aids understanding of the current state of eelgrass health; however, James Bay is a challenging environment for field research. Sea conditions are often adverse and the field season is limited by sea ice cover in spring and severe weather in the early fall. Water clarity is frequently poor in shallow waters due to wave action, making diving difficult and inefficient. In collaboration with the Cree Nations of James Bay, a reliable and effective method to survey eelgrass was developed to measure loss and identify possible causes of decline. Cree community members participate in the project, sharing their knowledge of eelgrass growth and distribution as well as monitoring eelgrass. Since 2016, we have worked with coastal Cree trappers to survey eelgrass beds in the northern Cree nations of Chisasibi, Wemindji, Eastmain, and Waskaganish. Monitoring is done from freighter canoes using underwater GoPro cameras in tandem with GPS-enabled iPads. Cree trappers are trained on the survey protocol and on how to use the equipment for observation. Salinity and temperature are measured using a YSI multiparameter probe or HOBO conductivity logger at each monitoring site. Depth, water clarity, substrate type, and traditional knowledge of a site are also recorded. Eelgrass canopy height and percent cover are estimated using visual analysis from the collected video; leaf color, presence of reproductive shoots, macroalgal species, epiphytes, and wasting disease are also noted. Video monitoring yields valuable data for assessing threats to eelgrass health by combining Cree knowledge and ecological science.

INUIT SELF-DETERMINATION IN RESEARCH: IMPLEMENTING THE NATIONAL INUIT STRATEGY ON RESEARCH - A NATIONAL PERSPECTIVE

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Inuit Tapiriit Kanatami

On March 22, 2018, Inuit Tapiriit Kanatami released the National Inuit Strategy on Research (NISR), a pivotal document that outlines the coordinated actions required to improve the way Inuit Nunangat research is governed, resourced, conducted, and shared. The NISR was developed in coordination with the Inuit Qaujisarvingat National Committee made up of representatives of each of the members of the Inuit Tapiriit Kanatami Board of Directors. The document promotes a shared understanding of the legacy of Inuit Nunangat research and connects this legacy to current research practices, defines Inuit expectations for the role of research in our regions and communities, and identifies areas for participation and action between Inuit and the research community. For far too long, researchers and research institutions have tended to be the primary beneficiaries of Inuit Nunangat research, despite the present and ongoing need for Inuit-specific data and information that can be used to shape solutions to our most pressing challenges. Furthermore, Inuit Nunangat research is too often governed, resourced, and carried out in a manner that limits Inuit participation, marginalizing Inuit from the benefits of research. The NISR seeks to remedy these problems. It identifies five priority areas in which coordinated action is necessary to facilitate Inuit Nunangat research that is effective, impactful, and meaningful to Inuit. These five priority areas are: 1) Advance Inuit governance in research; 2) Enhance the ethical conduct of research; 3) Align funding with Inuit research priorities; 4) Ensure Inuit access, ownership, and control over data and information; and 5) Build capacity in Inuit Nunangat research. Implementing the NISR will require a coordinated approach based on partnership. The interrelated, interdependent nature of these five priority areas, as well as the number of stakeholders involved in Inuit Nunangat research, means that new relationships must be brokered between Inuit, government departments, and research institutions in order to implement the NISR. This session will showcase the NISR and its implementation plan by inviting individuals from within Inuit organizations, government, agencies, and academia to discuss how they are helping move towards Inuit self-determination in research.

SMARTICE: APPLICATION OF A SOCIAL ENTERPRISE MODEL TO THE DELIVERY OF SEA-ICE MONITORING AND INFORMATION SERVICES

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SmartICE (smartice.org) is a northern social enterprise that puts into the hands of communities the technology that helps them adapt to unpredictable sea-ice changes, resulting from climate change. Inuit knowledge of sea ice has been acquired from centuries of observation and use. But in the last decades this traditional knowledge has become less dependable in the face of unprecedented environmental changes. SmartICE is the World's first climate change adaptation tool that integrates on-ice technology, remote sensing and Inuit knowledge to generate near real-time information on sea-ice conditions. It maintains a network of stationary and mobile sensors that measures and transmits sea-ice thickness data from community trails. It also maps sea-ice surface conditions from satellite imagery to inform safe travel choices.
It uses information technology to generate accessible products that match the needs of community users. In response to increasing community demand for its services and with the support of the 2016 Arctic Inspiration Prize (arcticinspirationprize.ca), SmartICE is expanding across the Arctic through a social enterprise business model. This business plan is consistent with Inuit societal values such as caring for the environment and community and being

innovative and resourceful. It also commits to maximizing social impact and creating positive change in Arctic communities, while applying an entrepreneurial approach to the delivery of novel sea-ice information services for the public and private sectors. The SmartICE information system not only benefits public safety, food security, and health and wellbeing, but also enables and supports economic activities for communities and industries alike. For example, we are demonstrating the application of SmartICE services for ice-based fisheries and tourism, which are typically carried out in the landfast ice zone where SmartICE operates. Although the primary goal is to preserve the health and safety of fishers and outfitters as they travel and work on the landfast ice, in doing so we will also help build climate-adapted ice-based tourism and inshore fishery by providing important information on landfast sea-ice thickness and travel hazards in near real-time (SmartICE services and products). We will work closely with outfitters and fishers to identify and address their industry-specific ice information needs and where relevant develop technology solutions to complement Inuit Knowledge.

ARCTIC BORDERLANDS, COMMUNITY BASED ECOLOGICAL MONITORING BY AND FOR GWICH'IN AND INUVIALUIT PEOPLE.

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Arctic Borderlands Ecological Knowledge Society is a community based, ecological monitoring program run by and for Gwich'in and Inuvialuit People in the range of the Porcupine Caribou Herd. The goals of the program are to keep a record of a changing environment and to share information for co-management of natural resources. This trans-boundary initiative has been documenting observations of ecological change made by local experts since the mid-1990's. Its methodology is unique and has been replicated by other CBM programs across the North. The data is held in trust for the participating communities and can be used by co-management boards, researchers, academics and others upon request. An example of its recent use is by Don Russell who used the caribou data to determine the relationship between climate indicators, body condition and spring herd recruitment. ABEKS data has been shown to be a reliable, stand-alone line of evidence when other evidence is unavailable. However, in order for ABEKS to make a meaningful contribution to co-management boards and other decision-making authorities, there needs to be a framework for decision making that includes local knowledge. Our ongoing challenge is to provide funders with examples of ABEKS influence in decision-making despite the absence of these mechanisms, while continuing to support the participating communities to document ecological change.

MODELLING THE CHANGING STORM SURGE REGIME AS A RESULT OF SEA ICE DECLINE IN THE CANADIAN BEAUFORT SEA

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Declining Arctic sea ice cover and increases in fetch are increasing the risk of damaging storm surges along the Canadian Arctic coastline. Storm-driven changes in water levels can result in coastal flooding, increased wave erosion, and low-water levels (negative surge). Extensive storm-induced flooding occurs under northwesterly winds mainly during the fall before sea ice has formed. Delayed freeze-up attributed to climate change maintains fetch in October when strong storms and winds can occur, and will likely increase the likelihood of storm flooding and the frequency of over-bank flooding. Although coastal ecosystems rely on sedimentation and salinization from small floods, large storm inundations can cause salinization of freshwater ponds and non-saline meadows, damage vegetation along the margins of permafrost plateaus, and melt subterranean permafrost causing underground hollows subject to collapse (thermokarst). This will accelerate erosion rates in coastal areas, and will likely introduce subsequent hazards and challenges to local communities and ecosystems. This work presents results from modelling storm surge events through forcing key meteorological and ocean variables. DFO/CHS water level gauge data from a number of water level stations were extracted and reduced to develop a database of surge events. Identification of synoptic meteorological drivers for extreme events were assessed using a synoptic climatology based upon principal components analysis (PCA) and k-means clustering of gridded NCEP-NCAR II mean sea level pressure data. High resolution gridded wind-wave reanalysis data from the MSC Beaufort Sea Wind and Wave Reanalysis (Oceanweather Inc.) was retrieved and is available at a 2.5km resolution (0.1°) for the continental shelf area near Tuktoyaktuk, NT. Wind data were processed to determine the characteristics of wind divergence and convergence associated with each synoptic type. These parameters are then used to simulate "worst case" storm surge events in coastal areas under varying synoptic forcing and sea ice

conditions using a water level modelling software package. Preliminary modelling exercises focus on two extreme surge events observed at Tuktoyaktuk from 31 August - 02 September, 2013, and from 29 - 31 October, 2013.

HIGH SCHOOL CITIZEN SCIENCE – CONTRIBUTORY OUTREACH IN HISTORICAL CLIMATE RESEARCH

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This paper presents the outreach activities of the SSHRC-funded Northern Seas Project out of the Arctic Institute of North America, University of Calgary. Northern Seas draws upon the surviving documents of British Arctic whaling vessels to further the observational record of sea ice extent and other environmental phenomena in the Canadian Arctic. Researchers are increasingly committed to communicating their activities and results to broader audiences outside academics. This communication is often conducted through talks, blogs and various sources of social media. Citizen science engagement involves direct public participation in research and can be a powerful medium in engaging a wider audience. Historical climate research is well placed to utilise this approach, where the extant documents are of general interest and a labour-intensive approach is required to digitize and transcribe the required observations. This approach has had great success with historical logbooks in an online setting by Old Weather and Weather Detectives. Northern Seas applies this approach in a classroom setting as a method of communicating the project's climate science aims through the participation of high school students. Working over two semesters with teacher Warren Lake and his Grade 10 students at Robert Thirsk High School, Calgary, three classes transcribed previously unexamined historical logbooks, contributing over a year's worth of previously unknown 19th Century environmental observations. This activity sparked much discussion on how knowledge of the climate is collected and around the historical whaling trade in the Canadian Arctic; a period in history most students were unaware of previously. Students across abilities became invested in the project, many becoming voluntary citizen scientists and working on 'their' logbook outside of the scheduled sessions. This investment and their contribution to knowledge helped to foster an equal forum for discussion between students and teacher/researcher as everyone had something new to contribute. The project has been shortlisted for the Governor Generals History Awards for Excellence in Teaching (results pending); a testament to its value and success.

CHARACTERIZATION OF DUST EMISSIONS FROM AN ACTIVELY RETREATING GLACIER IN THE CANADIAN YUKON

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Airborne mineral dust emitted in Arctic regions can have a significant impact on the northern atmosphere, as it can alter the energy balance of the atmosphere by interacting with solar radiation; dust also plays an important role in the biogeochemical cycling of metals and can have deleterious effects on air quality and public health. The impact of northern dust sources on the atmosphere and environment may change rapidly, as warming temperatures in the North can increase mineral dust production and source regions. However, at present, the impact of such changes is difficult to evaluate because there are very few scientific studies that characterize mineral dust in Arctic regions. To address this knowledge gap, we performed a mineral dust measurement campaign in May 2018 near the Ä'äy Chù (Slims River), a known site of strong dust emissions in the Canadian Yukon. Dust storms are regularly produced from the surrounding soils during the spring and summer; in addition, the rapid melting of a nearby glacier has routed waters away from the river valley, potentially increasing its dust-producing erodible surface area. We have collected air samples both directly in the dust source as well as at several sites in the surrounding area, to observe variations in the transport and quantity of the dust emitted. Weather data, such as pressure, temperature, and relative humidity, were also recorded to establish a link between these factors and the emission of dust. Using Raman microscopy, SEM/EDS, and ICP-MS, we have determined the mineralogy and trace element content of the collected dust particles. In addition, we have studied the physical characteristics of the dust – such as particle size distribution, morphology, and surface characteristics – using microscope imagery and data collected by an optical particle counter. Ours is the first field campaign to provide a physico-chemical characterization of dust emitted directly from a high-latitude dust source in Canada. Initial results indicate

dust concentrations measured at various sites, both in and around the dust source, are well above the air quality limits used by the World Health Organization (WHO) and the U.S. Environmental Protection Agency (EPA); this includes the local visitors' center, a site frequented by government employees, local residents, and tourists. In addition, SEM/EDS analysis demonstrates that the majority of the minerals emitted from the exposed streambed are aggregates composed of silicates, carbonates, and sulphides, in non-spherical forms. Future work will focus on calculating the flux of specific elements due to both dust emission as well as deposition on the surrounding landscapes.

SHIFTING OUR LENS: ENGAGING INUIT YOUTH IN OCEANS RESEARCH THROUGH PARTICIPATORY VIDEO

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Researchers across academia are increasingly using video to mobilize their research to larger audiences. However, in Inuit Nunangat, there are requirements and expectations that research be inclusive of community knowledge, and participatory video methodologies can help amplify community voices through co-creation and dissemination. Drawing from the experiences of an early career researcher working in Panniqtuuq, Nunavut, this presentation will highlight the results of a three-year participatory video project integrating capacity building, community engagement and filmmaking regarding Inuit Qaujimajatuqangit of climate change and oceans. As a team of scientists, community-based researchers, and filmmakers, we collaborated with youth, elders, fishermen, and hunters to document, visualize and mobilize local knowledge about social-ecological change. This research co-created a dynamic portrait of local knowledge, community resilience, important linkages between Elders and youth, and because of the unique qualities of video these findings were shared extensively online and through academic conferences and film festivals. This multimedia presentation will explore the challenges and opportunities of participatory video research as well as suggestions for how to evaluate impact beyond scholarly publications. By engaging communities in high impact, hands-on research, participatory video allows for local perspectives to be shared with global audiences and supports greater awareness and ideally action to address complex issues like climate change.

ARVIAT YOUNG HUNTERS UJJIQSUINIQ PROGRAM

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The Aqqiumavvik Society has committed to supporting work that focuses on becoming a healthy community that builds capacity; is self-assured, caring, and responds to the needs of individuals and families. Our programs monitor and use resources from the land, including local plants, small and large game, and fish. We demonstrate the potential of growing plants locally using several techniques from greenhouses to in-home hydroponic units. It is expected that for all of these activities it is important to understand the aspects of climate change that are shaping our future. This is critical given that climate change in Arviat is changing rapidly. It is impacting the length of seasons, ice conditions, travel, and the amount of and composition of vegetation, water systems, as well as the health of microorganisms, fish, and sea animals. In addition, the degradation of permafrost is causing extensive slumping, coastal erosion and unsafe travel conditions. This presentation will focus on the expansion of our current Young Hunters Program in Arviat within the Kivalliq Region which is funded jointly by Climate Change Preparedness in the North (CCPN) and Climate Change and Health Adaptation Program (CCHAP) over three years. Our key project goals are to train youth and develop their skills and expertise in building strong evidence around climate indicators, engaging the community in meaning-making around the indicators and data collected by youth, and using social media and information sharing techniques to promote discussions and responses to the data in an effort to promote consensus around a sustainable plan. The Young Hunters Program is a community-based project designed to develop sustainable harvesting in youth between the ages of 8-18. In the 8 years that the project has been operating, extensive work has been done with community Elders to document the knowledge and skills required for youth to not only become masters in sustainable harvesting and environmental monitoring, but also to become capable, confident and contributing human beings, according to inunnguiniq (Inuit principles for becoming capable). The Elders have told us that a critical skill for Inuit was close observation of the environment. They are concerned that youth today do not observe keenly and therefore cannot respond accurately to changes. Ujjiqsuiniq is the process that enables one to monitor and observe with confidence and ultimately to be prepared for different outcomes. This is an important expectation for all of our youth. We aim to incorporate this skill building process into our existing Young Hunters' curriculum so that these skills are developed across the age groups. We also want to extend the observation data so that data analysis becomes embedded in a community awareness program to help us, as a community, in monitoring and responding effectively to changes in the climate and our harvesting environment. We also explore the potential benefits from some of these changes so that our community can plan adaptations that will lead to improved conditions for food security and sustainable harvesting.

OCEAN COLOR VARIABILITY IN THE HUDSON BAY SYSTEM: IN SITU OBSERVATIONS AND SATELLITE VALIDATION

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Satellite and in-situ bio-optical measurements are analyzed in the Hudson Bay System, the largest inland sea of the world. The quality of satellite ocean colour retrievals such as the water-leaving radiance, chlorophyll-a concentration and diffuse light attenuation coefficient in the HBS was evaluated to ensure the data quality. This study is part of an effort to develop a satellite bio-optical model to better monitor and understand how phytoplankton dynamic is adapting to climatic and anthropogenic. In June 2018, above-water radiometry data were collected using a Satlantic's Hyperspectral Surface Acquisition System (HyperSAS, Satlantic Inc.) aboard the Canadian Research Icebreaker CCGS Amundsen in the scope of the BaySys expedition. A total of 30 days of continuous measurements along the ship track of above-water radiometric data are used to evaluate multi-satellite 8-days composite obtained from the Globcolour Project. In addition, in-water radiometric profiles are measured by the submersible spectroradiometer Compact Optic Profile System (C-OPS, Biospherical Instruments Inc.). A total of 83 light profiles were acquired in a total 27 stations across the HBS. Light profiles were analyzed to derive diffuse attenuation coefficient of downwelling irradiance (kd) and remote sensing reflectance (Rrs). The in-situ observations span a wide range of bio-geographic and bio-optical domains encountered in the Hudson Bay: landfast ice in the southern bay; mobile, fractures and compressed sea-ice; leads; the northern Hudson Bay polynya; marginal ice-edge zone; open water; river-influenced coastal zones; Hudson Strait; and Ross and Welcome sound.

METACESTODE INFECTIONS WITH ECHINOCOCCUS SPP. AND VERSTERIA SP. IN HUMAN: CHANGING PATTERNS OF DISEASE OVER A 15-YEAR PERIOD

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Echinococcal infections are thought to be emerging within their wild hosts' range across Canada. Several data suggest a geographic range expansion of echinococcal species in the last several years, including to urban areas. For example, the range of E. multilocularis in canids now extends to Ontario, and is an emerging life-threating zoonosis among humans in Western Canada. Meanwhile, E. canadensis is now found in a substantial minority of wolves and coyotes extending to Maine. In contrast to animal surveillance, very few data underpin our understanding of the epidemiology of human sylvatic echinococcal disease. The J.D. MacLean Centre for Tropical Diseases is the largest referral centre in North America focused on human zoonotic parasitoses. We report our experience with Canadian-acquired invasive cestodes and show the clinical and epidemiological patterns observed over the last fifteen years. Between 2003 and 2018, we assessed 87 cases of human echinococcal disease, 12 of which were acquired in Canada. Most of these were acquired in Northern Quebec. Using detailed clinico-epidemiological descriptions, we make the case for the possibility of changing patterns of disease over this period, including (i) increasing severity of disease, (ii) marked southern range expansion of human infections, and (iii) the emergence of previously undescribed pathogens in Eastern Canada. Specifically, we recently diagnosed the first known autochtonous E. multilocularis human infection in Quebec, acquired near Montreal. Moreover, we recently described first human case of Versteria sp., a cestode genetically related to Echinococcus spp., in a kidney transplant recipient from New-Brunswick. We also discuss the interpretation of available human sero-surveys performed during this period. Finally, we aim to integrate our data from human cases with current One-Health approaches with the aim of improving the ecosystem-wide health.

SALMON OF THE DEEP SEA: FIRST EVIDENCE FOR INTER ANNUAL SITE FIDELITY IN GREENLAND HALIBUT (REINHARDTIUS HIPPOGLOSSOIDES)

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Small-scale coastal fisheries are recognized at the international level to reduce poverty through the allocation of nearby natural resources to local communities that in turn promotes employment opportunities. In the Canadian Arctic, community-based Inuit fisheries for Greenland halibut (Reinhardtius hippoglossoides) may provide economic development and improved food security to a region that faces excessively high food costs. These developing fisheries would target Greenland halibut in coastal regions along Baffin Island, in conjunction with a pre-existing large-scale fishery that harvests fish in the offshore. In order to sustainably develop near-shore community fisheries in the Arctic, it will be necessary to understand the spatial ecology of Greenland halibut both on a broad scale, encompassing offshore connectivity, and on a local scale to determine population structuring as it applies to the spatio-temporal distribution of phenotypic diversity. Since September 2014, an extensive acoustic receiver array has been maintained in the coastal region of Scott Inlet, and Greenland halibut have been tagged and released with electronic tags that transmit uniquely coded IDs to the underwater receivers. Previous work identified two movement behavioural types of Greenland halibut in the coastal region; transients and intermittent-residents. Both behavioural types were tagged in the coastal area and both moved offshore into Baffin Bay in the late fall. However, the intermittently-resident fish returned either in the winter or spring while the transients were not detected again in the near-shore. In this presentation I will provide the first evidence of inter annual site-fidelity for a deep-water species inhabiting waters >600 m depth. Specifically, individual intermittent-resident Greenland halibut depart and return to Scott Inlet at the same time each year, typically within a few days. When considering whole population exit/entry times, almost all Greenland halibut move offshore near the end of October and into November. Return time is much more variable, yet can be broadly categorized into two groups: early returns in December/January, and late returns that span from February to April. Analysis of fish movement within Scott Inlet after re-entry also suggests temporally re-occurring network motifs, whereby individual fish are detected moving among the same receivers each year once they have returned. Given the predictability of movements on the individual level, yet variability seen at the population level, it is likely that the Greenland halibut population of Scott Inlet is polymorphic, expressing multiple movement behaviours. These findings will be discussed in the context of developing sustainable community-based coastal fisheries in the Arctic. Specifically, conservation of unique movement phenotypes is key to maintaining population diversity and stability, conferring protection in the face of a warming ocean. Careful planning in fisheries development is needed to ensure that fishing does not inadvertently target only one phenotype, reducing the population fitness. Such planning will have to be two-fold, incorporating both the offshore and inshore harvests. While inshore fishing can ensure that harvests are spatio-temporally distributed with respect to the coastal movement patterns observed herein, further work is needed to determine the impact offshore harvests have on the individual movement phenotypes.

LOCAL PERSPECTIVES ON HEALTHY AGING IN AN INUIT COMMUNITY, NUNAVUT

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Context: The number of older adults is growing rapidly in Inuit communities. Older adults face new health and social challenges and it is important to adapt health and social policies supporting healthy aging. Improving living conditions is relevant to support healthy aging in Inuit communities. For example, adapted housing conditions, accessible community services and availability of social support are important health promoting factors of older adults' health. But little is known about what older Inuit think about the living conditions important for their health. In this project, we investigate Inuit older adults' perspective of the role of living conditions on their health. Methods: The project took place in an Inuit community in Nunavut in February and March 2018. The research team already had links with organisations and community members and knew that the community was interested about a project on healthy aging. We interviewed twenty participants aged between 50 to 86 recruited through snowballing. We tried to recruit participants living in varied housing conditions to have a broader perspective on the living conditions experienced by older adults in the community. Participants lived in varied housing conditions (private, subsidized housing and long-term care facility) and most of them had spent most of their life in the community. Themes explored in in-depth interviews included aging and health, housing conditions, community conditions, activities carried out on the land, medical and leisure travels outside of Baker Lake, and mobility and accessibility. To validate the preliminary analyses of the in-depth qualitative interviews and complete missing information, a focus group was conducted with fours participants and an interpreter. Interviews and the focus group were later transcribed and analysed using a thematic content analyses method. Results: Participants described which living conditions were important for them to be healthy as they grew older. Participants reported that having houses in good state and adapted to aging health conditions, social support from family members, closeness of family members, community activities and time spent on the land were the main factors supporting their health. They reported limiting factors such as the lack of radio communication, mobility issues to get out of the house and to travel on the land, and having to live in another community to get health care. Participants also stressed the importance to be able to grow old in their own community and the lack of adapted medical and social services to promoted aging in place. Relevance: A better knowledge about individual, housing and community assets that support healthy aging is necessary to adapt health and social policies in Nunavut. Older adults feel that these policies should support aging in place to help them stay in their homes and their community as they grow older. Knowledge produced by this project can contribute to policies and programs targeting housing and community conditions to support healthy aging in Inuit Nunangat

NUNAVIK AND NUNATSIAVUT REGIONAL CLIMATE INFORMATION UPDATE

Barrette, Carl (carl.barrette@cen.ulaval.ca), Ross Brown and Robert Way, Alain Mailhot, Émilia Paula Diaconescu, Patrick Grenier, Diane Chaumont, Dany Dumont, Caroline Sévigny, Stephen Howell, Simon Senneville.

Centre d'études nordiques

This presentation summarize some of the key results from the climate chapter of the IRIS-4 second iteration. Climate observations and local knowledge provide largely consistent evidence of important changes in several key indices such as air temperature, precipitation, snow cover, lake and river ice and coastal sea-ice. The surface air temperature observing network shows that the IRIS-4 region is continuing to experience increasing temperatures. Future scenarios show warming trends with mean annual air temperatures increasing by ~4-8°C by the end of the century and with largest temperature changes (~3-13°C) projected for winter months. There is greater uncertainty in observed mean annual precipitation trends, but there is a consensus of a long-term increase since the 1950s. Projected change in precipitation could increase by ~20-35 % by the end of this century. The impact of warming on the duration of the period with freezing temperatures and the fraction of precipitation falling as snow is contributing to a significant decline in the number of days with snow on the ground. However, there is greater local and regional variability in the observed snow depth trends. Declining snow cover trends are projected to persist in the future and as well is the maximum snow depth over coastal areas of Nunatsiavut. Results show that projected changes in snow depth are less certain over Nunavik. There is relatively little long-term monitoring data for lake and river ice cover in the region but the available observations and community knowledge indicate a widespread trend for earlier ice break-up. Further declines in ice cover duration and stability are expected in response to projected warming. Glaciers in the Torngat Mountains continue to undergo substantial thinning and retreat since the 1950s in response to warming temperatures and this trend is expected to continue in the future. Sea ice cover has declined by ~30%/decade in coastal waters of Nunatsiavut and Hudson Strait-Ungava Bay since 1971. These decreases are the largest observed in Canadian waters. The ice-free period is projected to increase by 90-120 days by end of century in response to warming and are expected to have significant impacts on the access to traditional hunting areas.

OUT OF THE COLD: THE ARCTIC AS A HOTSPOT OF INTERNATIONAL POLITICS - CANADIAN AND EUROPEAN PRACTITIONERS' PERSPECTIVES

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Why does the Arctic matter? Where are we right now and where do we go from here? – These are the questions panellists will be asked to address. The discussion will bring together high-level practitioners of the realm of international affairs from Canada, Germany and the EU to give voice to different perspectives on Arctic governance. In the international arena, consensus may prevail that climate change wreaks havoc on the fragile Arctic ecosystems, that economic development should serve Arctic communities and not further harm the environment and that the existing legal framework needs to be further developed to respond to new challenges. However, on a number of other specific Arctic issues, diverging agendas may surface. With the Arctic strategies of Canada, Germany and the EU in mind, the panellists will notably address issues such as institutionalized cooperation, environmental protection, economic development, navigation, resource exploitation and scientific research. Particular attention will be paid to the concerns and priorities of the indigenous communities of the North as well as to the role they may want to play in the governance of their homeland.

THE CANADIAN ARCTIC MARINE MICROBIOME AND ITS POTENTIAL FOR HYDROCARBON BIOREMEDIATION IN THE NORTHWEST PASSAGE AND HUDSON BAY

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Effects of climate change in the Arctic such as reduced ice cover and longer ice-free summers have led to a substantial increase of human activities in this relatively pristine environment. Oil exploration and maritime shipping increase the probability of oil and fuel spills, putting Arctic marine ecosystems and northern communities at risk. Although hydrocarbon biodegradation by marine microorganisms has been extensively studied in more temperate waters, bioremediation under permanently cold conditions has not been studied in enough detail. To broaden our understanding of the Canadian Arctic marine microbiome and its potential for bioremediation, seawater was collected from Hudson Bay onboard the CCGS Amundsen as part of the BaySys expedition, and from the Northwest Passage (Cambridge Bay, Nunavut) onboard the R.V. Martin Bergmann. 16S rRNA gene amplicon sequencing of seawater samples and enrichment cultures inoculated with seawater amended with 0.1%v/v light crude oil and incubated at 4°C revealed a major shift in microbial community composition. Significant growth was observed in all Hudson Bay enrichments collected across the northern and eastern part of the bay, relative to no-oil controls, indicative of microbial metabolism in the presence of oil. Although not detected directly in environmental baseline samples that were screened using a moderate DNA sequencing effort (between 5000-10,000 sequence reads per baseline sample), microorganisms previously described as marine hydrocarbon degraders such as Thalassolituus sp, Marinomonas sp, Neptunomonas sp, Pseudomonas sp. and Shewanella sp. represented over 80% of the sequences in Cambridge Bay enrichments after 4°C incubation with crude oil. These results suggest that relatively rare (e.g. <0.01%) members of Arctic Ocean microbial communities are poised to respond to the presence of crude oil compounds, and could potentially be important components of mitigation and remediation strategies following an oil spill.

ON THE SIMILARITIES AND DIFFERENCES IN THE ECOTOURISM CHALLENGES FACING WEST BENGAL, INDIA AND NUNAVUT, CANADA

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Both the Canadian Arctic and West Bengal, India are experiencing the effects of anthropogenic climate change and a rapidly warming world. The Sundarbans of the Bay of Bengal, spanning the India-Bangladesh border, are the largest remaining mangrove forest in the world. Both here and in Canada's Arctic regions, there are charismatic megafauna: tiger and polar bear, respectively. There are also existing Ecotourism industries that aim to bring employment and income to the indigenous peoples who live locally. This alternative tourism aims to have lower environmental impacts than those of mass tourism, and also to be more ethical and sustainable. In March 2018 an international conference, to explore the benefits, costs and tractability of the Ecotourism concept, was held at Visva Bharati University in West Bengal. In contrast to the Canadian arctic, many parts of West Bengal, including the Sundarbans face high levels of mass tourism, which is a cause for concern in local communities. The questions of: if and how Ecotourism could influence mass tourism, were discussed, and various challenges were highlighted, that are mirrored elsewhere in the world, such as, "how will the views of all members of local communities be included in the tourism industry?". We present the results of a consultation that we carried out in February to March 2018, with environmental studies students at Visva Bharati about their view of Ecotourism, and if and how it could provide a sustainable pathway for their local communities. The consultation highlighted a strong interest in educating both local residents and tourists, and concerns about the need to measure and monitor environmental conditions and the impacts of both mass tourism and ecotourism. The results will be of interest to communities in Arctic Canada considering developing Ecotourism strategies.

HOW WELL CAN SUSTAINABLE TOURISM IMPROVE THE HUMAN SECURITY OF LOCAL PEOPLES IN THE ARCTIC?

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The discussion about whether sustainable development is a contradiction in terms has been going on for decades. Furthermore, the observation has been frequently made, that admitting that there are limits to growth generally has negative, short-term political consequences. Ecotourism, and other forms of alternative tourism, such as agritourism, seek to distinguish themselves from the mass tourism market in the same way that sustainable or green business seeks to distinguish itself from strictly for-profit business as usual, by striving to meet the "triple bottom line". We discuss how well the ecotourism concept is likely to provide a pathway for increasing the human security and sustainability of local communities in the arctic. We consider the relevance, for the arctic, of case studies from other alternative tourism sectors, such as agritourism and from other global regions such as Australia. For example, research elsewhere has investigated the impacts of an ecotourism experience on visitor attitudes - these are typically done pre- and immediately post-experience and show a positive improvement in environmental/ecological attitudes. We discuss the gap in research and data investigating the long-term legacy of ecotourism/agritourism experiences on the sustainable behaviour of visitors. Finally, we consider the potential for education, a key principle of alternative tourism, to be scaled-up in order to shift the norms of mass tourism, and we ask whether this mat be an effective way to prevent "over-tourism" and places from "being loved to death".

USING VISIBLE AND NEAR-INFRARED SPECTRAL REFLECTANCE TO ESTIMATE TUNDRA VEGETATION BIODIVERSITY, QIKIQTARUK – HERSCHEL ISLAND, CANADA

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Estimating biodiversity is essential for assessing how tundra ecosystems will respond to global change, yet traditional monitoring approaches using available optical satellite imagery do not fully capture all dimensions of biodiversity change in the Arctic. High spectral -resolution data are a potential solution to the challenges of differentiating spectrally similar tundra vegetation communities as well as estimating biophysical variables such as biomass, carbon fluxes, and green percent cover. Here, we explore the use of visible and near-infrared (VNIR) spectroscopy for the estimation of plot-scale plant biodiversity of two dominant low Arctic vegetation communities on Qikiqtaruk – Herschel Island, Yukon Territory, Canada. We collected spectral measurements near peak season in six long-term 1 × 1 m monitoring plots in each of the two vegetation communities in the summer of 2018. We compared these spectral signatures to biodiversity data extracted from point-framing estimates also collected near peak season in the same plots. We will use these data to test the relationship between spectral reflectance and biodiversity data at increasing fields of view (FOV) from 30 cm to 100 cm. These analyses will allow us to identify how and if spectral signatures can be used as a proxy for plant community biodiversity in addition to testing how spatial scale influences the applicability of VNIR spectroscopy as a monitoring tool for tundra plant biodiversity in the Arctic.

CAN GOOSE COLONIES SUPPORTED BY ANTHROPOGENIC ACTIVITIES IN TEMPERATE ECOSYSTEMS AFFECT THE ACTIVITY OF TUNDRA PREDATORS? A MULTI-SITE COMPARISON CONDUCTED AT A CIRCUMPOLAR SCALE.

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Ecosystems are currently modified by anthropogenic activities at an unprecedented pace. Many of these activities have negative impacts on biodiversity, but some animals succeed in taking advantage of these changes. For instance, some migratory species like snow geese (Chen caerulescens) have increased exponentially since the 1970s due to agriculture intensification in temperate ecosystems. In parallel, other migratory species that connect temperate to arctic ecosystems, such as shorebirds, are experiencing a worldwide decline caused by, among other factors, habitat degradation on staging and wintering areas. The hypothesis that the recent demographic explosion in goose populations may also contribute to the decline in arctic-nesting shorebirds is drawing more and more attention since the two groups of species share the same habitats and predators during their breeding period. Some site-specific evidences show that the sharp increase in goose populations can support arctic predator populations at higher abundance that what local prey species can support, but we still lack data to anticipate the extent of such effects at a circumpolar scale. The objective of this project is to study the impact of the presence of goose colonies on activity indexes of arctic foxes (Vulpes lagopus) at a circumpolar scale. To do this, we used harmonized protocols implemented in 12 arctic sites in 5 countries: Canada, Alaska (United States), Greenland, Sweden, and Russia. We compared an activity index of arctic foxes based on opportunistic observations gathered during summers 2016, 2017, and 2018 between sites with and without goose colonies, taking into account the phase of the lemming cycle and the average summer temperature (as an index of site productivity). This work is critical to portray how arctic predators respond to the presence of goose colonies at a circumpolar scale, and a highly needed first step before to investigate whether predation risk for shorebird nests increase where geese nest. This ongoing international collaboration will contribute determining whether the decline in arctic-nesting shorebirds may be partly attributable to the human-induced increase in goose populations, therefore feeding policy makers with the knowledge required to implement evidence-based policies in a world under global pressures.

IMPACT AND RECOVERY OF SEDIMENT AND PARTICULATE CARBON FLUXES FROM DISTURBED PERMAFROST WATERSHEDS

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Permafrost degradation and the related disturbance of the land surface have increased in recent decades in response to enhanced Arctic climate change. Physical degradation that disrupts the land surface can expose previously inaccessible erodible materials, significantly increasing erosion of slope suspended sediment and particulate organic carbon (POC). However, the scale of impact and the timescale of recovery for particulate fluxes to landscape disturbances in the High Arctic remain unclear. We investigated the impact and recovery of suspended sediment and POC erosion and delivery from localized active layer detachments (ALDs) at the Cape Bounty Arctic Watershed Observatory (CBAWO). Sustained above average air temperatures in early- to

mid-July 2007, combined with a major rainfall event, caused extensive thawing of ground ice and the formation of 100+ ALDs. ALDs resulted in the formation of new slope tributary streams and significantly increased hillslope erosion. This research utilizes multiyear (2007-2017) fluvial suspended sediment flux (SSflux) and POCflux data from two sub-catchments within West River watershed: Ptarmigan (PT) and Goose (GS). PT represents a channelized pre-disturbance and post-disturbance sub-catchment (10.8% of watershed area disturbed by ALDs), while GS represents an undisturbed control for comparison. Our results demonstrate that suspended sediment concentration (SSC) and POC concentrations are strongly correlated for PT ($r = 0.99$) and GS ($r = 0.95$) sub-catchments, with mean POC of 1.2% and 1.3% of the SSC in both streams, respectively. Pre-disturbance SSflux and POCflux were low, ranging from 0.005 (GS) to 0.183 Mg (PT) and 0.069 (GS) to 2.34 kg (PT), respectively. Post-disturbance, SSflux and POCflux increased minimally in GS, but increased by an order of magnitude in PT. Particulate fluxes continued to increase in PT until 2010, then showed exponential decay thereafter. Our results indicate that ALDs result in enhanced particulate erosion in the initial 3 years post disturbance and that new equilibrium states of particulate erosion are achieved within a decade following disturbance.

MINING REVENUES AND INUIT BUSINESS DEVELOPMENT IN THE EASTERN CANADIAN SUB-ARCTIC

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This paper assesses the impacts of mining projects, on business development in the eastern sub-arctic. The paper focuses on the Raglan Mine in northern Quebec and the Voisey's Bay Mine in Labrador. Through a comprehensive business survey, this paper shows that only 30% of businesses receive a significant percentage of their revenues from mining and exploration activities. The characteristics of these companies is examined. Using regression analysis, the impacts of partnerships, gender and company size on mining revenues are evaluated. The analysis reveals that partnerships are crucial to accessing mining revenues. Companies with partnerships are more likely to receive more mining revenues than companies without partnership. In addition, there appears to be a negative correlation between female ownership and mining revenues. Female ownership is also negatively correlated with partnership formation. Inuit businesses with higher mining revenues tend to be owned by males and tend to have partners, while female run businesses tend to have no partners and less mining revenues. This calls into question whether mining can indeed foster sufficient and equitable sustainable economic development if barriers to female entrepreneurship exist. The paper concludes with policy recommendations to help businesses without partners access mining revenues and remove any barriers to partnerships formation for female run businesses.

MEETING THEM WHERE THEY ARE AT – EVALUATING INNOVATIVE, CULTURALLY-CONTEXTUALIZED TRAINING MODELS FOR SUSTAINABLE INUIT YOUTH EMPLOYMENT

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SmartICE is in the process of developing a northern-based production centre (NPC) located in Nain, Nunatsiavut. The NPC will produce our innovative stationary sea-ice thickness sensors called SmartBUOYs. We have refined the SmartBUOY unit to incorporate assembly design modifications to permit manufacture by trained Inuit youth. SmartICE's goal is to ship the assembled SmartBUOYs to communities and industries across the Arctic from the NPC. In northern Labrador, Inuit youth face structural challenges, e.g. rapidly changing climate, food insecurity, higher rates of trauma exposure, and reduced access to sustainable employment. Approximately 45% of Nunatsiavut's population is under age 25, thus understanding ways to train Inuit youth, and provide employment opportunities within remote communities, are crucial to facilitating labour market integration in this context. Work Integrated Social Enterprises (WISEs), such as SmartICE, aim to link individuals typically facing multiple employment barriers to the labour force. Although WISEs operate across Canada, little information is available regarding best practices for developing holistic, person-centered training approaches for youth with high acuity needs. Little has been formalized about processes to adapt training

approaches from high-infrastructure, urban environments to remote contexts. Consequently, minimal information exists about best practices for developing contextually responsive outcome measures for WISEs, particularly in northern Indigenous settings. Our presentation outlines a project to design, pilot, and evaluate an innovative model to sustainably train and employ Inuit youth within their local context. SmartICE will partner with the Social Research Development Corporation, Choices for Youth and Nunatsiavut community stakeholders to generate a holistic, person-centered, and culturally responsive SmartBUOY training manual that outlines the key milestones and associated essential technical skills for SmartBUOY assembly; key socio-emotional skills associated with these milestones; and key supports required (ratios of staff, types of supports) in order to facilitate the technical and socio-emotional skill development and retention throughout SmartICE employment in the NPC. We will also produce a map of the adaptation process including a step-by-step guideline for translating training and production processes, as well as key employment support practices, from high infrastructure settings, to contexts with lower access to formal supports (remote, northern). The process will benefit SmartICE through the generation of a production plan for SmartBUOY assembly, including anticipated outputs during 'full-scale' production, grounded in the pilot testing and roll-out of the holistic training manual and employment support process with Nain youth.

MEASURING OUTCOMES OF TECHNOLOGY ENTERPRISE IN INUIT NUNANGAT: THE SMARTICE CASE STUDY

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SmartICE is a social enterprise that aims to empower Inuit communities to adapt to increasingly unpredictable sea ice. SmartICE offers a triple value proposition, benefiting people in northern communities; the planet through on-ice and remote sensing technology; and the economy by creating demand-led employment opportunities, and providing industries in the North with the information needed to maximize their economic potential. SmartICE aims to support development from a number of perspectives, and at different levels of outcomes or impact. While social enterprise is emerging in Canada as an approach/tool for community action and development, there is little information regarding best practices for evaluating the outcomes related to social enterprise or how to involve communities in measuring such outcomes, particularly in rural and Indigenous settings. Our presentation will describe an approach, informed by relevant theory and practice, to evaluating a social enterprise such as SmartICE, and within the northern Indigenous context. Given that SmartICE has developed strong ties with, and will operate within communities across Inuit Nunangat, within its triple value proposition, it is important to understand how best to measure outcomes from various perspectives (communities, industry, environmental), and across various levels (individual, community, societally). Recognizing the myriad of colonial practices and approaches to research and policy involving Indigenous peoples living in the Canadian Arctic, building an evaluation framework for SmartICE and social enterprises like it, must involve Inuit with whom, and communities within which, SmartICE will operate. In response to increasing community demand for its services and with the financial support of the 2016 Arctic Inspiration Prize, SmartICE is creating an implementation plan for expansion across the Arctic. As part of this process we are planning to design, pilot, implement, and evaluate the SmartICE Operations training process, across the continuum of SmartICE operations and technologies, within pilot and expansion communities. SmartICE is engaging project partners with expertise in design, implementation, and evaluation in employment-related supports and interventions; literacy and essential skills assessments; technical components of SmartICE technologies; and culturally appropriate approaches to skills and training. We are taking a developmental evaluation approach, which is a technique that is well-suited for not only tracking but also helping to shape processes at an early, innovative stage of development, with a focus on continuous adaptation and rapid response to feedback. Additionally, SmartICE will utilize the Piliriqatiginniq framework to guide all aspects of this project; the framework emphasizes the importance of recognizing and integrating Inuit values, and ways of knowing, when working with Inuit communities.

CARBON CYCLING AND METHANE DYNAMICS IN THE MACKENZIE RIVER FLOODPLAIN DELTA

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Methane, a potent greenhouse gas, is also a substantial source of carbon and energy for ecosystems in Arctic lakes. Complex communities of microbes in the water column and sediment in these lakes play an important role in the production and consumption of methane and ultimately influence the net amount of methane that is released to the atmosphere or cycled through local food webs. Canada's Western Arctic contains many large and complex lake systems, but research on the dynamics of methane and methane-cycling microorganisms, and the potential impacts of climate change on these processes in the region, has been limited. The Mackenzie River Delta in Canada's Northwest Territories, hereafter referred to as The Delta, is the largest river system in Canada, the second largest floodplain system in the circumpolar Arctic region and contributes substantially to the global methane budget. The Delta floodplain contains over 45,000 lakes, mostly small and shallow, which are incredibly productive compared to the surrounding tundra areas. These lakes have varied biogeochemistry and bio-availability of carbon based on their spatial distribution relative to the Mackenzie River and the influence of spring flooding events, permafrost thaw activity, and macrophyte density. This project characterizes the structure and activity of methane- and carbon-cycling microbial communities in a set of lakes that represent the range of biogeochemical conditions found throughout the Delta by using 16S rRNA gene sequencing data and biogeochemical measurements, taken at key points throughout the winter and open-water period of 2016. Initial results show that seasonal shifts in various biogeochemical factors, such as dissolved oxygen, methane, nutrients, carbon concentration and carbon bio-availablity, has an impact on microbial community composition and the rate of methane oxidation. Our results provide proxy measurements based on biogeochemical conditions found in different lake types and at different times of year, which correlate with microbial community structure and carbon-cycling processes. These proxy measurements will make the assessment of microbial activity, and the influence of microbes on methane oxidation and carbon cycling, easier to measure and provide a baseline for future impacts from climate change in the region. We also detected the potential for methanogenesis under oxygenated conditions in the water column of Delta lakes, found that methanogens in the sediment can contribute substantially to the Arctic methane budget, and detected a persistent population of methane-oxidizing organisms in a series of lakes representative of the type found throughout the Delta. These methane-oxidizing organisms were present in all lakes studied, and were present during winter ice-cover and throughout the open-water period. Rates of lake-water methane oxidation during an enrichment experiment were enhanced in the presence of added nutrients, and several taxa were observed with significant correlations to the ambient methane concentration of the lakes studied.

WILDLIFE RESEARCH AT CANADIAN FORCES STATION ALERT, ELLESMERE ISLAND

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Effective societal responses to rapid climate change in the Arctic rely on an accurate representation of region-specific ecosystem properties and processes. However, Metcalfe et al. (Nature Ecology & Evolution 2018) recently concluded, from analysis of 1,840 published studies across the Arctic, that relatively colder, more rapidly warming and sparsely vegetated sites (such as the polar deserts of the Canadian high-Arctic) are strongly under-sampled. This may bias the scientific consensuses that underpin attempts to predict and mitigate climate change impacts in the Arctic. We present a recent initiative by the Department of National Defence (8 Wing Trenton Environmental Management) and Université du Québec à Rimouski (UQAR) to partly fill this gap through a biodiversity/wildlife research program at Canadian Forces Station Alert, Ellesmere Island, 82°30'N. Alert is located 817 km from the North Pole and is the northernmost permanently inhabited place in the world. Building from long-term work conducted since 1975 by Environment and Climate Change Canada, we established in 2018 the DND 8 Wing Environment / UQAR Alert Wildlife Research

Laboratory. Five related long-term research objectives were determined: 1- Eco-physiology of migratory birds, 2- Behavioural ecology of northern mammals, 3- Ecology of the polar desert ecosystem, 4- Biodiversity monitoring, and 5- Management plans for Species at Risk and other listed species. We present the rationale, as well as first results, for each objective. Alert offers exceptional research opportunities due to its extreme climate and remote geographic location, its long term weather database, and its logistical facilities allowing year-round field work. This collaborative and cooperative research initiative with the Department of National Defence further promotes Federal statutory and regulatory compliance related to the Species at Risk Act.

EFFECTS OF CLIMATE CHANGE ON THE TUNDRA BIODIVERSITY OF NUNAVIK: EXPOSURE, SENSITIVITY AND VULNERABILITY

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Our capacity to project the effects of climate change on arctic biodiversity is making rapid progress. For example, one can link climate change scenarios to ecological niche models in order to build hypotheses about future distributions of species, and interactions among these species can be taken into account to project ecosystem-scale metrics far into the twenty-first century. Although this science is still far from mature, its outputs are already critically needed because efficient adaptation requires insights into the future (even imperfect insights are better than no insights). With the support of the Ouranos Consortium on Regional Climatology and Adaptation to Climate Change, we identified and mapped through modeling the vulnerability to climate change of the tundra of Nunavik. We first gathered enormous amounts of data on climate, plants, arthropods, birds, and mammals of northern Nunavik, as well as data on food chain links. We then modeled the current and potential future distributions of species and inferred potential changes in food chains. We did this work in 4,315 cells of 100 km2 each, which allowed us to map an index of ecosystem vulnerability for the tundra of Nunavik. We predict an important reorganization of species distributions and food webs in Nunavik, with effects on structure and functioning of tundra ecosystems. This talk presents many output maps and explains how to interpret them. Detailed results are freely available at https://ahasverus.shinyapps.io/bioclimaticatlas/, where hundreds of high-resolution maps can be downloaded. Raw data are also freely available in the collection Nordicana D, archived at the Centre for Northern Studies. We conclude with recommendations for future work, including acquisition of additional data on northern biodiversity, mandatory archiving of data from future research projects, and further development and validation of vulnerability indices at the ecosystem scale.

MAPPING THE CANADIAN ARCTIC MARINE ECOSYSTEM – A MICROBIOLOGICAL APPROACH

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Once considered a remote region, the Arctic has been going through dramatic fast-paced changes that are attributed to anthropogenic climate change. Reduced ice cover and longer ice-free seasons are providing new commercial opportunities, including for the global shipping industry capitalizing on shorter polar shipping routes, prospecting for petroleum, and surge in cruise ships. Such a surge in human activity also raises the possibility of an environmental disaster, such as an oil spill. While there is a considerable body of knowledge available for the fauna and flora in the Arctic, its microbial ecology remains largely unknown and understudied. Microbes are the first responders to any ecological disaster. As such microbial community measurements offer great potential as indicators of the ecosystem health, function, and changes. Here we present our efforts as part of GENICE – a project dedicated to “microbial genomics for oil spill preparedness in Canada’s Arctic marine environment” – to map microbial communities in Canadian Arctic ocean. Microbial community baselines in these environments can help us 1) monitor the effectiveness of future disaster response, 2) identify the microbes that can be involved in the disaster management and remediation planning, and 3) create a knowledge base of microbial life for this valued yet understudied ecosystem. An effective microbial baseline should be usable through time, readily comparable to the other ecosystems, and cost-effective. Microbial community analysis via high throughput sequencing of 16S rRNA genes from environmental samples satisfies these criteria. We have adopted the Earth Microbiome Project (EMP) protocol to 16S rRNA gene amplicon sequencing to make our data from the Canadian Arctic comparable to other ecosystems (such as the Southern Ocean, Atlantic Ocean, permafrost, and many other systems). EMP oligonucleotide sequences for PCR amplicon generation targeting bacterial and archaeal rRNA genes were modified to allow multiplexing of DNA sequencing libraries in order to generate data at lower cost. The specificity of these modified PCR primers was verified in silico to ensure they target known hydrocarbon degrading groups of bacteria, and the protocol was tested on a previously published mock community (a mixture of bacteria and archaea in known ratios) to ensure their appropriateness for targeting a wide range of the diversity in the marine microbiome. Based upon this work we have established a standard protocol that GENICE will use to map microbial diversity to establish useful baselines for the Canadian Arctic Ocean.

COMMUNITY HEALTH MONITORING OF NARWHAL (MONODON MONOCEROS): NECROPSY FINDINGS 2013-2017

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The authors worked with narwhal hunters from the community of Mittimatalik (Pond Inlet), Nunavut during the open water seasons of 2013 and 2017 in waters adjacent to Eclipse Sound and Navy Board Inlet. Following the harvesting of a narwhal, an honorarium was offered to interested hunters for access to the carcass to conduct a full necropsy examination. Ten narwhals were harvested along the northwest coastline of Milne Inlet, of the other three, two were on the west and one on the east coastline of Tremblay Sound. Of the thirteen animals, 11 were examined within one to two hours of harvesting; two animals were found dead and beach cast and were moderately autolyzed. While there were no findings which would impact the food safety of narwhal for the community, various findings of interest were noted. Internal parasitism (sinus, pulmonary and gastrointestinal) was more severe in younger animals and in some cases caused focal bronchopneumonia, which may have affected respiratory function. Incidental neoplasms were found in three animals: pulmonary chondroma in an adult male, intestinal leiomyoma and an adrenal lipoma in two adult females. Acute damage to muscle fibres was present in some animals. While generally good, body condition varied between age classes and reproductive status. Lymphoid depletion and abscessed lymph nodes were seen in a few animals. One older male had degenerative changes at the base of the tusk. Findings from 2013 were reported to the community in a poster format; the full findings from both years will be presented in community meetings in the fall of 2018, and at the ArcticNet 2018 conference. By working with hunters, a health baseline for narwhal is being constructed, so that any future health changes related to anthropogenic pressures can be measured effectively through continued community based monitoring.

FORMATION AND DEMISE OF AN ICING-DAMMED PROGLACIAL LAKE ON BYLOT ISLAND, NUNAVUT, CANADA

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In Sirmilik National Park on Bylot Island, Nunavut, Canada, an icing forms each winter at the terminus of Fountain Glacier. The icing is most likely fed by a spring that discharges year-round through an unfrozen talik within the proglacial permafrost. In the summer, portions of the icing melt as a result of increased solar radiation, warm air temperatures, and an influx of meltwater. In the winter, a proglacial lake often forms dammed by the upvalley glacier, underlying permafrost and downvalley icing. The objectives of this project were to: (1) characterize water flow through the proglacial area, (2) measure degradation of the icing through July 2014 and its impact on the lake and (3) infer the 2014 proglacial lake formation history. The methods employed were DGPS mapping of the surficial ice and lake bathymetry, time-lapse photography of the hydrological activity, and dye tracing to identify hydrological connectivity. Results indicate that: (1) Water flowed into, out of and through the proglacial lake area through pathways established during the lake area formation. Water sources feeding the lake include a spring, supra-glacial runoff, subglacial discharge, lateral stream, terrestrial stream, and meltwater from floating lake ice. (2) Icing degradation was most rapid at the marginal stream contact with running water resulting in a 0.8 m lowering of the lake water level. (3) The proglacial lake formed due to persistence of unfrozen water upvalley of the icing from the groundwater spring continuous water supply.

NUNAVIK'S COASTAL SYSTEMS IN A CHANGING CLIMATE

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This chapter focuses on the dynamic nature of Nunavik's coastal systems and the environmental drivers of coastal change in a changing climate. An understanding of how climate change affects coastal stability, and the nature of the coastal response, provides a basis for assessing potential changes in coastal hazards and the implications for human communities and infrastructure. These poorly documented emerging polar coasts of about 10,000 km in length are at the interface between nature and society, policies and practices.

CARIBOU ON THE MENU: DIET RECONSTRUCTION OF WOLVES AND BLACK BEARS ACROSS THE RANGES OF MIGRATORY CARIBOU IN NORTHERN QUÉBEC-LABRADOR

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Assessing predator diet is crucial to the understanding of predator impacts on the population dynamics of their prey. Migratory caribou herds in Québec-Labrador have been declining for the last decades, yet little is known about the contribution of caribou into the diet of it's main predators, wolf and black bear. While diet reconstruction based on the identification of prey remains in feces is mainstream, the short temporal window of this approach and its digestive bias against soft prey items have fostered the utilisation of complementary methods such as stable isotopes analysis and metabarcoding. In collaboration with Inuit and Cree hunters of Eeyou Istchee, Nunavik and Nunatsiavut we gathered various tissues samples of wolves and black bears and used them to estimate the diet of each predator species. With our three diet reconstruction approaches, we consistently found that caribou is the main prey in wolves' diet all year round, even if some wolves appear to specialize on other prey like muskoxen. Contribution of caribou to black bear diet was influenced by local prey availability and season with a higher occurrence of caribou within the spring diet of bears compared to fall, potentially highlighting that some bears predated on caribou calves within their first weeks of life. The complementary use of 3 approaches of diet reconstruction has allowed a robust description of predator diet. These informations constitute a first step toward elucidating the role of predators within the tundra food web and quantifying their impacts on migratory caribou populations.

COMING TOGETHER FOR CARIBOU: USING COMMUNITY-LED AUDIO-VISUAL METHODS TO EXPLORE RELATIONSHIPS AMONG INUIT AND CARIBOU IN LABRADOR.

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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, without insight from Indigenous knowledge. Through research-based, community-led, participatory audio-visual methods, this research works in partnership with Nunatsiavut and NunatuKavut to explore the ways in which changing caribou populations and hunting bans impact Inuit in Labrador. A combination of qualitative and visual research methods – including participatory video, PhotoVoice, focus groups, and community engagement events – will be used to explore how changing caribou populations and a hunting ban in Labrador have impacted Inuit communities, lives, and wellbeing. Through this process, this research will focus on highlighting the significance of caribou for Inuit; examine how changes in caribou management and populations may be impacting this historic relationship, while highlighting how this connection has and continues to persist through time; demonstrate the ways in which participatory audio-visual methods can co-produce knowledge and share Inuit wisdom related to caribou; and advance our understanding of how participatory audio-visual methods can be used for social and well-being inquiry. Through the production of community-based, research-oriented, participatory documentary film, photography, and art-making, this project brings together two diverse Inuit groups for caribou, for culture, and for conservation, and represents an exciting partnership among Labrador Inuit to 'work together' on telling the deep and enduring story of people and caribou. This presentation will share preliminary findings and filmings, and discuss the potential value and ability of visual research methods to both celebrate and enhance relationships between and among Inuit and caribou in Labrador.

TOXOPLASMA GONDII AND OTHER ZOONOTIC ENDOPARASITES IN FOXES AND LYNX IN ARCTIC AND SUBARCTIC REGIONS OF QUÉBEC, CANADA

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The Canadian North is undergoing unprecedented climate and landscape change, which will alter parasite distribution and prevalence. Understanding these changes will help to understand trophic relationships of wild carnivores and their prey, and to predict the potential for altered zoonotic risk for northern human populations. We aim to establish baseline levels of parasitism among carnivores in Nunavik and Subarctic regions in Québec, including zoonotic helminths such as the tapeworms Echinococcus multilocularis and E. granulosus/E. canadensis, roundworms such as Trichinella and Toxocara spp., and protozoans such as Toxoplasma, Giardia, and Cryptosporidium spp. Red and Arctic foxes (138) as well as lynx (72) carcasses were collected by local trappers across Québec during the winter of 2016/2017. We used morphological, molecular, and immunological methods to detect zoonotic parasites in blood, feces, intestines, brain, skeletal muscles, and heart. Fecal samples were analyzed by sugar flotation to detect parasite egg prevalence and intensity. Real-time PCR and melting curve analysis was used to detect and identify DNA from coccidian species in feces. Adult worms were collected from the small intestines by the scraping, counting, and filtration method. A magnetic capture technique on brain and heart was utilized to detect Toxoplasma gondii. Serological techniques (IFAT and MAT) were also employed for detection of antibodies. Thus far, we have detected Toxoplasma gondii in foxes. We will also report the presence of other potential zoonoses. Lynx are the proposed definitive host of Toxoplasma in subarctic regions, but intestinal infection has not been definitively demonstrated. As a sentinel species, with a high trophic position and scavenging diet, foxes give us a better idea of distribution and transmission of zoonotic parasites in northern ecosystems. This work provides important information on current wildlife and human health significance of parasites in northern ecosystems, and the basis for future predictive models.

THE INFLUENCE OF CHANGING WATERSHEDS ON THE DEMOGRAPHICS OF TRADITIONALLY-HARVESTED ARCTIC MUSKRATS

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Members of the Vuntut Gwitchin First Nation have expressed concerns regarding how environmental change will affect the availability of traditionally harvested wildlife like muskrat (Ondatra zibethicus) populations of the Old Crow Flats (OCF), Yukon, Canada. To determine how the availability and stability of this traditional food source could be affected by climate-driven environmental change, we monitored inter-annual fluctuations in the density of muskrat pushups in 228 lakes across the 5600 km squared OCF. Using demographic statistics calculated from these density time series, we combined principal component analysis, affinity propagation clustering, and redundancy analysis to model demography as a function of Landsat-based estimates of lake and watershed characteristics. We hypothesized muskrat populations with higher and more stable density time series were associated with lakes with (H1) more stable water levels (i.e. fewer seasonal water pixels) and (H2) longer ice free seasons. We categorized OCF muskrat populations as stable or eruptive based on the stability of their density [log10(Nt)] time series. Stable populations had approximately one third the maximum and minimum growth rates [Rt = logN(t) – logN(t-1)], one third the standard deviation of density, twice the mean density, but one hundred times the minimum density of eruptive lakes. We found support for H1 but not H2 as stable lakes had approximately triple the perimeter, lower NDVI values, 1.3 fewer summer ice free days, 5.4 % less seasonal water pixels (i.e. water land), and 20 % more water and 11 % less wood and shrublands in their watersheds. Local ecological knowledge suggested larger deeper lakes, likely correlated with later thaws and more stable water levels, are essential winter habitat, and that ice free seasons and water levels have been changing. Using the 1984-2015 Landsat archive, we found that on average the area of seasonal water in study lakes increased from 2.2 to 3.2 % and ice free seasons were 12 days longer. Arctic wetlands are changing; it is important to examine how changes drive the availability and stability of populations of traditional foods like muskrats.

CLIMATE CHANGE IMPACT ON MINE INDUSTRY IN THE NORTHERN CANADA

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Northern Canada mineral resources, like diamond, precious and base metals, attract mine companies since decades and new projects are in development. Mine exploitations are sensitive to climate and their infrastructure designs need to be in alignment with todays, but also future climate conditions to ensure productivity and environmental safety. During winter, the subarctic and arctic climates in Northern Canada lead to opportunities, like ice road transportation, and challenges, like low temperatures. A growing number of studies focus on climate changes in Northern Canada. They highlight historical and projected changes of relevant climatological parameters such as temperature, precipitation, sea ice cover, snow cover or permafrost. On the other hand, the mining industry, which faces new challenges and new opportunities connected to changing climate conditions, produces several documents related to this point. An example of disturbance for mine activities due to climatic changes in Northern Canada is the thawing permafrost. The later possibly induces geotechnical instabilities due to ground settlement or landslide. Roads, landing runway, dams, and buildings can collapse or become unusable. This can affect different aspect of mine industry such as transportation, operations, reclamation and, consequently, productivity. Using an extensive literature review, this presentation will give an overview of the impacts and the subsequent challenges that mine industry faces in Northern Canada under climate change and existing adaptation strategies.

POTENTIAL FOR COMPETITION BETWEEN EASTERN MIGRATORY CARIBOU AND MUSKOXEN IN NUNAVIK

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Several caribou and reindeer (Rangifer tarandus) populations are declining across arctic and subarctic regions, in part due to climate change and anthropogenic disturbance. In northern Quebec, the Rivière-aux-Feuilles (RAF) herd has declined over 70% during the past 20 years. During the same time, muskox populations (Ovibos moschatus) have increased considerably since their introduction in northern Quebec in the 1960's. This led Indigenous people and scientists to question the potential role of muskox in caribou declines. Our project was thus developed in response to local concerns over the possible impacts of muskox on caribou populations in Nunavik. Our objectives were to assess the potential for competition between caribou and muskox, particularly in regards to space use, habitat selection and diet overlap. In 2017, 44 muskoxen were fitted with GPS collars in the range of the RAF herd, where more than 100 caribou were already equipped with telemetry collars as part of an ongoing long term study. Moreover, 190 fecal samples were collected and analysed using DNA metabarcoding. Preliminary results suggest that spatial overlap is highest during spring and winter along the coast of Hudson Bay. In winter, muskox were found at higher elevation and ruggedness than caribou. In spring, both species tended to select for lichen cover. Although there were important seasonal variations, Ericacae and Salicacea were the plant families most consumed by both species. We conclude that the two species may thus compete for habitat and diet composition.

SEDIMENTARY DYNAMICS OF THE BELCHER GLACIER (DEVON ICE CAP, NUNAVUT) DURING THE LAST CENTURIES

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The Devon Ice Cap on the Devon Island in the Canadian Arctic has an area of 15 000 km2. Over the last decades, instrumental data have demonstrated that the area of the ice cap has diminished by 600 km2 (4%) as a result of climate warming. However, to place this reduction of the ice cap into perspective, it is necessary to know its past variability and dynamics. Thus, sedimentary sequences extending beyond instrumental records could provide a critical link to study the long-term natural glacier variability. In this context, the purpose of this study is to compare the sedimentological, mineralogical, geochemical (elemental and isotopic), and magnetic properties of a short sedimentary sequence (43 cm) collected in the proximity of the Belcher Glacier in order to document its glacier dynamics over the last centuries. The Belcher Glacier is the principal tidewater outlet glacier calving up to 30% of the total iceberg volume from the Devon Ice Cap. The core chronology was assessed from 210Pb measurements and indicates that the sediment core extends back to ca. AD 1300, with sedimentation rates ranging between 0.062cmyr-1 at the base and 0.145cmyr-1 in the uppermost part of the core (last 8 cm). C/N, δ13Corg., and δ15Ntotal indicate a dominant marine algae origin for the sedimentary organic matter, reflecting the inputs of sea-ice algae from the tidewater glacier. Sedimentation rates and most of our detrital proxies (notably, plagioclase, magnetite, total clays, Ti/K, Al/Ca, and δ15Ntotal) show an increase since the mid-19th century compared to the pre-industrial period (1300 to 1800 AD), likely related to a greater retreat of the Belcher Glacier. The variations observed in almost all detrital proxies measured in this study are synchronous with other regional records from the northern Baffin Bay, supporting the hypothesis that the recent retreat observed in the Belcher Glacier is mainly driven by changes in the intensity of the West Greenland Current.

IMPLICATIONS OF PERMAFROST DECAY ON PUBLIC INFRASTRUCTURE IN THE NORTHWEST TERRITORIES

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Through funding from Canadian Northern Economic Development Agency (CanNor), the NWT Association of Communities, working with geotechnical experts and environmental economists, produced a report which provides an economic analysis linking climate change and ambient air temperature to permafrost decay and premature infrastructure failure in 33 Northwest Territory communities. The report adopts two economic perspectives: one identifies the economic value at risk when public infrastructure fails prematurely; and, the second identifies the lost economic activity associated with the economic value at risk. We focus our analysis on eight types of infrastructure in the 33 communities: •Over 1,740 government buildings; •611 km of community roads and1,319 km of highways; •96 bridges and 230 culverts; •42 sewer systems assets and 72drinking water assets; and •28 airports. Based on the analysis, we conclude there is a high likelihood of significant economic costs in all 33 NWT communities that can be attributed to permafrost impacts on community, territorial and federal assets.
The total costs of the permafrost impact on assets in the 33 communities is in the order of $1.3 billion. On an annual basis, the economic losses are likely in the order of $51 million. The study also compares the value at risk relative to the $5.2 billion worth of infrastructure. The

study concludes with recommendations of next steps and technical opportunities that may be realized.

CALIBRATING PERMAFROST MODELS USING TEMPERATURE TIME SERIES OBTAINED FROM LABORATORY SOIL COLUMN EXPERIMENTS

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Ground temperature measurements are typically used to monitor permafrost. In thawing permafrost, temperature changes with time are often minute, intuitively creating the misleading impression that little change occurs. During this phase of thaw, latent heat transfer is strong and the amounts of ice, liquid water, and energy in the soil can change significantly while temperature change is subdued. Given that changes in subsurface ice and liquid water contents are important for human and biophysical systems, as well as for calculating the latent heat associated with ground energy fluxes, it would be desirable to monitor these changes in warming permafrost. Unfortunately, such measurements are rarely collected. Instead, they can be calculated, provided that soil parameters describing soil freezing behaviour and thermophysical properties are available. Previous research has demonstrated that these soil parameters can, in some cases, be estimated by using observed temperature time-series to fit the parameters of a numerical model. In particular, tests using synthetic data have shown promising results even after the addition of noise. However, when applying this technique to field data, testing is confounded by complicated soil stratigraphy, incomplete or missing soil parameter measurements and the possibility of sensor drift or bias. Alternatively, temperature time series in a laboratory soil column could be measured from a homogenous soil with known thermophysical properties. Such a dataset would permit method testing that is more realistic than using synthetic data but not as challenging as field data. Unfortunately, such experimental data are not readily available. A 50 cm tall laboratory soil column constructed with closely-spaced thermistors and temperature control plates on the top and bottom was used to generate temperature data at multiple depths in a series of experiments using different soil types and water saturation. The heat capacity, thermal diffusivity and porosity of the test soils was determined experimentally or instrumentally. Heat infiltration into the soil column was greater than anticipated based on the descriptions of similar experiments in the literature. The effect of the heat gain was parameterized and calibrated to correct the warm bias. Soil parameters were then estimated by fitting a numerical model to experimental data and the fitted model parameters were compared to the more conventional laboratory measurements to determine the accuracy of the fitted parameters. The outcomes of this research include a high spatial and temporal resolution temperature time series dataset with known uncertainties as well as improved testing of the method of soil parameter estimation from fitting numerical models. Finally, the opportunities and practical challenges of operating laboratory soil columns for permafrost research are identified.

RISKY BUSINESS: EFFECTS OF HUMAN HABITATION ON PREDATION RISK AND NEST SURVIVAL OF SUB-ARCTIC NESTING SHOREBIRDS.

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Nest predation risk is an important factor underlying the evolution of many life-history traits in birds; collectively high rates of nest predation can heavily influence individual behaviour, species' ranges, and population dynamics. Therefore, factors that influence predation rates of bird nests, especially of declining or threatened species, are of high conservation concern. On a large geographic scale, nest predation risk for ground-nesting birds tends to decrease with increasing latitude. Thus, when compared with individuals at other Arctic sites, ground-nesting shorebirds at the southernmost parts of their ranges in Churchill, Manitoba should experience higher levels of predation risk and lower levels of nest success, especially near town where human activity may increase predator activity. We hypothesized that proximity to human habitation would increase predation risk and decrease the nest success of six shorebird species nesting near Churchill. Daily predator surveys were conducted in each of four 2-km² plots of various distances to town, while predation risk was measured in each plot by conducting two ten-day artificial nest experiments. Simultaneously, nests of focal species were found and monitored until their fates were ascertained. On 16 of 44 real nests and 47 of 197 artificial nests, motion-sensor cameras were deployed to identify nest predators. In the study plot closest to town, predator activity was second-highest of the four plots at 5.25±2.64 sightings per hour, however predation risk was relatively low and apparent nest success remained the highest among the 4 plots

(60% of nests hatched, n=10). More than two-thirds of identifiable predators of artificial nests were avian, while for real shorebird nests nearly two-thirds of predators were mammalian. Although avian predators were more abundant during surveys than mammalian predators, the latter appear to be more important in determining nest success rates of shorebirds nesting in this region of the Subarctic.

PHOTOSYNTHETIC CAPACITY DURING THE GREENEDGE PROJECT: SEASONAL LIGHT ACCLIMATION CAPACITY AND OTHER PHOTOSYNTHETIC PARAMETERS OF THE PHYTOPLANKTON COMMUNITY IN THE MARGINAL ICE ZONE

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During the GreenEdge project, photosynthetic parameters were measured both on an ice-camp (April-July 2015 and 2016) near Qikiqtarjuaq, Nunavut, as well as during a cruise onboard CCGS Amundsen (June-July 2016) in Baffin Bay. A modified version of the radial photosynthetron from Babin et al. (1994) was used at the ice camp, allowing acquisition of up to 8 curves of 50 mL samples stressed at 12 light levels simultaneously. Samples were then filtered to provide photosynthetic parameters from the particulate fraction of the community. During the cruise, we used an improved version of the Lewis and Smith (1983) incubators, allowing acquisition of 10 curves of 2 mL samples stressed at 14 light levels at each cast. Samples were measured directly therefore providing photosynthetic parameters for the whole community. A total of 207 curves were acquired on ice and sea-water samples at the ice camp while 260 curves were completed during the cruise. Values of the maximum carbon fixation rate (PBmax) varied widely between 0.12 and 17.57 mg C (mg chl a)-1 h-1 whereas the light acclimation capacity (Ek) varied between 5.6 and 220.4 micro-mol m-2 s-1, comparing well with results from other campaigns in the Arctic Ocean. At the ice camp, Ek showed striking seasonal variability, with minimum values under ice-covered conditions and increasing as the snow and ice melted. A global distribution of the photosynthetic parameters in Baffin Bay for both ice and water samples will be presented. The photosynthetic parameters of the phytoplankton and ice algae communities will be compared to other eco-physiological properties collected concomitantly, such as variable fluorescence and phytoplankton absorption, and will be put in relation to the phytoplankton community structure and the environmental conditions.

ROLE OF THE NEST FLEA, CERATOPHYLLUS VAGABUNDUS VAGABUNDUS, AS A POTENTIAL BRIDGE VECTOR FOR BARTONELLA HENSELAE TRANSMISSION BETWEEN NESTING GEESE AND ARCTIC FOXES, VULPES LAGOPUS, IN NUNAVUT, CANADA

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Vector-borne disease in the Arctic may be of increasing wildlife and public health significance in a warmer and more globally connected Arctic. Previously, Bartonella henselae (the causative agent of cat scratch fever) was detected in blood collected from live-trapped arctic foxes, Vulpes lagopus, in the region of Karrak Lake, Nunavut. This bacterium is generally associated with cats and fleas, neither of which are widespread in Arctic ecosystems. Arctic foxes in the region opportunistically feed on migratory geese, their eggs, and their goslings. The Karrak Lake colony of lesser snow (Chen caerulescens caerulescens) and Ross's (Chen rossii) geese is infested with a nest parasite, the flea, Ceratophyllus vagabundus vagabundus. However, there have been no publications that have identified C. vagabundus vagabundus as a suitable vector for B. henselae. Due to the common landscape use between arctic foxes and migratory geese, we theorized that the nest fleas may serve as a potential vector for B. henselae. The objective of this study was to determine the prevalence of DNA of B. henselae in nest fleas collected from arctic fox den entrances and goose nests in 2014. Using polymerase chain reaction analyses, B. henselae was identified in 39% of pooled flea samples (n=51). This study provides supporting evidence that B. henselae occurs at low levels in the Karrak Lake ecosystem, and that nest fleas may serve as a potential vector for transmission. Further testing is being done to identify whether Ross's and lesser snow geese in the Karrak Lake colony may serve as a reservoir for B. henselae transmission, vectoring this parasite from temperate regions to the Arctic.

UK-CANADA ARCTIC RESEARCH COOPERATION - PAST, PRESENT AND FUTURE

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The United Kingdom and Canada have a strong history of research cooperation in the Arctic and across the High North. The Natural Environment Research Council's Arctic Office is working closely with Canadian colleagues to further develop and deepen these connections wherever it can. The Bursary Programme in 2017 and 2018 has been a key part of this approach. This session will provide an overview of the programme, place it in the context of wider work, outline the next steps for the programme and identify further upcoming opportunities for joint working.

INGO LEGITIMACY IN THE ARCTIC: THE WWF AS A RIGHTFUL ACTOR IN ARCTIC GOVERNANCE

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The World Wildlife Fund (WWF) is one of the most prominent and respected INGOs working on environmental governance issues in the world. This is especially true in Arctic politics, where the WWF is a prominent figure in regional cooperation, such as in the conservation efforts to protect the polar bear (WWF Arctic Programme). This paper will investigate issues of rightful actorness and insider-outsider politics in order to discuss how the WWF has maintained its international legitimacy through its navigation of its insider status with numerous actors, namely cooperation with states, indigenous peoples, research institutes and corporations. This paper will seek to explore the factors which have contributed to the status of WWF in Arctic governance discussions and how its approach to Arctic environmental issues both benefits and limits the organization's capacity to expand and participate in environmental politics in the region.

ENGO PARTNERSHIP POTENTIAL IN THE NORTH: THE CASE OF GREENPEACE AND CLYDE RIVER

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Environmental non-governmental organizations (ENGOs) frequently market their work as helping to promote minority voices in political discourse, such as indigenous peoples on Arctic issues. Using the literature on non-governmental organizations, this paper will engage with the debate about ENGO legitimacy, focusing on the role of Greenpeace in Arctic campaigning. Greenpeace has a controversial legacy in the north which has impacted its ability to work with local communities and peoples. It was able, however, to work with the people of Clyde River in their successful Supreme Court of Canada case - Clyde River (Hamlet) v. Petroleum Geo Services Inc. This paper explores ENGO partnership potential and the strengthening independent political voices of indigenous communities and peoples. It argues that ENGO partnership potential must not be seen as a 'one size fits all' and that organizations with previously poor records for involvement in the North can evolve. The strong motivating factor impacting Greenpeace's evolving approach toward Arctic campaigning is that local communities in the north, particularly indigenous communities, are gaining a stronger place within Canadian politics and are demonstrated that they will push back against outside actors claiming to represent their interests. At the same time, however, these communities have demonstrated a willingness to engage with these actors (e.g. Greenpeace) when such engagement is seen as beneficial to their own campaigning efforts. As such, it is important learn from the partnership outcome between Clyde River and Greenpeace in order to increase awareness of the partnership styles of ENGOs in order to best assess who might be a good potential partner for communities to complement their local campaigning needs.

UNEP COASTAL PERMAFROST RRA: RESEARCH AGENDAS FOR THE TERRESTRIAL ZONE

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Relatively rapid climate change is occurring in the western Arctic coastlands of Canada. Regional climate change is magnified near the coast because of a larger spatial extent and longer period of open water that raises regional temperatures and humidity at synoptic scale, especially in autumn. In addition, a more vigorous general circulation, driven within the global greenhouse, has brought more maritime air to a region previously dominated by continental conditions. As a result, annual mean air temperatures have risen in the region by over 3°C since 1970. 2017 was the second warmest year in the record, only surpassed by conditions in 1998, which were then considered to have a recurrence interval of 300 years. Rainfall has also been increasing, especially in late summer. Nine of the wettest 16 summers in the record have occurred since 2002. Several relatively well-understood physical processes, such as coastal erosion, thaw slumping, and ice-wedge degradation have accelerated due to these changes in climate. Ice-rich terrain has been the most susceptible to erosion. Current research with respect to these processes has shifted to their biogeochemical effects. Engineering practice is now required to mitigate their physical consequences, especially where they affect settlements and infrastructure. Research is now required to address the incremental effects of rising ground temperatures on the stability of structures designed to use permafrost to contain fluids, especially industrial wastes. This is because ground temperatures near the coast have increased steadily over the last five decades. The continuing incremental change since 1970 has been over 2.5 °C at 10 m depth. The adjustment is 3 °C at 5-m depth, as measured at two long-term monitoring sites on Richards and Garry islands. Such persistent permafrost warming may alter the service life or service standard for linear and municipal infrastructure. Accommodation of ground thawing in structural design is now likely to be required for facilities built with a service life of 50 years or more, replacing emphasis on permafrost preservation. Continuing containment of industrial wastes in permafrost sumps requires detailed consideration.

SEA ICE ROUGHNESS FROM AIRBORNE LASER SCANNER OBSERVATIONS IN THE CANADIAN ARCTIC ARCHIPELAGO AND RELATIONSHIPS TO C- AND L-BAND RADAR BACKSCATTER

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Synthetic Aperture Radar (SAR) sensor systems are regularly used for Arctic sea ice monitoring since the emitted microwave radiation penetrates cloud, and enables detection of surface characteristics in all weather conditions regardless of sunlight. Utilizing SAR for the retrieval of sea ice geophysical properties is an active area of research due to complex surface and volume contributions to measured SAR backscatter. Relationships between backscatter and the geometric surface roughness of sea ice, related to its deformation state, have not been explicitly quantified. This study aims to characterize the sea ice roughness regime in the Kitikmeot Region of the Canadian Arctic Archipelago and improve the capability of C- and L-band SAR to derive estimates of sea ice surface roughness during winter and summer conditions. The immobile nature of the landfast ice in this region is ideal as there is no ice drift between the airborne measurements and the acquisitions times of the SAR images, meaning datasets can be spatially co-located regardless of season. SAR images from ALOS PALSAR-2 (L-band) and RADARSAT-2 (C-band) sensors were acquired between March and June 2016 over Victoria Strait and M'Clintock Channel, areas that contain mixtures of landfast first-year ice (FYI), deformed first-year ice (DFYI) and multiyear ice (MYI). Backscatter from winter and summer SAR images were compared to surface roughness, defined as the root-mean-square (RMS) height deviation, measurements derived from an airborne laser scanner flown over the sea ice in early April 2016. Sea ice roughness ($\sigma surf$) was characterized by ice type, with FYI mean $\sigma surf$=0.13m, DFYI mean $\sigma surf$=0.27 m, and MYI mean $\sigma surf$=0.09m. In all SAR scenes, the strongest relationship between backscatter and $\sigma surf$ exists for DFYI. There is a significant relationship between roughness and backscatter at both frequencies and during winter and summer conditions. Relationships between $\sigma surf$ and C-band backscatter are more sensitive to incidence angle and polarization, whereas relationships using L-band backscatter were strong regardless of system parameters. Images of sea ice melt pond fraction, derived from an aerial survey conducted in June 2016, are used as a control to assess the influence of melt conditions on the radar backscatter. Overall, it is expected that the quantification of large-scale surface roughness of sea ice will enable further investigation of atmosphere-ocean factors that influence sea ice motion and melt/export during summer.

INCORPORATING LOCAL TRADITIONAL KNOWLEDGE TO IMPROVE PERMAFROST STUDIES

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More and more studies aim to address permafrost-related issues hindering the development of northern communities, industries, and transportation networks. Building and maintaining infrastructure, and relying on traditional subsistence activities for food security in regions underlain by unstable ground comes with additional costs in terms of technological and cultural adaptations. For such studies, the researchers can benefit from a close collaboration with Northern partners such as first nations or territorial organizations to better understand the problems at hand, and also to develop a more accurate understanding of landscape processes and permafrost dynamics. Presented here is our experience of how local knowledge and the participation of local land users and managers can be used in various contexts to develop hazard and permafrost sensitivity maps, geohazard vulnerability maps, or food vulnerability assessments. Studies taking place in communities such as Jean Marie River (NWT), Dettah (NWT), and Old Crow (YT), and along infrastructure such as the Dempster and Alaska Highways (YT) serve to illustrate how local knowledge linked to geoscience data can be used to understand landscape changes, permafrost conditions, surficial geology, or hydrology. Involving northern residents in the research process is essential to ensure that the work responds to northern needs and concerns, and builds on the local wisdom and knowledge obtained from daily interactions with their environment.

IMPACTS OF CLIMATE CHANGE AND INTENSIVE LESSER SNOW GOOSE (CHEN CAERULESCENS CAERULESCENS) ACTIVITY ON SURFACE WATER IN HIGH ARCTIC POND COMPLEXES

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Rapid increases in air temperature in Arctic and subarctic regions are driving significant changes to surface water. These changes and their impacts are not well understood in high Arctic ecosystems. This study explores changes in surface water in the high Arctic pond complexes of western Banks Island, Northwest Territories. Landsat imagery (1985-2015) was used to detect sub-pixel trends in surface water, higher resolution aerial photographs and satellite imagery (1958 and 2014) explored changes in the size and distribution of waterbodies, and field sampling investigated factors contributing to observed changes. The impact of expanding lesser snow goose populations and other biotic or abiotic factors on observed changes in surface water were investigated using an information theoretic model selection approach. Our analyses show that surface water declines are widespread in the pond complexes of western Banks Island and indicate that climate is the main driver. Model selection showed that proximity to the main lesser snow goose nesting colony was associated with more extensive drying and draining of waterbodies and suggests this intensive habitat use may reduce the resilience of pond complexes to climate warming. Changes in surface water are likely altering permafrost thaw, vegetation communities, and habitat quality, and should be investigated further.

ICECUBE: A NANOSATELLITE CONCEPT FOR CANADIAN ARCTIC MONITORING

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The adverse effects of global climate change require new and innovative solutions to monitoring and combatting the issue. Given its latitude and environmental sensitivity, changes to the Arctic regions are indicative of the state and progress of global warming.

The growing severity of climate change increases the cost and resource demand for monitoring efforts. New and economical methods need to be explored to adequately document changes for northern communities. Nanosatellite technologies allow for versatile and cost-effective applications. Existing technology allows for nanosatellites to provide services such as climate change monitoring, safe methods for scouting areas of interest and Arctic weather sensing. The continued development of nanosatellite technologies improves the accessibility of space, allowing for smaller organizations to benefit from valuable satellite services. These technologies empower communities with first-hand knowledge of the Arctic region to execute their own research missions. This paper presents a conceptual design for a nanosatellite in a polar and sun-synchronous orbit that will provide monitoring capabilities to Arctic communities. The satellite's earth observation camera has multi spectral imaging capabilities in the visual, infrared and red edge wavelengths. Imaging in these bands will enable data collection for Arctic agriculture such as generalized vegetation indices. Using this data, researchers will be able to evaluate and track the progression of climate change. Additionally, the satellite design will demonstrate novel and innovative technologies currently under development at the University of Manitoba Space Technologies and Advanced Research (UMSTAR) Lab, including a polar orbit communication system, thermal control technologies and an attitude and determination control system.

SULPHUR DYNAMICS IN PERMAFROST THAW LAKES

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Little attention has been given to sulphur (S) in thaw lakes, but its chemistry is of special environmental importance, since it plays a key role in natural organic matter (NOM) degradation. To understand sulphur dynamics in thaw lakes, we undertook studies in the Canadian subarctic in summer and winter. Water samples and sediment cores were collected from three thaw lakes. Results show that the amount of S is dependent on lake origin: in lakes derived from organic-rich palsa soils, S content is much higher than in mineral lithalsa lakes. NOM is the main source of S in the thaw lakes and its degradation in the water column and/or in the topmost sediment layers dominates S-mineralization. This process was more efficient in winter when the lake surface was frozen, decreasing oxygen availability, thus increasing the activity of sulphate reducing bacteria. Upon removal of lake ice, a rapid increase of sulphate occurred in the near-surface waters (5 cm) followed by its reduction within minutes, indicating the rapid system kinetics for both S reduction and oxidation. In deeper waters, dissolved sulphides promote the precipitation of metal sulphides, resulting in a sediment surficial layer that is enriched in amorphous trace element sulphides. These results show the importance of sulphur biogeochemistry and its strong linkage to lake origin, thus signalling the need for a regional assessment of sulphur related processes, based on broad, in-depth surveys of thaw lake origin.

A CARBON BUDGET FOR HUDSON BAY

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The tendency for a coastal marine system to absorb or release CO2 is largely influenced by the delivery of terrigenous organic carbon by rivers. Terrigenous organic carbon that is not buried with marine sediments may be remineralized to CO2, thus contributing to ocean acidification and net atmospheric CO2 emissions. Hudson Bay (HB) receives a disproportionately large amount of dissolved and particulate terrigenous organic matter, and is characterized by widespread aragonite under-saturation (Azetsu-Scott et al. 2014; Burt et al. 2016), and net CO2 emissions to the atmosphere (Else et al. 2008) relative to other North American Arctic seas. These features are consistent with the relatively low rates of primary production (Ferland et al. 2011, Sibert et al. 2011) and carbon burial (Kuzyk et al. 2008, 2009) observed in HB. However, we lack a quantitative understanding of how the organic and inorganic carbon systems are interconnected. We synthesize relevant literature on HB carbon chemistry in order to develop an overall carbon budget for the region. We subdivided the bay into four boxes, a freshwater dominated coastal conduit and marine-dominated interior subregion, each composed of a mixed layer and deep box. The fluxes of carbon in and out of each box, and the transformations within each box were estimated based on available literature and in some cases new data. Where possible, direct measurements of carbon flux were incorporated (i.e. river delivery of particulate and dissolved carbon, burial rates of carbon, air-sea flux). Other budget terms were parameterized based on their relationship with available datasets. We find that the vast majority of terrigenous organic carbon is remineralized in the mixed layer and to a lesser extent in deeper waters, contributing to net CO2 efflux and aragonite under-saturation. A mass-balance suggests the bay may be a stronger source of CO2 to the atmosphere and more susceptible to ocean acidification than previously thought, or, alternatively, current rate estimates of organic matter burial are too low. The budgeting exercise allows us to contrast HB with other Arctic peripheral seas. To more tightly constrain the carbon budget, we recommend increased effort to assess the fate of terrestrial carbon (burial vs. degradation) in this system.

VARIABILITY IN DAILY PCO2 CYCLES IN THE LOWER CHURCHILL RIVER

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Automated, high-frequency measurements of dissolved pCO2 in the lower Churchill River from May – October 2007 display pronounced diel pCO2 cycles, but the magnitude timing of the daily cycle varied over the study period. A sudden increase in river discharge the first week of August coincided with a shift from consistent pCO2 under-saturation and relatively small diel pCO2 ranges (150 μmol), to daily alternation between under and over-saturation with a much larger pCO2 range (300 μmol). Additionally, the maximum and minimum pCO2 concentration occurred at noon and midnight, respectively, during June, then shifted to 4PM and 4AM in early July, midnight and 2PM in late July, and noon and midnight in early August, suggesting a shift in the daily cycles of net primary production and net heterotrophy. We hypothesize that the higher discharge in early August may have enhanced the delivery of terrestrial organic carbon to fuel CO2 production in the river. Increased turbulence during high discharge would also act to bring the river closer to equilibrium with the atmospheric CO2. However, future work is needed to determine why the pCO2 range would increase with discharge, and why the diel pCO2 cycles would shift over monthly time scales.

SPATIAL ECOLOGY OF RINGED SEALS ACROSS A LATITUDINAL GRADIENT IN THE EASTERN CANADIAN ARCTIC

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The ringed seal is especially vulnerable to the rapid climate-driven decline of sea ice given its dependence on ice for birthing lairs, molting, and for prey derived from these sympagic ecosystems. Ringed seals occupy a broad latitudinal range that experiences high variation in ice conditions from the transient coverage of the sub-Arctic Hudson Bay, to the substantial year-round coverage of the high Arctic in the Lincoln Sea. Therefore, ringed seals as a species likely vary in their ability to adjust their seasonal sea ice habitat use to varying regional sea ice conditions. The well-studied southern end of their range in Hudson Bay will likely be the first to suffer from sea ice recession via demographic shifts, diet changes, and range contraction, but how ringed seals will respond over their entire range remains poorly understood. The objective of this study is to investigate the habitat selection of ringed seals along this heterogeneous latitudinal gradient of sea ice to identify differences in ringed seal occurrence that could be linked to sea ice conditions. We will use aerial survey data from the low Arctic (≤65° N Churchill, MB), mid-Arctic (>65° N to ≤75° N Pond Inlet, NU), and high Arctic (>75° N Alert, NU), and relate density to differences in remotely sensed sea ice data. We hypothesize that latitudinal variation in ringed seal density will reflect availability of preferred landfast first-year ice habitat, with density decreasing with increasing latitude. Preliminary results indicate ringed seal densities of 0.46-2.05 seals/km2 in Churchill, 0.24-1.40 seals/km2 in Pond Inlet, and 0.05 seals/km2 in Alert. Future work aims to link density to sea ice conditions and to the feeding ecology of ringed seals along a similar latitudinal gradient. To assess ringed seal feeding, we will measure carbon and nitrogen stable isotope ratios to indicate trophic position and food web dynamics, and highly branched isoprenoids (HBIs) to identify the relative source of primary production using ringed seal tissues collected from the low Arctic (≤65° N Arviat, NU), mid-Arctic (>65°N to ≤75°N Pond Inlet, NU), and high Arctic (>75°N Grise Fjord, NU and Qaanaaq, GL). We predict that at high latitudes, ringed seal diets will exhibit carbon and nitrogen values more representative of complex sympagic food webs, and HBIs characteristic of sea-ice derived production rather than pelagic signals. Results from both habitat selection and feeding ecology will inform us about how ringed seals adjust to regional sea ice conditions and provide baseline data to compare with as ice conditions change.

POTENTIAL IMPACT OF DECREASING TURNAROUND TIME OF CEREBROSPINAL FLUID ENTEROVIRUS POLYMERASE CHAIN REACTION (PCR) TESTING IN HOSPITALIZED CHILDREN

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Background: Enterovirus (EV) meningitis may be clinically indistinguishable from serious bacterial infections; patients are often hospitalized with empiric antibiotic therapy until diagnosis is confirmed. The detection of EV DNA in the cerebrospinal fluid (CSF) by polymerase chain reaction (PCR) is used to diagnose EV meningitis. While EV PCR analytical time can be as low as ~1 hour, in our center, EV PCR is sent to a reference laboratory, greatly prolonging test turnaround time (TAT). Thus, we aimed to assess the potential impact of decreasing TAT of CSF EV PCR testing among children <18 years old hospitalized at the Montreal Children's Hospital (MCH). Objective: To determine the impact of CSF EV PCR test TAT on hospital length of stay (LOS), intravenous (IV) antibiotic use and healthcare costs. Design/Methods: We performed a retrospective cohort study of children admitted to MCH with CSF EV PCR testing from Nov. 2014 to Nov. 2017. We reviewed medical records of each case. The primary outcome was the potential date of discharge if EV CSF PCR results had been available on the same day as ordered. Costs associated with delayed TAT were estimated by adding the costs of hospitalization, physician fee-for-service billing, medical day hospital visits, and IV antibiotic treatment that could have been avoided by obtaining the EV PCR results on the same day as CSF collection date. We estimated local CSF EV PCR testing to cost 175 CAD per sample. Data were analyzed by descriptive statistics. Results: CSF EV PCR testing was performed on 153 patients, with mean age of 2.8±4.4 years. The CSF EV positivity proportion was 44/153 (29%). Median TAT from test order to result was 4.0 days (IQR, 2.2-5.9). Median LOS was 5.0 days (IQR, 3.0-12.0). Overall, 86% of patients received IV antibiotics for a mean of 5.7±6.5 days. We estimated that by decreasing test TAT to same-day, overall LOS and IV antibiotic durations would decrease by 0.5±1.1 days and 0.7± 1.5 days, respectively. Yearly estimated cost savings of local CSF EV PCR testing was 11,729 CAD. Conclusion(s): Our data show that expediting TAT to same-day results should reduce unnecessary LOS, IV antibiotic therapy and costs in hospitalized children. Given the availability of simple and rapid EV testing methods for CSF samples, we expect these findings to be especially applicable to remote Northern healthcare settings.

HONOURING THE INTEGRITY OF INDIGENOUS KNOWLEDGE SYSTEMS THROUGH A KNOWLEDGE COEVOLUTION FRAMEWORK

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The responsible development of sustainable Northern fisheries is of paramount importance. Working alongside communities to establish culturally appropriate and effective management strategies based on traditional ecological knowledge and western science is required to ensure management is relevant, meaningful and does not have unintended negative consequences for communities. To achieve this, we develop a knowledge coevolution framework through which different knowledge types are joined to address multi-faceted research questions such as sustainable fisheries development and food security. Seated in a foundation of respect, open mindedness, and trust, collaborative and inclusive research creates an environment where Inuit self determination is respected, community members are empowered through active participation in all facets of the research process, and have a continuous input in the adaptation of research objectives and end goals. Our framework intends to insure that useful new knowledge is provided for indigenous partners without impeding the transfer and evolution of traditional knowledge. Here we discuss the theoretical basis for knowledge coevolution as well as practical applications of such a research process, using the Towards a Sustainable Fishery for Nunavummiut research project as a case study.

THE SPATIAL DISTRIBUTION OF ICE-WEDGE POLYGONS IN NUNAVIK

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The Arctic regions are experiencing a rise in surface temperatures at a higher rate than the rest of the planet. Ice wedges in polygonal terrain are one of the dominant features of permafrost that are affected by the deepening of the active layer and the thawing of permafrost provoked by climate warming. 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 ice-wedge polygons. Furthermore there is paucity of knowledge of the surface geological and ecological conditions where active (i.e. currently cracking under a propitious cold climate) and inactive (or fossil; i.e. non-cracking) ice wedges are distributed. For permafrost cracking and ice-wedge formation to occur, the ground temperature must in fact drop to temperatures at least below -10 °C and abrupt cold spells have to happen during the winter. If the temperature does not decrease rapidly enough, the material may contract without cracking (Lachenbruch, 1966; Mackay, 1984; Sarrazin and Allard, 2015). The objective of this project is to assess the activity of frost-cracking, ice-wedge polygons and tundra polygons across the bioclimatic zones of Nunavik. Since frost-cracking is a temperature-controlled process affecting materials with different rheological properties, it is assumed that polygon activity is related to surface climate conditions, soil materials, vegetation type and snow cover. We analyzed thousands of georeferenced aerial photographs (MFFP: 42 474/ CEN: 37 500) to make a thorough inventory of tundra polygons across Nunavik; in total 1073 tundra polygons sites were inventoried. For each identified site, the probable type of ice or soil wedge, the form of the polygons (e.g, open, closed, flat, high-center, low-center, nested networks), the surficial geological material and the vegetation cover type was recorded in a database. We also dug dozens of soil pits near Akulivik and Salluit to find out the degree of frost-cracking of the ice-wedge polygons under current different climate conditions and ground temperatures at the potential boundary between active and inactive ice wedges. Mapping the results indicates that ice-wedge polygons occur in a variety of sedimentary environments. The results also show that currently active ice wedge polygons in Nunavik occur only above 62°6'.0623" Lat N, in the herbaceous tundra and principally in organic-covered raised beaches and sandy fluvial terraces. The vast majority of polygons in the shrub tundra occur on top of drumlins and in sand deposits. Since their furrows are often colonised by shrubs, they appear to be currently inactive and, therefore they formed under colder past climates. The next step of the research will consist in using the TTOP model to define more precisely the ground temperature conditions that regulate ice-wedge activity in Nunavik under current and past climates.

RENEWABLE CAPACITY LIMITS: WHY THEY ARE IMPLEMENTED AND HOW THEY IMPACT ISOLATED COMMUNITIES

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Throughout Canada there is growing demand for utilities to supplement aging infrastructure with clean technologies that emphasize the usage of renewable resources, such as wind and solar. An abundance of renewable resources – even in the Arctic – make them an attractive alternative replacement for existing diesel generated power. However, the variable and unpredictable nature of these resources present challenges for utilities aiming to integrate them within existing power systems. Northern Energy Innovation (a research program at the Yukon Research Centre, Yukon College) aims to provide a comprehensive breakdown of the territorial policies and technical issues that impact a remote grid's reliability, adequacy, security and safety in a style of language that is accessible to the public. To prevent the variable and unpredictable nature of renewables from affecting services, utility policies or standards are in place in Northwest Territories, Nunavut and Yukon and limit the amount of renewable resources that can be integrated into a community's grid. The policies in place do not allow renewable resources to exceed a limit of 20 percent of installed capacity, however, the methodology used for setting these capacity limits is different for each territory. This presentation explains the differences between each territory's policies and their methodologies, illustrating how each policy will lead to significantly different outcomes in the amount of renewable resources that can be incorporated into a community. This presentation will also explain why these limits exist. Electricity utilities are mandated by the public utilities boards to provide reliable, adequate, secure and safe electricity for their customers. While diesel power has been a safe and reliable option for decades, there is political and public motivation to reduce diesel consumption and reduce greenhouse gas emissions in the Territories. Renewable resources provide a cleaner alternative, however, they come with technical barriers that can affect a utility's ability to meet their mandate. There are several technical considerations to integrating renewable resources in remote northern communities. This presentation will review these technical barriers while acknowledging that moving beyond technical considerations to a holistic perspective that scrutinizes social, economic and environmental benefits and barriers is ultimately necessary for discussing these capacity limits.

ATMOSPHERIC FORCING OF RAPID MARINE-TERMINATING GLACIER RETREAT IN THE CANADIAN ARCTIC ARCHIPELAGO

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Examining frontal changes of multiple marine-terminating glaciers on a decadal time scale can help identify when major changes have occurred and help determine the primary drivers of the trends observed. We have used statistical methods to determine relative influence of atmospheric versus oceanic temperatures on glacier retreat in the Canadian Arctic Archipelago (CAA) on a regional scale. We used archival aerial photographs and satellite imagery to map changes in frontal positions of 300 marine-terminating glaciers in the CAA (from southern Baffin Island to Ellesmere Island, excluding those on the northern coast). Results include total changes in area and length since the late 1950s, as well as trends in change rates across 6 time intervals. Over 94% have retreated from the late 1950s to 2015, and there is a similar temporal pattern of retreat throughout the region: glaciers show gradual retreat in early years, with a five-fold increase in retreat rates since ~2000. To understand the primary control behind the regional trend, the results have been analysed alongside ocean temperature records and atmospheric climate model results. Statistical analyses reveal that on a regional scale ocean temperatures have had little control on the frontal change rates. The clear correlations with surface melt, however, indicate that increasing atmospheric temperature has been the principal driver behind glacier front retreat across the region. In the presentation I will outline the methodology we used to extract glacier front information from archival visible band imagery. The methods we used to analyse the digitized ice front positions have been rigorous and have resulted in an extensive dataset of glacier-change measurements. Spatial analysis of this dataset using GIS indicated that there are no clear geographic differences in change-rates, but there is a strong temporal trend observed throughout the archipelago. I will demonstrate the statistical methods we used on both ocean temperature measurements (within 20 km of glacier fronts, at each standard depth) from the World Ocean Database (1972-2015), and melt rates for individual glacier basins from the latest 1-km downscaled version of the Regional Climate Model (RACMO), to explore the drivers behind the changes in all the glaciers in the study region. From these results, we show that marine-terminating glaciers in the CAA have been rapidly retreating in response to increasing surface ablation, and not to oceanic temperatures as observed elsewhere in the Arctic and Antarctic. Furthermore, ice volume change calculations over the same time period, from surface models produced from historical aerial photographs and recent imagery, indicate considerable surface mass loss. The sizeable impact on marine-terminating glaciers from the rapid atmospheric temperature increase in this region is evident.

JAN MAYEN GLACIER FLUCTUATIONS

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Jan Mayen is a small, remote island in the North Atlantic part of the Arctic Ocean, located 550 km east of Greenland, the nearest landmass. This island contains Beerenberg, the northernmost subaerial volcano, with an elevation of 2277 m a.s.l. The 20 tidewater and land-terminating glaciers which clad this volcano range in length from 4-9 km, and in area from 2-15 km2. These glaciers have experienced an oscillating retreat and advance pattern since the end of the last ice age that continues into current times. We present the most complete glacier fluctuation history of Jan Mayen to date, based on maps since the 1800s, historic records and glacier inventories, scientific literature, and remote sensing observations including aerial photography and satellite data. There are no discernable retreat/advance patterns related to position on the flanks of Beerenberg. Currently, calving fronts exist on both the north and south side of the volcano, but over the period 2000-2015, 3 of the 7 tidewater-terminating glaciers retreated onto land. While the current calving flux of Jan Mayen glaciers is negligible in comparison to Svalbard and Greenland glaciers, our research contributes to the Pan-Arctic tidewater glacier fluctuation and calving flux inventory currently in progress. Due to similarities in size and morphology of the Jan Mayen glaciers, this location presents a perfect setting to study individual and combined drivers of mass balance and ice flow on dynamic glacier changes, and to unravel complex processes at a small scale. For this purpose we will use our glacier fluctuation record in combination with long-term passive seismometer records, synoptic weather observations, radiosonde data, and energy balance measurements that were conducted on Sørbreen, the best studied land-terminating glacier. Passive seismometer data will reveal the seasonality of small-scale calving events that occur on the Jan Mayen tidewater glaciers. These glaciers do not terminate in fjords, where most current tidewater glacier research is focused, but instead along open-ocean coasts. In addition, Jan Mayen is commonly shrouded in fog and has related persistent low-level temperature inversions. The effect of these atmospheric conditions on glacier mass and energy balance are currently ill-quantified. Therefore, the glacier fluctuation records presented in this conference talk will feed into several process-based studied advancing the understanding of glacier dynamics across the Arctic.

DISTRIBUTION AND ORIGIN OF MAJOR AND TRACE METALS AND POLYCYCLIC AROMATIC HYDROCARBONS IN SURFACE SEDIMENTS FROM THE CANADIAN ARCTIC ARCHIPELAGO

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In Arctic, because of the continual diminution of the summer sea ice coverage during the last four decades, it has been speculated that the North West Passage within the Canadian Arctic Archipelago (CAA) could open to cargo transportation, which is a shorter route between Asia and North America compared to Suez or Panama. This new shipping route could allow the maritime industry to reduce their navigable distances by up to 40% and reduce consequently the fuel consummation and CO2 emissions. However, an increase in maritime transportation in the CAA is suspected also to enhance the releases of inorganic (such as water-soluble inorganic salts and mineral elements) and organic (such as polycyclic aromatic hydrocarbons or PAHs, polychlorinated biphenyls or PCBs) pollutants derived, e.g., from fuel and oil leaks and hydrocarbon combustion. In this context, the purpose of this project is to characterize the baseline spatial distribution patterns of major and trace metals (Al, Ti, Fe, Mn, Li, V, Zn, Cu, Ni, Cr, Pb and Cd) and PAHs (phenanthrene, fluoranthene, pyrene, benzo[a]pyrene, chrysene) across the CAA. To achieve this goal, several box cores (96) distributed over a large area covering the Canadian Beaufort Sea to the Baffin Bay were sampled during the 2016, 2017 and 2018 ArcticNet expeditions aboard the CCGS Amundsen. Three acid extractions will be performed on sediment samples and analyzed by inductively coupled plasma mass spectrometry to evaluate the distribution and potential bioavailability of major and trace elements. While, PAHs will be extracted using a solvent accelerated extraction system and quantified by gas chromatography mass spectrometry. Overall, the data obtained, combined with normalized enrichment factors and multivariate statistical (notably principal component and fuzzy c-means clustering analyses) will allow to provide a baseline of major and trace metals and PAHs, determine their associations and specific sites within the CAA with possible anthropogenic influences.

THE FATE OF PETERMANN ICE ISLANDS: USING THE CI2D3 DATABASE TO INVESTIGATE SIZE DISTRIBUTIONS AND MELTWATER DISPERSAL AFTER PETERMANN GLACIER CALVING EVENTS

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Episodic calving events at Petermann Glacier, northwest Greenland generate large ice islands that subsequently drift through Nares Strait, Baffin Bay and the Labrador Sea. The largest and most recent calving events occurred in 2008, 2010 and 2012 and created Petermann ice islands (PIIs) of ~30, 140 and 300 km2 in surface areal extent, respectively. Such large, tabular icebergs are potential hazards to regional shipping, and their ability to drift into relatively shallow water and reach southern latitudes (~42°N) results in risk to natural resource extraction operations offshore of Newfoundland. Furthermore, ice islands distribute freshwater from the Greenland Ice Sheet (GrIS) over a vast area as they drift and deteriorate. In this study we use the new Canadian Ice Island Drift, Deterioration and Detection (CI2D3) Database to investigate the dispersal of meltwater through the eastern Canadian Arctic and sub-Arctic after the 2008, 2010 and 2012 Petermann Glacier calving events. The CI2D3 Database represents ~17,000 observations of PIIs that were identified and monitored with synthetic aperture radar satellite imagery. A unique component of the CI2D3 Database is the capture of the ice island lineage, which made it possible to quantify the spatial distribution of meltwater for the numerous, individual PIIs that are represented in the database. The lineage was used to calculate reductions in ice island areal extent and model basal and surface ablation. The greatest amount of meltwater input, as calculated with a 50x50 km grid, was within the Petermann Fjord (2.0 milli-sverdrups (mSv)). Augmented input (up to 0.4 mSv) was also calculated in the vicinity of grounded ice islands. When integrated over a larger spatial area, we found that meltwater flux into the Baffin Island and Labrador currents resulting from deteriorating PIIs was not large enough to independently weaken the Atlantic Meridional Overturning Circulation. However, this meltwater input adds to the already increasing magnitude of freshwater from the GrIS. This is of concern due to the global implications of weakening deep-water convection in the Labrador Sea. Fracturing contributes to the further dispersal of meltwater as the individual ice hazards drift independently of each other. The database was also used to analyze ice island size-frequency distributions. These did not vary spatially or temporally and were best represented by a power-law model. The model slope (~ -1.7) suggests that fracture remained an important deterioration process throughout the lifespans and drift trajectories of the PIIs. This study of PII deterioration is the first to be conducted for the full flux of ice islands that are generated after Petermann Glacier calving events. The investigations were possible due to the unique information that is captured in the CI2D3 Database. The results are of value to both of the main ice island research themes: the implications of ice islands as marine hazards as well as their role in freshwater dispersal.

TŁĮCHǪ DǪTAÀTS'EEDI (TŁĮCHǪ SHARING FOOD AMONGST THE PEOPLE)

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Climate change is being felt acutely in Canada's north. For the Tłı̨chǫ people in the Northwest Territories, climate change is felt in many different ways. One significant impact is that climate change has put pressure on caribou populations, a vital source of both food and cultural identity. For the Tłı̨chǫ, adapting to climate change has meant addressing food security as well as cultural revitalization as both are now under threat. Tłı̨chǫ Dǫtaàts'eedı is a program that addresses food security in the four Tłı̨chǫ communities. It just so happens that while addressing food security, it also builds cultural resilience, promotes intergenerational relationships and community support networks, prioritizes traditional knowledge, promotes cultural practices, creates a culturally appropriate model for community justice and more. The program is simple. Tłı̨chǫ Dǫtaàts'eedı pairs young adults, who struggle in their community, with experienced harvesters. As a team they go out fishing, hunting, trapping, snaring and berry picking. Food that is harvested is brought to the community and distributed by the youth to Elders. On paper it seems simple. So why, in practice, does it seems more like magic? In our presentation we will talk about our program and delve into the key elements that make Tłı̨chǫ Dǫtaàts'eedı about so much more than just food security. We will discuss our community led measures of success and on the land evaluation, and we will introduce some of the people in all level of the program who make the program what it is.

THE DISTRIBUTION OF BIOACTIVE TRACE METALS THROUGH THE CANADIAN ARCTIC MEASURED DURING THE GEOTRACES PROGRAM

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Climate change is rapidly changing the Canadian Arctic Ocean system. The Arctic Ocean represents an important pathway of direct communication between the North Pacific and the North Atlantic. Modification of Pacific origin waters along this pathway can potentially impact climate relevant physical and biogeochemical processes in the North Atlantic. Here we present profiles of seven bioactive trace metals (Fe, Ni, Cu, Zn, and Cd) from the Canadian Arctic GEOTRACES program along this path in 2015 (GN02 and GN03). Samples were collected from 18 stations, covering the Canada Basin, the Canadian Arctic Archipelago, and Baffin Bay on two cruise legs on board the CCGS Amundsen (July 10th – August 20th and September 4th – October 1st). A peak in concentration was observed in Pacific-origin waters in the Canada Basin for all metals, with notable maxima observed in Cd, Zn and Ni profiles. Elevated trace metal concentrations and trace metal-macronutrient relationships indicate penetration of Pacific-origin waters into Baffin Bay. Insight into the modification of the Pacific-origin water during transit through the Canadian Arctic Archipelago will be discussed.

DEEP-SEA LOSS OF DISSOLVED IRON IN THE ARCTIC OCEAN: POTENTIAL INSIGHT INTO THE OCEANIC BUDGET OF AN ESSENTIAL TRACE NUTRIENT

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Here we present new measurements of total dissolved (1000 meters) waters of the Canada Basin in the Arctic Ocean measured during the Canadian GEOTRACES program. We show that compared to the major ocean deep basins Fe concentrations in the Canada basin are low in deep waters averaging 0.24 ± 0.08 nM. A compilation of deepwater dissolved measurements from the Arctic demonstrate that Fe concentrations diminish linearly with increasing deepwater age in the Arctic basins at a rate of ~ 4 pM per year allowing a first order estimation of Fe scavenging rate of 0.004 – 0.013 per year. A residence time of 77 – 233 yr for Fe in the Arctic Ocean is implied. This imbalance between sources and sinks in the Fe budget of the Arctic appears to be atypical and the potential for the system to provide insight into the global ocean Fe budget is discussed.

INUIT HEALTH AND WELLBEING IN NUNAVIK AND NUNATSIAVUT

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This Chapter applies a social determinants lens to health-related research published about Nunavik and Nunatsiavut since the last IRIS report (2013 to 2017), in order to further understand the state of literature regarding the health and wellbeing of Inuit in Nunavik and Nunatsiavut. Information is drawn from available published literature, Nunavik and Nunatsiavut’s most recent regional health plans, Inuit Tapiriit Kanatami’s 2014 report Social Determinant of Inuit Health in Canada, and related grey literature. Understanding the interconnectedness of determinants of health, this Chapter categorizes the published research into six determinants of Inuit health, and examines how these determinants influence health outcomes in these regions: land, environment and climate; cultural continuity and intergenerational transmission of knowledge; nourishing, accessible, and preferred foods and water; maternal health and early childhood development; livelihoods, socioeconomic status, and educational opportunities; and, health-sustaining systems, resources, and service provision. This Chapter highlights key research themes and gaps, as well as recommendations to improve Inuit health outcomes within these regions. This research indicates that 1) Inuit health in Nunatsiavut and Nunavik is a complex interplay among cultural, environmental, socioeconomic, and political shifts; 2) Inuit determinants of health need to be defined by Inuit, based on Inuit culture, lands, and water; and, 3) it is important to draw from Inuit strength and resilience to improve health outcomes in Nunavik and Nunatsiavut. Finally, although important research and policy change have occurred since the previous IRIS Report, more research, funding, and resources that take into consideration Inuit conceptualizations of health and wellbeing, Inuit self-determination in research, and already-present strengths and resilience, are needed to support Inuit health and wellbeing in Nunavik and Nunatsiavut.

SYSTEMATIC REVIEW OF FACTORS RELATED TO FOOD (IN)SECURITY STATUS IN NUNAVIK, QUEBEC

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Food insecurity is an urgent public health issue as it has been 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 Nunavik, Northern Quebec. Many large-scale and longstanding interventions have been implemented in Nunavik to address food insecurity, such as the Nutrition North Subsidy program and the Hunter Support Program. Despite these, and many other interventions, the most recent reports of food insecurity estimate that more than 50% of Inuit in Nunavik 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. In retrospect, it often becomes clear that more effective impact could have been achieved if the intervention had been 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 in Nunavik, we conducted a systematic literature review, following PRISMA guidelines, to identify all known direct and indirect factors that affect food (in) security status among Inuit in Nunavik. The following databases were searched for primary and grey literature: Web of Science, Medline, Academic Search Elite, Bibliography of Native North Americans, International Bibliography of the Social Sciences, PubMed, CINAHL, Érudit and PsycINFO. The keywords used included the terms Nunavik, food (in)security and several of their respective synonyms. To further retrieve relevant primary and grey literature unobtained by the database searches, we hand-searched the reference lists of included studies. Using a two-step screening process, all primary and grey literature, written in English or French, that quantitatively or qualitatively analyzed a direct or indirect relationship between one or more factors and food (in)security status among Inuit in Nunavik were included in the review. Data were systematically extracted from each study using a custom data extraction form. Content analysis was used to categorize sections of the full-text in sources and all identified direct and indirect factors related to food (in) security in Nunavik. This systematic literature review is the basis of a Master's research project proposal to statistically explore how 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 proposed project are expected to support the consideration and development of new interventions to address food insecurity in the region.

IMPORTANCE OF ROCK FLOUR TO CARBON CYCLING IN GLACIAL RIVER SYSTEMS OF THE LAKE HAZEN WATERSHED

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Northern freshwater and marine ecosystems have garnered keen interest from the scientific community based on their susceptibility to climate induced change. Canada's high Arctic contains heavily glaciated terrain that has succumbed to widespread glacier ice cover and mass losses over the past several decades. Consequently, seasonal pulses of glacier melt water to downgradient aquatic systems have also increased, thereby implicating hydrologic mass budgets and biogeochemical cycling. Dissolved inorganic and organic carbon (DIC and DOC) are key components of the global carbon cycle and require greater understanding in glacially-impacted freshwater systems. Lake Hazen is Canada's most northern large lake (75 x 12 km; max depth ~ 265 m) and is fed by seven (7) rivers dominated by glacial runoff, making it an ideal sentinel for change in the Canadian high Arctic. In this study, we discuss findings from an interannual dataset (2016 to 2018) comprised of intensive sampling sites for glacial river transects spanning headwaters just below glacier termini, mid-river, and river deltas discharging to Lake Hazen. Whereas findings thus far highlight biogeochemistries as changing aggressively along glacial river continua, the processes responsible for dictating these changes require greater resolution. Theoretical stable carbon isotopes of DIC (δ13C-DIC) were calculated using [DIC], pH, temperature, and pCO2 for a model system assuming equilibrium conditions and no additional sources of DIC for comparison with actual laboratory measured values. To explain departure of measured δ13C-DIC from theoretical values and to assess the importance of rock flour in these systems particulate phase δ13C-PC, PIC, and POC were interpreted in tandem with radiocarbon signatures (Δ14C). DOC composition was assessed using absorbance (aλ, Sλ-λ, SR), fluorescence excitation emission matrix spectra (EEMS), size exclusion chromatography (SEC), and stable carbon isotopes (δ13C-DOC). This research aims to deconvolute interplaying processes intrinsic to carbon cycling in glacial river systems, posit how this may be impacted by future changes in regimes of glacier melt water fluxes, and to approach a better understanding of what the implications could be for receiving aquatic systems in the Canadian high Arctic.

COASTAL AND OFFSHORE PERMAFROST IN THE SOUTHERN BEAUFORT SEA- STATE OF KNOWLEDGE AND APPRAISAL OF RESEARCH NEEDS

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Permafrost terrain makes up >30% of the world's coastline and underlies extensive areas of the continental shelf of the Arctic Ocean. The UNEP Rapid Response Assessment initiative is striving to address the state of knowledge of permafrost coasts and consider research needs in the continuum from the Arctic coastal plain to the offshore. While considerable research has been conducted on permafrost to date, investigations have largely focused on periglacial processes and the geotechnical properties of permafrost. There is increased recognition that permafrost must be considered within a multidisciplinary framework as a condition of the Earth that is varying in four dimensions. This talk will review the state of knowledge and research gaps associated with the dynamic environment of the southern Canadian Beaufort Sea where marine transgression has been ongoing for more than 10,000 years. In this area, submerged terrestrial permafrost and associated permafrost gas hydrates extend more than 100km offshore and can affect sediments up to 1000m below the seabed. The thermal impact of transgression is ongoing, resulting in unique geologic, hydrologic and biogeochemical processes. In the nearshore where the warm (>0°C) seabed temperatures are encountered, permafrost thaw occurs rapidly causing settlement and releasing fresh water and methane. In the mid and outer shelf, resident bottom water temperatures are negative. Here the submerged permafrost interval continues to warm slowly from base, substantially changing sediment properties at depth and degrading deeply buried gas hydrates. Geologic processes in this environment include sediment collapse and changes in deep geopressures as well as permafrost aggradation from the seabed. In the outer shelf and upper slope (water depths between 100-400m) seabed temperatures are positive and there is a complex coalescence of geologic processes that include extensive marine landslides, offshore thermokarst and sea floor expulsion features. In terms of appraising research gaps, we note that very little permafrost research has been conducted in the nearshore, despite this being the area where the greatest changes are expected. Societal concerns in this environment include the assessment of accelerating rates of coastal erosion that threaten communities on the coast, changing coastal ecosystems, contaminants and methane released from thawing permafrost, and loss archeological sites. Our lack of knowledge of coastal and near shore permafrost is in part a consequence of the shallow waters, which preclude access of larger Arctic research vessels normally used for marine investigations. Understanding of permafrost distribution and properties in the mid shelf, outer shelf and upper slope is more extensive, because industry has conducted hydrocarbon exploration in the past and collaborative international research programs have been undertaken in this setting. However, the area is vast and most scientific investigations only allow appraisal of the shallow geology and geologic processes. Our understanding of deeper geology and permafrost is substantially limited, as is our understanding of processes such as fluid and gas flux. Societal concerns in this area include quantification of geohazards related to oil and gas exploration, wide-scale seabed instability, submarine landslides possibly sufficient to generate tsunamis, and recognition of unique biological habitat.

THE INFLUENCE OF SEA ICE ON THE PROTIST SINKING EXPORT IN HIGH ARCTIC SYSTEMS

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The "biological pump", the photosynthetic fixation of carbon in the surface ocean followed by the sinking export of particulate organic carbon to the ocean interior, regulates food input to pelagic and benthic food webs, and ultimately the burial of carbon in the sediments. In the remote Arctic marine ecosystems, magnitude, composition and seasonal patterns of sinking flux of biogenic matter are best studied using moored autonomous observatories fitted with sequential sediment traps and sensors collecting sinking particles and environmental data throughout an annual cycle. Data from moorings deployed in a limited number of Arctic regions, including the Beaufort and Laptev seas, suggest that sea ice coverage variability can influence this biogeochemical process. Despite the deployment of long-term moorings in Svalbard fjords, the dearth of knowledge on sinking fluxes in these ecosystems limits our understanding of the drivers of this critical process for carbon cycling. The objective of this study was to assess the nature and magnitude of annual sinking flux of protists in two Svalbard fjords and identify forcing factors and implications for food web processes. One of the fjords, Rijpfjorden, has a seasonal ice cover whereas the other, Kongsfjorden, has been remaining almost ice-free since 2007. The latter is also more influenced by the Atlantic Water. We also compared protist sinking flux in the two Svalbard fjords with protist export in Queen Maud Gulf (QMG), an area of the Canadian Arctic Archipelago that experiences colder conditions leading to a much longer sea-ice season with thicker ice than in the seasonally ice-covered fjord. Interestingly, the protist total export was higher in the heavily ice-covered QMG than in Rijpfjorden for the 3 years compared. Furthermore, the export seasonal patterns were clearly different between QMG and the two Svalbard fjords. First protist peak export related to the spring-summer bloom occurred later in QMG than in the two Svalbard fjords whereas the peak flux of the obligate ice alga Nitzschia frigida occurred earlier in QMG in 2016 than in all years in Rijpfjorden. Succession in the protist assemblages being exported to depth was studied in the three systems through a multivariate approach. Drivers of the observed flux patterns are interpreted based on oceanographic and sea-ice cover information, and surface fluorescence data as a proxy for pelagic primary production.

ARCTIC CORRIDORS AND NORTHERN VOICES: WORKING TOGETHER TO REDUCE THE SOCIAL AND ECOLOGICAL IMPACTS OF INCREASING MARINE VESSEL TRAFFIC IN THE CANADIAN ARCTIC

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Increased navigability of Arctic waters, as a result of climate change has boosted commercial interest in northern shipping routes including the Northern Sea Route and the Northwest Passage (NWP). Vessel traffic in Arctic Canada remains substantially lower than in other parts of the global Arctic where ice dynamics, geography, and climate are more favourable including in Alaska, Greenland, Russia, and northern Europe. The NWP is not currently commercially viable. However, considering improved technology, infrastructure investments, and economic and political will, the NWP is very likely to become a regular trade route within the next few decades. This situation offers Canada a relatively short time period in which to develop appropriate maritime transportation management regimes aimed at positioning the nation as a global leader in Arctic oceans governance that is based on self-determined and shared leadership considering the multi-jurisdictional nature of the region, which includes federal and territorial governments as well as settled land claim areas. A promising approach to Arctic shipping governance in Canada includes 'Low Impact Shipping Corridors" (LISC) (previously referred to as the Northern Marine Transportation Corridors Initiative), which involves the identification of shipping routes where services and infrastructure can be prioritized and where shipping accidents can be reduced. The LISC is currently co-led by the Canadian Coast Guard, Canadian Hydrographic Service, and Transport Canada. Since 2015, the Arctic Corridors – Northern Voices research project has brought tougher federal agencies, transportation experts, and 14 Canadian Arctic communities to conduct a series of interdisciplinary research projects aimed at 1) improving our understanding of shipping trends and the potential impacts of ship traffic in Arctic Canada, 2) identifying potential management options and governance arrangements for increased ship traffic, and 3) ensuring that Inuit knowledge is properly infused into the prioritization of shipping routes and into the management of ship traffic. An overview of the project including major findings, outcomes, impacts, and next steps will be provided and can also be found at www.arcticcorridors.ca Support for this major partnered research initiative has been provided by: MEOPAR, Irving Shipbuilding, Clear Seas, Transport Canada, Canadian Coast Guard, Canadian Ice Service, World Wildlife Fund, Oceans North, ArcticNet, Polar Knowledge Canada, Social Science and Humanities Research Council, Nunavut Arctic College, Nunavut General Monitoring Program, Department of Fisheries and Oceans, and IKKARVIK among others.

MOBILIZING WATER DATA FOR DECISION-MAKING AND SHARED WATER STEWARDSHIP: DATASTREAM'S COLLABORATIVE OPEN DATA INITIATIVE

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Lack of access to data on the health of freshwater ecosystems is a chronic barrier to effective watershed management throughout Canada. While a range of community-based and government monitoring initiatives are generating valuable information, these datasets can be difficult to access and, in some cases, are not available at all. This is especially true for water quality data. DataStream is designed to address this challenge by providing an open access, online platform for sharing water quality data. DataStream's model supports a flexible platform to accommodate a wide range of water quality datasets contributed by diverse monitoring initiatives. These groups can "plug into" DataStream's data management infrastructure to store, visualize, and share their data. With a searchable database, contributors and other data users can access monitoring data collected by other across watersheds in a common data format that is aligned with internationally recognized standards. An initiative led by The Gordon Foundation, DataStream was first launched in the Mackenzie River Basin where it was built in collaboration with the Government of the Northwest Territories. Following its success in the Mackenzie Basin, DataStream is now being scaled up in collaboration with other regional water monitoring networks, most recently in Atlantic Canada. This presentation will discuss DataStream's ongoing efforts towards advancing ethically open data to support evidence-based, collaborative water stewardship.

ADVANCES MADE, AND LESSONS LEARNED IN DEVELOPING A COLLABORATIVE OPEN-DATA PLATFORM FOR COMMUNITY-BASED WATER MONITORING

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In the context of increasingly complex environmental issues, community-based and community-led water monitoring initiatives are generating valuable information to track the health, changes and impacts on local aquatic ecosystems. Yet barriers to data sharing and reusability remain chronic issues that hamper the ability to leverage this information to its full potential. To address this challenge, The Gordon Foundation partnered with the Government of the Northwest Territories to explore the potential of an online, open-access platform for sharing Western-scientific water quality data across the Mackenzie River Basin. In building Mackenzie DataStream, we sought to provide an independent home for data that would facilitate the sharing of information collected through diverse monitoring programs of varying scale, focus, and intent; and across multiple, sometimes overlapping, jurisdictional boundaries. Following its success in the Mackenzie Basin, DataStream is now being scaled up in collaboration with other regional water monitoring networks, most recently in Atlantic Canada. DataStream is designed to be as accessible as possible, including to those without a scientific or technical background, while offering a scientifically robust system for data storage and management that is aligned with internationally recognized data standards. Building DataStream is an ongoing, collaborative, and iterative process. This presentation will explore some of our key successes, challenges, and lessons learned, including around addressing issues of data security, access, and ownership; multi-sectoral, multi-disciplinary collaboration; and connecting people and data across remote regions.

RECENT CHANGES IN VEGETATION PRODUCTIVITY ACROSS THE BATHURST CARIBOU RANGE

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The productivity of tundra and boreal forest vegetation has undergone rapid change in recent decades. Increases in vegetation productivity, termed "greening" have frequently been attributed to the proliferation of deciduous shrubs and are occurring mainly in the tundra, while decreases ("browning") are often attributed to drought stress and have been observed primarily in the boreal forest. These changes are likely to substantially impact northern wildlife, including barren ground caribou. We used enhanced vegetation index values derived from MODIS satellite imagery to quantify changes in vegetation productivity over the past 20 years within the annual range of the Bathurst caribou herd, which has recently undergone a sharp population decline. Areas that have experienced forest fires in the last 50 years were removed from the analysis in an attempt to identify areas where climate may be the primary driver of change. We found substantially more greening than browning trends after the effect of fire had been removed. Specifically, significant greening occurred in 16% of the annual range (approximately 23,000 km2), while significant browning occurred in only 1% of the range. The herd's calving grounds experienced less significant change, with 10% (approximately 1800 km2) greening and less than 1% browning, while late summer range experienced the most change. Future work will include a dendrochronological analysis of shrub recruitment and growth, as well as a spatial analysis of caribou collar data. Together, these results will reveal the extent and magnitude of vegetation change within the herd's range, the mechanisms of that change, and the response of caribou to that change.

DIET COMPOSITION OF RINGED SEALS (PUSA HISPIDA) IN HUDSON BAY REVEALED USING STABLE ISOTOPES

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Understanding the dietary changes of a single species provides essential insights into trophic interactions within an ecosystem. Ringed seals (Pusa hispida) are opportunistic and generalist feeders consuming various fish and invertebrate species; making them an important link in the Arctic food web, as well as an important component of Inuit subsistence and culture. Previous diet studies have documented differences in ringed seal diets. However, few studies have been able to quantify temporal changes in diet. Stable isotopes (δ13C and δ15N) are useful tools for quantifying diets of predators and measuring population-level diet composition. The objective of this study was to examine the spatial and temporal diet variation of Hudson Bay ringed seals using Bayesian mixing models. Inuit hunters sampled tissues from seals harvested during the open-water period from 2003-2017 in three Nunavut communities: Arviat, Naujaat and Sanikiluaq. We used liver and muscle isotopic composition of approximately 1200 tissues collected from seals of both sexes and age-classes (juveniles and adult) to determine diet composition. Our preliminary results confirm temporal and spatial differences in ringed seal diet. For instance, average Arviat ringed seal isotopic signatures in 2003 of δ15N were 14.8 ‰, which increased to 16.4 ‰ in 2017. Diet composition determined using mixing models revealed that this was likely reflected by a decrease in common invertebrate prey (mysids, euphausiids, and amphipods) and increase in capelin (Mallotus villosus), and sandlance (Ammodytidae Spp.). The same increase in δ15N signature was observed in Sanikiluaq over the same time period, initially 14.9 ‰, which increased to 15.8 ‰ in 2017. Spatial differences were also observed, in 2017 average δ15N signatures were 17.5‰ in Naujaat, the northern most community in the study area. Ringed seals in Naujaat are likely consuming fewer invertebrates and more fish species compared to the seals in southern Hudson Bay, a consequence of shifting prey distributions. Both Sanikiluaq and Naujaat had similar δ13C signatures around -18.5‰ and were less depleted compared to Arviat, -21.3‰. These differences suggest that seals in Arviat are foraging in more coastal and benthic areas. Diet models will quantify prey proportions in the seal diets and will be used to explain the isotopic signature differences observed. Understanding factors affecting ringed seal populations will be essential for the development of co-management strategies, and to provide accurate predictions of the status of the Arctic ecosystem throughout this period of environmental change. This project will expand on previous work conducted in the Hudson Bay marine ecosystem to better understand current ringed seal foraging ecology and implications for seal health.

RESTORING PUBLIC TRUST: EVOLUTION IN THE NORTH AMERICAN MODEL OF WILDLIFE MANAGEMENT

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Experts who study wildlife management have documented important changes in the field over the last several decades. Most recently, these changes suggest a transition toward using wildlife management approaches that include the following characteristics: the involvement of stakeholder groups in decision making processes; the recognition that a healthy functioning ecosystem requires attention to all species, not just those of interest to hunters; respecting and including various sources of knowledge, such as local and expert knowledge, in decision making; and collaboration between relevant government departments that have a responsibility to manage various aspects of the landscapes where wildlife species live. Collectively, these are identified as characteristics of Integrated Resource Management (IRM) approaches. This study reveals that, with respect to the reported trend toward more IRM-focused approaches, there is a gap between what is written in the literature and how wildlife management is carried out. Evidence of this gap comes from a case study of the management response to significant caribou population declines on the island of Newfoundland on Canada's east coast. By conducting in-depth interviews with members of a insular Newfoundland Caribou management task force and by critically reviewing relevant news stories, government press releases, and government reports, I determined that while there is some evidence of integrative approaches being practiced in the context of Newfoundland caribou management, significant challenges remain that inhibit the adoption integrative approaches. These findings have implications for wildlife management practice in both Newfoundland and Labrador - the northern portion of the province - as opportunities are identified for a more stakeholder-engaged wildlife management structure that affirms the importance of seeking out, respecting, and integrating the views of those most directly affected by wildlife management policies.

OPTIMIZATION OF INDOOR AIR QUALITY (IAQ) PARAMETERS IN NUNAVIK DWELLINGS AND ITS IMPACT ON THE RESPIRATORY HEALTH OF RESIDENTS (PROJECT VENT-NUNAVIK): MICROBIOLOGICAL PART

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Nowadays, indoor air quality (IAQ) is a major issue for public health, particularly in the northern Canada. A multidisciplinary project, grouping several institutions as National Research Council of Canada (CNRC), the National Institute of public health of Québec (INSPQ), Laval University, NunaviK Health Department and Kativik municipal housing office (OMHK), aims to study the IAQ in dwellings in Nunavik regarding to the ventilation system. The main objective of the study is to assess the impact of ventilation system optimization on IAQ. To do this, dwellings with three types of ventilation systems (without ventilation, heat and energy recovery ventilation system) were investigated before and after ventilation system optimization. The IAQ was assessed measuring physical (airflow rate, temperature, relative humidity, PM10, PM 2.5), chemical (CO, CO2, COV, aldehydes) and microbiological (total bacteria, endotoxin, house dust mite concentrations and microbial biodiversity). Metadata were also collected at the two steps of the sampling: before and after optimization. To focus on the microbial part, bioaerosols were collected using high flow samplers (final volume of 20 m3 of air) and dust samples were harvested using a micro-vacuum (ASTM D7144 method on 225 cm2). Total bacteria and Penicillium/Aspergillus concentrations were both quantified by qPCR and microbial biodiversity were studied by high throughput sequencing targeting the bacterial barcode 16S rDNA

WHAT ROLE CAN TELECOMMUNICATIONS COMPANIES PLAY IN THE DEVELOPMENT OF CONNECTIVITY IN THE ARCTIC?

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(1) Versailles-Saint-Quentin University, Versailles, FranceDefined as a basic need in several Arctic countries, Internet access is an essential tool needed to take part in the globalized economy, a factor of economic development and a way to connect to the rest of the world via social networks, for isolated arctic populations. A priority of the Finnish Chairmanship of the Arctic Council, connectivity is a major issue for the development of the Arctic, which has been, and continues to be, the subject of numerous reports and conferences. While there is no circumpolar strategy for the development of Arctic telecommunications infrastructures and a circumpolar policy-making, what role do telecommunications companies have or could have in developing these infrastructures by cooperating with the various Arctic stakeholders ? The Arctic telecommunications companies has a strong expertise of developing infrastructures in rough conditions, that could help to shape the policies of telecommunications infrastructure development in the Arctic, while at the same time having interests that can sometimes diverge from those of local stakeholders.

FIRST ROV OBSERVATIONS OF THE COLD-WATER REEF-BUILDING CORAL LOPHELIA PERTUSA IN SOUTHWEST GREENLAND

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Lophelia pertusa is a long-lived reef forming cold-water coral of cosmopolitan distribution. In the Northwest Atlantic, reports of L. pertusa have been mainly restricted to the region between Nova Scotia (44.5 °N) and the Gulf of Mexico. In 2012, a piece of this coral was accidentally caught in a Rosette sampler during an AZOMP (Atlantic Zoning Off-Shelf Monitoring Program) survey in Southwest Greenland lead by Fisheries and Oceans Canada. In August 2018, we used the SuMo remotely operated vehicle (ROV) aboard CCGS Amundsen to video-survey the general location where L. pertusa has been discovered in 2012 (~60.3 °N). Our main objective was to collect imagery data to describe L. pertusa's depth distribution and its associated biodiversity, as well as its relationship to bottom geology and geomorphology at this location. A second site was also surveyed at ~ 0.45 km from the target site. Multibeam sonar bathymetry indicated almost vertical likely faulted bedrock, corroborated by the video surveys at both sites, with L. pertusa colonies growing on the steep rocky walls. We surveyed depths between ~710–990 m, with L. pertusa being observed between 750 and 940 m. Colony morphologies ranged from globular to shelf-like, and occurred on vertical, steeply sloping, or overhung bedrock surfaces. Dead Lophelia rubble was also commonly observed on rock ledges on steep bedrock walls between 770–935 m. Rubble piles often included both living and dead fragments of corals along with a diverse array of associates. Other corals observed growing on the bedrock surfaces near L. pertusa colonies include Primnoa resedaeformis and Paragorgia arborea gorgonians, bamboo corals (Isididae sp.), as well as soft corals (likely Duva florida, Family Nephtheidae) and Anthomastus sp. Soft corals seemed particularly large, being sometimes comparable in size to P. resedaeformis. Sponges include Geodia sp., Asconema sp. (glass sponge), Mycale sp., cf. Cladorhizidae sp. (carnivorous sponges), and encrusting species (e.g. Hymedesmia sp.). Other megafauna invertebrates commonly seen include Acesta sp. clams, sea anemones, pycnogonids, squat lobsters, crinoids, decapods, and sea stars (e.g. Henricia sp., cf. Novodinia sp.). Among fish we observed Redfish (Sebastes sp.), Wolffish (Anarhichas lupus), Cusk (Family Gadidae), white hake (Urophycis tenuis), and other unidentified species. On top of the ridges (~700 m), soft corals and sponges were common, but neither L. pertusa nor gorgonians were observed at those locations away from the vertical cliffs. Ongoing video analyses aim to identify potential patterns on the bathymetric distribution of live and dead L. pertusa colonies, as well as other megafauna seen in the videos. This Lophelia-rich system is still a pristine area, which may have escaped bottom-tending fishing gear due to its steep bathymetry. Protection of this site against future potential threats should be considered.

SIZE STRUCTURE AND CARBONATE CONTENT IN COLD-WATER SOFT CORALS

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Soft corals (Family Nephtheidae) are widespread in the Northwest (NW) Atlantic and are one of the most common groups of corals found in the Eastern Canadian Arctic, but little has been studied about their functional role. These corals have a flexible body mainly supported by a hydrostatic skeleton and $CaCO_3$ skeletal structures (i.e. sclerites) embedded in their tissue. As part of a Fisheries and Oceans Canada (DFO) project aiming to investigate functional roles of soft corals in Newfoundland and Labrador, and Eastern Arctic Regions, the main objectives of this study are to investigate patterns in the size structure and carbonate content of four soft coral species from Newfoundland to Baffin Bay in relation to latitude, depth, and season. Samples have been collected as bycatch during DFO annual bottom trawl surveys from depths ranging between 40-1480 m. Colonies were measured (height, width, and base width) and wet-weighed. For the carbonate content study, whole colonies were oven-dried, weighed (W1), and embedded in 5% HCl until complete dissolution of the $CaCO_3$ sclerites (~24-48 hours), then re-dried, and re-weighed (W2). Carbonate content was determined as colony % dry weight ([W1-W2]/W1). Our initial analyses indicate a significant effect of latitude on colony height in both Drifa glomerata (N = 637) and Duva florida (N = 952) colonies, and a significant effect of depth in colony height for the later only. Mean colony height was the highest in Labrador for D. glomerata colonies and in Southeast Newfoundland for D. florida colonies. Colony height and wet weight were highly related in both species, despite the potential for colony contraction in soft corals. In terms of carbonate content, our preliminary assessment indicates that $CaCO_3$ sclerites (carbonate) correspond to at least 45% and 30% of colony dry weight in D. glomerata (N = 12) and in D. florida (N = 14), respectively. There was no effect of latitude on the carbonate % of the examined specimens so far (from Fall samples and comparable depths), but an effect of colony height was identified in D. glomerata, with smaller colonies holding higher carbonate %. Ongoing analyses aim to also investigate patterns in sclerite metrics across latitude, depth, and season as well as carbonate and organic content in two other cold-water soft coral species (Gersemia rubiformis and Gersemia fruticosa). Our data show that despite having hydrostatic skeletons, these corals (particularly D. glomerata) largely rely on $CaCO_3$ as part of their bodies. Soft corals are one of the most conspicuous benthic invertebrates found in the Northwest Atlantic and Eastern Canadian Arctic. Understanding natural variations in colony metrics and $CaCO_3$ content across soft coral species, latitude, depths, and seasons is essential to build baseline information in the context of the potential anthropogenic impacts of fisheries and ocean acidification on these organisms and their interactions. and the fungal barcode ITS. Endotoxins were quantified by LAL assay. Finally, proteins Der p 1 and Der f 1 from house dust mite were measured using ELISA assay. 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 5.07101 copies/mg in air and dust samples respectively. The first results showed no differences in bacterial and Penicillium /Aspergillus concentrations between the several types of ventilation in air and dust samples. However, the heterogeneous metadata among the same group of ventilation and the important dispersion of concentrations values suggests an important variability of microbial parameters depending on the dwellings. Regarding to 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.

IMAPPIVUT (OUR OCEANS) MARINE PLAN: RECOGNIZING PEOPLE AND PLACE IN DECISION-MAKING

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As countries work to meet their international biodiversity targets to protect 10% of marine areas by 2020, Canada continues to explore effective mechanisms to achieve marine protection. At the end of 2017, the Government of Canada announced that it had achieved protection for 7.75% of Canada's marine areas through a combination of its three primary mechanisms for marine protection: Marine Protected Areas (MPAs), National Marine Conservation Areas (NMCAs), and Marine

National Wildlife Areas. As we move towards the 2020 deadline, both the federal government and Indigenous communities across the country have articulated the right of Indigenous communities, organizations, and governments to be involved in protected area designation and management. Inuit communities have identified over 20% of Arctic marine areas that need distinct management approaches. For example, Tallurutiup Imanga, established in 2017 in Lancaster Sound, Nunavut by the Government of Canada, the Government of Nunavut, and the Qikiqtani Inuit Association, became Canada's largest NMCA. Pathway to Canada Target 1 outlines the federal government's plans to achieve its 2020 biodiversity targets, which include emphasis on the creation of Indigenous Protected Areas (IPAs). The signing of the Labrador Inuit Land Claim Agreement (LILCA) in 2005 established the Nunatsiavut Government and Inuit region of Nunatsiavut in Labrador, Canada. LILCA (Chapter 6, "Oceans Management") sets out the ability of the Nunatsiavut Government to propose to the appropriate federal minister the creation of marine protected areas in the marine portion of the land claim. To pursue and fully implement Chapter 6 of the land claim, the Nunatsiavut Government initiated the Imappivut (Our Oceans) project in 2017 to create a marine plan for the 48,690 km2 of ocean area in the land claim. Imappivut is an integrated and adaptive marine plan that includes ecological, cultural, and economic needs of Nunatsiavut. Imappivut will establish guiding principles to inform decision-making related to the marine environment in Nunatsiavut. The plan will ensure that the priorities of Labrador Inuit are represented in any decisions impacting their marine environment. Imappivut takes a unique and integrative knowledge gathering and implementation approach that uses Traditional, local, and scientific knowledge to guide decision-making in Nunatsiavut waters. In addition, Imappivut has established working relationships with multiple government departments and agencies and non-government organizations to create cohesion in decision-making related to the marine environment. Imappivut compiles knowledge from a broad range of sources that will inform the creation of policies and programs that safeguard ecologically and culturally important areas for Labrador Inuit in the future, enhance safety on both open water and sea-ice, and ensure Labrador Inuit continue to have a healthy marine environment for future generations. Imappivut will make important contributions to conservation of biodiversity and will advance discussion around roles and rights of Indigenous communities in environmental management in Canada and internationally.

MODELLING GREENLAND ICEBERGS: THEIR PATHWAYS AS SOLID ICE AND MELTWATER

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Greenland icebergs populate the waters of Baffin Bay and reach the Grand Banks via the Labrador Current, where they stand in the way of important shipping lanes. Given the difficulty in monitoring the massive number of icebergs calved from Greenland, numerical models can be useful tools to understand iceberg trajectories. As a bonus, models also allow us to understand the pathways of iceberg meltwater and the manner in which it can affect ocean processes. With that in mind, we use the Nucleus for European Modelling of the Ocean (NEMO v3.4) coupled with two different versions of an iceberg module. The baseline version, used in all previous studies concerning Greenland icebergs, uses only the surface state of the ocean produced by the ocean model to move and melt icebergs. The second version, an improvement only applied to the Southern Ocean previously, allows the icebergs to interact with the three-dimensional ocean fields. When comparing the icebergs' distribution obtained by two simulations – each one using one version of the iceberg module, but otherwise identical – we observed that icebergs tend to move offshore when vertically-integrated ocean fields are taken into consideration. With this improved version, we used passive tracers to show how iceberg melt tend to enter the Subpolar Gyre while liquid Greenland discharge tends to accumulate in Baffin Bay. Although this suggests that icebergs would have a larger impact on Labrador Sea convection, icebergs act as a freshwater reservoir and so, when compared to an all-liquid discharge simulation, the mass of freshwater entering the ocean is slightly smaller, preventing further reduction of subduction rates in the interior Labrador Sea. This, however, might change in the future as Greenland calving rates increase.

PREDICTING POPULATION-LEVEL IMPACTS OF CONTAMINANTS IN MARINE MAMMALS

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Marine mammals like polar bears and killer whales are the most contaminated animals in the world. Persistent organic pollutants (POPs), like polychlorinated biphenyls (PCBs), can reach levels in these animals that raise concern as to potential individual and population health impacts. Here we explore the risk of adverse health effects of environmental contaminants in Arctic marine mammals. Several lines of evidence and approaches are presented in this risk assessment; 1) controlled in vitro exposure experiments, 2) risk quotient analysis, 3) mechanistic energy budget modelling, and 4) individual based modelling. PCBs continue to be the most important contaminant in terms of exposure levels and potential health effects on immunity and reproduction. Our results suggest that these legacy contaminants remain at high enough levels today that put vulnerable populations at risk, particularly killer whales and other toothed whales feeding at high trophic levels and in contaminant hotspots. While biomarkers and molecular effects are important tools for wildlife health assessments, it is important to move across levels of biological organization and predict effects occurring at the population level.

REMOTE SENSING OF OIL SPILLS IN A SEA ICE ENVIRONMENT: INVESTIGATIONS ON OIL COMPOSITION AND MITIGATION POTENTIAL

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Within the Arctic, global warming has led to continual decreases in sea-ice extent and thickness. Shipping and oil exploration is therefore becoming increasingly more feasible, thereby increasing the risk of crude oil or fuel being spilled into the marine environment. This impending possibility has led to a need for the development of oil detection and mitigation techniques suitable for ice-covered waters. Multidisciplinary studies of crude oil behavior in a sea ice environment were conducted at the University of Manitoba (UofM) Sea-ice Environmental Research Facility (SERF) over the course of three winters (2016-2018). Through these experiments, the presence of oil-in-ice was observed to increase the temperature and lower the salinity of the sea ice, thereby reducing the complex permittivity and normalized radar cross section (NRCS) of the ice. Furthermore, the changes made to the oil composition due to weathering (i.e., partitioning within sea ice, evaporation, dissolution, photo-oxidation, and biodegradation) led to spatial and temporal variations of oil permittivity in the sea ice. A resonance perturbation technique was used to measure the oil permittivities of the sampled oil-contaminated sea ice. The Quasi Two-Phase Tinga-Voss-Blossey and Polder–van Santen/de Loor Mixture Models for oil-contaminated sea ice were used to calculate the effective sea ice permittivity. Simulations using the modeled sea ice permittivity were performed to establish how changes in oil composition due to weathering processes affects the NRCS. The changes made to the oil's physical properties can potentially work as the basis of an oil type (i.e., light, medium, heavy) detection mechanism via remote sensing systems. This research seeks to aid in the advancement of oil spill preparedness suitable for Arctic waters. The development of remote sensing technologies will allow for fast response times to mitigate and minimize the extent of damage to Arctic waters and its local inhabitants. Furthermore, the capability of ascertaining the whereabouts and state of the oil-in-ice will provide guidance for an appropriate mitigation response, as the potential for various mitigation procedures (e.g., bio-remediation and in-situ burning) depend on the location and composition of the oil inside the sea ice.

CROWD-SOURCED BATHYMETRY IN NORTHERN CANADA

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A crowd-sourced bathymetry (CSB) scenario has been designed for the Northern Canada area as a response to situations where the lack of hydrographic infrastructure makes soundings reduction from basic depth measurements very challenging and where the data redundancy is not sufficient to use solely statistical tools as a mean of sounding estimation. The CSB scenario consist to train Inuit communities to the use of pre-qualified and integrated single beam systems. The pre-qualified systems used are Hydroballs, developed by CIDCO. During the summers of 2017 and 2018 workshops were done in different Northern communities. The presentation will detail the systems used, the deployments in the Northern communities and what are the benefits of this project for the local communities. In particular, we will detail the lessons learned throughout these two deployments and the data management, processing and dissemination phase of the project. This work has been conducted in the framework of the project “Crowd-Sourced Bathymetry in the Northern Canada area”, a project gathering the following partners from the COMREN network: - UNB (NB) - York University (ON) - Marine Institute (Memorial University) (NL).

SIX YEARS OF HIGH RESOLUTION MARINE DATA FROM THE CAMBRIDGE BAY OBSERVATORY: HOW LONG DO RECORDS NEED TO BE TO DETECT CLIMATE CHANGE?

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The Cambridge Bay Marine Observatory was installed in the summer of 2012, and has now monitored the near-shore Arctic environment for six winters, and counting. The core measurements include in water sensors such as temperature, salinity, and dissolved Oxygen, a shallow water ice profiler, and shore-based meteorological observations to monitor the atmospheric conditions. The cabled observatory can also support other specialized sensors for various studies, including Chlorophyll, pH, and pCO2 measurements to monitor biological and gas flux conditions. The data clearly reveal a suite of seasonal variations associated with the fall-winter transition, the cold winter ice growth period, and the dynamic spring transitions, both chemically, biologically, and physical. They are now clearly showing inter-annual differences and the range of variability in the freeze-up, ice growth, and melt processes. Do they hint at any longer-term climate signals? And more generally, how long do time series and environmental observations need to be before we can start to make reasonable assertions that we are seeing evidence of climate change? The observatory data, inter-annual variations, and climate assessments will be presented.

SAFE PASSAGE: A POLAR KNOWLEDGE CANADA PROJECT ON SEA ICE TO IMPROVE ARCTIC MARINE TRANSPORTATION

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“Safe Passage: Sea-Ice Research for Arctic Resource Development and Northern Communities” was a three year (2015-2018) project funded by Polar Knowledge Canada to study and quantify sea-ice conditions in Canada’s Arctic environments as it relates to marine transportation for both industry and communities. The project supported research at 6 Canadian institutions, lead by eight principal investigators. The research objectives included assessments, observations, model forecasts and studies across numerous regions in the Arctic, including Cambridge Bay and Dease Strait, Deception Bay and Hudson Strait, Baffin Bay, and the broader Canadian Arctic Archipelago. Several project elements included direct measurements of the marine and sea-ice conditions, including meteorology, ice cover, sea-ice thickness, and inter-annual variations, others included studies of satellite imagery of ice islands, and still others involved modelling the marine environment and simulating oceanographic and sea-ice dynamics. In all cases, the focus was on improving our knowledge and understanding of marine sea-ice, glacial ice hazards and how varying ice conditions affect transportation in Arctic marine corridors. The presentation will summarize the project objectives and findings.

INTERANNUAL DYNAMICS OF THE QUEEN MAUD GULF PELAGIC ECOSYSTEM

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The recent discovery of Franklin's ship HMS Erebus in eastern Queen Maud Gulf led to a burst of scientific interest for the Kitikmeot region. As part of the Kitikmeot Marine Ecosystems Study, a partnership with Parks Canada jointly funded by the W. Garfield Weston Foundation and ArcticNet, a moored sediment trap has been deployed for 3 consecutive years from October 2015 to August 2018 to better understand the dynamics of the Queen Maud Gulf pelagic ecosystem. Here, seasonal variations in phytoplankton, zooplankton and particulate organic matter collected in sediment traps deployed at ~85 m from October 2015 to September 2017 are presented along with physical parameters (snow, ice cover, water temperature and current velocities) to investigate the phenology of primary and secondary production along with downward fluxes of particulate matter. Results from the first 2 deployment years indicated that the presence of sea ice above the mooring provided favorable conditions to sustain the growth of the ice algae N. frigida until mid-July, while maximum diatom fluxes occurred during the ice-free period in September. Ontogenic succession in herbivorous copepods Calanus glacialis and Pseudocalanus spp. was observed. Reproduction and growth was regulated by ice algae and pelagic production as nauplii abundance was associated with ice algae and abundance of young copepodites coincided with the ensuing peak in diatom export. Rarely observed in conventional net samples, Calanus glacialis males were abundant in the sediment trap during winter, providing insight on the ecology of this important Arctic herbivorous copepod. A clear succession in copepodite stages was also observed for the omnivorous/detrivorous Microcalanus spp., Metridia longa and cyclopoids. Peaks in total particulate matter and particulate organic carbon fluxes in the absence of sea ice between August and October were associated with changes in current speed and direction, reflecting resuspension in this shallow area. High abundances of meroplankton and benthic organisms such as echinoderm larvae, nematodes, bivalve veliger and polychaetes observed throughout the deployments also reflected the influence of resuspension. Overall, these results indicate that the Queen Maud Gulf marine ecosystem is strongly influenced by the presence of sea ice. Preliminary results from the 2017-2018 deployment will also be presented.

DINOFLAGELLATE COMMUNITIES OF THE CANADIAN ARCTIC

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The expected increase of shipping activities in the Canadian Arctic due to global warming, the reduction of the sea ice cover and the economic development of the north, may increase potential introductions of nonindigenous (NIS) species via increased propagule supply from ballast water and biofouling vectors. At the same time, environmental conditions in some Arctic ports are becoming more similar to their connected source ports in temperate regions, reducing environmental barriers and increasing introduction risks. Once established, NIS are very difficult or nearly impossible to eradicate, thus prevention and early detection are important in managing risk. Dinoflagellate species are among the taxa that can have important ecological and economic impacts once released in a new environment, however the lack of information about native species can be an obstacle to detecting the arrival of new ones. Therefore, it is paramount to obtain detailed knowledge on their current distribution and ecology, which is limited in the Canadian Arctic. The main objective of this study is to characterize dinoflagellate communities in high risk Canadian Arctic ports to provide baseline data and detect the presence of potential non-indigenous species. Specific objectives are to: 1) compare dinoflagellate communities within and among ports and explain variations in relation to environmental factors; 2) determine changes in community composition over a period of 8 years in the most heavily used port of Churchill, tests for links to temporal variation in abiotic parameters; 3) examine correspondence between dinoflagellate communities found in ballast water samples collected during previous years with the results of the present work. Preliminary results indicate that 40 dinoflagellate taxa from 8 families were found in the ports of Churchill (2007 and 2015), Deception Bay (2016), Iqaluit (2015) and Milne Inlet (2017), including 7 taxa known to be toxin producers, which represented 17%, 54%, 33%, 5% and 8% of the dinoflagellate relative abundance of each port, respectively. The highest mean densities were measured in the port of Churchill 2015 followed by Deception Bay, Churchill 2007, Iqaluit and Milne Inlet and densities were significantly different between ports ($p = 0.001$). The highest mean diversity was measured in the port of Deception Bay, followed by Churchill, Milne Inlet and Iqaluit and the Shannon-Wiener index was also significantly different between ports ($p = 0.001$). The RDA analyses shows that dinoflagellate communities were separated into two groups, with respect to the number of days between sea ice melt and sampling. In fact, for Deception Bay and Churchill, sampling took place more than one month after the disappearance of the sea ice and for Iqaluit and Milne Inlet it was 10 to 22 days after. Dinoflagellate communities also differed among time periods (Churchill 2015 and 2007, $p = 0.001$). SIMPER analyses showed that the toxin producer species Dinophysis acuminata, most abundant in 2015, contributes to most of the difference between the two years of sampling. Further comparison to examine the correspondence between dinoflagellate communities found in ballast water samples collected during previous years and those of the present work is under way.

EXAMINING THE IMPACTS OF THE GEORGE RIVER CARIBOU HERD HUNTING BAN ON NORTHERN LABRADOR INUIT: AN INTEGRATED RESOURCE MANAGEMENT PERSPECTIVE.

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In addition to other dimensions, Integrated Resource Management (IRM) seeks to bring together relevant disciplines, ways of knowing, and sources of information to create effective, credible, and locally-informed resource and environmental management strategies. The current research employs IRM as a theoretical framework to examine impacts on the Labrador Inuit of the George River Caribou Herd (GRCH) hunting ban. The provincial government of Newfoundland and Labrador initiated a 5-year hunting ban in early 2013 in an effort to increase the GRCH population which has declined from a peak of 800,000 animals to less than 9000. With information form in-depth interviews conducted in the five Nunatsiavut communities of Nain, Hopedale, Postville, Makkovik, and Rigolet, preliminary results from this research clearly show that the Labrador Inuit depended upon the GRCH, once one of the largest caribou herds in the world, to fulfill their utilitarian, spiritual, and cultural needs. For generations, the hunting of the GRCH by the Inuit people provided them with a staple food supply, nourishment, and materials and facilitated the intergenerational sharing of knowledge and important social norms, all of which are critical to life in Arctic and subarctic environments. This research makes an important contribution to both theory and practice by clearly documenting the local and cultural impacts of provincial-level wildlife management policies, by giving a voice to Indigenous stakeholders in this context, and by identifying and evaluating best practice examples from other wildlife management contexts that can help inform future northern wildlife management policies that better reflect the needs of resource users.

PREVALENCE OF TOXOPLASMA GONDII IN BELUGA AND NARWHAL IN NUNAVUT, CANADA, AND THEIR POTENTIAL ROLE IN FOODBORNE TRANSMISSION

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Toxoplasma gondii is an intracellular protozoan parasite which infects humans and animals worldwide. Transmission occurs through the ingestion of oocysts shed by cats and other felines, ingestion of tissue cysts in raw or poorly cooked meat and organs, or transplacentally. Toxoplasmosis is generally asymptomatic, or mild and flu-like, in otherwise healthy humans, while immunocompromised individuals may develop severe complications. Congenital infections may result in miscarriage, stillbirth or long-term disability including intellectual disability. The seroprevalence of T. gondii is relatively high in humans worldwide, particularly where raw or poorly cooked meat is frequently consumed. In Canada, the seroprevalence is considerably higher in the

North than in other regions. According to the 2007-2008 Inuit Health Survey, 28% of participants in Nunavut had a positive test for T. gondii, while another study reported a 59.8% seroprevalence in Inuit from Nunavik, Quebec. T. gondii has been reported in a number of marine and terrestrial animals in the North, including walrus, seals, polar bear, caribou, geese and ptarmigan. Since beluga and narwhal are also widely consumed in the North, generally without cooking, it was important to investigate their potential role in the transmission of T. gondii. Sixteen beluga, Delphinapterus leucas, were harvested by Inuit hunters near the Nunavut communities of Sanikiluaq and Arviat. A total of 29 tissue samples were collected from these animals, including brain and spleen, along with 14 serum samples. Tissues were tested for the presence of T. gondii DNA using PCR to amplify portions of six different genes, while genotyping was performed by means of restriction fragment length polymorphism analysis. Serum samples were tested for the presence of anti-Toxoplasma antibodies using ELISA. Six (37.5% of 16) beluga were positive for T. gondii DNA, including 3 males and 3 females. Of the tissue samples, 7 (24.1% of 29) were positive (4 spleen, 3 brain). Three serum samples (21.4% of 14) were seropositive for T. gondii. All PCR positive samples were identified as T. gondii type II, which is also the most common in human infections. Blood samples were obtained from 205 narwhal, Monodon monoceros, harvested near seven communities in Nunavut, and tested by ELISA. A total of 70 (34.2% of 205) narwhal were seropositive, with the prevalence ranging from 0% to 66.7% among the communities. Seroprevalence was very similar between males and females. This relatively high prevalence of T. gondii in beluga and narwhal in Nunavut suggests that there is a potential risk in consuming raw or poorly cooked meat and organs from these animals. It is important to note, however, that these results are based only on the presence of T. gondii DNA in the tissues tested and anti-Toxoplasma antibodies in blood/serum; the presence of viable parasites was not determined. Country food is healthy and nutritious and, for most people, the benefits of consuming country foods outweigh any risks. However, people at risk for severe illness, including pregnant women and immunocompromised individuals, may be advised to freeze or cook meat and organs from harvested wildlife prior to eating.

A SLIPPERY SLOPE: THE INTERACTIONS BETWEEN ICE AND WATER DRIVING THE FUTURE OF OUR ICE SHEETS AND GLACIERS

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Water at the base of glaciers and ice sheets is a strong control on the flow speed of the overlying ice. Highly pressurized water, widely spread out across the bed of a glacier, can cause fast flow speeds of the ice. This in turn draws the ice to lower latitudes, enhances mass loss, and ultimately leads to sea level rise. However, if efficient drainage networks develop, preventing the spread of high pressure water, the flow speed of glaciers can decrease. The development of subglacial hydrological networks and the division of water flux between efficient and inefficient drainage networks varies depends on the type of ice body and its characteristics. Here I will discuss what we know about subglacial hydrology in regions ranging from Alpine glaciers, to the Greenland and Antarctic ice sheets; all significantly different systems both in terms of ice dynamics and hydrology. My own research into the interactions between ice and subglacial water utilizes the 2D Glacier Drainage System model (GlaDS) that has been applied to all of these regions, and I will discuss what we can determine from these model outputs along with the limitations that we face with modeling such inaccessible systems. I will also suggest various areas of hydrological research where we should focus on in the future to assess how ice bodies will react to our warming climate.

COULD CLIMATE WARMING IN THE HIGH-ARCTIC LEAD TO OVERHEATING IN A COLD SPECIALIST?

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The snow bunting (Plectrophenax nivalis) is an Arctic-breeding passerine that winters in snowy plains of southern Canada. As males arrive first on the breeding grounds in mid April, approximately a month before females, these birds experience relatively harsh and cold conditions throughout the year. The species is well adapted for these environments. However, recent observations suggest that their tolerance to moderate summer heat (~ 25°C), especially when actively flying, might be low. Since the Arctic is warming faster than the rest of the globe, it is expected that summer temperatures at the time of chick provisioning, when adults are actively flying, might limit the birds' scope for physical activity. Heat stress could therefore affect individual performance and reproductive success. Combining measurements on their wintering and arctic breeding grounds, our first objective was to determine the range limits of thermal tolerance in snow buntings. This required field measurements of basal metabolic rate (BMR), maximal thermogenic capacity (Msum) as well as minimal and maximal conductance (Cmin and Cmax). We also studied seasonal variability in these parameters to determine how phenotypic adjustments might affect thermal tolerance. From this range, we were then able to predict the ambient temperature at which sustained locomotor activity (e.g. flight or chicks provisioning) could lead to hyperthermia in these birds. Our results from Rimouski (Qc) and Alert (Nu) show that inactive snow buntings have a surprisingly high heat tolerance (ambient temperature of 36°C) and a high cold tolerance (< -90°C) in standardized conditions. However, our data also show that for a sustainable activity level representative of the chicks provisioning period (4 X BMR), the additive effect of heat and activity could push the birds above their heat tolerance limit at a much lower temperature (12°C in summer). Since they already experience this moderate temperature during the Arctic summer, snow buntings might be very limited in their capacity to cope with the predicted increases in Arctic temperature for the nearby future.

THE IMPLICATIONS OF CLIMATE CHANGE FOR POLAR BEAR TOURISM IN CHURCHILL CANADA

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The decline of polar bear populations, due in part to climate change, is thought to have led to an increase in the volume of tourists visiting the Arctic to view them. The irony of the increase in demand for polar bear viewing experiences is that air travel to remote Arctic locations where polar bears can easily be seen, causes an intensification of greenhouse gas (GHG) emissions, which directly contributes to climate change and indirectly impacts polar bear health. Churchill, Manitoba, Canada, a location often referred to as 'the polar bear capital of the world', attracts thousands of polar bear viewing tourists annually. This study presents the results of a tourist survey conducted in Churchill, Manitoba during the 2018 viewing season (October 17- November 17). The objectives of the study included to: 1) calculate the total greenhouse gas emissions from the polar bear viewing industry; and 2) identify polar bear viewing tourists' travel habits; attitudes and knowledge about climate change; willingness to modify their travel behavior in response to the long-term implications of climate change; and understanding of how their environmental impacts might be reduced. Project results were then compared to findings from a similar study examining greenhouse gas emissions, travel habits and potential mitigation strategies for the polar bear viewing industry in Churchill, Manitoba that was conducted 10 years ago. The results of this study will contribute to the existing literature and will also be shared with stakeholders and relevant policy makers in the region in order to support the continued development of a sustainable tourism industry in the region.

IDENTIFYING, MONITORING AND IMPLEMENTING ADAPTATION MEASURES FOR PERMAFROST DEGRADATION IN A COMMUNITY OUTREACH PERSPECTIVE IN KUGLUK TERRITORIAL PARK, NUNAVUT

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The main ATV trail in the Kugluk Territorial Park near Kugluktuk, (NU) leads up along the Coppermine River and provides access to park landmarks and inland resources. The ATV trail is experiencing significant damage due to permafrost thawing, melting of ice wedges, multiple landslide scarp retreats and intense gully erosion. Every year, alterations are made to the trail to have it usable, but the Nunavut Parks Division and community leaders are seeking long-term practical solutions to keep the trail operating while maintaining the quality of the ecosystem. A collaborative project between the Government of Nunavut's Nunavut Parks Division and Climate Change Secretariat along with Centre d'études nordiques and Polar Knowledge Canada surveys geomorphological processes and changes of permafrost conditions to help fulfill this objective. This community-based research project has two key objectives: (1) to gain new scientific and practical knowledge on active layer deepening and permafrost degradation, landslide erosion and associated impacts and (2) to build local capacity, with an emphasis on youth, and to monitor changes in local climate and permafrost. This ensures that the community is directly involved in initial fieldwork and the follow-up monitoring activities. During the summers of 2017 and 2018, geomorphological changes in the landscape were mapped with time-lapsed high resolution air photographs and satellite images along with high resolution (~cm) mapping of permafrost features and landslides with drone surveys and high precision GPS (RTK) surveying. Permafrost conditions were assessed by collecting permafrost core samples and conducting ground-penetrating radar surveys (GPR), particularly to detect and estimate the size of the ice wedges over a length of 3 km of trails. Two thermistor strings with logging systems were also installed to measure ground temperature regime. Local traditional knowledge and the involvement of multi-generation community members in all phases of the research project provide critical information and insights on the terrain sensitivity and inspiration for solution finding and decision-making. Educational outreach activities (e.g. open house/movie night, Park's Day, radio show, training sessions) on climate change and permafrost established communication between scientists and the community, helped gather local and traditional knowledge on landscape change in the region and stimulated interest in permafrost science activities. This project places the community in a leadership role in assessing and responding to the environmental changes that are coming with warming climate and thawing of permafrost.

AMPLIFYING VOICES: RECORDINGS FROM A RADIO ACTIVITY ABOUT THE LAND AND CLIMATE CHANGE IN KANGIQSUJUAQ, NUNAVIK

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Community involvement is an increasingly important aspect of doing research in Inuit Nunangat. Researchers are asked to be authentic, build relationships and offer their time and skills where they may be useful. Such involvement can for instance be done in partership with the school system. During my work on the Ice Monitoring project in Salluit, Kangiqsujuaq and Deception Bay (Safe Passage - Polar Knowledge Canada, Raglan Mine), I have dedicated more and more time to outreach at the high school level, as well as community communications. Exposure to voices such as Inuit Tapiriit Kanatami (ITK), Inuit speakers at ArcticNet, and others, taught me to go beyond scientific work and to develop a productive presence in the communities I visit. Through our scientific outreach at the high school in Kangiqsujuaq, relationships were formed with teachers which eventually led me to offer an activity based on my skills as a radio host. This activity is not linked to my research at all and serves no research purpose. My presentation will report on the Radio Project I did in Kangiqsujuaq, Nunavik, in collaboration with Arsaniq high school. In the 2017-2018 school year, a radio activity was done with a secondary 3-4-5 english class on the land and climate change. Students prepared questions with their teacher, and then recorded themselves discussing the importance of the land for them and answering each other's questions. Parents gave their consent for the recordings to be played on the radio. After editing, segments from the discussion were aired on CBC Radio One in Québec city (Breakaway, May 28th 2018) and CKIA FM 88,3 (Voix autochtone, April 9th 2018). The podcasts for these two radio events are still online (links below), and the students listened to them with their teacher. Some exerpts will be played during the presentation, to further amplify youth's voices. This outreach work is made possible by the W. Garfield Weston Foundation as well as Raglan Mine who organize their Environmental Forum in Kangiqsujuaq every year, providing an opportunity to their research partners such as myself to be present in the community and do activities such as these. (CKIA) https://www.mixcloud.com/marlène-bordeleau/students-from-kangirsujjuaq-talk-about-climate-change/ (CBC) https://www.cbc.ca/listen/shows/breakaway/segment/15547589

TERRASAR-X AND TIME-LAPSE PHOTOGRAPHY FOR SNOW ON SEA-ICE MONITORING IN DECEPTION BAY, NUNAVIK

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Snow is an important element of safety on the land for Inuit living in the Arctic; land users may be stranded on bare rocks for lack of snow on the ground. Snow is necessary for snowmobile transport on sea ice trails, and is closely tied to the thickness ice may reach on average in a given winter. While an observation of less snow in recent years was reported by salluimiut (J. Tuniq, ArcticChange 2017), climate projections for 2071-2100 feature an increase in precipitation over Nunavik (Ouranos, 2018). In this context, the Safe Passage research project (Polar Knowledge Research Program), which included Ice Monitoring in Salluit, Deception and Kangiqsujuaq, also focused on snow on sea ice. This presentation will report on snow information derived from three years of monitoring in Deception Bay, Nunavik (Hudson Strait). Time-lapse cameras have been taking hourly pictures of the bay since December 2015 as well as measuring air temperature. This database was used to develop a proxy for estimating snow accumulation on the bay. TerraSAR-X high-resolution satellite images have been acquired every 11 days since December 2015 and were analyzed to identify seasonal trends in backscattering from snow over sea ice. Fieldwork was done twice per winter since 2016 and includes snow and ice thickness measurements. Time-lapse camera pictures (N ~ 26 000) were filtered by view (four different views are acquired each hour) and visibility using machine learning (python-Tensorflow). The foreground in the field-of-view is highly exposed, and the wind-swept rocks are regularly almost snow-free. Ground pixels were classified as either snow or no snow using computer vision (python-openCV) and an average of snow cover fraction was computed daily. Daily snow accumulation was modeled as the increase in snow pixels from one day to the next, or as zero in the absence of a snow cover increase. TerraSAR-X images were processed by the German space agency (DLR). Backscattering statistics were computed for land pixels and water-ice pixels seperately. This presentation will show how the snow accumulation proxy compares to snow thickness measurements and discuss the winter and spring trends seen in the X-band backscattering from snow on sea ice. This project is a collaboration with the Kativik Regional Government and is supported by Polar Knowledge Canada and the Raglan Mine.

RECONSTRUCTING THE DEGLACIAL HISTORY OF THE LABRADOR ICE DOME ON THE UNGAVA PENINSULA, NUNAVIK, NORTHERN CANADA

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The climate variability of the last 15,000 to 7,000 years is commonly linked to the drainage of large glacial lakes that developed at the margins of the decaying ice sheets of the last Ice Age. These large meltwater outbursts are known to have perturbed the North Atlantic Ocean circulation, which plays a fundamental role in regulating Earth's climate. These former climate-forcing events are now under focus due to a growing number of studies showing that the present-day increase in freshwater releases from the melting of Greenland and other Arctic glaciers may potentially lead to a slowdown of the ocean thermohaline circulation and cause important climate feedbacks. This UK & Canada Arctic Partnership brings together researchers to work on a research program that will improve the accuracy of paleogeographic reconstructions in the Canadian Arctic, in regions that were presumably at the origin of these large meltwater events. The main objectives of this program are to build a comprehensive understanding of the former pattern of ice retreat and its role in the deglaciation and the development of glacial lakes and lake discharges during the last deglaciation of this Artic/sub-Arctic region. The key focus for this research collaboration is the region surrounding Ungava Bay in north-central Quebec and Labrador because this northern region occupies a strategic position to unravel these issues as it encompasses the zone of migration of the Labrador ice divide and most topographic depressions hosted glacial lakes. The region has a spectacular geomorphology characterized by various glacial/deglacial landforms as well as extensive shoreline sequences that record former ice sheet history and glacial lake levels. During the last deglaciation, the Labrador Ice Dome underwent a marked retreat of its south-southeastern margin towards northern latitudes, with the last ice sheet remnant resting on the center of the Ungava Peninsula. Although the temporal evolution of these ice sheet changes is well characterized in the south, the entire northern portion of the Labrador Sector of the Laurentide Ice Sheet remains largely unconstrained, mostly due to a lack of detailed understanding on the spatial distribution of the various landforms created during ice marginal retreat which provide critical information on the pattern and timing of deglaciation. This project addresses this deficit by producing the first detailed glacial geomorphology map of the northern sector of the Ungava peninsula using high resolution satellite imagery and will age constrain ice sheet retreat across the peninsula using both Terrestrial Cosmogenic Nuclide (TCN) dating and Schmidt Hammer Exposure Dating (SHED) analysis on targeted deglacial landforms. Here we present our initial results of the mapping programme which captures the spatial distribution of glacial landforms on the Peninsula from the Puvirnituq/Akulivik region on coast of Hudson Bay to the center of the Peninsula east of the Pingualuit National Park. We also report the results from our fieldwork campaign that was conducted in Nunavik in summer 2018 to collect suitable samples to constrain the timing of the deglaciation in this region for the first time using a combination of TCN dating and SHED analysis.

NORTHWARD SHIFTS IN OPPORTUNITY: SALMON IN THE CANADIAN ARCTIC

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Biodiversity change in the Arctic coincides with warming cycles and species' responses can manifest as distributional shifts. However, it is establishment rather than dispersal that may be limiting colonizations in these cold frontier areas. Therefore, accurate predictions of these biodiversity shifts require understanding of both the capacity of fish species to respond to environmental change, and the viability of the Arctic marine and freshwater habitats to support establishment in novel locations. A Canadian Arctic-wide community-based monitoring, called Arctic Salmon, is documenting increasing abundances and distributions of Pacific salmon Oncorhynchus spp., Atlantic salmon Salmo salar, and other "unusual fishes" in subsistence harvests. This was developed through a PhD thesis at the University of Manitoba, completed collaboratively with Fisheries and Oceans Canada, and has continued into a Liber Ero Postdoctoral Fellowship. Here we demonstrate the effectiveness of community-led monitoring to track biodiversity change across a vast and remote geographic area, and we establish the viability of Pacific salmon, Oncorhynchus spp., as indicators of ecosystem-level change in the Canadian Arctic. We also describe a novel model, which can be applied in a community-based approach, that aligns thermal tolerances with thermal regimes at critical groundwater oases to predict watersheds vulnerable to colonizations by salmon, and identifies the associated risk of competition with native char. By coordinating opportunities among subsistence and scientific approaches, we can better manage the development opportunities and predict the conservation impacts in a future Arctic.

COLD ICE IN A WARM BATH; PROGLACIAL LAKE TEMPERATURE OBSERVATIONS FROM AN ACTIVELY CALVING ARCTIC GLACIER FRONT AND SPACE

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It has been shown that glaciers in contact with proglacial lakes show accelerated mass loss rates through mechanical and thermal processes, particularly through the formation of thermal notches in the ice front (Carrivick and Tweed, 2013). Despite this and the consequences for downstream water temperatures and ecology, there are limited studies into the thermal regime of proglacial lakes. The abundance and temperature of these proglacial lakes in Arctic glacier systems has received relatively little attention despite proglacial lakes becoming more common as glaciers retreat from their Little Ice Age maxima (~100 years ago) and increasing air temperatures in Arctic Scandinavia (summer 2018). We present the results of the first application of thermal infrared (IR) imagery to explore changing proglacial lake surface temperatures. Observations were supplemented by several temperature point surveys, depth profile surveys as well as a number of continuous surveys conducted along the ice front using a remote controlled boat. Previous melt models for lacustrine terminating glaciers have been compromised by a lack of data from the hazardous water to ice contact point and assume a uniform 1 C temperature, we directly address this previous limitation here. We report night time temperatures of 3 C directly at the ice-water contact point following numerous ice berg calving events. Day time maximum proglacial lake surface temperatures of 10 C were observed during the fieldwork and surface skin temperatures of 10 C have been observed in satellite thermal image (2018) analysis. These are some of the first temperature observations from Arctic proglacial lakes.

AMINO ACID AND SULFUR STABLE ISOTOPES IN THICK-BILLED MURRE PREY: RELATIONSHIPS TO PREY DIET AND CONTAMINANT SIGNATURES

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Contaminant biotransformation and biomagnification are processes that affect contaminant burdens in wildlife. To interpret variation in contaminant levels in seabird eggs, used as bioindicators in the Arctic, it is important to understand how contaminants biomagnify through the food web. We evaluated the use of δ34S, along with other commonly used stable isotope signatures (δ15N and δ13C), for the determination of possible sources of contaminants in an Arctic food web (56 individuals of 15 species of fish and invertebrates). Hg correlated with δ34S (R2 = 0.72). When the combined effects of δ34S and δ15N were considered in mixed-effects models, both δ34S and δ15N together described Hg patterns in Arctic food webs better than either isotope alone. Legacy (PCB and DDE) but not emerging (PBDEs and PFCAs) correlated with trophic level (δ15Nphe-glu). Our results demonstrate the usefulness of δ34S and amino acid-specific analysis to account for variation in contaminants among marine animals. We also use these stable isotopes to identify potential diet of fish and seabird species.

BIOGEOGRAPHY OF ARCTIC WHITE HEATHER (CASSIOPE TETRAGONA)

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The last major ice age ended approximately 11 000 years ago. As the ice retreated species' range expansion is believed to have occurred rapidly. During this time, many tundra plant species may have dispersed out of Beringia and recolonized the Arctic. Understanding how organisms responded to climatic changes in the past could help us investigate how organisms will respond to the current rapidly changing climate. Cassiope tetragona is a diploid (2n=26) circumpolar plant commonly known as Arctic White Heather. At sites on Ellesmere Island, there are entire communities of plants that have been frozen under the glaciers for the last 400-2000 years. At Alexandra Fiord and Sverdrup Pass, C. tetragona has been well preserved under the glacial ice and, in 2017, ancient C. tetragona DNA was extracted from samples found there. The genomics of these plants can provide a window into the past and help us better understand how populations change and move across space. C. tetragona samples were also collected across its range: the Canadian Arctic, the Rocky Mountains, British Columbia's Coastal Mountains, Greenland, Svalbard, Northern Europe and Russia. At each site, thirty individual plants were sampled. Researchers at 35 different sites sent samples back to

UBC in the fall of 2017. We investigated the genomes of both the ancient and present day C. tetragona populations using genotyping by sequencing (GBS). This technique uses next generation technology to sequence thousands of matching DNA segments for many individuals. Comparing genetic diversity within and between populations, we can begin to investigate the rate of gene flow between today's populations. Using this high-resolution data, we will be able to test the hypothesized recolonization patterns and glacial refugium using population structure analysis. As the climate continues to warm and increase in variability, questions of species responses to this change continue to arise. Estimating the amounts of gene flow between current populations could help us determine the dispersal limitations of some Arctic species. Using this information we may be able to better understand how or if Arctic plant species are limited by dispersal. Understanding what limits species range expansions is essential to help predict where species can survive in the future.

YEAR-ROUND ATMOSPHERIC AND OCEANIC MEASUREMENTS TO BETTER UNDERSTAND AIR-SEA CO2 EXCHANGE IN THE ARCTIC

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In recent years, substantial progress has been made towards understanding the Arctic Ocean's role as a source or sink for atmospheric CO2. Through ship-based field programs, the international community has found that the majority of Arctic seas absorb CO2 from the atmosphere, typically at rates higher than average for the rest of the global ocean. However, most of those field measurements have been confined to the open water season. Some measurements are available near the end of ice break-up, or towards the beginning of freeze-up, but systematic observations of the complete annual cycle are rare. This observation gap limits our ability to understand the biogeochemical processes that drive spatial and temporal variability in CO2 exchange, and makes it difficult to predict how the Arctic Ocean's status as a "CO2 sink" might be affected by climate change. To address this gap, our research team has established an observation node near Cambridge Bay, Nunavut. Automated underwater instruments to measure dissolved CO2 (pCO2) and pH are allowing us to identify and quantify the biogeochemical processes that drive the marine carbonate system throughout the annual cycle. A novel micrometeorological installation is allowing us to make direct measurements of CO2 exchange. In the summer, an underway measurement system installed on a coastal research vessel allows us to observe spatial variability through the open water months. And a community-based field-sampling program, which allows us to make detailed measurements in even the most extreme seasons, augments all of these automated systems. In this presentation, we will present the early results of these efforts. We will show that biogeochemical processes in this environment are highly dynamic, even through the dark of winter. We will also show that CO2 exchange in the "shoulder seasons" (early spring, late fall) is more important than previously realized. Our findings will highlight the importance of year-round observations in understanding air-sea CO2 exchange in the Arctic.

COORDINATED GROUND AND AIRBORNE MEASUREMENTS OF SNOW STRUCTURE AND MICROWAVE BRIGHTNESS TEMPERATURES OVER TUNDRA

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In March 2018, a UK-Canada Arctic bursary enabled two researchers from the UK universities of Edinburgh and Northumbria to join colleagues from Environment and Climate Change Canada, Wilfrid Laurier University and Université de Sherbrooke in a campaign at Trail Valley Creek, NWT. Ground-based measurements included microwave radiometry and profiles of snow properties required as inputs to snow microwave radiative transfer models. Tundra plateau, valley and lake measurement sites were aligned with flight lines by the Facility for Airborne Atmospheric Measurements aircraft. Preliminary analysis of airborne passive microwave measurements show recurring geographical features in repeat flights but profound changes after reworking of the surface by periods of snowfall and high winds. Preliminary modelling shows some success in predicting brightness temperatures at 89 GHz from snow profiles. These results are significant for microwave imaging of the land surface and sounding of the atmosphere at high latitudes.

IMPROVING RESOURCE MANAGEMENT USING TK AND COMMUNITY-BASED MONITORING

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Despite best intentions and the availability of resources, Indigenous community researchers, analysts, and regulatory boards in the Northwest Territories (NWT) struggle in their efforts to meet policy commitments to incorporate traditional knowledge (TK) into resource monitoring and decision-making. Barriers to meaningfully including TK persist, due in part to differences in needs, worldviews, methodologies, and understanding among knowledge holders, researchers, and regulators. This presentation will explore the results of a two-year GNWT-funded research project into effective TK inclusion in resource management. The project sought to understand when TK is currently used in resource management and decision-making in the NWT, and how decision-makers (e.g., Mackenzie Valley Land and Water board, Wek'eezhii Land and Water Board, Wek'eezhii Renewable Resources Board, Mackenzie Valley Environmental Impact Review Board [MVEIRB], and GNWT Department of Environment and Natural Resources [ENR]) consider, interpret, and incorporate TK currently attempt to consider, interpret, and incorporate it. The project followed a three-pronged approach that included review of scholarly literature on TK integration and/or community-based monitoring (CBM), interviews with regulators and research practitioners, and structured reviews of major environmental assessments (EAs) in the NWT.

STACKS, RACKS, AND SUPERHACKS: COMMUNITY-BASED MONITORING IN THE DIGITAL AGE

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Northern Indigenous communities have expanded a great deal of effort to establish environmental monitoring programs informed by Indigenous Knowledge, often incorporating decades of social and cultural research. Much of this information was originally recorded and stored in difficult-to-access formats (e.g., interviews on cassette tapes, paper maps, and hard-copy documents), or held by outside agencies, rendering it difficult to deploy in day-to-day management. As a response to community desires to organize, retrieve, apply and share their IK, we developed Trailmark, a digital, web-based information management system (IMS) following principles of OCAP(r). Although pay-as-you-go cloud and web-based database management softwares were everyday facts in southern Canada, their application in the north was limited, and the field was largely dominated by southern universities and their associated data centres. Trailmark was unique in the field -- a small enterprise tech-start-up steeped in social innovation values, risk, and maxed-out credit cards. In this presentation, we will share some of the technical and user interface challenges we have encountered co-designing monitoring programs and software with northern Indigenous communities and agencies across the Arctic (and elsewhere), paying particular attention to the intersection between technology and research methods. In working together with communities to overcome certain technical (eg. connectivity, conditional logic) and user interface challenges, related problems in methodology were often overcome, with improved outcomes for knowledge co-production and natural resources co-management--but not always. Issues will be explored through small case studies of northern monitoring projects conducted by community partners in the Yukon, NWT, Nunavut, and Newfoundland.

UNDERSTANDING THE EFFECTS OF INDUSTRY ON THE PEACE-ATHABASCA DELTA (CANADA): DEVELOPING BASELINE HYDROLOGICAL CONDITIONS AND SEDIMENT METAL CONCENTRATIONS USING PALEOLIMNOLOGY

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The current Canadian economy is strongly dependent on two major natural resources: bituminous oil sands and hydroelectricity. The country's bitumen is mainly refined in the region of the Alberta Oil Sands in Alberta, on the Athabasca River, and the electric power industry in western Canada relies on hydroelectric dams (mainly the WAC Bennett Dam in the late 1960s and the current development of the Site C Hydroelectric Dam) on the Peace River. Both of these rivers supply water to the Peace-Athabasca Delta (PAD), adjacent to Lake Athabasca. The PAD is recognized internationally for its ecological, historical, and cultural significance (UNESCO World Heritage Site, Ramsar Wetland of International Importance). When industry operations began, effective monitoring had not been implemented. Consequently, pre-industrial reference conditions are unknown and can be difficult to define. As these industries have been developing through the decades, there has been growing concern over the effects of these industries on downstream ecosystems. Using paleolimnological techniques, we are assessing current environmental conditions of the PAD in the context of a pre-industrial baseline. Research focuses on lakes very near to the Peace River to reconstruct past hydrological conditions and to characterize sediment metal deposition derived from Peace River floodwaters. Results from sediment core analysis at lake 'PAD 65' show that organic matter content and □13Corg increase while C/N ratios decrease after 1970, suggesting a decrease in flood frequency. The timing of this stratigraphic shift aligns with changes in the Peace River hydrograph caused by river regulation as a result of the construction of the Bennett Dam. Notably, this is the first lake (of 31) with paleolimnological evidence to attribute hydroecological change in the PAD to the Bennett Dam, which suggests these effects are only evident in very close proximity to the Peace River. Other sediment cores from the northern part of the PAD show drying trends since the early twentieth century due to climate change. Analysis of sediment metal concentrations from three lakes in the Peace River sector of the PAD, normalized to aluminium, reveal that key metals of concern (e.g., Ni, V) are enriched relative to pre-industrial baseline concentrations in sediments supplied by Athabasca River floodwaters. This reflects that sediment carried by the Peace and Athabasca rivers are derived from different geological sources and, therefore, river-specific baselines need to be incorporated for interpreting sediment metal concentration data from lakes across the delta. These findings will be of interest to multiple stakeholders, and will inform stewardship and lake ecosystem monitoring of the delta.

IMPACT OF CLIMATE CHANGES ON AQUATIC RESOURCES IN COASTAL AREAS OF THE IVVAVIK NATIONAL PARK, YUKON: THE CASE OF DOLLY VARDEN (SALVELINUS MALMA)

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The northern Yukon Territory and the coastline of the southern Beaufort Sea are an important region for preservation of Inuvialuit and Gwich'in culture and the harvesting of marine food resources, notably through the fishing of the anadromous fish species, the Dolly Varden (Salvelinus malma). Due to its restricted habitat and decrease in some populations, the Dolly Varden was designated as a special concern species according to the Committee on the Status of Endangered Species in Canada (2010) and more recently under the legislation of the Species At Risk Act (2017). As stress from harvesting cannot be the only reason of population size decreases over the last decades, more efforts must be made on better understanding and assessing variations of the Dolly Varden environment and their impacts on its habitat and populations. Moreover, the highly dynamic and sensitive ecosystem of the southern Beaufort Sea coast exposes the Dolly Varden to severe changes and potentially to further stresses in the future for example through modifications of the primary producers and stratigraphy of coastal water masses. During field work in July and August 2018, sediment cores (< 1m thickness) and surface samples were collected from 4 different sites in the nearshore zone of the Ivvavik National Park and the Qikiqtaruk - Herschel Island Territorial Park (Yukon Territority). Sediment cores will serve to build temporal records of changes in surface and bottom seawater conditions through micro- and macropaleontological analysis. Bivalve shells will be used for sclerochronology to reconstruct annual cycles of productivity (Ba/Ca) and temperature (Mg/Ca) over decades, which could be compared with the Dolly Varden growth patterns and population sizes as assessed from the sclerochronology of recent otoliths from the Department of Fisheries and Oceans Canada (collected since 2011) as well as from fossil otoliths from surface sediments. We hope that existing meteorological and hydrological data and dendrochronological data around the Ivvavik National Park together with our suggested new paleoclimatological and paleoecological data will help to draw a comprehensive picture of the variability of the Dolly Varden habitat. Hence, the new datasets should help to evaluate the potential impacts of climate change on the vulnerability of the Dolly Varden. In the forthcoming years, we plan to collect long sediment cores, surface sediment samples, peat and river water samples in order to improve the temporal (historical) and spatial coverage of the records.

IMPROVING TERRESTRIAL PREDATORS' DIET ASSESSMENTS WITH RODENT MANDIBLES

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Predator-prey interactions have often been identified as key to understand population cycles of Arctic rodents and the movements of terrestrial avian and mammalian predators. Quantifying such trophic interactions has the potential of revealing critical information about ecosystem functions such as the energy flux within and among habitats. However, predator-prey relationships are often derived from the relative number of prey consumed, sometimes separated by species, and the energy flux is based on averaged body masses, which does not consider whether predators hunt for small or large individuals. We hypothesised that mandibles found in raptor pellets and mammalian scats could be used to obtain precise body mass estimates of rodents before they are consumed. To test this, we assessed the relationship between the body mass and the size of mandibles of seven species of lemmings and voles with museum specimens (n=2668) that were collected across the Canadian Arctic. We used four mandibular measurements taken on each specimen to consider possible lack of parts caused by degradation. Our results suggest that the body mass of small rodents, especially for lemmings, can be estimated with high precision with the distance between the base of the incisors and the back of the condylar process (average $R^2 = 0.74\pm0.09$) or angular process ($R^2 = 0.74\pm0.10$). Using the distance between the anterior side of the first molar and the back of the ramus also yielded good estimates of body mass ($R^2 = 0.62\pm0.18$), whereas the length of toothrow was the least reliable measure ($R^2 = 0.46\pm0.21$). Unexplained variability was highest in red-backed voles and was partly caused by pregnancy and geographic differences. In general, mandible size was well correlated with body mass, probably because lemmings and voles do not accumulate much fat as they remain active all year and generally live during only a few months. Using mandibles in prey remains provides more precise estimation of biomass consumed by predators, which is essential to quantify energy fluxes. Moreover, refining each predator's diet with the body mass of their prey may reveal how resources are shared in years of high rodent abundance in the Arctic.

ECOLOGICAL REGIME CHANGE IN THE ARCTIC MAY BE PREVENTING COMPLETE POST-WHALING RECOVERY OF BOWHEAD WHALES

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Bowhead whale (Balaena mysticetus) distribution and density has waxed and waned with geologic changes in circumpolar sea ice extent over the past 10,000 years. However, in 1915 after hundreds of years of commercial harvesting had ended, all three recognized bowhead populations were at historically low numbers. Since that time, the Bering-Chukchi-Beaufort population appears to have grown exponentially and recovered to pre-exploitation numbers, while the Svalbard-Barents Sea population remains low but has shown recent increases and the Eastern Canada-West Greenland (ECWG) population appears stalled at about half its pre-exploitation population size. The existing small (ca. 2 whales/year) co-managed Inuit subsistence hunts in Canada and Greenland likely continue historic hunting levels that have existed for millennia and are unlikely responsible for the observed stalled growth. To understand why the ECWG population has not shown the same exponential growth observed in the Bering-Chukchi-Beaufort, we explore three possible explanations: (1) carrying capacity has changed due warming-related ecosystem alterations; (2) increased predation by killer whales (Orcinus orca); and (3) prolonged over-harvesting of a number of key ecosystem components, including large whales, has reorganized the ecosystem, permanently moved it to an alternative sable state that supports fewer bowhead whales. To address these hypotheses, we first implemented a standard discrete time logistic growth model that used historical catch data over the past 500 years to estimate pre-exploitation abundance and carrying capacity, develop reference points, and management zones. Although the population is likely within the healthy (N50 to N70) zone, the estimated historic (i.e., pre-exploitation) population level of 18,500 bowhead whales was well above the mean estimate of 10,968 whales (95% CI = 0-18,944; SD = 9,064) in 2011. Thus, the population does not seem to have grown at the expected exponential rate or be approaching pristine carrying capacity. Traditional ecological knowledge and sighting records from the ECWG bowhead range have suggested that killer whale predation occurs frequently on bowhead whales – largely on vulnerable calves and smaller juveniles. Approximately 10% of ECWG bowhead whales display rake marks from killer whale attacks, a rate higher than found for other bowhead whale populations and higher than typical of baleen whale populations generally. The marine environment may have undergone a transformation due to novel species combinations and relative abundances that have not occurred previously. Key changes in ecosystem functioning due to human overharvesting may have inadvertently degraded the original 'natural' ecosystem making it very difficult to return to its previous state. Although conclusions are elusive, history reminds us that over-exploitation can have large-scale, unintended, and sometimes irreversible consequences.

SPRING PHYTOPLANKTON PHENOLOGY IN BAFFIN BAY

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Climate is driving major changes in the arctic including drastic lost of sea ice which is resulting in earlier and longer open ocean periods. This influence the photosynthetically available radiation (PAR) in the ocean and therefore influence the phenology of primary producers. Phytoplankton are key players in marine ecosystems and taxonomic groups provide different critical functions to the food web and to the biological pump. Yet there are only few studies on the phenology of phytoplankton during the spring season. The Green Edge project aims to fill this gap by studying biodiversity, key physical, chemical and biological processes taking place during the spring season. Aboard the CCGS Amundsen, the expedition navigated in Baffin Bay following seven transects, each including ice covered and open water stations, between June 5th and July 11th 2016. Phytoplankton abundance and community composition were assessed, using inverted microscopy and an imaging flow cytometer, to identify the key taxonomic groups prior, during and after spring bloom. Chlorophyll a concentration was also assess as a phytoplankton biomass proxy. Environmental variables measured included nutrients, temperature, salinity, sea ice concentration, daily PAR and number of days of open water (DOW) prior sampling. Several blooming events were successfully recorded mostly at the ice edge. Total phytoplankton abundance ranged from 0.15×106 to 12×106 cells L-1 with an average concentration of 0.8×106 cells L-1 at the surface and 2.8×106 cells L-1 in the chlorophyll-a sub-surface maxima (SCM). We will further use exploratory statistical analyses to disentangle the spatio-temporal distribution of different taxonomic groups and link them to environmental drivers.

QUANTIFYING PLANKTON AND PLASTIC COMPOSITION THROUGH THE NORTHWEST PASSAGE AND ATLANTIC ARCTIC GATEWAY

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In the marine environment, key components at the base of food chains—including phytoplankton and zooplankton—are short-lived and seasonal, and therefore may quickly reflect climate change through changes in their abundances, spatial distributions, and local species compositions. As such they can be sentinels in quantifying the effects of climate change. However, a key gap in understanding exists in quantifying the distributions and abundances of plankton based on in-situ sampling at the scale of the Northwest Passage and Atlantic-Arctic Gateway, as previous published analyses have relied exclusively on station-based sampling and not continuous sampling across this region. To address these issues, in 2016 and 2017 we quantified the rates of occurrences and local abundance of marine plankton sampled on spatial scales of ~10 nautical miles distance throughout these regions through the use of continuous plankton recorder (CPR) deployed from the RRS Ernest Shackleton prior to and during its escort of a cruise ship. In 2017, this resulted in oceanographic data and collections of biological plankton and plastic debris spanning 2800 nautical miles of ice-free waters. We characterize zooplankton and phytoplankton community compositional changes (enumerated by expert taxonomists) and their links to spatial variation in ocean and bathymetric conditions. In addition to documenting the dominant plankton species and spatial scales of community variation, we compare rates and local densities of plastic debris vs. biological plankton simultaneously collected. Across the sampled domain, 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 both illustrates the utility of continuous plankton recorder sampling to provide high resolution oceanographic, biological, and environmental baseline information within ice-free summer areas and demonstrates the utility of using industrial ships of opportunity (tourism vessels, icebreakers, shipping vessels) to effectively and inexpensively monitor the marine productivity potential of Nunavut's marine waters..

SHORT-TERM ICEBERG DRIFT FORECASTING – THEORETICAL COMPARISON OF THE DETERMINISTIC AND STATISTICAL-PLUS APPROACHES

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Forecasting the drift of icebergs is an important component of ice management activities for the East Coast Canadian offshore oil and gas industry. When an iceberg approaches an offshore facility, iceberg drift trajectory forecasts are generated to assess the risk of a collision in adequate time to undertake appropriate ice management measures. The widely-used deterministic approach assumes the most important forces acting on an iceberg can be predicted and, therefore, uses forecasts of relevant environmental drivers to predict iceberg motion through a double-integration of estimated iceberg acceleration. The statistical approach uses recent motion of an individual iceberg to predict the influence of ocean current vortices for up to 20 hours depending on the local oceanographic conditions. The hybrid, "statistical-plus", approach estimates mean ocean currents, wind and tidal effects deterministically, but small scale-ocean currents statistically, and adds these different drift components to generate short-term drift forecasts. The distinct theoretical basis of each of these two approaches is explained and compared in this presentation, and the implications for forecast accuracy over different timescales are outlined. These implications are then placed in the context of operational constraints on available environmental data and on the precision of iceberg size and shape estimates.

SPATIAL VARIABILITY OF WINTER ICE VELOCITIES IN RESPONSE TO WIND AND OCEAN CURRENT FORCING IN THE CANADIAN BEAUFORT SEA

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Continuous measurements of ice velocity, ice draft and near-surface ocean currents were obtained from an extensive array of upward looking sonar (ULS) moorings operated from September 2009 through September 2011 in the continental margin of the Canadian Beaufort Sea. Eight of the moorings were operated as part of the ArcticNet-Industry program while two moorings were operated by the Dept. of Fisheries and Oceans (DFO). The mooring sites spanned a total distance of about 100 km over the outer continental shelf and continental slope and about 125 km across the shelf/slope from the single mid-shelf site (55 m depth) to the deepest slope location (1010 m). Surface winds were provided by the Meteorological Service of Canada (MSC) Beaufort Wind and Wave Reanalysis gridded database. Ice formation in the region begins in mid-October, with ice drafts increasing through autumn and winter, reaching peak average ice drafts of 2.0 – 3.2 m in March to April. The monthly mean ice speeds are largest in the autumn with average values of 16 – 30 cm/s which decrease to only 2 – 5 cm/s by March and April. This marked reduction is shown to be largely due to the development of internal ice stress, since wind and current forcing exhibits only small reductions by comparison. In late autumn, the ice motion is dominated by large responses to episodes of moderate to large winds with ice to wind speed response factors of 2.7 – 3.5 % for easterly winds and 2.2 – 2.6% for westerly winds. The spatial variability of ice speeds, as expressed by the coefficient of variance (CV) are generally quite small with typical values of 13 - 50%. When wind speeds are low, combined with near-surface currents that are moderate to large, the ice velocities are dominated by near-surface currents with an ice to current speed ratio of 0.4 – 1.0. Due to the much smaller spatial scales of near-surface currents vs. winds, ice speed spatial variability is much larger than for the wind dominated regime, with typical CV values of 100 percent or more. By March to April, the response factor of ice to wind speed, under larger winds, is greatly reduced to 0.5 – 0.7 % for easterly winds and to about 0.2% for westerly winds. The turning angle of the ice drift is generally to the right of the wind, although the average angle is much larger for westerly winds (28 – 39 degrees) than for easterly winds (4 – 12 degrees); this difference results from the effect of the average southwesterly directed near-surface currents. The spatial variability of the ice speeds increases from those of autumn, with CV values generally exceeding 50%, under larger winds in mid-winter. A distinct spatial pattern in the ice to wind response factor occurs during March to April with larger values in the east, especially at outer shelf to mid-slope locations, of 0.6 – 0.8% vs. notably lower response factors of 0.3 to 0.45% in the west and at the mid-shelf location.

INTEGRATED MONITORING PROGRAMS FOR NORTHERN COASTAL COMMUNITIES

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With approximately 40% of the world's population living within 100km of the coast, it is critical that the ocean environment that these people depend on be persistently monitored. Fortunately, Coastal Communities are ideally situated to take the leading role in this effort by leveraging their knowledge and understanding of the surrounding environment and by taking advantage of existing community infrastructure to support a range of complementary monitoring systems. Ocean Networks Canada (www.oceannetworks.ca) is an international facility hosted and owned by the University of Victoria, and managed and operated by the Ocean Networks Canada Society, a not-for-profit established by the University in 2007. Ocean Networks Canada operates world-leading ocean observatories that have no equivalent in Canada, with an overarching vision to enhance life on Earth by providing knowledge and leadership that deliver solutions for science, society, and industry. The focus on "Society" in this vision is helping Ocean Networks Canada to drive the development of comprehensive Community Based Monitoring programs. One example is the Cambridge Bay Community Observatory, which has been supported by an ongoing Youth Science Ambassador program for over 2 years. Meanwhile, data collected by community members themselves (commonly referred to as "Citizen Science") is a concept that continues to evolve with changing technology, data demands, and collection techniques. This method has remarkable potential in coastal communities as the people who live there are without question the best suited to be working in the field; their understanding of the local environment and the risks and challenges remains unparalleled, allowing them to capture sought after data in a relatively large area around their community through all of the seasons. Furthermore, this approach tends to be much more cost effective by taking advantage of local resources, provides an often overlooked connection between the data and the people it affects the most, and has the potential to integrate local and traditional knowledge in to the planning process, the final data set, and how the data is visualized and used. Mature citizen science programs, such as those being supported and co-developed by Ocean Networks Canada and its partners, endeavor to leverage this community knowledge and to pair it with the funds and person time needed to supply the equipment and training to a population that is typically extremely capable and willing. The Cambridge Bay Community Observatory provides real-time, freely accessible data and has grown in size, use, and community impact every year since it was first installed. Support for this particular Community Observatory has continued to grow, with Cambridge Bay residents providing logistic assistance for observatory maintenance, participating in outreach and formal learning activities, and, more recently, collecting critical, winter-time data on snow depth and ice thickness. Oversight committees comprised of community members from Cambridge Bay, Kugluktuk, and Gjoa Haven are providing valuable insight and direction in order to better understand the needs of their individual community's. This presentation will discuss how Ocean Networks Canada is using much more than just observatories to establish and support comprehensive Community Based monitoring.

FOOD VISIONING FOR THE FUTURE: A METHODOLOGICAL APPROACH TO STRATEGIC PLANNING WITH ARCTIC COMMUNITIES

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A recent survey of food security in Nunatsiavut has identified food insecurity in the region as 59.3%. As a result, the Nunatsiavut Government is creating a regional plan to improve food security over the coming years. The Government has partnered with researchers in creating this plan to ensure that community perspectives are at the foundation of the food security plan, to increase capacity through bringing in research expertise in innovative methods and to evaluate the process to learn from and improve planning in Arctic regions. The process involves a series of participatory scenario planning workshops held in each of the communities and at a regional level to define what food security means for Nunatsiavummiut, to identify strengths and challenges in each community and to create a desired future vision of food security in the face of rapid social and ecological change in the region. This presentation will provide an overview of the visioning process and will identify the advantages and challenges of using participatory scenario planning for community-based planning in Arctic regions.

DEFINING COMMON INTERESTS, ENHANCING CAPACITY, WORKING TOGETHER: AN OVERVIEW OF THE CREATION OF A RESEARCH/GOVERNMENT COLLABORATION IN NUNATSIAVUT

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Over the past decade, we have seen increased calls from communities, funders and academics to improve dialogue between knowledge producers and knowledge users to create usable science that is, pertinent, good quality and produced in a timely manner. In an Arctic context, we also see increased recognition of the value and ethical responsibility to connect Indigenous and Western ways of knowing in research. This talk will discuss the creation of a collaborative project between Nunatsiavut Government and researchers at the University of Leeds, UK, to try to improve knowledge mobilization in community-based research and strategic regional planning. The talk will outline the key principles of knowledge mobilization including principles of respect, mutual understanding, and researcher responsibility. The talk will also provide a detailed outline of the process so far (one year into a three-year project) and discuss some of the tools used, including a Theory of Change model and participatory scenario planning. Finally, we will discuss some of the current insights and challenges arising from this collaborative research process.

STRUCTURAL CHARACTERIZATION OF NATURAL ORGANIC MATTER IN THERMOKARST LAKES IN THE EASTERN CANADIAN SUBARCTIC

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Thermokarst lakes, a result of the thawing of ice-rich permafrost, are widespread in subarctic and Arctic regions, displaying over the last decades a continuously higher contribution to the global carbon cycle. Thawing of permafrost not only enables the delivery of considerable amounts of natural organic matter (NOM) to aquatic systems, but is also linked to methanogenesis of organic matter, resulting in substantial releases of methane (CH4) into the atmosphere. Dissolved organic matter (DOM) is a highly complex mixture of chemical species present in every natural aquatic system, with a widely variable composition depending on its source. This research aimed to provide insight into the structural characterization of DOM from thermokarst lakes in subarctic regions. Several analytical techniques were applied, including fluorescence spectroscopy, Fourier-transform infrared spectroscopy (FTIR), nuclear magnetic resonance spectroscopy (NMR), and elemental analysis (CNHS). Samples were collected at different depths from three different thermokarst lakes (SAS-1A, SAS-1B and SAS-2A) in the Sasapimakwananisikw (SAS) river watershed near the community of Kuujjuarapik / Whapmagoostui (Nunavik, Canada). Thaw lakes, SAS-1A and SAS-1B, are located south of the SAS river and associated with the same palsa zone (with different proximities), and thaw lake SAS-2A, is located north of the SAS river. Water samples were filtered, extracted and characterized to obtain structural information. The extreme complexity of the samples hindered the possibility of successfully obtaining profound structural information, however, significant changes were detected at different SAS thaw lakes and depths. – All the samples displayed a high level of complexity in molecular composition, which also proved to be a challenge for a clear separation of its components. However, significant changes were detected among the different thaw lakes and depths. Although all DOM samples displayed a terrestrial derived origin, SAS-1B appeared to display the lowest H:C ratio. The fluorescence data obtained from the excitation-emission matrices suggested a significant presence of "fresh" DOM at the surface of lake SAS-1A, contrary to the other samples, suggesting an input of recently fixed carbon (e.g. from aquatic macrophytes). Contrary to expectation, the SAS-1B sample appeared to display closer similarities to SAS-2A, clearly noticeable in both fluorescence EEMs and FTIR spectra, despite being geographically located near lake SAS-1A; neither of these samples showed a conspicuous "fresh" carbon content Since there is currently very limited research on the structural characterization of DOM from permafrost thermokarst lakes, these results provide the first step to a more profound characterization of thermokarst DOM, to better understand the biogeochemistry of these waters.

THE CANADIAN HIGH ARCTIC RESEARCH STATION (CHARS): DESIGNING A MEETING PLACE AS A MEETING GROUND

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The subject proposed aims to support the session's topic in an unconventional way, outside of the standard realm of scientific research. It relates to the CHARS ERA but will focus on the new CHARS facility itself. This new "base-camp" was designed to operate as more than just another arctic research station. The overarching vision was to develop a meeting place that was going to function as a meeting ground. One of the design team architects will present a short walkthrough not only of the CHARS 8,000m2 facility, but also and just as significant, the design process that led to its design. In many ways the design process mirrored the knowledge-sharing that is now sought between researchers and community representatives from across the Kitikmeot region. Knowledge-sharing was in fact an essential part of the process that led to the design and construction of the CHARS campus. The main objective was to create a built environment that would be conducive to knowledge-sharing. Inuit Qaujimajatuqanjit (IQ) principles were applied to both the design process and the facility's design. For the sake of clarity, the main features and highlights of the integrated design process and the facility will be analyzed through the lens of the following five guiding principles. • Commission: Canada's Northern Strategy • Community Relevance: Cultural context of the Kitikmeot Region, Nunavut and the Inuit Nunangat Territory • Technical Feasibility: Bioclimatic conditions in the Kitikmeot Region • Users: Multidisciplinary, National and International scientists operating in a built environment facilitating knowledge-sharing with the community • Sustainable principles integrated in the CHARS

THE ARCTIC INSPIRATION PRIZE: ENCOURAGING, ENABLING AND CELEBRATING NORTHERN INNOVATION

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As the largest annual prize in Canada with a specific focus on the Arctic, the Arctic Inspiration Prize encourages, enables and celebrates the inspiring achievements of the people of the North. 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. Since the inception of the Arctic Inspiration Prize, over $8.4 million has been awarded to 22 diverse teams enabling innovative projects in education, preserving traditional knowledge and language, community inclusion in science, sustainable housing, performing arts and health. The Arctic Inspiration Prize is an ever-growing network that includes Indigenous organizations, academia, governments, industry, philanthropy, and arts and cultural groups who share a common goal: to recognize northern innovation and excellence and encourage teamwork for the betterment of life in the Canadian North. As of December 2017, the last step in achieving full northern ownership, independence, and sustainability of the AIP was completed. Encouraged by the broad support of the AIP from across the Canadian North and South, the Co-Founders made a gift totaling $60 million to the AIP Charitable Trust. The Prize has now become entirely Northern-owned and Northern-led. The AIP's impact is increasingly visible across the North and South through its exceptional Laureate teams who are fostering innovation and creativity, strengthening collaborations across the North and between the North and South and bringing benefits to individuals, organizations and communities.

BOWHEAD WHALES USE ADAPTIVE FORAGING STRATEGIES TO MAXIMIZE FEEDING OPPORTUNITIES

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As zooplanktivorous predators, bowhead whales (Balaena mysticetus) must routinely locate prey patches of sufficient energetic densities to meet their metabolic needs. However, little is known about Eastern Canada-West Greenland bowhead whale foraging behaviour and the quality or quantity of their prey in Canadian waters. We used a new approach to study bowhead feeding ecology in Cumberland Sound, Nunavut, that included: 1) multi-scale biologging, 2) an unmanned aerial system (i.e., drone), and 3) vertical prey collection at discrete depths using an optical plankton counter (OPC) and net collections for species identification and enumeration. Tag attachments for 17 whales ranged from 0.8 to 15.6 hours for fine-scale time depth recorders (TDRs), and for several days to weeks for long-term SPLASH tags. Analysis of drone-shot video showed that the whales did not feed at the surface during daytime (0-20 m), while the SPLASH tag data indicated that they made two types of probable foraging dives: long, deep square-shaped dives (80% of dives; 260 m ± 35 SD) and short, shallow square-shaped dives (16%; 22 m ± 5 SD). Vertical profiles of particle size and abundance from 72 OPC casts consistently revealed two layers of prey likely comprised of calanoid copepods (dominated by lipid-rich Arctic species—Calanus glacialis and C. hyperboreus) at depths that corresponded to bowhead whale dive depths from both fine-scale TDR and coarser-scale SPLASH tag data. The deep layer consistently contained fewer, but larger, particles (10% greater biomass) than the shallow layer. Higher and more predictable zooplankton biomass at depth may explain why the whales conducted proportionally more deep feeding dives. Bowheads may offset the increased energy costs of prolonged deep foraging dives by opportunistically exploiting shallow prey layers when they occur in high-abundances. Combining drones with tag-derived dive data and prey sampling showed a more complex feeding ecology then previously understood, and provides a means to evaluate the energetic balance of individuals under current environmental conditions.

CANADA'S ENGAGEMENT IN THE ARCTIC COUNCIL ARCTIC CONTAMINANTS ACTION PROGRAM (ACAP)

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The Arctic Contaminants Action Program (ACAP) is one of the six permanent Working Groups of the Arctic Council. Established in 2006, ACAP was founded as an Arctic Council action plan to remove the Arctic pollution sources identified through the Arctic Monitoring and Assessment Program (AMAP). ACAP's mission is to contribute to the reduction of environmental risks and prevent pollution of the Arctic environment through development of pilot projects that build capacity and demonstrate emission reduction activities for contaminants. ACAP is composed of four expert groups, including the Expert Group on Short-Lived Climate Pollutants; the Expert Group on Persistent Organic Pollutants and Mercury; the Expert Group on Waste; and, the Indigenous Peoples Contaminants Action Program. Currently, nineteen projects are being undertaken under ACAP – these projects address a range of pollutants and pollution sources, however none of these projects are being undertaken in the Canadian Arctic. In 2017, the Arctic Monitoring and Assessment Program (AMAP) published a report on Chemicals of Emerging Arctic Concern. Among other findings, this AMAP report determined that local contaminants sources are of greater importance than previously thought. Local sources include community waste sites and sewage outflows, among others. Further, as the Arctic economy continues to evolve, Arctic regions subject to economic development will be at a heightened risk of exposure to chemicals of emerging concern. The report therefore recommends that Arctic States consider the need for additional national and regional action to control and communicate the risks of pollutants within Canada is currently working to increase its participation in ACAP through activities including: • increased representation of Canadian experts on constituent expert groups; • proposal and implementation of pollution prevention, pollution reduction, and best practice demonstration initiatives in the Canadian Arctic under the auspices of ACAP; and, • enhancing international action on short-lived climate pollutants and other Arctic Contaminants. This presentation will provide an overview of the ongoing activities of ACAP including an apercu of ongoing projects under the ACAP Expert Groups. The presentation will also highlight opportunities for Indigenous peoples, northerners, policy makers, scientists, and engineers, to become involved with this Working Group.

CLIMATE SENSITIVITY OF HIGH ARCTIC PERMAFROST TERRAIN DEMONSTRATED BY WIDESPREAD ICE-WEDGE THERMOKARST ACROSS THE CANADIAN ARCTIC ARCHIPELAGO

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Ground-ice conditions dictate permafrost landscape response to climate-driven thaw. Ice-wedge networks underlie polygonal terrain and comprise the most widespread form of massive ground ice in continuous permafrost. Ice-wedge thermokarst, increasingly reported at local-scales, is associated with ground subsidence and ponding, development of high-centred polygons, and thermoerosional channels. Our research shows that recent thawing of hilltop ice-wedge networks is transforming many upland areas across the Canadian Arctic Archipelago. Change detection using high-resolution images coupled with Landsat reflectance trends indicates broad-scale increases in ponding from ice-wedge thaw on hilltops, which has especially affected ice-cored moraine on Banks Island and Victoria Island. The abrupt and widespread increase in ice-wedge ponding results from anomalously warm summers and indicates top-down ice-wedge thaw. Millennia of cooling climate have favoured ice-wedge growth, and an absence of ecosystem disturbance combined with surface denudation by solifluction has produced hilltops and sloping terrain underlain by extensive ice-wedge networks truncated at the permafrost table. The veneer of thermally-conductive mineral soils and absence of surface organic cover amplify upland active-layer response to summer warming. For these reasons, the intensity of ice-wedge thermokarst on Arctic uplands contrasts more muted responses to warming in low and subarctic environments. The magnitude and extent of the changes we observe has significant implications for ground thermal regimes, patterns of soil moisture, ecological change, and hydrological and geochemical fluxes. Increasing field evidence of thermokarst in Arctic permafrost highlights the need for integrated approaches to monitor change and investigate the cascade of environmental consequences.

DEVELOPMENT OF A MOLECULAR METHOD TO DETECT AND IDENTIFY TAENIID EGGS IN FRESH PRODUCE

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Zoonotic taeniid cestodes are amongst the most important food-borne parasites affecting human health worldwide. Contamination of fresh produce with the eggs of Echinococcus granulosus s.l., E. multilocularis, and some Taenia species shed primarily by dogs, wolves and foxes, poses a potential food safety risk. Humans consuming contaminated fresh vegetables, fruits, and berries could become infected and develop cystic or alveolar echinococcosis or larval infection with Taenia spp. However, only very few studies have attempted to investigate the potential contamination of fresh produce and the available methods to do so are unreliable.
The objective of this project therefore was to develop and validate a sensitive and reliable method to detect contamination of fresh produce (leafy greens and berries) with eggs of zoonotic taeniids. To optimize the wash procedure for recovery of taeniid eggs from produce, we spiked samples of romaine lettuce and strawberries with Taenia eggs and washed with glycine buffer, sodium pyrophosphate or 0.1% Alconox, a common laboratory detergent solution. Alconox proved to be the most effective wash solution for this purpose. Commercially available DNA extraction kits designed to work with difficult matrices, and offering the advantage of reliability and standardization, were used to extract DNA from the robust thick-walled taeniid eggs. We compared the performance of the Qiagen QiaAmp DNA Stool mini kit and the FastPrep FastDNA Soil kit from MP Biomedicals to extract DNA from 500, 100, 50, 10, 5, and 2 Taenia eggs. With both methods, the limit of detection was 2 eggs, with 1 / 5 and 2 / 5 samples positive using the Stool mini kit and the FastPrep soil kit, respectively. Additionally, DNA samples extracted using the FastPrep soil kit yielded lower Cq values in qPCR. Therefore, this kit was adopted for further use. Using previously published primers from a conventional multiplex PCR method targeting mitochondrial DNA, we developed a real time quantitative PCR for molecular detection of taeniids. This qPCR, with melt curve analysis included for species identification, can identify the E. granulosus complex, E. multilocularis, as well as all tested Taenia spp. In a series of spiking experiments, multiple samples of romaine lettuce and strawberries were spiked with 500, 100, 50, 10, 5 or 0 Taenia eggs. All spiked samples tested positive in the qPCR, indicating that the newly established protocol to retrieve and detect taeniid eggs on produce has a sensitivity of as few as 5 eggs per sample in both romaine lettuce and strawberries. Once further validated, this method could be employed for surveillance of these and other matrices to assess the potential risk for consumers.

CLAMS AS A SOURCE OF TOXOPLASMA GONDII IN IQALUIT, NUNAVUT

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Introduction: The seroprevalence of Toxoplasma gondii in Inuit communities of Nunavik is twice the global average. Ingestion of T. gondii oocysts may cause toxoplasmosis, a disease with worldwide distribution and clinical signs ranging in severity from asymptomatic to severe and life-threatening for immunocompromised individuals and children infected in utero. The robust environmental stage of the parasite (oocysts) can only be shed in feces of felids and could reach coastal waters via overland runoff. Uptake and concentration in bivalve shellfish may subsequently lead to seafood-borne exposure in humans if consumed raw or undercooked. Clams are an important country food in Iqaluit both in terms of cultural continuity as well as an affordable and available form of sustenance. To further investigate if shellfish may be relevant to the transmission of toxoplasmosis in Arctic communities, this study was designed to evaluate whether T. gondii is present in clams collected from Iqaluit, Nunavut. Methodology: Clams (Mya truncata) were donated by local harvesters from nine locations over a one-week period in September 2016 in and near Iqaluit as part of the People Animals Water Sustenance (PAWS) project investigating enteric illness in Iqaluit. Digestive gland and hemolymph were collected from each clam, DNA extracted, and polymerase chain reaction (PCR) targeting the 18S ssRNA gene performed to test for presence of T. gondii DNA. Samples that yielded amplicon products consistent with T. gondii were further processed for sequence analysis. Results: Six of 390 (1.5%) digestive gland and two of 328 (0.6%) hemolymph samples were confirmed positive for T. gondii. In total, eight of 390 clams had confirmed (>99% identity via sequence analysis) T. gondii DNA, with an overall prevalence of 2%. The eight T. gondii-positive clams were collected at two sampling sites (three at Apex, and five at Red Island), both within 5 km of the Iqaluit town center. The limited sample size, short duration of sampling, and relative low number of positive samples precluded statistical analysis for determining spatial or temporal risk factors associated with T. gondii contamination of clams. Conclusions: Molecular confirmation of T. gondii DNA in clams harvested for food in Iqaluit was intended to be useful for public health practice in Iqaluit. The source of T. gondii oocysts contaminating clams in this region is still unknown and deserves future investigation. Relatively few domestic cats are known to be present in Iqaluit, and wild felids are absent from this locale. Advection of oocysts from Southern waters through ocean currents or in migratory fish may be possible. These results on T. gondii in clams can support public health messaging, particularly for high risk people including pregnant women and patients who are immunocompromised.

THE ROLE OF KEY CHARACTERISTICS ACROSS SCALES IN INUIT HOUSEHOLD FOOD SECURITY STATUS

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Food security is one of the most important public health issues facing northern communities today. In 2014, the Canadian Council of Academies Expert Panel characterised the food security issue in northern Indigenous communities as a crisis. The development of effective public health interventions to address this crisis requires a strong understanding of the nature of the issue and its causes at the appropriate scale(s). Our current knowledge of food security prevalence and the factors influencing it are predominantly focused at the regional or territorial level only. However, significant differences exist from one community context to the next, particularly in northern regions, in terms of the economic opportunities available, accessibility to a diversity of land and sea-based resources, and access to market food outlets, to name a few. These contextual characteristics have the potential to influence the role and strength of key predictors of a household's ability to regularly access adequate, safe and healthy foods. In 2014-15 a community level assessment of household food security status was conducted in the Nunatsiavut region. Analysis of this database examined the role of key household and individual characteristics on household food security status at the community and regional scales. The differing role of variables at the regional and community levels will be explored and discussed. This examination across scales was done to highlight the importance of considering community specific interventions and support community level initiatives in the region in the future.

DEGLACIAL RESPONSES IN THE CHANNELS OF THE WESTERN AND CENTRAL CANADIAN ARCTIC: A YOUNGER DRYAS SIGNAL?

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Chronologically constrained records of end Pleistocene deglaciation and Holocene ice margin oscillations in the eastern Canadian Arctic Archipelago (CAA) show little evidence for the Younger Dryas (YD) cold interval (12.9-11.7 ka BP) – an event otherwise widely recognised from the circum-North Atlantic and beyond. Until recently, glacial behaviours coincident with, or in direct response to, the YD in the central and western CAA have been documented only from very limited and ambiguous terrestrial and marine records. This has made any assessment of the impact of the YD on the western and central Arctic margins of the Laurentide and Innuitian ice sheets difficult to determine. However, new work over the last five years has now begun to outline what appears to be a record of re-advance along the northern-central and northwestern margins of the Laurentide Ice Sheet (LIS) coincident with and immediately following the end of the YD chronozone. This talk explores the latest evidence based on geomorphic, marine sediment core, and seismic data from the central and western regions to suggest that, not only did the Arctic sector of the Laurentide Ice sheet respond to the YD, but that this response was dramatic and expansive, marked by the rapid establishment and subsequent collapse of multiple extensive floating ice shelves. Further, that this behaviour had major dynamical implications for the stability of the LIS following the YD. Given the proximity of the western CAA to regions implicated in the initiation of the YD event, a linked response to YD forcing mechanisms can be entertained. And while much more work remains to be done to determine the detailed response of the Laurentide margin and to further constrain chronologies, a region-wide YD response is now emerging as a meaningful hypothesis.

CLIMATE CHANGE IMPACTS ON TUNDRA ECOSYSTEMS: PERSPECTIVES FROM THE PAST

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The early to mid-Holocene was as warm or warmer than present across the Canadian Arctic, although the timing of the warm period varied from place to place. Studies of the pollen from lake sediments document the impacts of this warming on terrestrial Arctic ecosystems. I will discuss lessons from the past that have relevance to understanding the current changes. Dispersal to the Arctic occurred shortly after local ice retreat, suggesting that terrestrial ecosystems can respond rapidly to future climate changes. Climate warming tends to affect production of Arctic ecosystems more than biodiversity. However, computing the resemblance of fossil pollen assemblages of the warmer, early Holocene to all modern samples shows increasing dissimilarity in the past suggesting the present provides an incomplete analogue for future warm periods.

CAN AN ARCTIC TURBOT FISHERY ADAPT TO CLIMATE CHANGE? AN EMPIRICAL STUDY FROM THE PANGNIRTUNG COASTAL COMMUNITY IN BAFFIN ISLAND, NUNAVUT, CANADA.

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Global climate change is warming the Arctic. Inuit fishery systems are undergoing rapid change. Using the social-ecological systems resilience approach, this paper examines the extent to which an Inuit turbot fishery can adapt to climate change. We studied the Pangnirtung Inuit fisher community located in Baffin Island, Nunavut, Canada. The winter turbot fishery is the only commercial fishery co-existing with Arctic char subsistence fishery. Annually, the turbot fishery brings a large amount of resources (about C$ one million) to the community, mainly through fish selling and seasonal employment opportunities, significantly boosting Inuit livelihoods. The fishery is managed primarily by the community's largest employer, Pang Fisheries, under the supervision of Department of Fisheries and Oceans regulations. Climate change impacts such as warming sea water, changing sea ice conditions, and unpredictable extreme weather affect the Inuit way of life – including the turbot fishery – in different ways. The turbot fisheries system's key adaptive responses are: 1). an increasing trend towards including turbot in the meals of young Inuit, 2). the use of technological advancements such as motorised long-line pullers, GPS, VHF radios, and the internet for weather updates, 3). experimentation on summer turbot fishing using long-line trawling, 4). the sharing of turbot fishing knowledge/skills among neighbouring communities, and 5). the expansion of international niche markets for turbot fish products. However, additional attention is required on: a). researching turbot fishing spots, b). promoting turbot cooking recipes among Inuit youth, c). encouraging participatory decision-making, and d). further diversification of turbot markets. The paper argues that the adaptive responses of the turbot fishery create an entry point for adaptation to climate change but are not as promising, as such adaptations are eventually connected to global systems.

DRIVERS OF SEASONAL CHANGES IN THE BODY CONDITION OF POLAR BEARS ACROSS NUNAVUT, CANADA

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Polar bears (Ursus maritimus) rely on stored energy to survive periods of low prey availability. Their ability to accumulate and store energy can be influenced by foraging opportunities and habitat conditions. Adipose tissue acts as the primary site for energy storage in polar bears and an individual's adipose tissue lipid content provides an index of overall fatness. Lipid content has been used as a measure of body condition in western Hudson Bay and southern Beaufort Sea; however, a lack of data exists on body condition across the species' range, especially during winter and summer when capture efforts are limited. We investigated seasonality in body condition of polar bears across Nunavut, Canada, as well as the influence of intraspecific and sea ice variables on body condition. We analyzed adipose tissue samples from 1230 polar bears harvested in 2010-2017 across two ecoregions with varying sea ice regimes: seasonal ice ecoregion (i.e. Baffin Bay, Davis Strait, and Foxe Basin) with year-round samples and archipelago ecoregion (i.e. Gulf of Boothia and Lancaster Sound) with samples from August – May. Polar bear body condition was influenced by harvest date, sex, age class, date of break-up, and date of advance in both ecoregions. Both seasonal ice and archipelago ecoregions showed similar seasonal patterns in body condition with polar bears experiencing their lowest lipid content in the spring and highest lipid content in late summer/early fall. However, lipid content in bears in the seasonal ice ecoregion began to decline a month earlier than bears in the archipelago ecoregion (February to April and March to May, respectively). Body condition began to improve in the spring when seal pups are most accessible, and bears showed their highest lipid content in July in the seasonal ice ecoregion and September in the archipelago ecoregion. Differential timing of changes in body condition is likely a function of spring sea ice break-up occurring earlier in the seasonal ice ecoregion than the archipelago. Seasonal fluctuations in body condition suggest that polar bears are in a negative energy balance through most of the year, revealing the importance of the spring/summer feeding period. Ongoing and projected declines in sea ice conditions may result in reduced access to prey and longer onshore fasting periods. Harvest-based monitoring of body condition may facilitate the detection and prediction of polar bear responses to climatic change across their Canadian range.

MOBILIZING KNOWLEDGE FOR DEVELOPING INDIGENOUS COMMUNITY CHAMPIONS FOR CLIMATE CHANGE ADAPTATION IN YUKON

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Roberta Wally is a bright, young leader from the community of Carcross, Yukon, who is being trained as an Indigenous Community Climate Change Champion. The training is being hosted by the Arctic Institute of Community-Based Research and is part of a two-year initiative called: Mobilizing Knowledge for Developing Indigenous Community Champions for Climate Change Adaptation in Yukon (a.k.a the Yukon Indigenous Community Climate Change Champions (YIC4) Training Project), which is funded by Polar Knowledge Canada and Crown-Indigenous Relations and Northern Affairs Canada. Roberta is one of 27 Indigenous youth from across Yukon and other northern regions who are taking part in the project. During phase 1 of the training, youth learned from Elders, community-based researchers and scientists about climate change from the global to local context, with knowledge grounded in both Indigenous and western scientific worldviews. Over the summer, Roberta led her community in collaboration with two other YIC4 youth champions to assess the current activities going on, as well as understand needs and priorities in the areas of food/water security, species/habitat areas, infrastructure/transportation, culture/health/social, and economy. In January 2019, during phase 2, the 27 youth will come back together to further analyze their individual assessments and develop leadership, communications and advocacy skills for planning and implementing future climate change adaptation projects. During this presentation, Roberta is going to be talking a bit about the project in general and will share her experiences as a youth champion working with her community on the land as well as explain some of the current opportunities and challenges related to climate change adaptation in her traditional territory.

SEASONAL CYCLES IN NUNAVIK: COMMUNICATING ENVIRONMENTAL OBSERVATIONS FROM THE CAIMAN NETWORK

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The CAIMAN network (French acronym for "Cameras at Marine Infrastructures in Nunavik") was set up by INRS in six Nunavik communities for Transport Quebec and KRG to study changes in ice conditions and support research on impacts and adaptation to climate change. The data acquired since 2009 are used to document the coastal ice regime in Nunavik and to support the development of adaptation measures. Today, the camera network includes over 20 cameras in seven sites across Nunavik. To date, over 350 000 photos have been acquired and the number is now growing by more than 100 000 every year. They represent a unique source of information in a region where climate change is significant and where local and historical environmental observations are scarce. In this context, Polar Knowledge Canada is providing funding (2017-2019) to make a better use of the network information and to increase its dissemination at the community level. This is done by first, analyzing all photos since 2009 to determine various environmental indicators such as ice, snow and vegetation seasonal cycles, as well as climate information derived from observations of sun, fog, rain, wind and temperature). The results are then put together in a comprehensive way and presented in the form of a special calendar distributed in all Nunavik's communities. Here we present the CAIMAN Network and the environmental observations collected to date, as well as the process leading to the production of the calendar, which is a mix of scientific data, photo series from the camera network and Inuit art. We also present the website where all photos and derived data are also available.

NEAR REAL-TIME CLIMATE AND PERMAFROST DATA INTEGRATION IN SUPPORT OF THE DEVELOPMENT OF THE COMMUNITY OF SALLUIT, NUNAVIK.

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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 way, on a terrain that has difficult topographical constraints and ice-rich permafrost. Under the warming climate, those challenges require regularly updated information on permafrost temperatures, rates of summer thawing of the active layer and on georisks to be readily available to support land use planning, construction and security assessments in the face of potential landslides. Therefore, it is especially important to have continuous data to observe the evolution of permafrost and the impacts of climate change. Given the abundance and spatial distribution of monitoring instruments (i.e. thermistor cables, DTS-fiber optic cables, SILA automatic meteo station), integration of data and day-to-day observation of the thermal conditions will allow monitoring of the performance of buildings and help community management. As for now, these installations are working individually and the data must be downloaded from the instrumentation on site on an annual basis. The main goal of this project is to integrate the information of permafrost temperature and climate monitoring within the existing geospatial information and databases already produced by the Centre d'études nordiques (CEN) in Salluit in an online database that will be updated in real time and easily accessible. This will also provide information on climate factors, such as air temperature, precipitations and wind speeds. Furthermore, it will allow us to anticipate and predict the risk of hazards such as landslides. The centralisation of the information using a geographic information system (GIS) represents a valuable asset for the strategic planning of Salluit. This process includes updating the CEN's mapping base to take into account the community's continuing expansion. This analysis will be conducted using an integrated view of the village of Salluit and the various problems the community is facing as part of the development of its territory.
The updated version of the mapping will be available on ArcGIS online for the institutions involved in the planning of the community's development. Therefore, the database will be presented as interactive maps and aerial photographs and will integrate graphs and tables allowing climate and ground thermal regime evolution with the different monitoring instruments in the village. The data will be integrated into the master plan of the community produced by the Kativik Regional Government (KRG). The creation of a pre-warning signal of landslide risks in the active layer of permafrost in late summer is also planned.

FISHES IN THE POLAR NIGHT

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Most fishes are visual predators and generally rely on light to forage. Curiously, several species thrive during the polar night and continue to feed and even reproduce in the dead of night. Despite the accumulation of evidence that fishes and their predators continue their biological activities throughout winter, knowledge on fish ecology during the polar night remains an important data gap in polar regions. We reviewed studies on the winter ecology of the 12 most abundant species in the Arctic. Arctic specialists such as the Arctic cod (Boreogadus saida) are well adapted to the dim-light environment and continue to feed and conduct diel vertical migrations throughout the polar night. Yet, most boreal fish species also feed to a certain extent during the polar night, although pelagic fishes have higher rates of empty stomachs than bottom-dwelling species. The timing of spawning is the main ecological difference between Arctic and boreal fish. Most Arctic fishes spawn in winter and hatch in spring or early summer, during the peak of secondary production, to feed on copepod eggs and nauplii after resorption of the yolk sac. In contrast, boreal fishes generally spawn in spring, summer or fall and hatch after the short production bloom prevailing in the Arctic. Our review supports the hypothesis that the ability to reproduce during the polar night, rather than the ability to feed, is the key adaptive trait of Arctic fishes and the main factor limiting boreal fishes to colonize the high Arctic.

SENTINEL NORTH INTERNATIONAL ARCTIC FIELD SCHOOLS: A TRANSDISCIPLINARY AND MULTICULTURAL EXPERIENCE FOSTERING LEADERSHIP AND INNOVATION

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Université Laval's Sentinel North program is implementing an innovative transdisciplinary training strategy to encourage the development of the young experts needed to address some of the complex challenges facing the changing circumpolar North. A key element of this ambitious program is the deployment of International Arctic Field Schools (IAFS) that provide students, from north and south, with a unique opportunity to interact with high-profile scientists and local experts from diverse fields of expertise as part of a hands-on practical scientific setting in northern and/or highly technological environments. The first two editions of the IAFS took place in Iqaluit, Nunavut in March 2018 and onboard the CCGS Amundsen in Baffin Bay in July 2018. Already, over 40 graduate students and 11 Inuit college students from 20 institutions in 10 countries have benefitted from direct interactions with over 30 international experts from disciplines such as physics, biology, chemistry, geography, geology, oceanography, human health and social sciences. Through an integrative multi-faceted approach that includes lectures, case studies and field trips, the school allows participants to address complex and interrelated scientific and socio-economic issues, fostering the development of a holistic vision. The schools also provide participants, many who have never been North, with an invaluable opportunity to experience the North and interact directly with Northerners either as mentors or fellow participants. Through experiences and testimonies, the presentation will highlight the challenges and opportunities brought by this new transdisciplinary and multicultural northern scientific training initiative.

PRELIMINARY RESULTS OF WWF-CANADA'S EASTERN ARCTIC MARINE CONSERVATION NETWORK DESIGN PROJECT

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Climate change impacts in the Arctic, such as reduced sea-ice cover, migration of southern species into the Arctic, and decreased Arctic species numbers, are affecting Inuit ways of life. There is an urgent need to identify and to protect key areas in the Arctic marine environment to maintain Arctic species' health and ecosystem functions, mitigate impacts of human activities on ecosystems, and ensure that Inuit can maintain cultural and subsistence connections with the marine environment. Marine conservation area networks are a key tool in oceans management to inform and achieve marine conservation goals, support marine spatial planning, contribute to environmental impact assessments, and more. In the Canadian Eastern Arctic marine bioregions, candidate locations for stand-alone marine protected areas (MPAs) are being identified without considering broader network planning for the region. World Wildlife Fund–Canada (WWF-Canada) has undertaken a marine conservation planning process to identify and map a proposed network of priority areas for marine conservation in the Eastern Arctic. This presentation will present the results of the WWF-Canada's MPA network design mapping project, including the approach, methods, and outcomes. The map will be a tool to policy makers and managers to support the creation of an Eastern Arctic marine conservation network. Drawing on a wide range of biophysical and geophysical data, Marxan analysis, and subject matter expert input, the proposed network design includes both representative and distinctive areas and account for connectivity in the Arctic marine environment.

SCIENCE OUTREACH AND YOUTH ENGAGEMENT IN AN INNOVATIVE ON-THE-LAND CAMP IN THE NWT

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Northern Canada is one of the most rapidly warming regions on Earth. This warming is resulting in dramatic changes to ecosystems across Canada's North. These changes will increasingly affect young Northerners, as the health of the land and people are closely tied. It is imperative that the next generation understands these changes and challenges and are empowered to lead efforts to measure and monitor the impacts, as they are the future leaders in their communities. As part of the ongoing Northern Water Futures (NWF) project, led by Wilfrid Laurier University and partner institutions, and with funding from NSERC PromoScience, an innovative on-the-land camp was planned with community partners to engage Indigenous youth in the Dehcho region of the Northwest Territories (NWT) in hands-on science learning activities. This project featured NWF researchers, namely graduate students, who developed interactive land-based educational programming to build interest and skills for youth in the scientific study of the impacts of land use and climate change on water and ecosystems in the North. During the on-the-land camp experience, youth learned about scientific inquiry, techniques, and mapping technology to measure changes in water quality, permafrost conditions, and ecological function. The camp also included traditional knowledge holders who shared Indigenous perspectives on the land and water. Together, science and traditional knowledge empowered the youth through activities and games. This intensive, experiential format is preferred by communities in the North, as it fosters relationship building, mutual understanding and culturally-appropriate forms of learning. As youth are important stakeholders in the North, opportunities to learn from both Elders and researchers on the land will shape their abilities to be future leaders in their communities and inspire them to become involved in research and monitoring. As a first of three on-the-land camps that the NWF researchers will deliver, a camp at Willow Lake in August 2018 proved to be highly successful and provided many insights for growth and further development in the coming years. Youth were particularly interested in the integration of modern technology to understand our environment, most notably, an exercise that involved using iPads to survey and map the different ecosystem features. Generally, hands-on-activities were the most engaging for youth and provided the best opportunity for learning. In the next two years, NWF researchers will enhance their on-the-land programming by receiving specific training to develop age appropriate educational materials, understand the needs and limits of their audience, as well as work together with traditional knowledge holders in advance of the future camps. This training will facilitate integration of knowledges within camp activity sessions, in contrast to separate activity sessions for traditional knowledge and western science. Overall, this camp helped build a deeper understanding, for all participants, about the importance of protecting, caring for, and monitoring the land, water and wildlife.

USING UNMANNED AERIAL VEHICLES (UAVS) TO MAP AND MONITOR THE EFFECTS OF CLIMATE DRIVEN CHANGES ON THE WESTERN ARCTIC ENVIRONMENT: A CARIBOU HILLS CASE STUDY

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Climate driven changes are affecting the landscape and the way of life of the people of the Western Arctic. The effects of climate driven changes on the landscape of the Western Arctic are visible along the coastlines, inland to the valleys, water channels, and along the slopes. The protection of the people, infrastructure, and wildlife against the negative effects of climate driven changes will require unique mitigation strategies. The development and implementation of these unique mitigation strategies will require affordable, current, accurate, scalable, and specific spatial information. In general, the collection of spatial information can be costly and time consuming. However, this cost can increase exponentially in areas, such as the Western Arctic due to the rugged terrains and extreme conditions. In addition, the extreme conditions and inaccessible landscape also pose a risk to data collectors thus, the extensive use of non-contact data collection techniques example, satellite remote sensing (SRS). Although a suitable option, the application of SRS in the Western Arctic environment does have its limitation, especially in the collection of spatial information to support monitoring and mitigating against climate driven changes. That is, information from SRS can be: • Very costly to obtain; • Affordable resolution not suitable for local activities (i.e., development and implementation of local models; • Not current; • Data not available on demand; and • Data discovery can be very time consuming. The above points to the need for more cost effective methods of collecting spatial information in the Western Arctic. This can be in the form of either the application of new techniques to replace SRS or the integration of SRS with other techniques to enhance the product for Western Arctic users. This paper explores the possibilities of using unmanned aerial vehicles (UAVs) remote sensing techniques as a substitute for SRS where possible, as well as, a technique to be used in conjunction with SRS data to produce more enhanced products. That is, can UAV remote sensing techniques on its own or when integrated with satellite imagery produce more cost effective, current, and reliable high-resolution spatial information to support the management of the effects of climate driven changes in the Western Arctic? This hypothesis was explored through a hazard-mapping project of the landslides along the Caribou Hills (within the vicinity of Reindeer Station) in Inuvik, NT. The aim of the project was to use UAV remote sensing techniques to map the landslides along the Caribou Hills and monitor their characteristics overtime (e.g., their size and shape; soil types; surrounding vegetation; volume of soil displaced; and the presence of active run-offs within them). The results of the case study were used to determine the feasibility of UAV remote sensing as a viable cost effective alternative to SRS. The results were analysed within the context of cost, delivery time, resolution, required skillsets, the possible benefits of integration with SRS, and ease of use. The paper presents a description of the case study, methodologies used, the results, analysis of the results, and main conclusions that can be drawn from the analysis.

IDENTIFYING AND MAPPING NATURAL HAZARDS WITHIN KANGIQSUJUAQ SURROUNDING AREAS

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A major concern related to climate change is the thawing of permafrost causing erosion of land, rock and mud, drainage of lakes and increase the accumulation of sediments in rivers. Climate changes may also create unstable areas prone to avalanches in winter. All these natural hazards may have an impact on traditional harvesting sites such as rivers and lakes. The goal of this project is to help the community of Kangiqsujuaq identifying and mapping areas outside of the community that are either currently unstable or that are vulnerable to become more unstable as changes in climate continue. This project also aim to identify shifts that may impact on-the-land “infrastructure” such as camp sites and access trails. It is also projected to produce an identification guide and map in order to give a training to the land users to understand the process that are happening on their territory so they can keep monitoring these areas in the future.

BRIDGING THE DIGITAL DIVIDE TO SUPPORT COMMUNITY-BASED MONITORING IN THE CIRCUMPOLAR NORTH

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While community-based monitoring has been identified as an important method for tracking and adapting to the impacts of climate change, many communities in the Circumpolar North lack the necessary information and communication technology (ICT) infrastructure required to support the collection and dissemination of data relevant to these programs. In particular, limited internet bandwidth – which results in low throughput and high delay - and a complete lack of cellular connectivity limit the ability of Northern communities to collect and share environment and health data that have been identified by communities as necessary for the development of intervention and adaptation strategies. This is evident in the Inuit community of Rigolet, Nunatsiavut, where community members have been piloting the eNuk health and environment community-based monitoring program. Led by the Rigolet community and developed in partnership with researchers from the University of Guelph, the Labrador Institute of Memorial University, and the University of Alberta, as well as the Nunatsiavut Government, eNuk has been designed to allow users to record observations while in the community and off on the land using hand held mobile devices. Data that are collected on hand held devices are made available through on online website only when users are directly connected to the internet or through wireless signal. This limitation, coupled with limited ICT infrastructure is a bottleneck (at best) in the community-based monitoring program. At worst, it represents a potential health risk because information pertaining to safety issues (e.g. poor ice conditions) is not transmitted in real-time. To bridge the digital divide, the community is exploring alternative ICT known as wireless mobile mesh networks. Wireless mobile mesh networks are formed using a collection of mesh-enabled devices that have Wi-Fi, Wi-Fi Direct, and/or Bluetooth capabilities. In particular, these capabilities are used to create connections between devices instead of to a central device like a Wi-Fi router or cell phone tower. The resulting mesh network is capable of passing data from one device another. In this way networks can form where they are needed, as they are needed, without the overhead of installing and maintaining complicated and potentially costly ICT. In this discussion, we will begin with an overview of the community-led eNuk software, and outline design considerations that need to be made to accommodate the resulting lack of ICT infrastructure in the community of Rigolet. Wireless mobile mesh networks will be described; including considerations such as relevant device density required to sustain a dynamic network, maximum distance between devices to sustain a data linkage, transfer speeds, and more. This will also include a broader discussion of their potential to facilitate the collection and dissemination of data within community-based monitoring programs such as the eNuk health and environment software, and the design considerations required to implement them.

AEROSOL VIRUSES RELEASED FROM THE MELTING CRYOSPHERE: SENTINEL MICROORGANISMS FOR A CHANGING ARCTIC

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Viruses have critical roles in the environment, by maintaining biodiversity and microbial community structures. They drive evolution of their hosts through genetic exchanges, affect microbial populations through lysis, and control the productivity of aquatic ecosystems by redirecting carbon into the microbial loop. Viruses are also of direct importance to human populations, as they can include pathogens that may cause disease. The Arctic cryosphere is a reservoir for viruses – indeed, permafrost and glaciers, with their freeze-thaw cycles, can release viral particles that were previously trapped in ice for thousands of years. The viruses can be transferred to the atmosphere by aerosolization and recolonize the modern landscape of the North. Climate change is accelerating melting of the cryosphere and the production of aerosols from aquatic surfaces, potentially increasing the number of viruses in the air and their ability to disperse in the Arctic. These viruses may then recolonize Northern aquatic ecosystems and affect their productivity or may include potential human or animal pathogens that could impact community and ecosystem health in the Arctic. The « aerosol virome », the atmospheric viral community, has long been studied in the context of health care, as it is of critical importance for the transmission of infectious diseases. However, few studies have investigated environmental aerosol viromes, and none have focused on viruses freed from the thawing cryosphere into the environment. Here, we present preliminary results from our first field season for our project, aiming to characterise the aerosol virome of the surroundings of Thores Glacier (Nunavut) in the High Arctic. This unique site allows us to study how the glacier and surrounding permafrost may be releasing viruses into the atmosphere, and how these viral particles are dispersed to Thores Lake, adjacent to the glacier. Using next generation metatranscriptomic sequencing and bioinformatics tools, we aim to describe the viral diversity found in the glacier, the air, the surrounding permafrost and in the lake. We will also determine which viruses are emerging from the melting cryosphere, and how they move between the atmosphere and the lake. Finally, we will attempt to identify viral taxa that may be used as sentinels for change in the North. A better understanding of the aerosol virome of the warming North is critical, as this recycling of viral genomes may allow for a new colonisation of the Arctic environment. This may have consequences on human health in the North, and on productivity and nutrient transfer in aquatic ecosystems.

REMOTE SENSING OF FRESHWATER ICE PHENOLOGY IN CANADA'S NORTH IN THE ERA OF ABUNDANT OPEN-ACCESS SATELLITE IMAGERY

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The ice phenology of freshwater lakes throughout the Northern Hemisphere has undergone important climate-induced shifts over the past century. It has estimated that the length of the ice-free season has been increasing an average of 12.3 days/century. In Canada's North, where freshwater lakes and wetlands cover 15 to 40% of the landscape, monitoring ice phenology is vital given its important impacts on climate, socio-economic, ecological and hydrological systems. Remote sensing techniques are particularly well suited to tracking phenological events (e.g. spring break-up and autumn freeze-up) over vast and remote regions. The rapid and dynamic nature of ice phenology events has restricted any large-scale monitoring efforts to satellite sensors with frequent revisit times (e.g. MODIS, AVHRR), but their low spatial resolution (e.g. > 500 m) limit observations to larger water bodies which make up only a small fraction of northern landscapes. However, the increased abundance of open-access satellite imagery from different sensors has provided opportunities to reduce the trade-off between spatial and temporal resolution. In this study, we present an algorithm developed in Google Earth Engine (GEE) that combines imagery from multiple sensors into a single coherent time series of freshwater ice phenology observations over all of Canada at a 30-metre resolution for the spring seasons of 2014 to 2017. Using both optical (Sentinel 2 and Landsat 8) and SAR (Sentinel 1) imagery, we build reference datasets from a variety of lakes across Canada to optimize classification trees using machine learning to discriminate ice/snow, water, and clouds. Given the low performance of cloud-masking algorithms in optical imagery captured in winter, we combine the classified images into a single time series, then apply a temporal filter based on a pixel-wise logistic regression to remove misclassifications. Finally, we run a change detection algorithm to estimate the date a pixel transitioned from ice to water. We test the accuracy of our results against 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 provides: (i) an accurate estimate of spring break-up events at a high spatial resolution (30 meters), (ii) a scalable method readily applied to other subarctic and arctic regions, (iii) an updatable workflow capable of ingesting new images added to the GEE repository, and (iv) a coherent time series easily improved by adding classified imagery derived from other sensors.

STUDIES ON THE NUTRITIONAL ECOLOGY AND BEHAVIOUR OF POLAR BEARS UNDER HUMAN CARE

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Many diverse behavioural and physiological adjustments allow Arctic species to cope with changing photoperiods and seasonal shifts in temperature and food availability. Climate warming poses a threat to polar bears (Ursus maritimus) because in some areas, declines in Arctic sea ice are leaving less time for polar bears to adequately prepare themselves for progressively longer periods of onshore fasting. It is likely that changes in energy expenditure and nutritional intake associated with reduced food availability will be reflected in changes in blood biochemistry, body temperature, and behaviour. We used a combination of seasonal feeding, animal training, voluntary blood draws, body temperature analysis, and behavioural observations to quantify relationships between energy intake and the nutritional and physiological status of polar bears under human care. Four polar bears housed at the Toronto Zoo were maintained on a seasonal feeding regime whereby bears were in a positive energy balance in the winter and spring, and in a negative energy balance in the summer and fall. All 4 bears were trained to present their front paw through a blood sleeve for a voluntary blood draw using positive reinforcement training. A blood chemistry analyzer was used to generate a biochemical profile for each bear and successive sampling allowed us to monitor shifts in the biochemical blood values that could be reflective of changes in organ function and metabolic processes in response to seasonal energy intake and changes in body condition. Small temperature loggers were inserted into fish or meatballs and consumed by the bears, allowing us to monitor changes in core body temperature across season. Surveillance cameras allowed us to monitor the activity levels of the polar bears while on exhibit. These data allowed us to create an activity budget for the bears and monitor changes in relative activity levels throughout the year. The behavioural observation data were compared to temperature data and used to elucidate relationships between changes in body temperature and activity levels that were indicative of metabolic savings or behavioural thermoregulation strategies. The results are relevant to our understanding of how wild polar bears may respond to seasonal changes in food availability, and the long term consequences of a warming Arctic and climate-driven habitat loss.

CHARACTERIZATION OF BENTHIC COMMUNITY STRUCTURE, BIODIVERSITY AND ACTIVITY FROM CONTRASTING REGIONS OF ICE COVER IN THE WESTERN BARENTS SEA

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The northern high latitudes are experiencing some of the most rapid and severe climate change recorded globally, but the response of Arctic benthic ecosystems is poorly understood. Here, we quantify the effects of whole community macrofaunal burrowing and ventilation behaviour and associated sediment-water nutrient fluxes across the boundary between strongly Atlantic- and Arctic-dominated water masses in the western Barents Sea. We find that differences in assemblage composition, organism activity and standing stock along the continuum of sea ice-covered to open water strongly affect nutrient transformations and fluxes, although the pattern of variation can vary between years and is contingent on which invertebrate species are prominent. Our findings indicate that the contribution of the Arctic seafloor to regional and global carbon and nutrient cycles will fundamentally alter in the near to medium term.

IMPACT OF IMPLEMENTATION OF GASTROINTESTINAL PATHOGEN MOLECULAR TESTING IN THE QIKIQTAALUK REGION, NUNAVUT.

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Objectives: The advent of automated molecular infectious disease diagnostic panels has for the first time allowed for accurate and comprehensive on-site diagnostics for various infectious disease syndromes in remote northern communities. We present the data from the implementation and evaluation of on-site molecular testing for enteric pathogens at a hospital that provides laboratory testing for the Qikiqtaaluk region of Nunavut. Methods: All stool samples submitted for microbiological testing at were assayed using a Health Canada licensed multiplex molecular assay (BioFire Filmarray™ Gastrointestinal panel, bioMerieux Inc.). This assay detects 22 enteropathogen targets (13 bacteria, 4 parasites, and 5 viruses). Overall pathogen detection rates and public health reportable pathogen detection rates were compared between the pre-implementation period (June 1st, 2016 to May 31st, 2017) and the post-implementation period (July 14, 2017 to July 13, 2017). In the post-implementation period samples positive on molecular testing for a reportable bacterial pathogen were immediately forwarded for attempted culture recovery. Mean time from collection to result was also compared between molecular testing and stool culture in the post-implementation period Results: In the pre-implementation period a total of 322 stool samples submitted were submitted for a total of 481 separate microbiological tests. During this baseline period a total of 18 samples had at least one potential enteric pathogen detected (5.6%). A total of 5 patients (1.8%) who had testing for a reportable enteric pathogen had one detected. In the post-implementation period 295 stool samples were submitted for microbiological testing of which 137 (46%) were positive for at least one enteropathogen. 37 of detected pathogens were reportable to public health and 83 potentially treatable enteric pathogens were detected. In the post-implementation period the mean time to result for molecular testing (n=293) was 1.8 days (median 1 day, interquartile range 0 – 3 days) and for stool culture results (n=23) the mean time to result was 8.6 days (median 6 days, interquartile range 4 to 9 days). Discussion: Establishment of on-site molecular panel testing for enteric pathogens significantly increased the yield of diagnosis of infections of public health and clinical importance and significantly improved the time to result reporting. Further evaluations of clinical impact and other infectious disease syndrome testing is needed.

UPWARD DIFFUSION OF BOTTOM ICE DIMETHYL SULFIDE DURING TEH ADVANCED MELTING STAGE OF ARCTIC FIRST-YEAR SEA ICE

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Time series of dimethyl sulphide (DMS) distribution in snow, sea ice, under-ice waters and melt ponds, were conducted at an ice camp located offshore Qikiqtarjuaq (Baffin Bay, Nunavut). The sampling was achieved from June 2 to 27, 2015 during the melt period. Maximum DMS concentrations (212 to 840 nmol l-1) were measured in the bottom 0.1 m of sea ice, where Chl a ranged between 1.8 and 40 mg m-2. The density structure of the brine network went from a vertically unstable gravity drainage phase to a vertically stable phase as the ice melting season advanced. Thermohaline changes within sea ice controlled the distribution of DMS at the bottom 0.1 m of the ice, and within the interior ice. During the gravity drainage phase, bottom ice Chl a and DMS concentrations decreased by 70 and 60%, respectively, and contributed to the underlying water column. Concentrations of DMS were low (<30 nmol l-1) in the interior ice during the gravity drainage phase, while the thermohaline stabilization of brine density structure during the subsequent vertically stable phase allowed the DMS present in the bottom ice to diffuse upward within the ice. Interior ice concentrations reached 109 nmol l-1 below locally impermeable ice layers under locally refrozen ice and under melt ponds during the vertically stable phase. Estimated DMS diffusion flux through the ice ranged between ~140 and 300 nmol m-2 d-1 during the vertically stable phase, which indicates that upward diffusive processes from the bottom of first-year sea ice (FYI) represent an important mechanism by which DMS may reach the atmosphere in ice-covered oceanic systems.

BEYOND TRANSLATING AND DATA COLLECTING: FURTHERING LOCAL RESEARCH AND COMMUNITY-BASED MONITORING IN THE KIVALLIQ

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The wildlife co-management regime in the Kivalliq region of Nunavut consists of the Kivalliq Wildlife Board (KWB) and seven community-based Hunters and Trappers Organizations (HTOs) who work with each other and other co-management partners and observers – including the Nunavut Wildlife Management Board, designated Inuit organizations, federal and territorial government agencies, non-government environmental organizations, and industry – to make decisions and regulations on wildlife and environmental management. Inuit knowledge that contributes to management decisions develops through one's lifetime and is passed on from generation to generation. Drawing on over two years of anthropological research in the Kivalliq, including participant-observation and qualitative interviews carried out with community members in Rankin Inlet and Chesterfield Inlet, this presentation highlights achievements that have been made in successfully integrating traditional ecological knowledge aspects of Inuit Qaujimajatuqangit (IQ) into wildlife and environmental management decisions. Insights from individuals who have worked in the co-management regime, including members of KWB and HTOs, on how and when this works well are presented and discussed. Further, examples of both historic and current local community-based monitoring projects will be touched upon – some which have been quite successful, while others have experienced challenges. While progress has been made regarding the inclusion of IQ in co-management processes and some community-orientated research projects have been successful, there are still a handful of challenges in creating a truly meaningful network of community-based monitoring initiatives that truly result in co-produced knowledge that empowers local Inuit to fully engage in the co-management regime.

Challenges to be discussed include communication between organizations, management of data and access to it, moving from community-based data collection to community-based data analysis and reporting, coordination of various research initiatives across a huge geographic region, financial and human resource constraints, and distrust and disdain with management practices expressed by some community members. Remaining optimistic about interest expressed in the Kivalliq of further developing community-based research initiatives, including community-based monitoring programs related to research on fauna, flora, and cultural and physical landscapes, this presentation ends by suggesting possible and practical ways to address some of the challenges noted and move forward. A key recommendation is made on the need for a regionally-based research development and coordination centre that could develop local research capacity, serve as an archive of research data and reports, guide outside researchers on local protocols and needs, and further improve local and regional co-management partners' abilities to effectively provide evidence-based information that contributes to co-management decisions.

DEVELOPING MICROBIAL COMMUNITY BASELINE DATA TO SUPPORT BIODIVERSITY MONITORING IN THE CAMBRIDGE BAY AREA OF THE ARCTIC

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The Canadian High Arctic Research Station (CHARS) located in Cambridge Bay, Nunavut, is in a region near four major Arctic biogeoclimatic subzones, making it an excellent area to explore biodiversity and the impacts of climate change and other environmental stressors. The CHARS Experimental and Reference Areas (ERA) comprise terrestrial, freshwater and marine habitats, providing unparalleled opportunities to explore and catalogue Arctic biodiversity using traditional and genomics-based techniques across the different biogeoclimatic subzones. This study presents a preliminary characterization of the microbial diversity in soils from several ecosystems within an intensive monitoring area. The objective was to develop baseline data on the microbial community structures present in soils at different depths within each of the four ecosystems analyzed. Test pits were prepared in 4 different ecosystems (Dryas integrifolia – Carex rupestris on well drained mesic site, Cassiope tetragona – Tomenhypnum nitens on moderately drained snowbank site, Salix richardsonii – Carex aquatilis on imperfectly drained, thin organic site, and Carex aquatilis on poorly drained, organic deposit site) with the soil, in most cases, being sampled to the permafrost. The high pH soil (7.8-8.5) was visually distinct by depth and ecosystem with extensive plant roots near the surface in the latter three ecosystems, while the majority of the depth profile in the first ecosystem was dominated by mineral soil. From these test pits, replicate soil samples were collected from several depths in sterile Falcon tubes, transported on ice, frozen within several hours of collection and maintained frozen until analyzed. Nucleic acids were extracted from soils using a cetyltrimethylammonium bromide (CTAB) protocol, the DNA was purified, quantified and PCR amplified using universal archaeal-bacterial primers (V4-V5 region, 16S rRNA gene: 515F-Y and 926R) and eukaryotic primers (V4 region, 18S rRNA gene: 565F and 948R) prior to sequencing (Illumina MiSeq). Sequences were analyzed using in-house pipelines, with sequences being compared against public sequence databases (e.g. NCBI, Greengenes). A comparative analysis of the sequence results across the different ecosystems will be presented. The results are being analyzed for microbial community composition and relative abundance of major taxa, by ecosystem type and by depth. Comparative analyses will explore similarities between ecosystems and the identification of potential indicator taxa that might distinguish each of the different ecosystems. This data will be combined with the physico-chemical data from each of the soils and analyzed in relation to screening data on the flora and fauna of the different ecosystems. The microbial community structure data will complement the other biodiversity data that has been developed from these ecosystems, serving as a baseline reference point and the starting point to assess any future changes in biodiversity linked to environmental drivers, such as climate change. These data will also complement other research being conducted in the area on aquatic microbial communities, carbon exchange processes in soil and plant nutrient uptake/exchange cycles.

INCORPORATING SALLUIT COMMUNITY VOICES IN ARCTIC MARINE CORRIDOR MANAGEMENT

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As Arctic climate changes and waters increasingly become more navigable, there is global interest in exploiting new routes, resources, and environments. One consequence is the increase in shipping traffic in Arctic Canada. This growing activity provides potential benefits such as increased opportunities for resource extraction, tourism, and community resupply services. It may also bring risks, including security threats, vessel incidents, environmental disturbances, and the degradation of historically or culturally significant areas. This new landscape creates pressure on local communities and residents, particularly Inuit, who are intrinsically linked to the land and environment for sustenance, cultural practices, and personal well-being. Increasing vessel traffic has prompted the need to establish governance across the region, to implement travel strategies, create infrastructure, and provide support to both travelers and communities who may be impacted by the changes. The Canadian Coast Guard, Canadian Hydrographic Service, and Transport Canada are co-leading the development of a network of low-impact shipping corridors (LISC). These corridors encourage vessels to use routes that minimize risk and impact on communities and the environment. Therefore, the need to include Northern voices, concerns, and management strategies in the LISC is vital if they are to serve all who use them. The Arctic Corridors and Northern Voices project aims to integrate Inuit and Northerners' knowledge, concerns, and recommendations for management into the LISC. Participatory mapping, semi-structured group discussions, and individual interviews - many co-facilitated by Inuit community researchers - were conducted in eleven communities. This presentation will outline the research experience of one community, The Northern Village of Salluit, Quebec. Analyses focused on maintaining the integrity of respondents' narratives with discussion conducted in the participant's language of choice, translated into English, audio-recorded, and transcribed. Knowledge gathered during these interviews was digitized and mapped using ArcGIS. The maps created include significant socio-cultural and ecological sites, current and historic travel routes, and preferred corridor locations based on the community's use of the land and marine environments. Participants also identified current and potential future impacts of shipping in and around the community including ecological, environmental, financial, and cultural well-being. These impacts and associated concerns stemmed from changes in nearby ecology (animal behaviour, ice conditions, and shoreline conditions), increases in danger while traveling (ice conditions, vessel noise disturbance, and vessel wakes), and an increase in personal expenses (time, money, food insecurity), and economic losses. Participants identified a number of potential changes to the LISC which would improve the safety of the corridors, including reduced-speed zones, no-wake zones, limited-wake zones, preferred ice-breaking locations, no-icebreaking locations, and hazard location response zones. Additional recommendations included improved communication between government, marine vessels, and communities, and an increase in charting the area to help identify safe passage routes and environmental changes. Further, this study demonstrated that the inclusion of local Inuit and Northerners' knowledge in the development of the corridors is imperative. This will ensure the LISC consider the people who use the land, ice, and water every day for sustenance and cultural livelihood, while maintaining both economic and environmental obligations.

PROTOZOAL POPULATION SHIFTS ACROSS CLIMATE GRADIENTS AT THE ARCTIC/ SUBARCTIC INTERFACE

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Population genetic, molecular and serological methods were applied to establish baseline prevalence and species type for protozoal agents infecting marine mammal and terrestrial wildlife populations resident or migrating between Arctic and subarctic ecosystems. Our goal was to investigate longitudinal trends of protozoan population shifts in the Arctic that may impact the distribution, health and exposure of marine mammals, terrestrial wildlife, and human populations to protozoal pollutagens. We applied pan-coccidian primers (18S, trans-ITS) that specifically amplify tissue encysted protozoal agents to 261 Arctic marine species (81 cetacean, 10 mustelid, 170 pinniped). Prevalence was 65% (169/261) and 15 different protozoal agents, the majority of which were novel species, were identified infecting Arctic marine mammal species. One Arctic protozoal agent enzootic as a benign infection in Ringed Seals (Sarcocystis pinnipedi) caused a fatal epizootic in 406 Grey Seals that died of necrotizing hepatitis over a 3 week period in 2012 on Hay Island, off the coast of Nova Scotia. Another parasite (Sarcocystis lutrae) enzootic in Arctic foxes was widespread in Northern sea otters (prevalence of 50%) and has emerged since 2015 to infect terrestrial and marine mammals in sub-Arctic ecosystems. Our current work is attempting to define how Arctic parasites have spread South. Our findings suggest that climate change is a factor, allowing immunologically naïve, previously unexposed marine mammal populations such as Grey Seals to overlap with Ringed Seals when historically polar ice sheets limited their intermixing. Finally, our genetic and follow-up immunohistochemistry analyses has identified Toxoplasma gondii infection, a highly endemic parasite in the sub-Arctic, in 5/36 (14%) healthy, hunter-harvested Arctic Beluga collected between 2008-2010. Retrospective serological studies also identified 10 Toxoplasma seropositive animals among 60 blood specimens (6% prevalence) collected between 2004-2012. This parasite is known to infect Beluga from the St. Lawrence Seaway, but has not previously been reported to infect Arctic Beluga. Our data suggest that marine mammals are important sentinels of Arctic ecosystem health as well as sources of protozoal pathogens that could conceivably pose a human health risk or impact threatened marine mammal stocks

HOW PRODUCTIVE ARE LAKES AND PONDS IN THE KITIKMEOT REGION? A FIRST ESTIMATION OF PRIMARY, BACTERIAL AND ZOOPLANKTON PRODUCTION OF GREINER LAKE WATERSHED

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Arctic lakes are prominent features of the Kitikmeot landscape and essential for fish such as Arctic char, lake trout and lake whitefish that are at the apex of aquatic food webs of the region. Traditional Inuit diet is heavily dependent on these fish that spend all or part of their life cycle in freshwaters. However, fish production is not homogeneous across the landscape and traditional knowledge reports indicate that although many lakes are known for their high fish yield, other lakes are known for poor fishing success. The growth, reproduction and survival of the fish at the top of the food chain is dependent on trophic level processes that transfer energy and carbon from phytoplankton and benthic alga to zooplankton and other fish prey. However, little is known about the relative importance of these processes for generating fish biomass and quality, or how these processes are affected by external environmental drivers. Furthermore, the effect of the environment is expected to change with global warming, for example, phytoplankton and bacterio-plankton that recycle essential phytoplankton nutrients are predicted to be differently influenced by direct and indirect effects of climate change. Direct effects such as rising temperatures are predicted to increase phytoplankton and bacterial production rates. Alternatively, indirect effects of terrestrial inputs such as high coloured dissolved organic matter (CDOM) from thawing permafrost may increase bacterial production but decrease phytoplankton and benthic algal production due to decreasing available light for photosynthesis. These questions highlight the need to understand factors controlling plankton and benthic resource production and how these communities will be influenced by a changing environment. Our aim is to identify key ecosystem processes that sustain healthy ecosystem function that results in fish yields compatible with local demand. To achieve this, we sampled 21 lakes and ponds in August 2017-2018 in the Greiner Lake watershed to estimate algal, bacterial and zooplankton production. The lakes and ponds were hydrologically connected, but were very diverse in terms of size, depth and limnological characteristics. This morphometric diversity was reflected in the phototrophic and heterotrophic production rates that we measured. Specifically, bacterial and zooplankton production was several orders of magnitude higher in headwater ponds compared to larger lakes downstream. The difference between headwater and other lakes was apparent in pelagic and benthic algal production. Size and depth of the lakes and ponds seem to be a determining factor for all heterotrophic and phototrophic production. Our results provide essential baseline data on planktonic and benthic biomass and production rates in Kitikmeot freshwaters including the CHARS Experimental and Reference Area (ERA), which has been selected for a long-term monitoring by Polar Knowledge Canada. Further work will focus on understanding the diversity of communities and production over longer time frames. This work lays the foundation for identifying the determining factors that result in the heterogeneity in fish production across these Arctic freshwater systems and will provide the community with background information needed for maintaining the ecosystem services of the Greiner lake watershed for the local Inuit community.

A MAYOR'S ASSESSMENT OF A COMMUNITY THREATENED BY COASTAL EROSION

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I have been invited to give this talk by the United Nations Environmental Program who are conducting an assessment of coastal permafrost research needs. Tuktoyaktuk/Tuk-tu-yaaq-tuuq or short version "Tuk" (Inuvialuktun: resembling a caribou), is an Inuvialuit Hamlet of about 965 people which is located on the shores of the Arctic Ocean at the tip of the Northwest Territories. Tuktoyaktuk is located in a low-lying setting where ice-rich permafrost is widespread. A tour of our community ice house quickly will reveal to any visitor, that Tuk is a permafrost community with the permafrost both above sea level and below is in some cases nearly pure ice. Many tourists who visited our community this summer on the new Inuvik to Tuktoyaktuk road will know first hand that the community is very exposed to waves and winds. As the Mayor, my council and I are facing substantial challenges. We are dealing with accelerated rates of coastal erosion that day-by-day tear away our coastline; we are dealing with storm surges that can flood parts of the community. We are on the front line of climate change in the Arctic, but frankly are seeing no concrete action to help us solve our problems. While we appreciate scientific and engineering studies that have been ongoing in our community, we encourage you to address the real problems. Constrain the geological processes that are ongoing including sediment erosion and movement, but most especially consider the thawing of permafrost in our cliff sediments and below sea level. We then need engineers to give us practical solutions that will solve our problems and protect our community. We also want to see solutions that our community can participate in. We have talented skill base, we know our local environment, and we need employment. Now is the time for action

PHASE CHANGE AND WATER MOVEMENT IN SHALLOW PERMAFROST INFERRED FROM BOREHOLE OBSERVATIONS OF LIQUID WATER CONTENT AND TEMPERATURE NEAR YELLOWKNIFE, CANADA

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Three experimental installations for measuring temperature and liquid water content as well as surface heave/subsidence were made in summer 2017 near Yellowknife. All three quantities are measured with hourly resolution. The measured depths for temperature and liquid water content extend from 0.1 to around 2 metres. Temperature is calibrated to +/- 0.02 ºC except for one borehole that is accurate to only +/- 0.1 ºC. Water content is measured with a repeatability of a fraction of a percent, but absolute calibration is work in progress. Surface heave/subsidence is measured with an accuracy of +/- 0.5 mm. This contribution will show results based on data from July 2017 to June 2018, possibly to November 2018. The derived freezing characteristic curves, although limited by the temperature range experienced at each depth, are of high quality and predominantly show clear hysteretic behaviour. Water movement in the frozen soil can be inferred during periods when the experimental freezing curves (volumetric liquid water content as a function of temperature) deviate from their otherwise smooth exponential shape. Additionally, short episodes of increasing liquid water content occur in cooling permafrost. This contribution will present the major phenomena observable from the combined data set of temperature, liquid water content and subsidence. Inferred water content in freezing soil will be discussed in more detail. This work contributes to better understanding the behaviour of near-isothermal permafrost. This is important because permafrost in many locations is subject to thaw i.e., the gradual loss of ground ice. Here the relevant changes of material properties are incompletely understood based on temperature observation alone.

RESPONSES OF ARCTIC TUNDRA SHRUB SPECIES TO CLIMATE CHANGE: DIFFERENCES BETWEEN BIOTIC AND ABIOTIC FACTORS, AND BETWEEN SHORT- AND LONG-TERM EFFECTS

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Climate change in arctic tundra is projected to affect multiple biotic and abiotic factors, including increases in air temperature, soil fertility, snow depth, and changes in caribou herbivory. These effects may alter plant community composition differently by shifting niche space to favor particular species' life-history strategies. Here we report the results of a series of long-term (12 years) manipulative experiments (control, greenhouse summer warming, low nitrogen addition (LN), high nitrogen addition (HN), high phosphorus addition (HP), high nitrogen plus high phosphorus addition (HNHP), snowfence, and caribou exclosure treatments) in a mesic birch hummock tundra ecosystem. Aboveground biomass change in 5 major shrub plant species was repeatedly measured using a point framing method in three separate years (2005, 2011, and 2017). Significant temporal (over 12 years) changes in shoot biomass were observed under control, warming, HN, and HNHP, but not under other treatments, for three dominant species: Rhododendron subarcticum, Betula glandulosa, and Vaccinium vitis-idaea. Specifically, biomass of B.glandulosa increased under control, warming, HN and HNHP treatments, biomass of V. vitis-idaea increased under control and warming but decreased under the HN and HNHP treatments, and biomass of R. subarcticum increased under the control and warming treatment but decreased under the HNHP treatment. Furthermore, over the 12 years of treatments, biomass of the two evergreen species, R. subarcticum and V. vitis-idaea decreased, whereas biomass of the deciduous species, B. glandulosa increased, with both HN and HNHP treatments. These findings show that vegetation biomass responds most significantly to warming and nutrient addition manipulations, with the dominant species being mostly affected.

SPATIAL DISTRIBUTION OF RIVERINE TRACERS IN SOUTHEAST HUDSON BAY

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Here we present recent seawater measurements of dissolved organic matter (DOM) with stable isotope ratios of barium and strontium in southeast Hudson Bay. The winter and summer surveys (2015-2017) were conducted in collaboration with Inuit and Cree from communities located in the coastal corridor. Surface distribution of DOM, Sr and Ba highlighted the significant impact of freshwater inputs on the carbon system in eastern James Bay and in the coastal corridor near the Belcher Islands. Stronger terrestrial signal was observed in the coastal corridor during the winter season, likely due to increased amounts of river runoff from controlled river systems. These results support earlier studies that winter river plumes have a stronger influence on coastal waters than summer river inflows.

HYDROGRAPHIC AND BIOGEOCHEMICAL CONDITIONS IN NORTHEASTERN COASTAL JAMES BAY AND SOUTHEASTERN HUDSON BAY DURING WINTER AND SUMMER OF 2016-2017

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The watershed and coastal environment of eastern James Bay have undergone evident change since the late 1970s. The change may be attributed in part to climate change, which has reduced the season of ice cover by freezing up later and melting earlier than usual in this region. It is also attributed in part to altered seasonality and magnitude of river discharge associated with diversions and dam construction on the La Grande River beginning in the 1970s. These alterations to the natural system provide potential mechanisms for changing the freshwater and nutrient dynamics in northeast coastal James Bay and the downstream area of southeast Hudson Bay. In view of the scarcity of data collected in this area prior to 2016, this study aims to introduce the present-day hydrographic and biogeochemical conditions of the area as context for ongoing and future studies of potential threats to eelgrass (Zostera marina), an essential vegetative species for maintaining the ecosystems located along the coast in this area. Eelgrass is an important part of the Cree culture in this area and has been recently showing indications of decline in spread and health. Fieldwork was conducted in conjunction with the Cree Nation of Chisasibi and the Arctic Eider Society. Oxygen isotope ratio data ($\delta 18O$) and nutrient concentrations (phosphate, nitrate, and silicate) were obtained from analyzed water samples taken in eastern James Bay and southeast Hudson Bay to help describe the nutrient distribution in this area based on the seasonal freshwater composition. The data encompasses winter, spring, and summer of 2016 and 2017. CTD profiles were also taken to better understand the structure of the water column. River and seawater end members were established based on $\delta 18O$ and salinity data, and were used to determine the freshwater composition of all individual samples. In winter, the La Grande was found to be a very low source of phosphate (0 to 0.15μM) but a high local source of nitrate (just above 5μM) relative to the marine waters that circulate along the northeast James Bay coast (above 0.6μM phosphate, 3μM nitrate). Southeast Hudson Bay had higher nutrient concentrations overall, in comparison to eastern James Bay sites. Preliminary interpretation of the results suggests that the northeast James Bay coast is oceanographically isolated from the deep, nutrient-rich waters that lie below the winter mixed-layer in Hudson Bay (at a depth of 100m). Because dissolved inorganic nitrogen is generally the limited macronutrient for phytoplankton growth in the Hudson Bay system, riverine contributions may play a disproportionate role relative to upwelling in controlling phytoplankton and algal growth in northeast coastal James Bay.

FACTORS INFLUENCING THE MENTAL WELLNESS OF COMMUNITY HEALTH WORKERS IN NAIN, NUNATSIAVUT

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Objective: We aim to understand how community health workers within the Nunatsiavut Department of Health and Social Development (DHSD) maintain or improve their mental wellness at work. Background: Community health workers are vital to the kind of community-based, culturally grounded healthcare service delivery that has been promoted as a strategy to increase access and reduce barriers to healthcare for Inuit, especially those living in remote communities. Little is known about what factors facilitate and create barriers to community health worker mental wellness and worker access to mental health supports in these contexts.In collaboration with Nunatsiavut DHSD staff, we explore how frontline workers, their managers or team leaders, as well as higher-level supervisory staff, maintain or improve their mental wellness at work, and/or coordinate (for supervisory staff) mental health supports in order to contribute to psychological health and safety in the workplace. Methods: We use a qualitative case study approach and gather multiple sources of data including interview data from three worker perspectives – program support staff, team leaders, and supervisory staff – as well as policy documents, media articles and peer-reviewed literature to understand what factors influence community health worker mental wellness, and workers' perceptions of access to supports to improve and maintain mental wellness in Nunatsiavut. Findings: Our research identifies job role, organizational, community and individual factors that facilitate and create challenges to community health worker mental wellness within one Nunatsiavut community. In particular, trauma exposure of workers directly and indirectly influenced their mental wellness, however the degree to which this was attributed to levels of staff mental wellness, and the accessibility of mental health supports, depended on the level of respondent embeddedness within the community of Nain. Conclusion: Understanding how historical and current contexts can influence workers' experiences of organizational policies within Indigenous-led organizations can help inform contextually responsive approaches to developing workplace mental wellness policies.

MANAGING ACOUSTIC IMPACTS ON MARINE MAMMALS IN THE WESTERN CANADIAN ARCTIC

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Vessel traffic has been increasing throughout the Arctic, and this may lead to increased negative impacts on marine mammals, including acoustic impacts. Marine mammals rely on acoustics for effective communication, prey detection, and predator detection. Underwater noise from vessels can influence the effectiveness of how marine mammals use acoustics, and can cause other issues including increased stress levels and behavioural disturbance. In this presentation, we will examine how vessel traffic in the western Canadian Arctic might impact marine mammals, and then assess a variety of management tools that can be used to reduce these impacts, including corridors, exclusion zones, and vessel slowdowns.

ASSESSING VESSEL SLOWDOWN FOR REDUCING AUDITORY MASKING FOR MARINE MAMMALS OF THE WESTERN CANADIAN ARCTIC

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Noise from shipping traffic can lead to acoustic masking, reducing the ability of marine animals to detect and use biologically-important sounds. Vessel-slow down may be an alternative mitigation option in regions where re-routing shipping corridors to avoid important habitat for marine mammals is not possible. We investigated the potential relief in masking from a 10 knot speed reduction of container and cruise ships. Based on ambient sound measurements and real shipping data, the percentage reduction in the available listening space for marine mammals as a container or cruise ship passes under varying speeds and ambient sound conditions was shown. The mitigation effects from slower vessels (travelling at 15 knots compared to 25 knots), in terms of auditory masking, was not equal between ambient sound conditions, species or vessel-type. For example, under quiet ambient conditions, a speed reduction from 25 to 15 knots resulted in smaller listening space reductions by 16–23%, 10–18%, 1–2%, and 5–8% respectively for belugas, bowheads, bearded seals, and ringed seals, depending on vessel-type. However, under noisy conditions, those savings were between 9 and 19% more, depending on the species. This was due to the differences in species' hearing sensitivities and the low ambient sound levels measured in the study region. Vessel slowdown through sensitive habitat could be an effective mitigation strategy for reducing the extent of auditory masking.

CHARACTERIZATION OF ARCTIC FISH SKIN AND INTESTINAL MICROBIOMES WITH POTENTIAL FOR MONITORING FISH HEALTH.

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Northern populations of Arctic char (Salvelinus alpinus) can be anadromous, migrating annually from the ocean to fresh water lakes in order to escape freezing in sub-zero temperatures. Such seasonal behaviour demands

that these fish and their associated microbiomes adapt to changes in their environment. We have characterized the bacterial community compositions of anadromous S. alpinus, netted by Inuit guides at fresh ice-covered and open sea water fishing sites selected in and around King William Island, NU. An on-site lab facilitated the aseptic sampling of epithelial mucosal associated microbiota from the skin and intestines of individual fish. After shipment south, DNA extraction and high-throughput sequencing of PCR-amplified 16S ribosomal RNA gene fragments generated an index of bacterial taxa for the respective microbiome samples. Multivariate statistical analyses suggest that microbial community compositions are linked to salinity. Microorganisms with putative psychrophilic and geochemical cycling properties were also identified, suggesting that these taxa have potential for further study as probiotics for fish husbandry. The microbiome data will not only contribute to our understanding of the roles microbial assemblages play in host fish but will also be useful for future benchmark assessments of the overall health of fish stocks as climate change, increased commercial shipping, energy and extraction industries impact the lower Northwest Passage. Such assessments are important for a sustainable commercial fishery for Gjoa Haven, NU (Towards a Sustainable Fishery for Nunavummiut; TSFN, arcticfishery.ca).
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MOBILIZING LOCAL KNOWLEDGE FROM THE KITIKMEOT REGION TO INFORM UNDERSTANDING OF, AND RESULTING CO-MANAGEMENT STRATEGIES FOR, THE DOLPHIN AND UNION CARIBOU HERD

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Mi'kmaw elder Albert Marshall coined the term Etuaptmumk (two-eyed seeing), to explain the concept of using the strengths of Indigenous ways of knowing together with the strengths of Eurocentric ways of knowing. With Etuaptmumk, we can minimize individual knowledge limitations, create a new way of understanding environmental problems and work to mitigate power imbalances between communities and academics. The application this of approach in the Arctic would be extremely valuable to overcome logistical research obstacles and to promote community-based research, collaborations and effective partnerships between those from an Indigenous and Eurocentric way of knowing. The next step to apply these theoretical concepts is to understand, and then respect, the differences between Indigenous and Eurocentric knowledge and the implications these have on establishing successful partnerships. By delineating the knowledge systems and using boundary work concepts, we can begin to understand how to appropriately and effectively facilitate interactions between them. Though it is neither practical nor ethical to focus on overcoming the monumental differences between Indigenous and Eurocentric ways of knowing, we have the potential to create successful intercultural collaborations by interacting with the boundaries of the knowledge systems. Kugluktuk, Nunavut, is a town located in the Kitikmeot region on the Canadian mainland, has a population that is 99% Inuit and is one of at least 5 communities that depend on Dolphin and Union caribou for subsistence and cultural practices. Recent aerial surveys and local knowledge studies are demonstrating that this caribou herd is in decline, and local knowledge observations further detail this decline with poorer body conditions, increased disease and fewer calves. As a case study, I will explain how we are employing this theoretical understanding of knowledge systems to improve our protection strategies for the Dolphin and Union caribou herd. In Kugluktuk, the Kugluktuk Angoniatit Association: Hunters and Trappers Organization is the local Inuit wildlife authority and is responsible for representing the community's wildlife concerns at the regional level. Furthermore, the Government of Nunavut is obligated to consider Inuit Qaujimajatuqangit (knowledge) in wildlife management decisions, yet meaningful incorporation of this knowledge has been difficult as there are no formal strategies in place to help facilitate knowledge transfer between communities and the Government of Nunavut. We are using qualitative methods as a tool for creating collective Inuit Qaujimajatuqangit accounts about the Dolphin and Union caribou herd from 2003 and 2018 interviews. This community-based and participatory project will help us to better understand the health status of the Dolphin and Union caribou, help inform co-management strategies to protect this herd, give power to the community to represent their voice at the territorial level, and demonstrate how it is essential in effective co-management initiatives to have a deep understanding

and respect for all the cultures, people and partnerships involved.

ICING PROTECTION SYSTEMS FOR UAVS IN THE ARCTIC

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Unmanned aerial vehicles (UAVs) offer great opportunities in the Arctic. They can deploy a large variety of remote-sensing instruments into inaccessible areas at low cost without putting human life at risk. Many potential applications have been theorized in past and many of them have been realized today. For example, sea ice monitoring, iceberg tracking, oil spill detection, glacial photogrammetry, vegetation & wildlife observations, search & rescue operations, power line inspections and many more. Seizing these opportunities can be highly relevant for the Arctic as it may improve our understanding of the ecosystem, allow for safe shipping operations, improve living conditions and provide a multitude of scientific data. However, there are severe challenges to UAV operations in the Arctic. In particular, atmospheric icing poses an important technical challenge. When ice collects on an aircraft during flight it will decrease the aerodynamic performance by decreasing lift, increasing drag and deteriorating the stall behavior. Experience shows that this often can lead to the loss of a UAV. Currently, there are no mature icing protection systems (IPS) available for UAVs. Effectively, this means that during icing conditions UAVs need to stay grounded or face an substantial risk. This study investigates general requirements and design specifications for an IPS enabling all-weather capability for UAVs. Reliability, energy efficiency, and weight are key variables that have to be selected carefully depending on the platform and mission type. Several potential technical solutions are discussed and two protections strategies explored on a generic UAV example. Anti-icing systems prevent any ice to form on a surface by continuously providing heat to it. De-icing systems allow for a certain amount of ice to form which is then periodically removed. The characteristic advantages and disadvantages of each system are presented. Data is provided by both, computational fluid dynamic (CFD) simulations and experiences from a UAV-IPS developed at NTNU.

SEA ICE SURFACE FEATURE CHARACTERIZATION AND SURFACE ROUGHNESS QUANTIFICATION FROM UAV IMAGERY

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The use of unmanned aerial vehicles (UAVs) as platforms for scientific data collection has rapidly grown due to the ongoing development of micro-remote sensing technologies and the steady decrease of the price of UAV platforms. This has allowed for the expansion of UAV data collection into areas where spatially and temporally high-resolution remote sensing data does not exist, such as the Canadian Arctic. UAV data collection in the Arctic is restricted by the harsh climate and limited GPS capability, meaning previous research in this field is narrow. By providing methods of data collection, analysis and interpretation, this project aims to contribute to the field of UAV applications in Arctic settings. Data collection for this project was completed aboard the CCGS Amundsen as part of the 2018 BaySys campaign. UAV imagery was collected between June 1 – 24 for 13 survey sites across Hudson Bay. A DJI Phantom 4 and a DraganFly Commander was used to collect RGB and multispectral aerial imagery over sea ice floes, respectively. Overlap between consecutive images was specified to allow for orthomosaic and digital elevation model (DEM) generation. An array of ice conditions were surveyed, as the month of June is characterized by extensive sea ice melt in Hudson Bay, and survey sites were located in both coastal and offshore regions. UAV imagery was processed using the Pix4D software, for which multispectral orthomosaics and DEMs were generated for all survey sites. Maps of surface features (e.g. melt ponds, sediment presence) were generated in ArcMap using a supervised classification technique based on in situ sea ice property data. DEMs were preprocessed in MATLAB to remove distortion resulting from a lack of ground control points, and surface roughness metrics were generated. This project will present a detailed summary of these methods of data processing for UAV imagery collected over sea ice, as well as a proposed method of integration of results from both data types to generate a relationship between sea ice surface property and surface roughness.

INUIT POST-SECONDARY EDUCATION – EXPERIENCES AND RECOMMENDATIONS THROUGH SURVEYS AND INTERVIEWS

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This session will explore Inuit Post-Secondary (PSE) and discuss specific recommendations developed to improve the Federal funding program structure and general PSE experiences for Inuit as a whole. This includes suggestions on creating more culturally appropriate courses, support, and mentorship at PSE institutions, the need for all-encompassing financial support for Inuit students, and the ultimate goal of more Inuit-relevant PSE opportunities in Canada. In Canada, Inuit have the lowest level of Post-Secondary Education (PSE) completion rates, with 2% of Inuit having attained a University degree compared to 23% of non-Indigenous Canadians. The obstacles and experiences of Inuit students are not often shared or understood by their non-indigenous peers. Inuit Tapiriit Kanatami (ITK) set out to collect and analyse data to develop Inuit-led recommendations to improve Inuit PSE attainment rates and experiences. ITK and Savanta teamed up in a two-phased project to complete surveys and interviews with Inuit across Canada. Key results, themes, and recommendations will be explored in this session. The surveys sought to understand the factors that contribute to Inuit attendance and success at PSE. Some of these factors included increased employment opportunities, financial barriers, family obligations, and encouragement from friends and family. The survey also asked Inuit what could improve their PSE experiences, with over 1,800 responses received. Many noted factors such as having more Inuit-specific PSE courses, training and support, having access to mental health support, increased financial support, and northern-based academic institutions, amongst others. Respondents were also asked about available PSE funding and access to other supports, with over 1,700 comments and recommendations. Many respondents were not aware of the number or type of Federal funding opportunities available to Inuit students. Some of the recommendations included improved communication about funding opportunities, improved resources to apply for funding, and the need for a more streamlined application process. Interviews allowed for a chance to dig deeper into Inuit PSE experiences. A total of 70 individuals from all four Inuit Nunangat regions were asked to participate and in total, 28 telephone interviews were completed. Participants described factors that encouraged them to go to PSE, such as wanting employment and financial security or encouragement from parents. Others noted factors that have discouraged them from PSE, such as varying academic standards between northern and southern secondary institutions, financial, social and cultural barriers, and often times family obligations. This presentation will summarize these Inuit students' stories and survey findings, to share some insight into Inuit experiences, struggles, and recommendations to improve PSE.

INUIT-DRIVEN SOCIAL MEDIA AND RESEARCH TOOLS ON THE SIKU.ORG PLATFORM: DEVELOPING AN APPROACH TO FEATURES, INTELLECTUAL PROPERTY AND DATA STEWARDSHIP THAT BENEFITS LONG-TERM INUIT SELF-DETERMINATION.

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SIKU, the Inuit Knowledge Wiki and Social Mapping Platform is a social media online platform and mobile app designed with and for Inuit. It provides a wide variety of tools and services towards Inuit self-determination in research, education and environmental stewardship. Winner of the 2017 Google.org Impact Challenge in Canada, over the last year substantial progress has been made in developing, conducting workshops, consultation, piloting in northern communities and obtaining design input and feedback from Inuit hunters, youth including Nunavut Sivuniksavut and community-driven research programs. Far too often, Inuit knowledge and observations have been considered anecdotal by academic communities. The unique research tools available on the SIKU platform and mobile app prove a means for Inuit to document their land-use observations on an ongoing basis, providing a detailed quantitative data set that can be used to bolster their reports and analysis of observations that were previously considered qualitative. Through the tools and services of the SIKU platform, communities and Indigenous organizations can define and implement their own research programs, as well as steward and analyze their own results for their own purposes. As such, it is an important distinction that the platform is designed to facilitate Inuit self-determination in research and stewardship, rather than citizen science (i.e., where the public helps crowd source collection of data towards academic endeavour). In addition to the tools and services provided by the platform, an important component of aligning the approach of SIKU with Inuit Tapiriit Kanatami's National Inuit Strategy on Research involves consultation on approaches to data stewardship, intellectual property rights and tools and permissions that support the unique needs of Inuit, towards refining a Terms of Use and Privacy Policy for the platform, as well as defining logic for sharing, permissions and other features. This presentation will highlight the approach and logic defined to-date through ongoing consultation, and seek additional input moving forward towards how SIKU can best facilitate the parallel needs of individual contributors, projects, communities and Indigenous organizations, towards the long-term benefit of Inuit self-determination.

CREATION OF THE HUDSON BAY CONSORTIUM AND OUTCOMES OF THE 2018 HUDSON BAY SUMMIT

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The inaugural Hudson Bay Summit was held in Montreal from February 27 to March 1, 2018 to huge success. After many years of planning and efforts by the communities and indigenous organizations of James Bay and Hudson Bay, 27 communities along with representatives from 97 organizations including indigenous organizations, governments, academics and non-profits came together to officially launch the Hudson Bay Consortium and hold workshops on coordinating research in the region, planning for protected areas and coastal restoration, as well as to forge ahead on the next steps for the consortium. The Hudson Bay Consortium is intended to be an ongoing forum to discuss local priorities, foster regional partnerships and facilitate Indigenous self-determination. This represents an important milestone towards working together for the long-term stewardship of the region. The history of this effort goes back most noticeably to Voices from the Bay, a ground-breaking initiative in the 1990s for collaboration across the region, and for mobilizing Inuit and Cree knowledge of the ecosystem. The current effort will help facilitate continued regional efforts for stewardship and planning (e.g. Through the Eastern Hudson Bay/James Bay Regional Roundtable, and coordinating with the Western Hudson Bay Neighbours Roundtable). In the lead-up to the Summit, feedback and consultation from communities and organizations across the bays informed a Vision Statement and Guiding Principles that formed the basis for formally creating the Hudson Bay Consortium, as an important declaration of our desire to work together and make sure Hudson and James bays remain healthy for the benefit of future generations. While a lot has been accomplished, the work is just beginning. Through the summit workshops, important outcomes and next steps were identified to drive the work forward. This includes formalizing a steering committee and formation of working groups on priorities for protected areas, restoration, environmental monitoring and communications. The collaborative process put community voices first, and resulted in both tangible maps, and thoughtful discussion on research priorities for Inuit and Cree communities. Another major outcome of the summit was dialogue facilitation both amongst and between communities, regions, and various levels of government. This was particularly important for participants to better understand the existing rights and ongoing work of land claim organizations. Broad support and participation of the Federal government across a range of departments towards better understanding the priorities of the communities and the region was encouraging. Overall, the Summit clearly demonstrated the many benefits of coordination and working together for the benefit of Indigenous self-determination and stewardship of the region that can continue to be achieved through the newly created Hudson Bay Consortium.

SHEDDING A LIGHT ON CLIMATE CHANGE ADAPTATION PROGRESS AND RESEARCH NEEDS IN EEYOU ISTCHEE AND NUNAVIK (QUÉBEC, CANADA)

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This presentation aims to inform the audience about recent findings from two synthesis studies that examine the current state of knowledge on climate change and adaptation research. Progress made in the last decade in Nunavik and Eeyou Istchee James Bay give way to a clearer vision of multiscale needs for future research agendas and it underlines the importance of coordinating policy and decision-making efforts in this domain. In subarctic Quebec, although a wide array of climate-related impacts has been observed locally, scientific research has been fragmentary. In order to better understand challenges associated with climate change, the "State of climate change and adaptation knowledge for the Eeyou Istchee James Bay territory" project combined existing scientific and local knowledge to describe climate impacts, ongoing adaptation initiatives, and major research gaps for sectoral and crosscutting issues. On the other hand, in Nunavik, while significant amounts of funding have been invested in climate change research, limited understanding still remains on if, how and where adaptation is really taking place. The "State of Knowledge and Gap Analysis on Climate Change Adaptation in Nunavik" report used a systematic literature review to examine the adaptation landscape and progress in Nunavik, providing an adaptation baseline assessing future progress in adaptation and highlighting gaps in research, policy and implementation. Both studies provide stakeholders with results that can guide and prioritize future research, land-use planning, development and adaptation decision-making in the light of various effects of climate change already observed and projected in Northern Quebec .

DOCUMENTING INUIT KNOWLEDGE OF LIGHT GOOSE POPULATION DYNAMICS IN THE KIVALLIQ REGION, NUNAVUT: IMPLICATIONS FOR WILDLIFE CO-MANAGEMENT AND KNOWLEDGE CO-PRODUCTION IN INUIT NUNANGAT

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Scientific research has linked increasing light goose (Snow and Ross' Geese) abundance to habitat degradation in some portions of the central and eastern Canadian Arctic, which could be contributing to declining populations of sympatric (co-occurring) bird species. Liberalized harvest regulations implemented to date for non-Inuit hunters have not been successful in reducing the light goose population. Inuit living in Nunavut have harvested light geese and lived near goose colonies for generations. Inuit Knowledge (IK) includes important information about light goose ecology that could complement scientific monitoring and inform co-management efforts. Over the past two years, we conducted a collaborative research project aiming to: (1) document Inuit Knowledge about light goose populations and their interactions with the land, water, other animals (including other bird species), and people in the Kivalliq region of Nunavut; (2) document Inuit-identified strategies for light goose management that address Inuit concerns and perspectives; (3) increase the capacity of Kivalliq residents to conduct research on wildlife; and (4) explore opportunities for the combined use of IK and scientific information in light goose research and management. This study was undertaken as a partnership between Environment and Climate Change Canada, the Irniurviit and Nivvialik Area Co-Management Committees, the Arviat and Aiviit (Coral Harbour) Hunters and Trappers Organizations, and Carleton University. It was led by two Project Management Committees (PMC) comprised of representatives from partner organizations. In 2017, we conducted interviews, group discussions, participatory mapping, and sites visits with 41 residents from Coral Harbour and Arviat, Nunavut, to document Inuit Knowledge about light goose ecology and management. In 2018, we held a final project workshop where IK holders (including PMC members), biologists, and wildlife managers shared their knowledge and developed joint recommendations for the management of light geese in the Kivalliq region, Nunavut. This project also involved the training and participation of four community researchers from Arviat and Coral Harbour. Here, we report on our project experiences and research findings, and discuss their implications for wildlife co-management and knowledge co-production in Inuit Nunangat. We describe the participatory research methods implemented and the role of Inuit in project governance. We present key project findings, including: (1) past and present cultural significance of light geese to Inuit; (2) Inuit ecological knowledge of light goose population dynamics, habitat impacts, and interactions with sympatric species; and (3) Inuit-identified strategies for light goose management in the Kivalliq region. We also discuss opportunities and challenges associated with the combined use of IK and scientific information in light goose research and management. Lastly, we highlight the potential for participatory research and knowledge co-production to support effective co-management of wildlife populations and Inuit self-determination.

USING EDUCATIONAL WORKSHOPS ON RINGED SEAL ECOLOGY TO ENGAGE INUIT YOUTH IN CONTAMINANTS RESEARCH

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The ringed seal (Phoca hispida) is a species of high cultural, economic and nutritional importance in Inuit Nunangat. Scientists work in collaboration with Inuit to conduct research on spatial and temporal trends of legacy and emerging/new contaminants in ringed seals from the Canadian Arctic. Developing innovative tools and ways of communicating research with Inuit youth, Elders and community members addresses a shared interest among Inuit and scientific researchers. Since 2016, we conducted three educational workshops in Nunavut (Resolute Bay and Arviat) and the Northwest Territories (Sachs Harbour) in collaboration with local schools and hunters and trappers organizations. The main goals of these workshop were to: (1) allow scientists working on contaminants in ringed seals to share information about their work with northern residents (with a focus on Inuit youth); (2) provide an opportunity for Inuit Elders to share their knowledge with students and researchers in seal ecology and traditional methods for hunting/preparing seals and identifying abnormalities and diseases; (3) increase the engagement and interest of northern students and community members in contaminants research and traditional seal harvesting; and (4) identify best practices for engaging and communicating with Inuit youth. By developing innovative educational tools built on science and Inuit Knowledge, our project will help scientific researchers, educators, and community members interested in Inuit engagement in research.

INUIT SELF-DETERMINATION IN RESEARCH: IMPLEMENTING THE NATIONAL INUIT STRATEGY ON RESEARCH - A TRI-AGENCY PERSPECTIVE

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On March 22, 2018, Inuit Tapiriit Kanatami released the National Inuit Strategy on Research (NISR), a pivotal document that outlines the coordinated actions required to improve the way Inuit Nunangat research is governed, resourced, conducted, and shared. The NISR was developed in coordination with the Inuit Qaujisarvingat National Committee made up of representatives of each of the members of the Inuit Tapiriit Kanatami Board of Directors. The document promotes a shared understanding of the legacy of Inuit Nunangat research and connects this legacy to current research practices, defines Inuit expectations for the role of research in our regions and communities, and identifies areas for participation and action between Inuit and the research community. For far too long, researchers and research institutions have tended to be the primary beneficiaries of Inuit Nunangat research, despite the present and ongoing need for Inuit-specific data and information that can be used to shape solutions to our most pressing challenges. Furthermore, Inuit Nunangat research is too often governed, resourced, and carried out in a manner that limits Inuit participation, marginalizing Inuit from the benefits of research. The NISR seeks to remedy these problems. It identifies five priority areas in which coordinated action is necessary to facilitate Inuit Nunangat research that is effective, impactful, and meaningful to Inuit. These five priority areas are: 1) Advance Inuit governance in research; 2) Enhance the ethical conduct of research; 3) Align funding with Inuit research priorities; 4) Ensure Inuit access, ownership, and control over data and information; and 5) Build capacity in Inuit Nunangat research. Implementing the NISR will require a coordinated approach based on partnership. The interrelated, interdependent nature of these five priority areas, as well as the number of stakeholders involved in Inuit Nunangat research, means that new relationships must be brokered between Inuit, government departments, and research institutions in order to implement the NISR. This session will showcase the NISR and its implementation plan by inviting individuals from within Inuit organizations, government, agencies, and academia to discuss how they are helping move towards Inuit self-determination in research.

AN INNOVATIVE APPROACH TO PUBLIC OUTREACH IN SUPPORT OF THE CONSERVATION AND PROMOTION OF ECOLOGICALLY IMPORTANT AREAS IN BAFFIN BAY AND DAVIS STRAIT, CANADA

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In 2017, Fisheries and Oceans Canada (DFO), in collaboration with stakeholders including co-management organizations, the fishing industry and environmental organizations, established three closures in Canada's Eastern Arctic where commercial fishing using bottom contact gear was prohibited. These management measures protect 67,242 km2 of ecologically important areas identified through scientific assessments in Baffin Bay and Davis Strait. In particular, high concentrations of vulnerable species of corals and sponges are protected. Existing partnerships between stakeholders were strengthened during the above process and led to an innovative public outreach project promoting the importance of these areas and sustainable fishing practices. Inhabitants of Baffin Island, Nunavut are generally unaware that corals and sponges exist in the waters off their coast. To improve awareness throughout Nunavut and adjacent communities of the Arctic marine ecosystem (including the role of corals and sponges) and protection efforts, a music video was created which involved youth and performance artists from Iqaluit, Nunavut. The music video incorporated two culturally important mediums - conversation and storytelling. It started with a special science class given to elementary school children where they learned about the deep Arctic ecosystem via a food web game and other activities. Shortly thereafter, interviews with the children were conducted by a musician and actor where the artists learned about the students' understanding of corals, sponges, and the Arctic marine food web. Song lyrics were created based on what the musician heard. The music video, consisting of interview clips as well as the song itself, demonstrates a creative approach, based on traditional knowledge transfer systems, to communicating information on Arctic ecosystems and sustainable fishing practices. It also demonstrates a unique collaboration between government, industry and environmental organizations to promote conservation initiatives. This presentation will include the music video, outline the steps taken in its development, and discuss successes and lessons learned by those involved.

MIGRATORY PATTERNS OF WHITEFISH IN THE MACKENZIE DELTA REGION

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In the Mackenzie Delta region, the migratory łuk digaii (whitefish; Coregonus nasus) is a critical food fish for the Gwich'in peoples. With three known migratory types (anadromous, semi-anadromous, and resident) that spawn in the Peel, Arctic Red, and Mackenzie rivers, fish that utilize different habitats are likely to experience different regional changes in this shifting Arctic system. However, there is much that we do not know about fish use of these three rivers, and the extent of their migration between different parts of this system. In collaboration with three Gwich'in fishers in addition to the Gwich'in Renewable Resources Board and the Tetlit Renewable Resource Council we established a community-based sampling program in summer 2017. Using samples collected from this program on the Peel River, we have investigated the migratory patterns of over 100 whitefish. Here, in a follow-up talk to our initial presentation discussing our community-based approach, we present the results from otolith microchemistry analysis. Using a Bayesian hidden Markov model applied to strontium otolith microchemistry we have identified fish use of major spawning rivers and the ocean, and the age at which they migrate between habitats. Results indicate that life history patterns are highly diverse, with a wide range of migratory histories; this may bode well for resilience to forthcoming climatic changes.

SUPPORTING NORTHERN-LED ENVIRONMENTAL MONITORING INITIATIVES THROUGH TRAINING IN THE USE OF INSTRUMENT TECHNOLOGY FOR OCEAN DATA COLLECTION

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Current methods in ocean data collection depend heavily on the use of scientific instruments and computer-based archival and analysis. Lack of availability of training programs and materials in the use of instrument technology and data tools specifically designed for Inuit Nunangat limits the potential for northern-led monitoring programs. With increasing demand for employees skilled in data collection and analysis and Inuit-led monitoring programs, there was a need to create a training opportunity which combines the theory and methods for data analysis, field work and hands-on experience with instruments, and opportunities for exploration of connections between instrument-based data collection and Inuit Qaujimajatuqangit (IQ). Ocean Networks Canada (ONC) is partnering with Nunavut Arctic College (NAC) to integrate modules on Instrument Technology into the Environmental Technology Program (ETP), in a collaboration supported by Polar Knowledge Canada. Ocean Networks Canada, an initiative of the University of Victoria, operates and manages innovative cabled observatories that supply continuous power and Internet connectivity to various scientific instruments located in coastal, deep-ocean, and Arctic environments. Nunavut Arctic College has five campuses and community learning centres located in all 25 communities of Nunavut which bring programs home to people throughout the territory. The Environmental Technology Program is a two year diploma program that incorporates classroom, lab, and fieldwork to develop the necessary skills for graduates to find employment as environmental practitioners. The materials created for Instrument Technology modules, which have been integrated into the field camp portions of the ETP, introduce students to marine sensor technology, with background on underwater cabled observatories and shore-based coastal weather stations. Students learn about the diversity of marine sensors, why and how they are used, and the challenges and opportunities presented by operating technology in marine and freshwater environments, both in ice-covered and open-water conditions. Previous to this work, the ETP did not have a dedicated course addressing this topic. The materials were adapted from a college-level Instrument Technology course that was developed by ONC with Northwest Community College, Prince Rupert campus, which is now a regular part of the Applied Coastal Ecology program (see: https://www.nwcc.bc.ca/course/ace-196-instrument-technology). The course at NAC is being piloted during the 2018/2019 school year. This presentation will describe the motivation and development of the course and report on findings and improvements during the first half of the pilot year.

VOICES FROM THE NORTH – CANDID INUIT POST-SECONDARY EDUCATION STUDENT EXPERIENCES

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Inuit have some of the lowest rates of Post-Secondary Education (PSE) in Canada, though their land, people, and environment are frequently the subjects of research often led by Southerners. Where are the Inuit voices in academia? What can we do to make these important voices stronger? This session will highlight recent research undertaken by Inuit Tapiriit Kanatami's (ITK) on Inuit PSE investigating Post-Secondary student experiences and a look into the barriers that often prevent Inuit students from attending College or University and attaining adequate financial assistance. Presentations are invited that present research on a range of Inuit PSE issues including exploring the push and pull factors affecting PSE participation and retention, feedback on applying for PSE, transitioning to the South, living away from home, support systems, classroom and peer experiences, and reasons for deciding to continue with PSE or to return home. Research results are solicited that can inform recommendations for the Federal government, academic institutions, professors, researchers, Inuit organizations, Inuit students, and their classmates to improve Inuit student retention in PSE. This session aims to take an introspective look at higher education that will challenge conference delegates and encourage a more inclusive and holistic approach to research in the Arctic and studies in the South.

USING ONLINE PLATFORMS TO COMMUNICATE SCIENCE AND STIMULATE INTERNATIONAL PUBLIC ENGAGEMENT

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Education and outreach activities inspire the next generation of polar scientists and inform citizens, and therefore need to be an integral part of any polar research program. The Association of Polar Early Career Scientists (APECS) is a multidisciplinary, international organization dedicated to maintaining a network of early career researchers (ECRs) to share ideas, develop collaborative research directions, provide career development opportunities, and promote education and outreach related to polar research. APECS has stimulated polar literacy through innovative science communication, well-integrated public outreach and engagement, and partnerships with Arctic and Antarctic organizations. Examples of one- and two-way engagement between APECS' members and the general public are illustrated in our involvement with digital events and social media initiatives. Successful events include Antarctica Day, webinars, and APECS' annual online conference. One of our popular social media initiatives are biannual Polar Week celebrations; these include Twitter campaigns, Reddit "Ask Me Anything" discussions, and photo and video contests. We do most of our public outreach during Polar Week or Antarctica Day, and this is reflected in the fact that engagement with our social media channels during those times is much higher than during other months. APECS Canada has participated in several events during Polar Week, including social media initiatives as well as annual documentary screenings. Specifically, APECS Canada took part in Biotweeps, which consists of a Twitter account, blog and Facebook page that feature a different biologist every week with the goal of communicating science to a broad audience (https://biotweep.wordpress.com/). During Polar Week, APECS members hosted the Biotweeps account each day to share their research. APECS posted 314 times in total with high engagement, rate of retweets and likes on posts. Benefits to using modern technologies and techniques for stimulating public engagement about polar research include easier dissemination of ideas across geographic distances, with minimal cost and a low carbon footprint. However, there are limitations to using online platforms, specifically when engaging with northern audiences in remote places with limited internet connectivity. We will touch on some potential ways forward for engaging with these audiences. While this presentation focuses on APECS' experiences, we will also highlight how innovative communication promotes international discussion and cooperation across disciplines, then offer suggestions on how to incorporate similar elements into other outreach programs.

MINING-INDUCED FLOODING AND USE OF DETERRENTS FOR MITIGATING IMPACTS ON ARCTIC NESTING BIRDS

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Mining and other forms of resource development frequently result in disturbance to wildlife that is difficult to avoid, and technological options to mitigate these impacts are therefore of great interest to resource developers and conservationists alike. Agnico Eagle Mines Ltd. (AEM), located 70km north of Bake Lake, Nunavut, has proposed the Whale Tail Project for the development of a mining pit within the northern portion of Whale Tail Lake. The project includes the construction of two dykes that will divert water from the proposed mining pit into surrounding lakes and tributaries. The proposed flooding will elevate the water levels by 4 masl over two years, causing approximately 157 ha of tundra to be flooded during the time of birds' nest initiation. The Migratory Birds Convention Act (1994) (MBCA) prohibits the harm of migratory birds and the disturbance or destruction of nests and eggs, and the company is therefore committed to avoiding or minimizing this harm. This study explores mitigation options to deter birds from nesting in an area, so that the impacts from mining-induced flooding or other localized disturbances in can be mitigated. In this first year of study, visual deterrents including Mylar® and Jackite© were tested during the nestling stage of Lapland Longspur, to determine behavioural responses. Adults were observed 30 minutes before the erecting of deterrents and 30 minutes after, noting the frequency of feeding, foraging and alert behaviour, as well as the frequency of absence. Although samples were small, results suggest that there was some change in frequency of behaviours, (e.g. an increase in alert behaviour and a decrease in foraging). In the second year of study, visual and auditory deterrents will be deployed prior to nest initiation on a larger sample of birds, as a more definitive test of efficacy of these deterrent.

ALLOCATION AND SUB-ALLOCATION OF NUNAVUT ADJACENT COMMERCIAL FISHERIES RESOURCES

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Large scale commercial fisheries in the Canadian Arctic consist primarily of Greenland halibut (aka turbot: Reinhardtius hippoglossoides) and Northern shrimp (Pandalus borealis). Within Nunavut and Nunavut adjacent waters, the Nunavut Wildlife Management Board (NWMB) and the Department of Fisheries and Oceans Canada (DFO) are responsible for co-management of these resources. However, depending on the location of the stock at different scales; inside vs. outside the Nunavut Settlement Area, Northwest Atlantic Fisheries Organization fishing areas, different process for allocation and/or sub-allocation occur. Here we highlight the different processes that occur across Nunavut and Nunavut-adjacent waters for both species, and how the co-management structure differs in these circumstances. Last, we outline the Nunavut sub-allocation process as identified in the NWMB's commercial fisheries allocation policy in determining access to the resource. In doing so, we highlight how the co-management process works to address ongoing tensions between meeting the needs of fishing enterprises, such as security of allocation, with desires for Land Claims beneficiaries to maximize the value they obtain from their adjacent resources.

RESEARCHING MIGRATORY FISH IN A CHANGING WATERSHED: A COMMUNITY-BASED MODEL

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Migratory species that occur over large spatial areas present an ongoing challenge to effective sampling and the detection of how species respond to changing landscapes. One such species, łuk digaii (whitefish; Coregonus nasus) is an important food fish in subsistence fisheries throughout the rapidly warming Mackenzie River Delta, and harvesters capture these fish throughout summer and fall migrations. Continued access to these fishing practices is important to food security for the Gwich'in peoples, but it remains uncertain how watershed changes may affect łuk digaii abundance and life history. To this end, we have established a collaborative project to collect baseline information on łuk digaii in the lower Mackenzie River and develop a monitoring program to detect changes in migration timing, abundance, and population demographics such as size-at-age. This partnership includes the Gwich'in Renewable Resources Board and three Renewable Resource Councils, and we collaborate with four Gwich'in harvesters. Harvesters collect a suite of biological data on fish caught in subsistence fisheries at three locations: on the Peel River near Fort McPherson, the Arctic Red River near Tsiighetchic, and the Mackenzie River near Aklavik. This co-presented talk will include insights from one of the community harvesters who has been involved for two sampling seasons and one of the scientists overseeing the project. We will describe the community-based study design and present preliminary findings on łuk digaii size-at-age, catch rate, and anadromy. The presentation that follows will further explore migratory diversity revealed from the first year of data collection.

HOTSPOTS OF VULNERABILITY TO MARINE INVASIVE SPECIES INTRODUCTIONS: INSIGHTS FROM HABITAT SUITABILITY MODELLING UNDER CURRENT AND PROJECTED CLIMATE CHANGE SCENARIOS

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The risk of aquatic invasive species (AIS) introductions in the Arctic is expected to increase with ongoing trends of greater shipping activity, resource exploitation, and climate warming in the region. We identified a suite of AIS (benthos, zooplankton, macroalgae) with the greatest likelihood of introduction and impact in the Canadian Arctic using the Canadian Marine Invasive Screening Tool (CMIST). The 23 riskiest species were then modelled to predict potential distributions at panArctic and global scales using MaxENT. Modelling was conducted under present environmental conditions and two future global change scenarios (2050 and 2100). Results show that hotspots or regions in the Arctic where suitable habitat was present for the greatest number of modelled AIS are in the Hudson Complex, Northern Labrador, Chukchi/Eastern Bering Sea, and Barents/White Sea. For the complete suite of AIS assessed, the future overall predicted distribution change at an Arctic scale was a habitat gain of +5.8% for 2050 and +14.1% for 2100. However, when separated by taxa, benthic invertebrates and macro algae showed a higher future habitat gain than planktonic species. When the same analysis was done at a global scale, the projections showed that by 2050 and 2100, there will be a slight overall habitat loss. This suggests that most of the modelled species will find better environmental conditions in colder regions, with a trend of positive pole-ward shifts in future distributions, particularly in the Arctic. This approach will aid in the identification of present and future high-risk areas for AIS in response to global warming.

IGLULINGMIUT WEATHER AND ICE FORECASTING

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If I'm going out on the land, I don't bother with the weather report. I look out the window and determine what the day is going to be. I rely on what I have learned over the years from my parents and grandparents. I listen to the weather on the radio, or I look online for the weather on the day. But I don't rely on weather forecasts, wind especially is inaccurate when I travel outside of Igloolik. Translation is another issue. The Inuktitut version of the weather forecast comes from Iqaluit and it is like another language (not just another dialect). So most people follow the English, and Elders rely on English-speaking people to translate the information. I have worked with many researchers on weather and ice projects, and I have taught traditional survival and wayfinding skills at the Cultural School in Clyde River. At the ArcticNet conference I would like to talk about some of the things I consider when preparing for a trip. I will give examples of my travels from Igloolik across Fury and Hecla Strait, and longer trips to Arctic Bay, to Pond Inlet, to Clyde River, and even to Greenland. As hunters, we like to hear about new weather or ice products. We will look into new products and see how they work for us. But mostly we rely on our own knowledge, and there are a few of us now who are still confident in doing this. Learning through experience is the best way, but the weather changes quickly now and our Elders are not as confident in predicting the weather any more. Younger hunters come to me at times to ask for advice before travel. I'd like to talk about some of the things that I tell them. I will also talk about some of the challenges in using weather and ice services in Igloolik.

ICE ECOLOGY IN ARCTIC LAKES

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All Arctic lakes freeze in winter and most of them for more than 8 months but for a shorter duration each year. Reductions in lake ice thickness, coverage and duration may have important consequences on safety of animals and people across moving ice and for the traditional use of the lake ice by Inuit households, but also on aquatic ecosystems. However, very little information is available on the winter ecology of lakes and only 2% of peer-reviewed freshwater literature includes under-ice lake processes. Considering that the ice cover period on lakes and rivers around the world is decreasing every year, it is clear that there is an urgent need for research on ice ecosystems in order to be able to make accurate predictions about the impacts of ice cover loss on the ecology and functioning of lakes. In this study, we sampled 6 Arctic lakes in Kitimeok Region near Iqaluktuuttiaq (Cambridge Bay, Nunavut, Canada) in early (October-November 2017) and late winter (April-June 2018) to characterize the composition of lake ice in terms of nutrients, carbon and algae. We found that ice contained substantial concentrations of inorganic nutrients and carbon. Compared to the high biomass of ice algae present in sea ice, the lake ice algae were less abundant but taxonomically diverse. Our results also suggest that because of the large proportion of lake volume that ice occupies in late winter, the storage of nutrients and carbon, and the inoculum of algae it contains have an underestimated role in stimulating spring and summer production in Arctic lakes ecosystems. This study demonstrates that we currently underestimate the role of freshwater ice in aquatic ecosystems and that studying Arctic lake ice is necessary to predict the effects of global warming on these fragile ecosystems.

MONITORING THE INUVIK TUKTOYAKTUK HIGHWAY - AN EXAMPLE OF COMMUNITY BASED MANAGEMENT AND MONITORING

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In November 2017, the Inuvik to Tuktoyaktuk Highway (ITH) was completed providing road access to the Arctic Ocean. The road is of importance to all Canadians, particularly to the residents and beneficiaries of the Inuvialuit Settlement Region (ISR), as the ITH corridor crosses Inuvialuit private lands established under the Inuvialuit Final Agreement. In addition, the road provides increased access to fish and marine mammal resources owned and used by the communities of the ISR. Concerns about the sustainability of these resources during the environmental assessment process and the construction of the highway prompted the communities to create their own voluntary compliance Community Fishing Plan (CFP). The CFP promotes the conservation and protection of fisheries resources and acts as a guide to both ISR residents and visitors. In combination with the Fisheries Joint Management Committee, a community based monitoring program was implemented in 2018 to determine the success of the CFP, provide education to travellers, and track activity levels along the highway. Additional monitoring efforts were also conducted, which included highway fisheries mitigation projects and fisheries assessments in lakes adjacent to the highway. This presentation details the development of the program, governance, methodology and preliminary results from 2018. A recommendation is provided on the utility of the pilot program as a model for an Indigenous environmental stewardship program of a similar nature for all of the ISR 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.

A NEW FULL-WAVE ELECTROMAGNETICS SOLVER FOR FAST ANALYSIS OF MICROWAVE SCATTERING FROM SEA ICE

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In Arctic applications, electromagnetic modeling methods are used to interpret how microwaves interact with snow-covered sea ice. Results can be interpreted to establish how thermodynamic and physical processes give rise to radar scattering signatures, and can be instrumental in guiding hardware development for future remote sensing platforms. To be a useful tool for remote sensing applications, an electromagnetic solver should be fast, computationally efficient, and provide the user with outputs that can be compared to experimentally-obtained radar measurements for validation. Furthermore, the solver should provide a framework for a user to input sea ice parameters, such as multiple layers, surface roughness, and volume inclusions that are representative of brine and air pockets. To date, modeling scattering from sea ice remains a complicated problem, with many formulations providing complimentary results. In our previous work, a novel solver formulation referred to as the Surface-Volume-Surface Electric Field Integral Equation (SVS-EFIE) was proposed for scattering problems on 3-D homogeneous dielectric objects in free space and multi-layered media. Attractive features of SVS-EFIE include: a single product of integral operators, a reliance on only an electric-field-type of Green's function, and a reduction in the number of unknowns by half compared to traditional surface integral equation formulations. As a result, SVS-EFIE is particularly effective for simulating electromagnetic interactions in multilayered media including snow-covered sea ice. Presently, memory requirements and the computational complexity of dense matrix operations and storage for a conventional Method of Moment (MoM) solution of the SVS-EFIE limits its application to small problems. This work presents a novel framework for simulating electromagnetic wave scattering from sea ice using SVS-EFIE by extending our previous implementation to fast direct solutions for the SVS-EFIE based on the hierarchical (H-) matrix framework and algorithm parallelization for rapid and efficient computation of sea-ice scattering problems. The utility of the developed algorithm will be demonstrated for candidate sea ice scattering scenarios. The performance of the algorithm in terms of accuracy, computational time, and required memory will be presented, and future plans for expanding the capabilities of the framework will be discussed.

WHAT HAPPENS WHEN YOU ADD PREYS TO AN ARCTIC ECOSYSTEM? MODELING THE APPARENT COMPETITION BETWEEN SNOW GOOSE AND SEMIPALMATED SANDPIPER

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Combined effects of climate change and agricultural intensification has led to a massive increase in geese populations in the last decades. Millions of geese migrate annually from agricultural lands to arctic nesting areas generating a massive flow of additional food for arctic predators that boost their productivity. Such demographic response in predator populations to inputs from other ecosystems (hereafter “allochthonous inputs”) has likely induced indirect impacts on tundra-nesting shorebirds. Indeed, predation risk on shorebird nests has been found to increase in areas of high geese abundance. This could represent one of the underlying causes of the recent decline in many shorebird populations. Simultaneously, shorebirds can experience a release in predation rates during peak phases of the lemming cycle, because the latter prey is the preferred food resources of most tundra predators. Despite local empirical evidence of the consequences of snow goose and lemming abundance on shorebird nest survival, we lack the tools to predict the extent of these impacts at a circumpolar scale. Thus, the main objective of this project was to predict the effect of increasing snow geese populations on the nest predation rate in a declining shorebirds species, the semipalmated sandpiper. To achieve this, we used differential equations parameterized with data from sites with and without geese to create a mathematical model that helps us understand the mechanisms behind the decline. Preliminary results from our models show that, as expected, the predation rate on semipalmated sandpiper nests is higher in presence of a snow goose colony. However, our model suggests that predation rate on semipalmated sandpiper nests is higher when there is a peak in lemming abundance than when lemming abundance is scarce. This finding goes in contradiction with most scientific literature on the interaction of snow geese and lemming's abundance to date. Our model supports the hypothesis that the growing presence of snow goose, an overabundant species, may have negative indirect impacts on arctic-nesting shorebirds. This model represents a unique predictive tool, because it contributes to a better understanding of the complex mechanisms underlying the impacts of anthropogenic pressures on species of conservation concern while taking into account the trophic web to which they belong.

DETERMINING THE ENERGETIC CONSEQUENCES OF TERRESTRIAL FORAGING ON SEADUCK EGGS IN AN APEX MARINE PREDATOR, THE POLAR BEAR

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The decreasing spatial and temporal extent of Arctic sea-ice is the greatest threat to polar bears' continued persistence in the wild. Sea-ice is critical for polar bears to hunt their main prey (seals), and the lengthening 'ice-free periods' are forcing polar bears to spend more time in coastal terrestrial environments. The onshore migration of polar bears has now aligned with many bird species' breeding schedules and polar bears are increasingly foraging on eggs in lieu of ice-based hunting. Using unmanned aircraft vehicles (UAVs), we recorded 22 hours of polar bears foraging on common eider eggs and deployed 33 trail video cameras on East Bay Island (Northern Hudson Bay) during the summers of 2016-2018. Using these data, we examined variation in individual polar bear foraging behaviours and estimated associated energy budgets, to gain a better understanding of the energetic consequences of this novel foraging behaviour. By coupling energy budgets with variable behavioural modes, this study provides an energetic quantification of polar bear terrestrial foraging ecology as the resultant effect of sea-ice loss.

CLYDE RIVER KNOWLEDGE ATLAS: LINKING INUIT KNOWLEDGE AND TECHNOLOGY TO MOBILIZE KNOWLEDGE AT THE COMMUNITY LEVEL

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Cyberatlas technology is increasingly finding applications in rural and Indigenous communities around the world for a variety of uses – from mapping land and resource use, to documenting traditional knowledge, to asserting rights and sovereignty. The technology blends digital mapping capabilities with multimedia to create a highly visual, interactive tool that communities are using for research, education, sharing narratives, decision-making, and more. For the last two years, the community of Clyde River, Nunavut, has been developing a cyberatlas that focuses on the marine environment and brings together Inuit knowledge, science, technology, and visuals arts (photography, videography, and drone imaging) to assemble a rich resource of knowledge about the area. The project builds on an open source software platform that incorporates the experiences of other communities and projects while allowing for customization to meet specific needs. The atlas was initiated locally and is managed by young Inuit technicians, artists, and leaders from the community who train and exchange skills with visiting university-based researchers and other technicians. This presentation marks the public release of the Clyde River knowledge atlas. We will demonstrate various modules and features of the atlas, ranging from the history of the community, to marine resources, to weather knowledge and forecasting tools. The Clyde River Knowledge Atlas is one example of how technology, science, and Indigenous knowledge can come together for the benefit of a diverse group of users, but especially a small northern community, putting knowledge into action and supporting Arctic residents in taking control of research and decision-making around their lands and waters in their own way.

WORKING TOWARDS REALIZING THE FULL POTENTIAL OF ENGAGING INUIT YOUTH IN PROFESSIONAL AND RESEARCH ACTIVITIES: EXAMPLES FROM THE NUNAVIK MARINE REGION WILDLIFE BOARD

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In recent years, there has been an increasing emphasis to develop early and ongoing communication toward meaningful partnerships with Northern Indigenous communities, to provide training opportunities and employment for Northerners, and to offer science education and outreach activities for youth. This has led to increased funding for training opportunities, and emphasis on the importance of involving the community in research activities. However, for both transient researchers from the South and Southern professionals who work for organizations in Inuit communities, it is not always clear: 1- how to effectively create a meaningful win-win scenario with regards to training and education, nor 2- how much capacity should be ultimately devoted to education. In light of Truth and Reconciliation, there is a need for the processes associated with education capacity and funding in Northern communities to be re-evaluated for effectiveness. In Nunavik, communities have a high proportion of Inuit youth (67% of the population under age 35) and a high unemployment rate but also a high proportion of professional employment occupied by non-Inuit. Given this, the importance of ensuring that youth of Nunavik are equipped for the future to contribute in professional and research capacities is fundamental. The Nunavik Marine Region Wildlife Board (NMRWB) is a wildlife co-management board with responsibilities regarding the training of Nunavik Inuit to build capacity in wildlife research and management (NILCA 5.2.4 g). The NMRWB has recently been dedicating more resources to fulfill its education mandate and seizing various opportunities to involve Nunavik youth in environmental monitoring, from hiring student interns to providing in-kind support to bring high school students to attend conferences and relevant meetings. Recently, in collaboration with local and regional partners such as Innalik school, the local wildlife committee and the Arctic Eider Society, the NMRWB initiated a field-based educational and environmental program that would allow high school students to conduct their own research including everything from data collection to community reporting. Already key elements can be identified as essential for the success of this program for all parties involved, including the youth participants: Addressing current wildlife concerns; co-operation with local and regional partners; and a true commitment from the organizations to maximizing the value for Inuit youth education.

ONE HEALTH IN THE EASTERN SUBARCTIC – DISEASES AT THE INTERFACE OF HUMAN, ANIMAL, AND ENVIRONMENTAL HEALTH

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One Health is an approach that recognizes that human, animal, and environmental health are inextricably linked, and involves multiple disciplines and non-academic stakeholders in addressing complex health problems. This approach is well-suited to addressing wildlife diseases of importance to human health in the Arctic because of the close ties among land, wildlife, and people in the North. People in these regions rely on healthy, stable wildlife populations for food security, cultural continuity, and livelihoods. However, this close relationship with the land and wildlife can place people at higher risk of exposure to wildlife diseases. Recent work in the Eastern Subarctic assesses the current health risks presented by wildlife diseases through community consultation and testing for diseases in wildlife, and projects the impact of rapid regional climate change on these health risks through statistical analyses and modelling. This chapter explores how wildlife diseases and parasites are introduced, maintained, and spread in the Eastern SubArctic with a focus on wildlife/dog/human interactions, rabies transmission, food borne parasites in harvested wildlife, and environmentally transmitted enteric pathogens. This synthesis of recent One Health research in the IRIS 4 region provides evidence for public health, wildlife managers, and communities in the Canadian Arctic to assess and mitigate the current and future risks of wildlife diseases.

GENOMIC TOOLS TO ENABLE NON-INVASIVE MONITORING OF POLAR BEARS

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The polar bear (Ursus maritimus) is an iconic species, integral to indigenous culture and arctic ecosystems. Despite this, their large distribution precludes range-wide monitoring with enough frequency to provide robust subpopulation size and health estimates. The collaborative BEARWATCH initiative is working towards developing a non-invasive and more responsive monitoring system for polar bears that meaningfully includes our northern partners. Here I will present on the development of a genetic marker system that will be used to individually identify faecal samples collected as part of a developing community-based polar bear monitoring initiative. We are first using DNA from harvested bears to characterize genetic diversity at single-nucleotide polymorphism (SNP) markers across the Canadian Arctic, and then selecting specific SNPs that can be used to study non-invasively collected faecal samples. This genotyping system will allow the correct genetic identification of unique individuals, with a higher success rate than microsatellite genetic markers, allowing other data collected from the faeces (e.g. diet, heavy metal loads) to be attributed to specific bears. The non-invasive, faeces-based genetic monitoring of polar bears will enable the simultaneous collection of data from different populations on a more continuous basis than has been previously possible using more invasive and expensive approaches.

A CLIMATOLOGY OF FOG IN THE CANADIAN ARCTIC FROM MORE THAN HALF A CENTURY OF SURFACE WEATHER OBSERVATIONS

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Fog occurs frequently in the Arctic and influences the surface radiation balance, hydrological budget and in-flux of airborne pollutants. Reduced visibility is both a major hazard and limits remote sensing data acquisition of earth surface features. Observing fog using satellite remote sensing is problematic because it is difficult to measure whether clouds touch the ground, plus higher-level clouds may obscure fog. Surface weather observations, therefore, provide the best record to derive fog climatologies from. We present the longest surface weather observation record of fog to date from Meteorological Service of Canada weather observing stations in the Canadian Arctic. This record allows us to address two broad questions: (1) What are the types, frequency, timing, and long-term trends of fog? (2) What are the spatial patterns of fog, and how do they link to moisture sources and synoptic patterns? We downloaded hourly historical weather data from Environment Canada for 25 stations, of which nine were selected as focus stations based on optimal record length, continuity, and spatial distribution. Records span 33 to 62 years. We investigate fog type (ice fog, freezing fog, liquid/mixed-phase fog); yearly and monthly frequencies of fog days; total, daylight, and working hours; temperature and visibility ranges; temporal trends and spatial patterns; correlations between fog occurrence and synoptic patterns, and with Arctic Oscillation (AO) and Atlantic Multidecadal Oscillation (AMO) patterns. We address data inhomogeneities. The maximum yearly number of fog days is 110 (Sachs Harbour) and station averages range from 42 (Baker Lake) to 75 (Resolute) days. Fog occurs mainly in the melt season (May – Sept). Visibility during fog is generally < 10 km, but < 1000 m only occurs 11–37% of the time, suggesting that fog is often discontinuous. Dense fog most often occurs at Sachs Harbour. The highest fog-frequency occurs in the period 1979–1982, while for most stations the lowest frequencies occur after 2000. Few stations show a significant temporal trend in fog frequency; namely Iqaluit (decrease), Resolute (decrease) and Sachs Harbour (increase). For Resolute, correlation of fog occurrence with various types of synoptic-scale circulation (Alt, 1979) shows that years with higher fog frequency have mainly Island-type and Other-type, while years with lower fog frequency occur predominantly with Cyclonic- and Other-type. Yearly fog occurrence at most stations anticorrelates to the AMO, while fog at some stations correlates with the AO.

COMMUNITY-BASED MONITORING AND DATA SOVEREIGNTY: LEARNING THROUGH THE ELOKA AND INTAROS NETWORKS

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Across the Arctic, Indigenous communities are working towards sovereignty and self-determination, which involves an ongoing negotiation of relations with nation states, regional and state government agencies, and international organizations (among others). In this paper, we focus on governance of data and information generated by community-based observing and monitoring (CBM) programs, with a particular interest in data sovereignty. Data sovereignty has been defined by the US Indigenous Data Sovereignty Network as "the right of Indigenous peoples to govern the collection, ownership, and application of their own data." Governance arrangements, particularly those related to co-management, shape the way that Indigenous Knowledge is transformed into observational data, such as data documented in community-based monitoring programs. Paradoxically, the desire to gain greater self-determination often leads to the adoption of standardized protocols for data collection, documentation, and dissemination, so that observations can be recognized by formal governance systems. Awareness of innovative approaches to data management and visualization can help support efforts toward data sovereignty while also facilitating documentation of community-based observations. We draw on examples of CBM programs with different intended uses of CBM data and information, including local use, co-management, and use by non-local researchers for conventional science. For each example, we describe approaches to data management that have been used to support community ownership and control of data, while also discussing some limitations and challenges. We draw from the experiences of programs affiliated with two networks: the Exchange for Local Observations and Knowledge of the Arctic (ELOKA), which provides data management support for Indigenous communities and researchers, and the Integrated Arctic Observing System (INTAROS), an EU funded initiative to develop an integrated observing system of systems that includes community-based observing.

"IT DEPENDS ON WHAT YOU REFER TO AS 'ON THE LAND'": HOW ASSESSMENT MECHANISMS MAY FURTHER DISPOSSESS INDIGENOUS PEOPLES OF LAND, CULTURE, IDENTITY AND HEALTH AND WELL-BEING

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Despite growing opportunities to attend to the impacts of extractive industries on the health and well-being of Indigenous people, challenges resulting from a lack of data, community-industry relations, historical and ongoing ethical issues of data ownership, and lack of accounting for differing worldviews persist. Through a case study working in partnership with Little Salmon Carmacks First Nation (LSCFN), in Yukon, Canada, this research examines the complex relationships between land, cultural identity, and well-being. Data were collected using in-depth interviews and a number of participatory events with citizens of LSCFN. Data were co-analyzed with the support of a community research assistant and staff of the LSCFN Health and Social Department. Challenging the process of assessing impacts of extractive industry on Indigenous peoples' health and well-being is the use of language and values not reflective of local contexts, cultures, or histories; health disparities that find origin in settler colonialism; and constructs of Indigenous identity that obscure Indigenous peoples' lived experiences of persisting structural inequities and ongoing colonial legacies. Findings suggested that the phrasing "going on the land", a commonly applied proxy used to explain Indigenous people's relationship with land, fails to reflect the ongoing dispossession of First Nation citizens from their homelands. Instead, the phrase appears to have essentialized land-based activities to mean only participating in an ancestral or cultural activity. While these land activities are important to Indigenous peoples' health and well-being, not accounted for and obscured through the reliance on the phase "going on the land" is the ongoing dispossession, resilience, and realities of Indigenous people in face of settler colonialism. Through this finding, we examine the extent to which settler constructs of Indigenous identity applied by governance mechanisms further dispossess peoples of land and cultural identity and what this in turn means for mechanisms assessing impacts of extractive industry on Indigenous health and well-being.

BACTERIAL COMMUNITIES AND DIVERSITIES IN TUNDRA SOILS FROM CANADIAN ARCTIC

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Soil bacteria play important roles in Arctic tundra soil biogeochemical processes such as carbon and nitrogen cycling. However, the bacterial assemblages and functions in tundra environments are still poorly understood. Here, we explored the bacterial communities, distribution patterns and the relationship between biotic/abiotic factors in surface soils from principal tundra vegetations in the Canadian Arctic. A total of 200 tundra soils for bacterial DNA analysis were collected from eight line transects (150m in each length) during summer. The bacterial communities, assessed by high-throughput sequencing of 16S rRNA gene fragments (V3-V4 region), were dominated by various uncultured members related to six phyla; Acidobacteria, Proteobacteria, Actinobacteria, Chloroflexi, Verrucomicrobia, and Planctomycetes. Bray-Curtis dissimilarity index showed that bacterial communities were divided into four distinct clusters. Each cluster significantly correlated to the type of tundra vegetation and soil properties (pH, soil moisture, NH4 and carbon - nitrogen ratio). Bacterial communities in Cluster 1, mainly Acidobacteria and Actinobacteria, were equally distributed throughout the sampling area. Bacteria from Cluster 2 dominated by Chloroflexi and Actinobacteria, were found in high moisture environments and high cryptogam coverage. Cluster 3 which consisted mainly of Acidobacteria and Planctomycetes thrives in environments with high C/N ratio, relatively low pH and high coverage of dwarf-shrubs of Ericaceae (e.g. Empetrum nigrum, and Vaccinium vitis-idaea). Verrucomicrobia, Planctomycetes and Acidobacteria abundantly found in Cluster 4 significantly related to high pH, high NH4 concentration and high coverage of graminoids (e.g. Carex spp.). The results from this investigation suggest that Arctic soil bacterial communities would also be affected by vegetation and soil properties caused by environmental changes.

USING ARCGIS STORY MAP AS TOOL TO EDUCATE AND FACILITATE GEO-SPATIAL KNOWLEDGE TRANSFER

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The story of shoreline change in the community of Tuktoyaktuk, located along the shores of the Beaufort Sea within the Inuvialuit Settlement Region has been around for many decades. At erosion rates between 1-2 m/yr the coastline has changed significantly in the last 60 years. Tuktoyaktuk is rich in oral history and traditional knowledge of what has happened and how the ocean and permafrost thaw have ultimately changed the map of the town forever. Luckily, the change over this time period has been well documented with photographs, mapped shoreline positions and documented rates of change. This project combines all of these photographs, maps and stories in a GIS (geographical information system) story that is not only an excellent way to show the change across a geo-spatial scale but also an excellent way to preserve and share this history in a way that makes sense to all. Geo-spatial data and knowledge is information that is associated with a unique position on the Earth's surface. Canada Centre for Mapping and Earth Observation (CCMEO) is one of the leading agencies developing opportunities to discover and learn more about geo-spatial data in the Inuvik Settlement Region. The Inuvik Satellite Station Facility (ISSF) established in 2009 is destined to develop into a geospatial hub, lending to anticipated employment and business opportunities in the geospatial sector in the Inuvik region. For this future employment demand to be met, there is opportunity to develop interest in geomatics and remote sensing in Inuvik youth, developing capacity from the ground up. Through a partnership with the Inuvialuit Regional Corporation, a geospatial summer intern was hired from Inuvik. This created the first stepping stone for local youth interested in geospatial data, and hopefully will lead to future training and opportunity for young Indigenous with a keen interest in STEM fields. To help visualize the serious issue of coastal change in Tuktoyaktuk, a web application was developed using ArcGIS Online's Story Map templates. Through a series of maps, photos, and narrative text, this application educates the user about the impacts of coastal change along the Arctic Ocean coastline near Tuktoyaktuk. Users can explore digitized coastlines from 1947-2018, photos from across time periods, major events, and research projects, and learn about different coastal erosion protection methods and outcomes. The application also includes information about the Northwest Territories, the community of Tuktoyaktuk, Tuktoyaktuk Harbour and some of its important uses. Here we highlight "Coastal Erosion in Tuktoyaktuk, NT" Story Map not only as a unique science communication tool, but also as a way to promote the new geo-spatial opportunities being fostered in the North.

SEARCH AND US APPROACHES TO NAVIGATING THE NEW ARCTIC

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The Study of Environmental Arctic Change (SEARCH) is a multi-disciplinary, multi-institutional effort to synthesize a system-level understanding of the changing Arctic and to inform policies with that understanding. While synthesis relies on cross-disciplinary collaboration, informing policies with science depends on collaboration among scientists and policy makers. Both types of collaboration require conversations across language and cultural divides. SEARCH employs knowledge exchanges, networks, and workshops to advance synthesis, and SEARCH informs policy through short briefs that provide expert answers to policy-relevant questions. The briefs open the way for sustained dialogues and collaboration with policy makers. As part of that sustained collaboration, SEARCH—in collaboration with U.S. and international partners—will convene a novel conference, Arctic Futures 2050; Science to Inform Policy in September 2019. The conference will bring together Arctic scientists and decision makers to expand our collective ability to inform policy with science. A sustained conversation between Arctic scientists and decision makers is required to "enable resilience" and to safeguard "human welfare and environmental sustainability in the Arctic," goals of the U.S. National Science Foundation's Navigating the New Arctic initiative.

HOW MUCH SAMPLING EFFORT IS REQUIRED TO OBTAIN LESS BIASED AND MORE PRECISE INDEXES OF PREDATOR ACTIVITY IN TUNDRA ECOSYSTEMS?

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In tundra food webs, predators play a key role in modulating the dynamics of trophic interactions. To better understand how these interactions are affected by global pressures such as climate change, it is essential to monitor predation risk at a large spatial scale across the Arctic. Yet, this represents an important challenge given the logistical constraints of working on terrestrial vertebrate species in remote areas. Predation risk is influenced by both the abundance of predators and their movement rates. Using traditional methods to estimate abundance (e.g. capture-recapture methods) and movement rates (GPS collars or backpacks) is not suited for most terrestrial vertebrate species because they are usually found a low density in the Arctic. We thus developed a simple method to index activity rates of predators using incidental observations. The objective of this study was to determine how the sampling effort (number of observation hours) influences the bias and precision of this index of activity rates (number of predators observed per 100 observer-hours). During summers 2016 and 2017, we conducted opportunistic observations of avian predators and arctic foxes in 13 arctic sites located around the polar circle. The implementation of this common protocol at a circumpolar scale is steered by the Interaction Working Group (IWG) that includes the 13 sites managed by researchers from 5 countries (Canada, USA, Groenland, Russia, and Sweden). Using binoculars, we recorded daily the number of arctic foxes and avian predators seen per hour spent on the field per observer. We computed the bias and precision of the indices of activity rates of avian predators and of arctic fox, respectively, for different values of the sampling effort (full sampling effort; reduced sampling effort: 500, 450, 400, 350, 300, 250, 200, 150, and 100 observer-hours per site per year). We calculated the bias using the following formula: (index value REDUCED SAMPLING EFFORT – index value FULL SAMPLING EFFORT) / index value FULL SAMPLING EFFORT. We calculated the precision through the coefficient of variation (CV), using the following formula: standard deviation of the index value REDUCED SAMPLING EFFORT / mean of the index value REDUCED SAMPLING EFFORT). We estimated the influence of the sampling effort on the bias and CV, respectively, using generalized linear mixed-effects models (GLMMs). Our results show that, for both avian predators and foxes, the bias decrease with the sampling effort. The bias remained below 0.5 (threshold above which the bias is considered severe) above a sampling effort of 289 and of 302 hours for avian predators and foxes, respectively. The CV increases with the sampling effort for both avian predators and foxes. It remained below 0.5 (threshold above which the precision is considered low) for the range of reduced sampling effort tested (i. e. from 100 to 500 observer-hours). This methodological study is critical to assess the sampling effort required to minimize bias and maximize precision of indexes of predator activity in tundra ecosystems. Such indexes are highly needed to understand how predation pressure is modulated along large-scale environmental gradients across the Arctic.

THE ANOMALOUS SEA ICE GROWTH AND DRIFT IN THE HUDSON BAY IN 2017/18 CAUSED BY THE ENHANCED CYCLONIC ATMOSPHERIC CIRCULATION

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Two oceanographic moorings equipped with upward looking current profilers and sonars were deployed in western Hudson Bay from September 2016 to June 2018 and collected a continuous time series of sea ice thickness through two winters. During winter 2016/17, sea ice grew steadily to a peak thickness of 1.2-1.3 m whereas during winter 2017/18 the ice only grew to a peak thickness of 0.8 m. We attribute the difference in ice thickness to the different atmospheric circulation patterns that prevailed during these two winters. Winter 2017/18 was characterized by strong cyclonic circulation that drove persistent northwesterly winds, whereas winter 2016/17 was characterized by weaker cyclonic circulation that led to numerous reversals in surface winds. Considering that northwesterly winds are favorable for opening the polynya in northwestern Hudson Bay, we suggest that during winter 2017/18 the ice cover over both moorings was continually replaced by new ice formed upstream in the polynya. Furthermore, the numerous reversals in surface winds during winter 2016/17 also resulted in stronger deformation of the ice cover, which is evident in the ice draft time series. The difference in atmospheric forcing regimes between these two winters not only contributed to changes in the ice cover at the mooring locations, but also impacted the regional sea ice cover and the regional pattern of breakup. Using remotely sensed fields of ice drift (OSI SAF) and ice thickness (Cryosat-2) we further examine the difference between these two winters and examine the spatial distribution of remnant ice during the melt season. Overall, enhanced cyclonic atmospheric circulation during winter 2017/18 caused faster ice drift towards eastern Hudson Bay and dynamically thickened the ice cover, thereby delaying breakup and impacting the summer shipping season. In contrast, weaker cyclonic activity during 2016/17 reduced dynamic ice growth in eastern Hudson Bay and left thicker ice types in the southern portion of Hudson Bay where the remnant ice cover melted out in a manner typical of previous years.

CHANGE IN MULTI-TAXA COMMUNITIES ALONG A ENVIRONMENTAL GRADIENT IN THE CANADIAN SUBARCTIC TUNDRA

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Ecosystem functions in the Arctic tundra can be affected by changes in the community structure of various taxonomic groups. One of the shortcomings in previous studies on community structure; however, has been the narrow focus on trends in species richness of organismic groups at the taxonomic level, rather than on the multi-group communities that coexist and share resources in ecosystems. We compiled a species inventory of 200 communities for vascular plants, soil bacteria, and fungi, and 104 communities for collembola communities in Kuujjuarapik-Whapmagoostui, Quebec, Canada. Vascular plant communities were collected from eight line transects (150 m) including 25 quadrats (1 m2). A total of 200 tundra soil samples were collected from each quadrat for bacterial and fungi DNA analysis. The collembola communities were collected from 13 quadrats along each transect, using the Tullgren method. In each quadrat, soil properties (pH, soil moisture, NH4, and carbon nitrogen ratio) were measured. Vascular plant communities changed along changes in the carbon nitrogen ratio, NH4, and pH, which can be explained by the dominance of graminoids (e.g., Carex spp) with the higher pH and NH4, and the dominance of woody species (e.g., Empetrum nigrum, Vaccinium vitis-idaea, and Rhododendron tomentosum) with the higher carbon nitrogen ratio. With the increasing dominance of woody species, α- and β-diversities decreased. Other taxonomic groups also showed similar trends for α- and β-diversities, except for the trend in α-diversity of the collembola communities. Besides diversity, the composition of communities in terms of vascular plants, bacteria, and fungi also changed with the increasing dominance of woody species. In the sub-arctic region, greening with shrub expansion is an explicit landscape change. Such changes (i.e., the increasing dominance of woody species) may lead to homogenization through the loss of multi-taxa with the resulting loss of diversity.

STUCKBERRY VALLEY LAKES: SENTINELS OF ENVIRONMENTAL CHANGE AT CANADA'S EXTREME NORTHERN LIMIT

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Despite being at the northernmost fringe of land on Earth, the northwest coast of Ellesmere Island is a highly dynamic region at the interface of the Canadian Arctic Archipelago and the Arctic Ocean ice pack. The region contains a variety of aquatic ecosystem types, including fiords, meromictic lakes, epishelf lakes, and supraglacial meltwater ponds. Many such ecosystem types exist at the climatic limits of their viability and when environmental thresholds are crossed they are often manifest as ecosystem regime changes. The region has seen important Holocene climate variability, however little is known about the history of ice shelves or sea ice prior to the late 19th Century. This information is critical for assessing the recent degradation of coastal ice in the context of long-term natural variability. Eight km to the west of Clements Markham Inlet, Stuckberry Valley (82° 54' N, 66° 56' W) ascends from the ocean to encompass a series of four unnamed lakes, the last of which is situated 56 m asl. The marine limit in this region was 124 m asl and these lakes were thus submerged sea floor depressions when glaciomarine environments appeared following glacial retreat ~11.4 cal ka BP. Isostatic uplift later sequentially separated the lakes from the ocean. To our knowledge, it is the only chain of coastal lakes spanning such an altitudinal gradient on the northern coast of Ellesmere Island. With their different time spans in isolation, these lakes present a unique opportunity to reconstruct past sea ice cover and to evaluate natural climate variability. In summer 2017, we sampled sediments of four lakes which were previously completely unexplored. Here we present preliminary results from our project, a multidisciplinary study that seeks to understand the ecology and history of these lakes through studies of photosynthetic pigments, hyperspectral imaging spectroscopy, Micro XRF and paleomagnetic analyses.

EXAMINING THE POTENTIAL IMPACT OF INCREASED VESSEL TRAFFIC NOISE ON MARINE MAMMALS IN THE PROPOSED TALLURUTIUP IMANGA (LANCASTER SOUND) NATIONAL MARINE CONSERVATION AREA

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Recent reductions in sea ice extent in the Canadian Arctic, as a result of global climate change, has led to an increase in maritime navigability and it is expected that there will be an increase in shipping activities related to tourism, fisheries and trade in the future. There is already increased interest in the commercial viability of the Northwest Passage as evidenced by the recent sailings of cargo vessels such as the Nordic Orion (2011) and the Nunavik (2014) and the unprecedented number of yachts, cruise ships and new research vessels such as the Chinese research icebreaker Snow Dragon (2017) and cruise ship Crystal Serenity (2016, 2017). Tallurutiup Imanga (Lancaster Sound) a marine area that will soon become a National Marine Conservation Area (NMCA) that spans approximately 110,000 square kilometers, is located at the eastern entrance of the Northwest Passage. The area is rich in ecological and cultural significance and the protection of Lancaster Sound has been in progress for decades. With the official boundaries set in August of 2017, the future protection and management of the new NMCA will be crucial to protecting its integrity, especially as commercial shipping is expected to increase precisely in this area. Our ongoing research project aims to: 1) utilize an existing ship track database developed using Canadian Coast Guard (NORDREG) data, to evaluate shipping trends in Lancaster Sound from 1990 to 2016; 2) project future shipping traffic in the region based on best available data; 3) model the current and potential future impact of vessel noise on relevant marine mammal species in the NMCA; and 4) propose spatial management options for reducing noise impacts from increased marine traffic. In the presentation, we will provide preliminary results from the study.

PREVALENCE, DISTRIBUTION, DIVERSITY, AND IMPROVED DIAGNOSTICS FOR ZOONOTIC ECHINOCOCCUS SPP. IN THE CANADIAN NORTH

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Wild canids (foxes, wolves, coyotes) are essential parts of a balanced ecosystem especially in Northern Canada. These animals serve as reservoirs or definitive hosts to zoonotic helminth parasites like Echinococcus multilocularis and E. canadensis. Increasingly, climate change affects the life cycle and distribution of both hosts and parasites in the North, creating a need for baseline knowledge of the prevalence of parasites and for improved diagnostic tools. In this study, wild canids (184 foxes, 23 wolves, and 77 coyotes) from Quebec, the Yukon (39 red foxes, 9 Coyotes, 38 Wolves,) and the Northwest Territories (39 Arctic foxes) were examined for the presence of Echinococcus spp. using the sedimentation, filtration and counting technique (SFCT), considered the gold standard for wildlife surveillance. A multiplex polymerase chain reaction (PCR) was used to determine the species of 3-10 individual Echinococcus worms in each positive animal. We also tested fecal material from canids to evaluate the performance of centrifugal flotation for helminth eggs, which is the most common technique in veterinary diagnostics, and a newly developed point of care coproPCR test kit. Overall prevalence of Echinococcus spp was 13% (54/409) wild canids of Canadian North. Echinococcus multilocularis was detected in Arctic foxes from Banks Island and Victoria Island of the Northwest Territories (NT), at a prevalence of 26%. E. canadensis was found in 71% of Yukon wolves, 35% of Quebec wolves, and 12% of Quebec coyotes. The outcome of this work, so far, has revealed that Victoria Island NT is a new geographic record for E. multilocularis, and higher prevalence for E. multilocularis in Arctic fox in the NT and E. canadensis in wolves in the Yukon compared to QC and to previous studies. Parasite genotyping results will be presented, as there may be differences in pathogenicity for people between G8 and G10 strains of E. canadensis, and European and North American strains of E. multilocularis. We also demonstrate that a new fecal PCR for tapeworm has substantially higher sensitivity than fecal flotation, which has promising implication for use in wildlife surveillance and veterinary clinics and diagnostic laboratories, along with ease of use by inexperienced evaluators.

SPACEBORNE SAR DATA ASSIMILATION IN NUMERICAL SEA ICE PREDICTION SYSTEM

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Spaceborne synthetic aperture radar (SAR) high resolution (at or below 50 m) images from the ongoing satellite missions such as Canadian RADARSAT-2 currently provide the most reliable information on sea ice conditions. Dual-polarization RADARSAT-2 HH-HV ScanSAR imagery is the main source of data for operational production of Ice Charts at the Canadian Ice Service (CIS). The upcoming Canadian RADARSAT constellation mission (RCM) equipped with three SAR platforms will further increase the amount of SAR data over the Arctic region. Automated interpretation of SAR images is challenging, but there is a strong interest in making use of the large quantities of SAR observation in numerical sea ice prediction systems such as the Environment and Climate Change Canada's (ECCC) Regional Ice-Ocean Prediction System (RIOPS). In this study we assess impact of automatically derived information from SAR data in the RIOPS sea ice concentration analysis system over a 12-month period. More than 7,000 RADARSAT-2 HH-HV images acquired over the Canadian and adjacent waters being monitored by CIS were collected for 2013. Our previously developed technique for automated detection of ice and open water from SAR with very high accuracy of 99.8% [1], [2] was utilized in order to derive ice and open water retrievals from the collected SAR data. The following data assimilation experiments over the year 2013 were conducted: (1) Control experiment with all currently used satellite data sources (i.e. SSM/I, SSMIS, AMSR2, AVHRR), except CIS manually derived ice charts from SAR data (which indirectly represent SAR data). (2) Charts experiment; similar to Control experiment, but with CIS Ice Charts included, and (3) Six SAR experiments with different options; similar to Control experiment, but with our SAR retrievals included. Our verification results demonstrate that impact of SAR retrievals in sea ice analysis system is similar to the impact produced by the CIS Ice Charts. Main improvements in the SAR runs were found near land. This is similar to the spatial distribution observed with Charts run, as mostly the same images were used for Ice Chart production. More detailed verification results for different Arctic regions and seasons will be discussed in the presentation. [1] A. S. Komarov, and M. Buehner, "Adaptive probability thresholding in automated ice and open water detection from RADARSAT-2 images," IEEE Geoscience and Remote Sensing Letters, vol. 15, no. 4, pp. 552-556, April 2018. [2] A. S. Komarov, and M. Buehner, "Automated detection of ice and open water from dual-polarization RADARSAT-2 images for data assimilation," IEEE Transactions on Geoscience and Remote Sensing, vol. 55, no. 10, pp. 5755-5769, October 2017.

ABORIGINAL LIAISON PROGRAM AT STATISTICS CANADA

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The Aboriginal Liaison Program serves as a bridge between Statistics Canada and Inuit communities and Inuit organizations. Some our program objectives include working in partnership with First Nations, Métis, and Inuit communities and organizations to build strong relationships, increase understanding and access to our data sources for decision-making and community planning activities; build statistical capacity of Aboriginal peoples and organizations; liaise with communities and organizations on Statistics Canada surveys and other important initiatives. In particular, this presentation will give an overview of the program and showcase how to find data on the Statistics Canada website. This presentation will give an overview on Inuit data at the territorial and community level; data distribution to Inuit governments, organizations and communities; data and information request support through personal consultations; networking that leads to establishing durable and meaningful relationships. We aim to improve outreach to client groups such as Inuit communities through statistical capacity building.

INUIT SELF-DETERMINATION IN RESEARCH: IMPLEMENTING THE NATIONAL INUIT STRATEGY ON RESEARCH - AN INTERNATIONAL PERSPECTIVE 3

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On March 22, 2018, Inuit Tapiriit Kanatami released the National Inuit Strategy on Research (NISR), a pivotal document that outlines the coordinated actions required to improve the way Inuit Nunangat research is governed, resourced, conducted, and shared. The NISR was developed in coordination with the Inuit Qaujisarvingat

National Committee made up of representatives of each of the members of the Inuit Tapiriit Kanatami Board of Directors. The document promotes a shared understanding of the legacy of Inuit Nunangat research and connects this legacy to current research practices, defines Inuit expectations for the role of research in our regions and communities, and identifies areas for participation and action between Inuit and the research community. For far too long, researchers and research institutions have tended to be the primary beneficiaries of Inuit Nunangat research, despite the present and ongoing need for Inuit-specific data and information that can be used to shape solutions to our most pressing challenges. Furthermore, Inuit Nunangat research is too often governed, resourced, and carried out in a manner that limits Inuit participation, marginalizing Inuit from the benefits of research. The NISR seeks to remedy these problems. It identifies five priority areas in which coordinated action is necessary to facilitate Inuit Nunangat research that is effective, impactful, and meaningful to Inuit. These five priority areas are: 1) Advance Inuit governance in research; 2) Enhance the ethical conduct of research; 3) Align funding with Inuit research priorities; 4) Ensure Inuit access, ownership, and control over data and information; and 5) Build capacity in Inuit Nunangat research. Implementing the NISR will require a coordinated approach based on partnership. The interrelated, interdependent nature of these five priority areas, as well as the number of stakeholders involved in Inuit Nunangat research, means that new relationships must be brokered between Inuit, government departments, and research institutions in order to implement the NISR. This session will showcase the NISR and its implementation plan by inviting individuals from within Inuit organizations, government, agencies, and academia to discuss how they are helping move towards Inuit self-determination in research.

INUIT SELF-DETERMINATION IN RESEARCH: IMPLEMENTING THE NATIONAL INUIT STRATEGY ON RESEARCH - A FOCUS ON PRIORITY AREA #4: ENSURING INUIT ACCESS, OWNERSHIP, AND CONTROL OVER DATA AND INFORMATION

Kora, Anita (1)

Inuit Tapiriit Kanatami

On March 22, 2018, Inuit Tapiriit Kanatami released the National Inuit Strategy on Research (NISR), a pivotal document that outlines the coordinated actions required to improve the way Inuit Nunangat research is governed, resourced, conducted, and shared. The NISR was developed in coordination with the Inuit Qaujisarvingat National Committee made up of representatives of each of the members of the Inuit Tapiriit Kanatami Board of Directors. The document promotes a shared understanding of the legacy of Inuit Nunangat research and connects this legacy to current research practices, defines Inuit expectations for the role of research in our regions and communities, and identifies areas for participation and action between Inuit and the research community. For far too long, researchers and research institutions have tended to be the primary beneficiaries of Inuit Nunangat research, despite the present and ongoing need for Inuit-specific data and information that can be used to shape solutions to our most pressing challenges. Furthermore, Inuit Nunangat research is too often governed, resourced, and carried out in a manner that limits Inuit participation, marginalizing Inuit from the benefits of research. The NISR seeks to remedy these problems. It identifies five priority areas in which coordinated action is necessary to facilitate Inuit Nunangat research that is effective, impactful, and meaningful to Inuit. These five priority areas are: 1) Advance Inuit governance in research; 2) Enhance the ethical conduct of research; 3) Align funding with Inuit research priorities; 4) Ensure Inuit access, ownership, and control over data and information; and 5) Build capacity in Inuit Nunangat research. Implementing the NISR will require a coordinated approach based on partnership. The interrelated, interdependent nature of these five priority areas, as well as the number of stakeholders involved in Inuit Nunangat research, means that new relationships must be brokered between Inuit, government departments, and research institutions in order to implement the NISR. This session will showcase the NISR and its implementation plan by inviting individuals from within Inuit organizations, government, agencies, and academia to discuss how they are helping move towards Inuit self-determination in research.

INUIT CIRCUMPOLAR COUNCIL (ICC) – GLOBAL ACTIONS ON CONTAMINANTS

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Inuit have called the Arctic home from time immemorial. Today many Inuit continue to rely on traditional food sources – food hunted and gathered from the land, water, and sky. Many continue to rely on drinking water gathered from multi-year sea ice, the rivers, and lakes, and rain. The health of Inuit is tightly connected to the health of the Arctic environment. Inuit are disproportionally affected by contaminants which undergo long-range transport, bioaccumulate in the Arctic ecosystem and lead to concentrations of concern in some Inuit populations, potentially impacting their overall food security, health, and well-being. Therefore, the Inuit Circumpolar Council (ICC) is very engaged in work towards reducing contaminants and has been instrumental in the negotiations leading up to the Stockholm Convention of Persistent Organic Pollutants, which was adopted in 2001 and entered into force in 2004, as well as the Minamata Convention on Mercury, which was adopted in 2013 and came into force in 2017. Research and monitoring in the Arctic has been crucial for the negotiation and implementation of these conventions, to reduce and where possible eliminate contaminants in the Arctic and prevent further detrimental impacts to the environment and human health. Verification of the effectiveness and success of the Stockholm Convention have been noted, for example through declines of concentrations in the environment for POPs listed in the annexes of the convention. However, thousands of new chemicals continue to be added to the environment, and global action is rather slow and reactive. This paper will review current activities ICC is involved with to support global policy-making processes, where these activities are still lacking, and provide some recommendations on ways to move forward to achieve a clean Arctic environment.

INTRODUCTION TO THE UNITED NATIONS ENVIRONMENT PROGRAMME COASTAL PERMAFROST RAPID RESPONSE ASSESSMENT

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Coastal permafrost is a dynamic, but understudied, element of the Arctic that is presently responding to climate warming with potentially far reaching impacts on terrestrial and marine processes, ecosystems, geohazards, biogeochemical processes and fresh water flux. To address societal needs at local, regional and global scales we believe it is necessary to identify and address key research gaps and to adopt a transdisciplinary approach to permafrost research. Because of the challenges and costs of undertaking research in the Arctic, international cooperation and coordination will be increasingly important. The UNEP coastal permafrost Rapid Response Assessment is an effort by leading scientists and institutions to assess critical research gaps related to Arctic coastal permafrost and to consider how these gaps can be addressed through international cooperation. In consultation with international agencies, indigenous groups, local communities and relevant government departments, we aim to look at research priorities affecting the well-being of those living in Arctic coastal communities and to determine the global-scale drivers that are influencing issues such as natural emissions of greenhouse gases. We envisage outputs from this rapid assessment will include a summary of research needs over the coming decades, policy recommendations on how international collaboration can and should address these needs, and outreach products and data portals informing the public about the importance of permafrost. The RRA effort started in May 2018, with a northern consultation effort based in Inuvik, NWT. This talk will outline the goals and objectives of the RRA and reflect on guidance and suggestions we have received through our consultation. We welcome input from the ArcticNet community during the discussion portion of this session.

THE HUDSON BAY INTEGRATED REGIONAL IMPACT STUDY (IRIS) AND FUTURE RESEARCH PERSPECTIVES

Kuzyk, Zou Zou (1) (lauren.candlish@umanitoba.ca), L. Candlish (1), M. Kamula (1) and D. Barber (1) on behalf of the IRIS Steering Committee

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The Greater Hudson Bay Marine Region, comprising Hudson Bay, James Bay, Foxe Basin, Hudson Strait and Ungava Bay, is the largest inland sea in the world to experience a seasonal sea-ice cover. A massive amount of freshwater enters the Marine Region from its large watershed, which covers a third of the Canadian landmass. Its ecosystems are broad and varied, with both year-round presence and seasonal abundances of fish, birds, and marine mammals. There are forty coastal communities, mostly Inuit and Cree, who have depended on the waters and icescapes for their food, culture, mobility, and livelihoods for millennia. The significance of environmental change in the Marine Region is thus most profound for these people; yet the results of scientific studies have not been widely disseminated outside academia nor influential with regard to policy. Inuit and Cree priorities such as changes in coastal sea ice affecting safety of travel have escaped scientific agendas. We have recently completed the ArcticNet Integrated Regional Impact Study (IRIS) for the Greater Hudson Bay Marine Region. The IRIS report incorporates results from scientific studies, published compilations of traditional knowledge, insights of Inuit and Cree represented through the IRIS steering committee, input from community meetings at which components of the IRIS were presented, and comments from a variety of stakeholders who contributed to the editorial team. The goal of this document was to provide relevant and practical information for regional decision-makers in an accessible format. In this presentation, we will summarize the process, which was an example of cooperation among the regional, national and local partners and academics. We will give a short overview of the topics addressed in the report and the key recommendations that have emerged, including perspectives on future research priorities.

MEDIA REPRESENTATIONS OF ARCTIC TOURISM – THE CASE OF THE CRYSTAL SERENITY

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The Arctic region is the subject of significant media attention, especially since the advent of global warming. It is therefore surprising that only a few academic studies focused on studying empirically and analyzing the nature of the media coverage related to the region. This presentation will provide such empirical investigation by analyzing Canadian media coverage of the two voyages of the cruise ship Crystal Serenity. The Crystal Serenity went through the Arctic during the 2016 and 2017 summers, generating significant media attention. The initial cruise raised many concerns (environmental, social, safety) while also making experts speculate on its possible economic impact for local communities. This presentation will analyze 34 articles from traditional media as well as 404 tweets (using the #CrystalSerenity) to figure out how the voyages were framed in traditional and social media. This, in turn, can help us understand the type of perceptions most widely diffused in Canadian society about mass tourism, northern development and sustainable environmental protection.

CONTRASTING BIO-PHYSICAL RELATIONSHIPS BETWEEN ARCTIC MYI AND FYI

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Multi-year sea ice (MYI) is disappearing rapidly with ongoing climate change and yet our understanding of how the Arctic ecosystem will change with the replacement of MYI by first-year sea ice (FYI) is limited. Contrasting bio-physical properties between MYI and FYI from the same region can provide key insights into the future Arctic Ocean. Here we present an unprecedented dataset of 89 MYI (range: 2.1–4.6 m) and 75 FYI (1.4–1.8 m) cores combined with extensive snow, ice and under-ice light surveys from adjacent landfast FYI and MYI sites within the MYI-dominated Lincoln Sea. Our results from FYI support the commonly documented de-coupling patterns observed between bottom-ice algal chlorophyll a biomass and snow depth, as a result of varying snow cover over a level surface. In contrast, the MYI sites showed a coupled bottom-ice algal chl a biomass – snow depth relationship. We also observed a spatio-temporal change in the pattern of PAR transmittance below FYI based on under-ice ROV surveys, but no change under MYI. We suggest that the coupling of chl a and snow depth for MYI is a result of the stable light field created by the undulating surface of MYI, which produces a consistent snow redistribution pattern as snow is removed from high elevation regions and deposited into low elevation regions. Although our results indicated that the overall mean chl a biomass was higher for FYI compared to MYI, we maintain that MYI provides a more predictable and stable light environment for ice algae, which may be an important factor in terms of access and reliability of food source for ice-associated organisms.

DISSOLVED ORGANIC MATTER AS A KEY VARIABLE IN THE CHANGING ARCTIC LIMNOSCAPE

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With ongoing climate warming, northern ecosystems are experiencing unprecedented changes in their structure and functioning, largely linked to permafrost thawing. Previously frozen soils export organic carbon, nutrients and contaminants to aquatic ecosystems, modifying their thermal structure, light environment, biogeochemistry and microbial ecology, with consequences on the services provided to northern communities, especially in terms of safe drinking water. Among other effects, the compounds leaching from thawing permafrost strengthen water column stability, reduce light and oxygen availability, stimulate methane production, and turn systems into net heterotrophy. A preoccupying consequence is also their potential to create conditions for a rising dominance of noxious cyanobacterial blooms in northern lakes. Moreover, disinfection of drinking water with chlorine, typically employed to inactivate pathogens, can result in the formation of potentially carcinogenic disinfection by-products through the reaction of chlorine with dissolved organic matter and cyanobacteria. Increase in the external loading of dissolved organic matter to freshwaters is a process known as lake browning, a phenomenon described at many locations on the planet, but reports at high latitudes are still limited. In this presentation, we will discuss which limnological processes lake browning can affect in aquatic ecosystems, and how water quality may change in landscapes altered by permafrost thawing.

LOCAL AND REGIONAL LANDSCAPES OF FEAR: USING CITIZEN SCIENCE AND A NON-INVASIVE INDEX OF STRESS TO ASSESS SNOWSHOE HARE PERCEPTION OF RISK

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The snowshoe hare's 8-11 year population cycle is fundamental to the ecosystem dynamics of Canada's boreal forest. The cycle is driven by predation (lynx, coyotes, great-horned owls), and hare stress levels have been shown to be acutely sensitive to even subtle variation in predation risk. These changes can have cascading effects on health and reproduction. Long-term data on fur returns suggested that hare cycles were largely synchronous across their range, however recent years have been characterized by phase asynchrony in their northwestern range. We examined hare populations' physiological sensitivity to variation in predator pressure across regional and local scales in the Yukon Territory from 2014-2017. The measurement of fecal cortisol metabolite concentrations in fecal samples offers a simple, non-invasive index for the measurement of stress in wild populations. Local citizens were recruited throughout the Territory to collect samples in February of each year, allowing for a regional comparison of winter hare population stress estimates in Kluane Lake, Whitehorse, Faro, Mayo, and Whitehorse. For the local scale comparison, fecal samples were collected along a 25km-transect near Kluane Lake over the same time period. Variation in relative risk was determined from population density estimates for both hares and their main mammalian predators that were collected by the Community Ecological Monitoring Project (CEMP). At the local scale, overwinter track counts for hares and their predators were conducted following fresh snowfall events, and averaged over 5-km blocks of the transect. Across regions, hare density was estimated from annual hare fecal pellet censuses, and predator density from winter track transects. This academic-citizen scientist-governmental collaboration allowed for a simple and efficient large-scale assessment of community dynamics that could easily be reproduced and incorporated into ongoing monitoring activities in the Yukon, and may be useful for detecting large population changes or responses to environmental perturbation over time.

LAKE SHORELINE EVOLUTION AND PERMAFROST-RELATED DRIVERS, RANKIN INLET, NUNAVUT

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The western coast of Hudson Bay in the Kivalliq Region of Nunavut is rich in natural resources and has potential for resource development. In addition, the establishment of a transportation and transmission corridor between Manitoba and the Kivalliq region has been under consideration for several years. Knowledge of permafrost conditions and processes is required to understand climate change impacts and to aid in developing adaptation solutions. However, the scarcity of permafrost data along the western coast of Hudson Bay hinders understanding of historical and contemporary permafrost conditions and sensitivity to climate warming. Local and traditional knowledge on permafrost and landscape change was gathered at a participatory mapping workshop in Rankin Inlet in 2016 to improve regional characterization of permafrost conditions. Among various observations, the most recurrent was of decreasing lake water levels. Analysis of historical air photos and satellite imagery was completed for 215 lakes near Rankin Inlet, and validated by field observations. The objective was to determine if permafrost-related drivers could explain the observed lake level changes after accounting for fluctuations in lake area caused by variations in the hydrological cycle, inferred by historical snow and precipitation conditions. Analysis results indicated that lakes in the study area were either expanding, draining, or remaining stable. Draining lakes were easier to identify than expanding lakes, which were only perceptible by subtle local changes in shoreline morphology. This might explain why local knowledge holders have preferentially reported low lake water levels in recent years. The distribution of lake expansion and drainage was influenced by surficial geology. A disproportionately high number of observations of lake expansion occurred in undifferentiated till and marine sediments. Draining lakes were more commonly found in glaciofluvial sediments, especially in areas of high topographic relief. Seasonal and inter-annual ground surface displacement measured with Radarsat-2 and ALOS-2, respectively, were used to validate areas of change near lake shorelines. Though translation of these remotely-sensed datasets to real displacement measurements is not straightforward, general relations were nonetheless established between the displacements and locations of stable, expanding, and draining lakes. These relations support (1) the thaw of ice-rich layers near the top of permafrost where localised lake expansion is observed, and (2) increased lake storage resulting from active layer thickening in coarse sediments. We also hypothesize that ice-wedge degradation is involved in lake water level changes. The results of this study contribute to a better understanding of the relation between permafrost and surficial geology, and how these terrain units could respond to a warming climate.

LISTENING TO THE SONGS OF THE ARCTIC: LARGE SCALE MONITORING OF AVIAN PHENOLOGY

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As the climate is getting warmer in the arctic, the phenology of living species is changing as well. Most migrating birds, for instance, have advanced their arrival date on nesting sites in response to advanced snowmelt. Despite this, some bird populations are declining, which might be caused by an inappropriate phenological response to the changing environment. However, due to the remoteness of polar regions, the cost and logistics involved, few studies describe how climatic variation impacts the phenology of arctic birds. Moreover, studies are usually led only in a few study sites at a time and usually close to each other. This leads to a lack of understanding of the mechanics of phenological variation at a global scale. Recent advances in acoustic technology now allow us to use small and cheap automatic devices that can record sounds for months and collect lots of data in a way that is cheaper, more precise, more objective and more replicable. Thanks to the collaboration of members of the Arctic Shorebirds Demographic Network and the Interactions Working Group, 55 acoustic recorders were deployed in 20 sites across the arctic, ranging from Alaska to Svalbard, during the summer of 2018. The recorders were deployed along latitudinal and longitudinal gradients. In 7 sites, multiple recorders were deployed to study variations at a smaller geographical scale. A soundscape approach, considering all vocal species by calculating indexes representing the bird communities' complexity is presented here. This approach allows for a fast analysis of the sheer amount of data collected. While the species assemblage can be different between two sites, species of the same families can often be found to provide points of comparison. By continuing and expanding this experiment, we hope this will 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.

A REVIEW OF KILLER WHALE (ORCINUS ORCA) ECOLOGY IN A CHANGING CANADIAN ARCTIC: RESEARCH PRIORITIES AND FUTURE DIRECTIONS

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Killer whales (Orcinus orca) are a widely distributed apex predator with a broad ecological niche as a species. Killer whale occurrence in the Canadian Arctic is thought to be limited by the extent and duration of seasonal sea ice. It has been suggested that the increasing length of the open-water season has led to an increase in killer whale abundance and/or a changing distribution in the Canadian Arctic. Despite increased research efforts, our understanding of killer whale ecology in the Canadian Arctic remains limited. The objectives of this review are to summarize our knowledge of Canadian Arctic killer whales, and to identify areas where additional research is required. We provide an update on our knowledge of Canadian Arctic killer whale population size and structure, seasonal distribution and movements, predation and feeding ecology, and threats. We use this information to establish research priorities and suggest future directions for killer whale research in the Canadian Arctic. An improved understanding of Canadian Arctic killer whale ecology is crucial for effective stock management of killer whale prey species that are of considerable economic and cultural importance to Inuit (e.g. narwhal, beluga, bowhead whale, and seals), and to better understand the ecological consequences of a changing Canadian Arctic climate.

CORPORATE SOCIAL RESPONSIBILITY AND CONSENT. COMPARATIVE PERSPECTIVES ON MORAL ISSUES OF THE MINING INDUSTRY IN NEW CALEDONIA AND CANADA.

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Mining has undergone a profound transformation over the past twenty years. On the one hand, it has experienced unprecedented expansion under the triple effect of the explosion in global demand, the development of transnational corporations and incentives from international donors for more liberalism and a redesign of the legal frameworks for mining (Campbell, 2010). On the other hand, the sector has been heavily criticized following major environmental scandals and human rights violations, which have contributed to the progressive integration of the principles of sustainable development by mining companies (Dashwood, 2012). The development of norms, standards and protocols associated with Corporate Social Responsibility (CSR) is in line with these reflections aimed at “moralizing” and “humanizing” capitalism in a way and promoting more ethical behaviour towards human rights and the environment (Hopkins 2007; De Neve, 2008). These recent transformations potentially reverse a long history of environmental, social and political disasters. They encourage the deployment of new regulations and practices, redefining relationships between companies, public authorities and groups concerned, and introduce new formats for political negotiation (O’Faircheallaigh &Ali, 2008). The objective here is to try to capture the different registers mobilized about the “moral”, “ethical” or even “citizen” behaviour expected of mining companies, and by whom in mining encounters. This requires both identifying the constellation of actors in these relationships, and the different types of discourse they carry. The challenge here is to overcome the impression that diverse groups with divergent interests can suddenly speak the same language (Kirsch, 2016), thus distinguishing the language of CSR, from indigenous rights, consultation and cooperation. To analyse this question, I will put into perspective two situations of mining encounters, the first in New Caledonia regards two large mining companies, Vale New Caledonia and Koniambo Nickel SAS, the second in Canada concerns two other companies, under the same international groups, Voisey’s Bay and Raglan. Based on fieldwork in New Caledonia and review of literature, this presentation will focus on lexicons regarding CSR, indigenous peoples rights and cooperation frameworks, in order to understand the legal and political contexts that may or may not favour the establishment of local partnerships through them, and apparatuses which emerged. Ultimately, this paper aims to demonstrate how moral issues related to sustainable development in extractive industries are not only shaped by global discourses but also by local mining encounters. Bibliographie Campbell B. (dir.), 2010, Ressources minières en Afrique. Quelles réglementations pour le développement ?, Presses de l'Université du Québec. Dashwood H., 2012, The Rise of Global Corporate Social Responsibility: Mining and the Spread of Global, Cambridge, Cambridge University Press. Hopkins, Michael. 2007. Corporate social responsibility and international development: Is Business the solution? London: Earthscan. O'Faircheallaigh C., Ali S., 2008, Earth matters: indigenous peoples, the extractive industries and corporate social responsibility, Sheffield, Greenleaf. Rajak, D., Dolan, C. (Eds.), 2016, The anthropology of corporate social responsibility, Berghahn, New York.

THERMAL STATE OF PERMAFROST AT SITES IN NORTHERN BRITISH COLUMBIA AND SOUTHERN YUKON, CANADA

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The thermal state of permafrost is important to global observing systems, for infrastructure and resource development planning in the Arctic and Subarctic, and in relation to potential greenhouse gas emissions caused by the breakdown of previously frozen organic matter. Despite these needs, and in contrast to an extensive network of long-standing monitoring sites in the Mackenzie Valley, few sites were being actively monitored in northern British Columbia and the Yukon prior to the International Polar Year. Boreholes which were drilled in 2007-2008 or in subsequent years are now starting to have long enough records that spatial and temporal trends in ground temperatures can be examined. We present results from more than 20 shallow boreholes which have been monitored for at least 5 years. Most are located in the zones of discontinuous permafrost traversed by the Alaska Highway Corridor (57.4-62.6°N) but the network extends as far north as Red Creek (65.2°N) in the continuous permafrost zone on the Dempster Highway. Borehole elevations range from 320 m asl at Dawson to 2080 m asl on Mt. Granger near Whitehorse, with high elevation sites falling within areas of continuous mountain permafrost. Average ground temperatures vary spatially from -0.1°C in the south, to -3°C near the Alaska border, to -2°C at Red Creek and as low as -4.3°C at the highest elevation site. Permafrost thickness, determined from temperature records or inferred from electrical resistivity tomography (ERT), is 5 m or less at the warmest sites but exceeds 65 m (the maximum depth of investigation using ERT) at the coldest. The colder sites show greater inter-annual variability in ground temperatures and possible warming trends. The latter, however, are influenced by 2016 as being the warmest year on record (1948-2017) in the Yukon-northern B.C. mountains region. Two of the warmest sites show settling of the ground surface around the boreholes, and evidence of talik development associated with thaw of the uppermost layers of permafrost. We conclude that most of the sites north of 61°N in the extensive discontinuous permafrost zone or at high elevations remain resilient to thaw. Valley bottom sites south of this latitude in the sporadic and isolated patches zones, however, are vulnerable to thaw caused by ongoing climate warming and surface disturbance, and some are actively thawing.

QUANTIFYING THE MECHANISMS AND WIDER IMPACTS OF ACCELERATED EROSION IN ICE-RICH PERMAFROST COASTS

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Analyses of the Western Canadian Arctic coastline have revealed substantial increases (up to 110%) in coastal erosion over the last two decades, following a sustained period of relatively consistent retreat since the first aerial surveys in the 1950s. Arctic permafrost cliffs comprise over 34% of the Earth's coastlines, yet understanding of the sensitivities and impacts of accelerating coastal erosion in these regions remains extremely limited. Accelerated rates of retreat have been accompanied by higher frequencies and magnitudes of collapse, threatening coastal communities, nearshore and back barrier ecosystems, and critical infrastructure across the Arctic. The NERC (Natural Environment Research Council) UK-Canada bursary program has enabled the addition of UK expertise to enhance and complement a wider comprehensive assessment of the state of the Beaufort Sea coast, currently being undertaken by Natural Resources Canada. The bursary support has facilitated the development of new ideas that combine in-depth local knowledge and long-term datasets developed by Natural Resources Canada, with novel approaches to detail the thermodynamic behaviour and thaw processes at key sites. Multi-platform and multi-resolution survey approaches have been combined with novel in situ monitoring and targeted geochemical sampling to add new dimensions to the understanding of permafrost cliff erosion processes and their impact within the coastal zone. Here we present a summary of the NERC UK-Canada Bursary funded research into the drivers, responses, and wider impacts of permafrost coast erosion. It is important to set the long-term erosion trends in context and re-evaluate previous rates and inferences of the resultant contribution of material into the coastal zone. Peninsula Point within the Pingo Canadian Landmark (~10 km west of Tuktoyaktuk) proved to be an excellent study site with clear and variable exposures of massive ground ice. We set the long-term erosion trends in context with photogrammetric analysis of historic aerial imagery and use of unmanned aerial vehicles (UAVs) as a tool for contemporary volumetric change detection. Time-lapse imagery helps us investigate the contribution of specific failure mechanisms and the relative influence of and interplay between extreme storm events and more frequent processes. Innovative geophysical approaches (both passive and active seismic) have been used to identify and model key sub-surface layers, critical to understanding future geomorphic behaviour and thermal responses. The thawing and decomposition of frozen organic carbon poses a threat to the global climate and a component of this research has employed a combination of point-based and diffuse source gas monitoring to help establish the flux and wider impacts of permafrost coast erosion processes. Through the combination of three-dimensional photogrammetric temperature mapping and in situ monitoring this research is building towards a better understanding of climate driven coastal change, which will ultimately lead to enhanced community resilience to permafrost landscape change.

EMPOWERING NORTHERN COMMUNITIES TO RESPOND TO CLIMATE CHANGE IMPACTS: PROGRESS, CHALLENGES AND LESSONS LEARNED

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Just over one year ago, the Climate Change Preparedness in the North (CCPN) and Climate Change and Health Adaptation (CCHAP) federal funding programs joined forces and embarked on a new approach to support communities with climate change adaptation initiatives across northern Canada. This presentation will provide background on the new approach, an overview of the progress made thus far, and share lessons learned from the perspectives of the programs and the community liaisons. It will set the stage for the session Empowering Northern Communities to Respond to Climate Change Impacts. In addition to this introductory presentation, the session will include the presentation of five projects funded under these two programs, one from each region namely Yukon, Northwest Territories, Nunavut, Nunavik and Nunatsiavut. Each of these five projects will be presented by project team members. Canada has made a commitment to meaningfully engage Indigenous peoples in federal initiatives. Based on what was heard in engagement sessions with communities across the North, a new regional/territorial-based governance approach for CCPN and CCHAP was developed and rolled out in the three territories, Nunavik and Nunatsiavut starting in the 2017-2018 fiscal year. This new approach establishes a mechanism for community stakeholders and knowledge holders in each jurisdiction to provide funding recommendations to CCPN and CCHAP on projects that are important for their respective regions through the establishment of Regional Climate Change Committees on Adaptation. The five different committees review and recommend projects that reflect the priorities of the region. In addition, a community liaison position was introduced in each of the five jurisdictions to help potential program proponents, especially those with limited capacity, develop project ideas and access funding. These enhancements help support community-led projects that develop local and regional capacity to tackle challenges posed by climate change, while at the same time building resilience and creating positive change through concrete adaptation actions. Together CCHAP and CCPN have funded more than 60 projects since the inception of this new approach. They have supported a wide range of climate change adaptation topics such as food security, youth engagement, hazard mapping, wildlife habitat enhancement and geotechnical investigations. This presentation will provide an opportunity to explore the challenges and lessons learned in delivering this new approach.

CO-DESIGN OF A LESS INVASIVE METHOD FOR TAGGING EASTERN BEAUFORT SEA BELUGA WHALES (DELPHINAPTERUS LEUCAS)

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Marine mammal telemetry data provides critical information on movement and dive behaviour that can be used to understand the influences of a changing ecosystem on the species, track changes in the ecosystem as well as provide data needed for management and decision-making (e.g. marine spatial planning) among other applications. Due the to often invasive approaches used in telemetry studies many concerns have been raised by Inuit and others on the handling and attachment methods. Here we present a co-design approach where Inuvialuit and scientists are working together on innovation, to test new attachment methods and telemetry technologies on the Eastern Beaufort Sea (EBS) beluga whales (Delphinapterus leucas). There are different methods used to live capture, handle and place satellite linked receivers on belugas and cetaceans. Methods used to live capture EBS beluga whales have been adapted to the murky waters of the Mackenzie Estuary where they are herded to shallows and captured with an encirclement net method, they are then safely restrained to place a satellite receiver ventral to the dorsal ridge. Methods for tag placement involve the insertion of three pins through skin and blubber to secure the tag, referred to as the backpack attachment. Following a community tour in the Inuvialuit Settlement region where community members and boards requested the testing of less invasive methods a co-design workshop was held to refine tagging protocols and methods as well as discuss less invasive approaches. In July of 2018 we proceeded with a trail of a pop off archival satellite tag (MiniPAT by Wildlife computers) using a single point attachment. MiniPATs provide vertical dive data along with temperature yet lack the horizontal movement data. The tagging team of beluga hunters and scientists proceeded on designing and testing a harpoon based deployment method. A total of four MiniPAT tags were deployed by a harpoon single point attachment method on four beluga whales. In addition four MiniPATs were tethered to backpack attached satellite linked tags onto beluga whales to enable a comparison of data collection. Tags were programed to pop off at the end of September. Early results prove promising for the attachment method and data collection. A fall workshop is being planned to address improvements on the attachment methods that will be based on TEK.

GLUCOCORTICOIDS MEDIATE SHORT-, BUT NOT LONG-TERM, LIFE HISTORY TRADE-OFFS IN A SEABIRD

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The limitation of energy is a primary driver underlying variation in reproduction, survival, life histories, and trade-offs across species and individuals. Despite the importance of determining the underlying mechanisms driving energetics and therefore variation in life history decisions and trade-offs, few studies in free-living organisms have been able to causally link the two. Glucocorticoids (GCs) are energetic hormones that influence resource acquisition and are therefore a strong candidate mechanism underlying life history trade-offs. Within the context of individual GC phenotypes, we examined the impact of an experimental increase of baseline corticosterone (primary avian GC) in wild-living, pre-breeding female common eiders on the trade-off between reproduction decisions that year (breeding propensity, timing of laying), return rates the following year, and long-term survival. Low corticosterone phenotype females administered high dose treatments had shorter delays prior to laying following migratory arrival, earlier timing of laying, and the highest reproductive success compared to control females. Conversely, high corticosterone phenotype females had the shortest delays prior to laying, earliest laying dates and moderate reproductive success. Despite short-term changes to laying decisions and success, we found no influence of treatment on breeding propensity, return rates the following year, or long-term survival. These results suggest that GCs play a phenotype and stage dependent, but nonetheless central mechanistic role in mediating the trade-offs surrounding key, fitness-related investment decisions and driving variation in individual strategies for mitigating the costs of life history trade-offs. Determining how individual physiological phenotypes impact fitness in Arctic-breeding species will provide researchers with the predictive capacity to determine whether an individual's phenotype will better enable it to succeed when faced with the expected constraints of a rapidly-changing Arctic.

DEVELOPING AN INDICATOR: UNDERSTANDING VARIABILITY AND TRENDS OF BELUGA WHALE BODY CONDITION AND INFLUENCE OF ENVIRONMENTAL DRIVERS

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Currently the co-management for the Tarium Niryutait Marine Protected Area (TN MPA), located in the Inuvialuit Settlement Region, is selecting a suite of indicators for monitoring. Body condition is one proposed health indicator for the TN MPA species of interest, the Eastern Beaufort Sea (EBS) beluga. This research builds on previously developed body condition indicators; blubber thickness and girth, using four sex-specific models which account for age, size, location, and timing of harvest. Here, we assess the temporal body condition trends from harvested EBS belugas from 2000 to 2015 to; (1) Examine both the harvest season and inter-annual variability of beluga body condition; (2) Compare trends between each body condition index; (3) Test three climate variability metrics which impact the EBS belugas across their home range (Pacific Decadal Oscillation (PDO), sea-ice minimum (SIM), and (Arctic Oscillation)) for potential influence on body condition. Results indicate that there is a significant decrease in the female girth index and a significant increase in the male blubber thickness index over a harvest season. Both girth indices (male, female) and blubber thickness indices (male, female) are highly correlated demonstrating that condition changes hold across sexes. However, the male blubber thickness index lags the girth index by 2 years and the female blubber thickness index lags the girth index by 3 years. As a result, the male girth index was selected as the body condition indicator to test with climate variability metrics. Results show that beluga body condition has a significant negative relationship with both PDO and SIM. Overall, body condition is a simple measure collected on harvested whales but understanding the change captured by these metrics is complicated. Since the EBS belugas are long-lived, travel through different sub-Arctic and Arctic ecosystems, and are moderately sensitive to climatic change, it is important that condition indicators are used along with other suggested indicators including hunter observations and biotracers to better understand changes captured.

CO-DESIGN, CO-DELIVERY OF A NEW BELUGA TAGGING PROGRAM IN THE INUVIALUIT SETTLEMENT REGION

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Animal telemetry or 'tagging' is a highly sensitive topic, particularly in the context of marine mammals and northern communities where the live capture, handling, and attachment of transmitters contravene cultural norms through use of invasive methods and interference with species of subsistence value. We provide an overview and lessons learned on how a project designed to address community-driven research priorities and meet regional management needs, but where the best available scientific approach is controversial (beluga tagging), was advanced and strengthened through a co-design process that integrates Inuvialuit traditional and local knowledge (TLK) and Western Science. The 2018/2019 Eastern Beaufort Sea beluga tagging program builds on existing relationships between scientists, regional co-management boards and community members established from partnered delivery of long-term beluga harvest-based research and monitoring, and the co-management framework established in the Inuvialuit Final Agreement. However, given the scale and sensitivity of the tagging program, program success was enabled by advancing beyond shared priority-setting exercises, project approval processes and funding arrangements, to full partnership between boards, communities and scientists for program co-design and delivery. The co-design process for the beluga tagging program followed an iterative approach implemented through various approaches (e.g., board, community, and steering committee meetings; knowledge-sharing workshops, field implementation, science outreach and near real-time data sharing through social media). Community perspectives and TLK were integrated with science at all stages of project management, for examples, leading to the co-design of field and Animal Use Protocols that minimize potential field interactions with harvesters and address community concerns related to tagging, designing a communication strategy specifically for Inuvialuit communities, and the development of innovative, less invasive tagging technologies. Next steps are to incorporate TLK into interpretation of telemetry data to co-produce knowledge about beluga movement ecology. Telemetry programs are expensive, and together, TLK and science can be used to identify cost-effective indicators that are applicable to community-based monitoring, support regional management needs, and drive future research agendas based on both scientific and Inuvialuit knowledge. Overall, program success was based on not only gaining community support and buy-in for tagging, but on moving to a place where Inuvialuit direct program governance, are formally recognised as equal partners and collaborators, and have ownership over program data and outcomes. Recognizing Inuit rights to data ownership is particularly critical to program success. Data must not only be accessible, but results should be shared widely with community members.

ERECT SHRUBS MODULATE CARBON DISTRIBUTION IN SOILS OF THE QARLIKTURVIK VALLEY PROSTRATE TUNDRA, BYLOT ISLAND, NUNAVUT

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Research in tundra ecosystems has well documented the increasing spread of erect shrubs throughout the Arctic as well as their consequences on water, energy and nutrient cycling (Myers-Smith et al. 2011). Few studies have yet examined the feedback impacts of shrubification on soil carbon (C) cycle. Our objective was to quantify the balance and distribution of organic carbon in soils of alluvial fans associated with Salix richardsonii spread at the northern limit of its distribution range. Comparisons of soil carbon dynamics were carried between colonised and uncolonised areas but also between hydrologically active and inactive alluvial fan zones. Based on the soil bank mechanism framework (Fontaine et al. 2011), soil C balance was predicted to vary according to the availability of fresh energy-rich C (e.g. plant litter) that stimulates microbial populations and decomposition of soil humified organic matter. While microbial stimulation leads to an increase of humification and soil C storage when microbial nutrient requirement is fulfilled, it conducts to soil C loss through mineralisation at low soil fertility. We then assumed that shrubification, which increases fresh energy-rich C input, will impact soil C balance on the long term depending on soil nutrient fertility, which is related to hydrological activity. Soil cores were sampled in a total of 30 patches located along two alluvial fans and spanning three sediment input levels (None, Low, High) and two S. richardsonii colonization levels (In, Out). Each core was later differentiated into horizons (H0/H1/H2) and sieved at a range of mesh sizes to separate four organic matter (OM) compartments (roots, coarse and fine particulate OM and recalcitrant OM). Results showed a decrease in C/N ratio and an increase in 13C composition with decreasing OM compartment size, indicating that C respiration was greater than nitrogen absorption. Soil 12C has been preferentially respired during this process. These patterns were weaker in fertile conditions, leading to a C accumulation in the recalcitrant OM compartment in the presence of Salix. Variation in soil C storage in relation to shrub cover was confirmed by OM 14C dating. This study provides new insights into the short-term effects of Salix richardsonii on High Arctic tundra ecosystem functions. More generally it highlights that the soil bank mechanism framework can be appropriate to disentangle soil C storage variation related to shrubification. Further studies on soil C sequestration associated to ecosystem fertility are highly encouraged. References Fontaine, S., et al (2011) Fungi mediate long term sequestration of carbon and nitrogen in soil through their priming effect. Soil Biology & Biochemistry 43:86-96. Myers-Smith et al. (2011) Shrub expansion in tundra ecosystems: dynamics, impacts and research priorities. Environmental Research Letters 6: 045509.

BLOOM TIMING EXPLAINS SUCCESSION OF PROTISTAN FUNCTIONAL COMMUNITY STRUCTURE

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Using a functional trait approach to understand spatial and inter-annual phytoplankton dynamics may provide more information on the direct links of community structure to ecosystem processes than conventional taxonomy. Yet this approach remains under explored. Here we use a functional trait approach to understand the spatial and inter-annual variability in protistan community structure across the Labrador Sea. Sampling occurred along a transect of three major water masses, during the same week over three consecutive years. A biogeographic pattern in taxonomic composition across water masses was observed each year, but no spatial pattern in functional trait composition was identified. Among years, variability was observed in both. We tested if among year variability could be explained by the onset bloom timing. Indeed, we found a clear shift in autotrophic versus mixotrophic dominance 35 days before bloom peak. Size structure helped explain this switch. Although the 5-10 μm phytoplankton size class dominated at all times, autotrophs in both the 10-20 and >20 μm size categories overtook mixotrophic species closer to the peak. Succession in community structure from both a trophic and size shift perspective will influence how we assess carbon cycling efficiency and sequestration potential supporting the notion that assessing effect traits of communities provides more information with regards to linking structure to function at the ecosystem level.

UNDERSTANDING IMPACTS OF WEATHER, CLIMATE, AND CLIMATE CHANGE ON THE PHYSICAL, CULTURAL AND SOCIAL ENVIRONMENTS IN THE NORTH

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Climate change and its impacts have led to increased interest and challenges in the Canadian North, including for northern community and economic development activities. These changes also result in the need for more reliable weather, water, ice, and climate (WWIC) data and accessible information. Despite the growing banks of arctic data from various sources (global, federal, municipal, academic, business, community), there exist gaps in understanding of available and reliable WWIC data and products. In addition, associated services using that data, as currently offered to communities and stakeholders across northern Canada, are highly variable in terms of reliability, credibility, and availability. This poses challenging new questions regarding the impacts of weather, climate, and climate change on the physical, cultural and social environments of northerners, including how they use WWIC information and services as part of adaptation strategies. By better understanding how stakeholders and northern communities access and use available information, we can identify gaps in data and support requirements, and recommend ways to bridge those identified gaps. Questions framing the early stages of my doctoral research include: - How do the needs for WWIC information and services in the North differ from the needs in southern Canada? What are key contributing factors? - What kinds of WWIC information and services are relevant, and in demand, by northern communities to enhance adaptation practices and mitigate social and cultural impacts of environmental change? - How could suppliers (Federal, provincial, municipal, private) address impacts to the meteorological (WWIC) service requirements in northern communities, and in surrounding lands and waters? - Can change management methodologies and behavioural science approaches be integrated within government agencies and communications to help address northern community needs?

ASSUMPTIONS IN THE DELIVERY AND ANALYSIS OF A COMMON TOOL USED TO ASSESS INUIT FOOD SECURITY AND THE IMPLICATIONS ON UNDERSTANDING FOR THIS IMPORTANT PUBLIC HEALTH ISSUE IN THE NORTH

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Understanding an individual or household's ability to gain access to enough safe and healthy foods on a regular basis can provide insight on a number of aspects of the health status of that individual or those household members. The applicability of current measurement tools to assess food security among different segments or groups of the Canadian population is a current topic of debate. What has received little critical attention in this discourse though are the implications different modes of application and assumptions made in analysis have even when using common food security assessment tools. A common tool used by Canadian food security researchers is a modified version of the USDA Household Food Security Survey Module. This tool has been used to generate food security prevalence levels at the national scale and across the North. Our current understandings of food security status in Inuit Nunangat are based on this tool. However, differences exist in how this tool is administered and how its generated data is analyzed. The use of different participant screening methods, ways of dealing with 'No response' and 'I do not know' response options, and how households are categorized on the food security scale vary among studies. These differences have implications that must be appreciated to fully understand the nature of this important public health issue in the North and elsewhere. We describe these differences and discuss their implications using household food security data from the communities of Nunatsiavut as a real-world example.

EFFECT OF PLANT COMMUNITY STRUCTURE ON SOIL RESPIRATION OF TUNDRA ECOSYSTEM THROUGH MULTIPLE ECOSYSTEM FUNCTIONS IN CANADIAN ARCTIC

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Rising temperatures are expected to stimulate global soil respiration, both by accelerating rates of carbon (C) cycling via autotrophic respiration and heterotrophic decomposition of organic matter. Arctic ecosystems have one of the largest amount of C stored in the soil organic layer, and recently have experienced increasingly warm temperatures and is more sensitive to warming. While soil respiration can be considered as an ecosystem function depend on activity of organisms' community, it is controlled by other multiple ecosystem functions; above and belowground biomass of plant community, also community structure of decomposers. In this study, we have two question, 1) Can tundra plant community structure change in multiple ecosystem functions and the effects consequently affect soil respiration? 2) If so, what attributes of community structure affect soil respiration through which ecosystem functions or decomposer communities? Study site locate within 10 km of Whapmagoostui-Kuujjuarapik (WK), Quebec, Canada (55˚N). In WK where locate the northern limit of the forest, forest vegetation and tundra vegetation coexist. Our survey was conducted in the tundra vegetation area. We used line transect survey for our study. We set eight 150m lines in study site and installed 25 quadrat (1m2) in each line. We measured some soil environments, community structure of vascular plant and four ecosystem functions to analyzing those relationships. We estimate that three attributes of community structure can control which ecosystem functions using generalized least squares models. For integrating key predictions from competing theories into a network of multivariate expectations, we established a structural equation model (SEM) including soil respiration and other ecosystem functions that depend on the plant community structure. As the result, there was a significant correlation between three attribute of community structure and multiple ecosystem functions. Different attributes of community structure modified different ecosystem functions, such as aboveground biomass, belowground biomass, organic carbon quality, and fungal richness, all of which are potential fundamental to soil respiration. From SEM analysis, soil respiration was affected by two attributes of community structure; total coverage and species diversity through aboveground biomass and fungal community structure. The results suggested that plant community structure can change soil respiration by modifying litter quantity and decomposer activity. This indicate that estimation of current plant community structure or its dynamics are important for understanding the carbon cycling of tundra ecosystem under the climate change.

THE EFFECT OF TAR SPOT PATHOGEN ON HOST PLANT CARBON BALANCE AND ITS POSSIBLE CONSEQUENCES ON A TUNDRA ECOSYSTEM

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The relatively low biological diversity and more simple plant and animal communities in Arctic ecosystems is ideal for understanding of complex host-parasite interactions and the total effect of pathogens on ecosystem. As a model case, we estimated the effect of a plant pathogen on the carbon dynamics of the Arctic ecosystem in Spitsbergen Island, Norway. Study species are the polar willow (Salix polaris), a dominant species of the Arctic region as a host plant, and its common pathogen, Rhytisma polare which causes tar spot disease on S. polaris. We measured the photosynthetic activity, respiratory activity and growth rate of the host plant and the pathogen, then simulated the annual carbon balance of the host plant and annual effect of the pathogen. By integrating those results into a previous ecosystem carbon compartment model, the pathogenic effect on carbon dynamics at the ecosystem level was also evaluated. From the simulation, healthy polar willow was evaluated to gain annually 5.08 mg of carbon from atmosphere per leaf. In contrast, an infected leaf by tar spot disease showed lower carbon balance than that of healthy leaf owing to the following two pathogenic effects. First, the pathogen covered the host leaf and inhibit their photosynthesis (inhibition effect), reducing carbon assimilation by 0.49 mg per leaf. Second, for their growth, the pathogen absorbed and utilized carbon from the host plant (consumption effect). From the simulation, the consumption effect was 5.50 mg of carbon per infected leaf, greater than the inhibition effect. The pathogenic effect on the carbon dynamics at the ecosystem level was calculated based on the assumption that one-third of the leaves were infected. Compared with the non-infected ecosystem, the infected ecosystem showed a 2.9% decrease in the carbon assimilation by the plants from the atmosphere. This decrease is depending on inhibition effect on host plant productivity. On the other hand, the consumption effect resulted in the change in two carbon flow in the ecosystem, an increase in the amount of carbon release from terrestrial organisms to the atmosphere by 23.3% owing to pathogenic respiration, and an increase in the amount of carbon flow from terrestrial organisms to the ground soil by 117% because the dead pathogens' bodies on the host leaves drop into the soil. This study revealed the following two points. First, the tar spot pathogen have a far greater impact on the host carbon balance through their carbon consumption rather than the inhibition of host photosynthesis. The fact lead to the second point, the pathogen can change ecosystem carbon dynamics largely without reducing the host plants' productivity.

SHARING TEA IN THE FIELD: STORYTELLING AND TRUST-BUILDING, THE HOPES OF RESEARCH IN THE NORTH

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Relationship building is often informal and grows naturally. Meaningful interaction takes time. As early career researchers working within a developing and rapidly changing North, developing a comprehensive and balanced understanding of current northern issues so as to have the ability to explain and share your research within their context is one of the most important assets at our disposal. Northern research has an important role to play in the lives of northerners, and local interest cannot be underestimated. The political climate of northern decentralization of power, and local self-governance, means that trust-building is essential toward conducting effective northern research. Trust-building in science communication and outreach is both about science integrity and knowledge mobilisation. It is part of scientific integrity to also embrace concepts associated with other worldviews, as other external sources of knowledge can provide precious information that conventional science could never obtain. Revaluing these knowledge sources is critical for learning and fostering trust. This is where collaboration with decision-makers, northern communities and stakeholders becomes important to the Arctic scientist engaging in science communication. Science communication can play a role in fostering empathy in our work through developing solutions rather than problem identification, and by educating hope rather than emphasising threats. In fact, numerous studies find that fear can have unintended effects, leading the public to ignore or minimize problems where people feel powerless. This action-focused, problem-solving and hopeful communication approach to knowledge mobilization of science is an important skill to build in early-career researchers, as it directed both towards the collaborative priorities that research can address, and the way the results of that research can be communicated after publication. What can we do as scientist to ensure that our work is trusted, and how to get scientific information to the people that need it in a way that they can understand and use it? These are the questions early career researchers must ask themselves, and listen for answers in the stories they are told. Time for tea can go a long way.

ARCHITECTURAL ADAPTATIONS: RESEARCH, DESIGN, AND POSSIBLE FUTURES IN THE NORTH

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While much exciting scientific research continues to be conducted from research stations and field camps in the North, there has been little study of the impact these research communities on built form, housing design, or urban development. This project presents an exploration of science, technology, and possible futures for cross-disciplinary and cross-cultural collaboration to advance architecture in the Arctic. I will offer my experience spending time in communities in Yukon and Northwest Territories from August - October of 2018 with the goal to observe, learn from, and hypothesize how climate science research can influence architecture and urban development and to identify areas for community engagement and capacity building for cooperative and imaginative scientific and design research. Permafrost degradation, coastal erosion, snow melt, and sea ice formation and break-up periods are among a host of challenges that changing environmental conditions are bringing to arctic and sub-arctic communities. In addition, scientific expeditions, natural resource extraction, and continued attempts at modernization all belong to a history of colonization and compromised autonomy for Inuit and First Peoples who have inhabited the Arctic for millennia. The extreme diversity of environments and shortage of appropriate housing and community buildings, coupled with research practices, rapidly deploying infrastructures, new landscape economies, and associated cultural norms for temporary and permanent habitation are producing evolving and novel examples of built environments along with their social and physical constructions. I propose how two images of the Arctic exist within this context; the ‘technological’ and the ‘natural’. Research stations, prefabricated housing, cold-climate building strategies, renewable energy technology, and remote sensing and data management, meet with traditional harvesting practices and the production of environmental and geographical knowledge through storytelling and millennia of experience. Learning from the realities of these two Arctic images poses the fundamental question: What are the impacts and influences of the technological and the natural on possible futures in Arctic communities and their attendant meaning for housing, urbanization, and modernization? Taking Northern research stations as a point of departure, I unpack the potential of integrating and extending scientific methods and procedures into the built environment, including material selection and logistics, foundation and permafrost stability monitoring, hybrid heating and ventilation systems, cold-climate energy performance, and opportunities for advances in environmental impact assessment techniques to evaluate future development. Research stations offer a unique opportunity to conduct design research and contribute to more inclusive collaboration with Inuit and indigenous communities, ensuring traditional cultural needs are met in housing design and construction. This new collaborative space also has the potential to provide opportunities for education both in the classroom and in the fields of building design and construction, as well as to inspire imagination for possible futures in the Arctic.

OBSERVATIONAL AND EXPERIMENTAL EVIDENCE FOR COMPENSATORY EFFECTS OF CLIMATE CHANGE ON ARCTIC-NESTING SHOREBIRDS

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One of the hypothesized effects of climate change on arctic-nesting shorebirds is a reduction in the growth and survival of chicks due to climate-induced changes in the phenology of their prey (i.e. mismatch hypothesis). We have evidence that growth rates of chicks can be hindered by asynchrony between chick hatch and food resource peaks, however results are not consistent across species and/or latitudes. In addition, our recent research has revealed that the temperature increases that may drive asynchrony between chick hatch and food resource peaks, may decrease energetic requirements of chicks via reduced thermoregulation costs, and thus compensate for the potential negative effects of reduced food availability (mismatch trade-off hypothesis). To test the latter hypothesis, we conducted a systematic literature review and extracted metabolic data in relation to ambient temperature for thirty-three different species of shorebirds. We also conducted an experiment to test for effects of ambient temperature on resting metabolic rates (RMR) of shorebird chicks (Dunlin and Least Sandpiper) in Churchill, Manitoba (59°N, 94°W) during the summers of 2014 and 2015. Data extracted from the literature revealed a significant inverse relationship between oxygen consumption and temperature in seven of the eight shorebird genera. Experimental data indicated that for Dunlin chicks, RMR was not affected by ambient temperature, however it did increase marginally with age. For Least Sandpiper chicks, RMR decreased as temperatures increased but was not affected by age. In conclusion, experimental and observational data indicate that although there is the potential for decreased energy demands for chicks as arctic temperatures rise, effects will vary by species. These results emphasize the need for more detailed physiological and ecological data to test hypotheses regarding the direct and indirect effects of climate change for multiple species across a latitudinal gradient in order to build comprehensive models of climate change vulnerabilities.

ESTABLISHING THE CHARS EXPERIMENTAL AND REFERENCE AREA AS A FLAGSHIP MONITORING SITE IN THE CIRCUMPOLAR ARCTIC

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POLAR's mission is to anchor a strong research presence that serves Canada and the world, while advancing knowledge of the Arctic in order to improve economic opportunities, environmental stewardship, and the quality of life of Northerners and all Canadians. POLAR also aims to support multi-disciplinary and multi-institutional studies. The Canadian High Arctic Research Station (CHARS) located in Cambridge Bay, Nunavut is managed and operated by POLAR as a hub for northern science and innovation. A key goal for CHARS is to establish the CHARS Experimental and Reference Area (CHARS ERA) as a Flagship Monitoring Site in the Circumpolar Arctic. This presentation outlines the multi-scalar, whole-of-ecosystem approach that is planned for the CHARS ERA, including the establishment of hypothesis-based, long term experiments in terrestrial, freshwater and marine-coastal ecosystems. Of interest as well is the connectivity and exchange of materials and energy between ecological realms. The plan proposes that long term monitoring experiments will be designed and implemented by sets of northern science communities of practice in a range of subject areas, e.g., soil processes, vegetation monitoring, small mammals, and shorebirds, to establish a best practices approach that would benefit from the collective wisdom of the northern science community. Process models developed by local scale experiments would be scaled up to regional levels using remote-sensing based modeling approaches.

DEVELOPING KEY FOOD SECURITY SKILLS AMONG INUIT YOUTH: THE EXPERIENCE OF A PILOT PROJECT IN NUNATSIAVUT

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Being food secure, or able to access, through acceptable means, enough healthy, safe and nutritious foods of a preferred nature for a healthy and active lifestyle, is based on four key assumptions: that food is available, accessible, safe and healthy to consume, and that individuals have the required skills and knowledge to access, prepare and consume those food items on a regular basis. Globally, younger generations are challenged in a number of ways in terms of the development and refinement of fundamental food skills that support their ability to perform healthy diet behaviours. Pressures on time, access to various forms of fast food and over processed food stuffs, trends towards privileging of convenience over quality, and a lack of appreciation for basic food knowledge and skills all threaten younger peoples' ability to become food secure individuals or the heads of food secure households as young adults. These challenges are perhaps even greater in Indigenous food systems in the context of environmental, social, economic and cultural changes taking place in many locations around the world, such as the Canadian North. In Inuit communities, the development and retention of land and sea-based and food related skills is critical for individuals, households and communities to continue to be food secure and ultimately, healthy into the future. To begin to address the need for the development and enhancement of these food related skills among young people in Nunatsiavut, a pilot program was created to help foster the learning and practice of skills related to the hunting, fishing, gathering, preparation, consumption and knowledge of wild foods in the region. This summer young people and Elders were brought together from the 5 Nunatsiavut communities to share and practice wildlife food related knowledge and skills at Base Camp in the Torngat Mountains. Youth and Elders spent time on the land and sea hunting, fishing and gathering key wild food species and then time preparing, sharing and consuming them at Base Camp. Throughout the program, youth learned about wild foods and developed key food related skills while strengthening their connections to the land and one another and Elders and other Inuit Knowledge holders involved. They returned to their home communities having been introduced to or having furthered their abilities and knowledge that will help them become more independent, self-reliant providers for themselves, their families and communities. Reflections on this pilot program and plans for its future operation include appropriate ways through which to evaluate its impact and value to the participants and on the sustainability of the culturally unique food systems of the communities of Nunatsiavut.

COMMUNITY DRIVEN SOLUTIONS FOR INCREASING FOOD SECURITY RESILIENCE IN NUNATSIAVUT

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Communities in Inuit regions of Canada face unique challenges in addressing food insecurity, such as extreme weather conditions which impact food transportation and changes in wildlife availability and accessibility which impact access to country food. In 2014 the Nunatsiavut Government partnered with Trent University, McGill University and the University of Guelph to conduct a large household survey in the 5 Nunatsiavut communities with the goal of producing community specific household food security prevalences. Select aggregated results from the Nunatsiavut Food Security Survey, as well as some community-specific results for all 5 Nunatsiavut communities will be presented and discussed. Results from the 2014 Nunatsiavut Food Security Survey illustrate the importance of community level data in creating a community level understanding of food security. Nunatsiavut communities are rapidly growing and changing, placing new pressures on development planning for sustainable, healthy communities. At the same time, climate change is having an increasingly pronounced impact in the region, affecting infrastructure, community services and the wellbeing of residents. It is expected that climate change and associated environmental changes will impact all dimensions of food security in Nunatsiavut. The impacts of climate change on the food system and on community and individual wellbeing are widespread, and include things like : making it more difficult for people to spend time on the land, to travel on the land, to spend time outside the community in all seasons, to go wooding, to hunt and fish and collect berries, and to visit cabins. These activities are central to the health and wellbeing of residents and to their ability to provide food for their families. Climate change is also impacting the transportation of market foods into the region, with increased anomalous weather events, and decreased seasonal predictability. Addressing these impacts and the potentially harmful consequences they will have requires government policies and programming that encourage and facilitate the practice of land-based activities, among other things. Long-term planning is needed to sustainably fund and implement climate change adaptation strategies in Nunatsiavut, and should include programs within communities that help residents access the resources they need to safely engage with the land, that will encourage the practice of traditional skills, that teach youth and that incorporate traditional knowledge and values such as sharing. Some of the many innovative community-driven solutions that are being implemented in Nunatsiavut, such as innovative skill development programs, community freezer programs, youth oriented land-based programs are presented and discussed.

PATTERNS OF MENTAL HEALTH-RELATED VISITS AT COMMUNITY NURSING CLINICS IN NUNATSIAVUT: A POPULATION-BASED STUDY

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Introduction: Inuit across the Circumpolar North face many health disparities, often amplified by ongoing environmental and socio-cultural changes. Mental health is a major public health concern, as Inuit experience a substantial burden of trauma and suicide compared to non-Indigenous populations. Climatic changes that are concentrated in the Arctic may increase distress for individuals and communities who rely on the environment to support their livelihoods, culture, relationships, and wellbeing. Inuit-driven research from across the Inuit Nunangat have voiced explicit concern for mental health among other climate-sensitive health outcomes, asking that it be incorporated into research priorities, funding decisions, and vulnerability assessments. However, mental health data are often limited, and there is a need to better characterize the state of mental health so researchers, healthcare providers, and decision-makers can make informed planning and policy decisions as they respond to the impacts of a changing climate. Purpose: The aim of this study was to characterize patterns of mental health use in community nursing clinics in Nunatsiavut, Labrador, based on de-identified clinic data. The objectives were to: (1) determine the prevalence of mental health-related clinic visits; and (2) describe the distribution and types of mental health-related visits across the region. Methods: This retrospective, population-based study analyzed de-identified patient data from all five community nursing clinics in Nunatsiavut for the period of January 2009 to December 2016. Data for all visits was extracted from the regional health authority's electronic health records system. Mental health-related visits were defined by records with a presenting complaint or a discharge diagnosis related to mental health. We used an include case definition to increase sensitivity and case capture. Key characteristics such as age, sex, and ethnicity were analyzed using descriptive statistics. Preliminary Results: Patients presented at Nunatsiavut community clinics with a variety of mental health concerns, including, but not limited to, acute social distress, suicidality, and psychiatric symptoms or diagnoses. Of the total clinical patient visits reported at clinics, mental health was among the top non-communicable disease visits. Of these mental health-related visits, very few required emergency Telehealth services and/or medical evacuation. On average, patients presenting with mental health-related concerns were middle-aged, and predominantly female. Significance: Given the remote locations of Nunatsiavut communities, community clinics are often a first point of contact for the health care system and mental health services. The results provide a preliminary indication of the patterns of health service use for mental health concerns for residents in Nunatsiavut communities. Data from this study provides a baseline for evaluation of future health programming and adaptation strategies, and serves as an important first step in planning analytical investigations of associations between the use of mental health services and relevant covariates. This research will help inform regional and local public health policies and programming as mental health has been identified as a priority area among many strategic reports in both public health and climate change contexts.

ACCESSING AND ASSESSING ENVIRONMENTAL INFORMATION: COMMUNITY-IDENTIFIED METRICS AND MODIFIERS THAT MATTER IN A CHANGING CLIMATE

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Introduction: As the Arctic undergoes dramatic changes in its physical environment due to climate change, Inuit throughout the Circumpolar North are experiencing disruptions to their livelihoods, cultural practices and knowledge-sharing, food security, human safety, and overall health and wellbeing. Amidst these changes, monitoring and surveillance are consistently identified as key health-related adaptation strategies. There is also a need for monitoring that prioritizes Indigenous knowledges and sciences, and that integrates locally relevant socio-environmental factors to provide decision-makers and communities with effective evidence-based knowledge. Understanding the need for Inuit-owned and Inuit-run monitoring and surveillance programs, Rigolet, Nunatsiavut, Labrador is designing and developing a community-based mobile monitoring program (eNuk), with the goal of allowing community members to actively track changes and share information about their environment and health in a timely and efficient manner. Purpose: The aim of this study was to support and inform the ongoing development of the eNuk program by exploring how Rigolet Inuit perceive, prioritize, and interact with meteorological variables on the land and in the community. The objectives were to: (1) identify meteorological conditions, including measures and thresholds important to community members' decision-making processes both on and off the land; and (2) explore other contextual factors that modify how meteorological conditions are interpreted, and decisions are made. Methods: Qualitative data were drawn from in-depth, semi-structured interviews with community members in Rigolet conducted by community research leads (co-authors IS and CF) from January to Fall 2018. Participants were asked what types of meteorological information they used; how they received, interpreted, and shared information; and how it all informed their practices, and wellbeing. Following each interview, data were transcribed verbatim, and team debriefs took place to ensure ongoing co-analyses were grounded in community understandings of environment and health. Thematic analysis was employed along with the constant comparative method, to explore patterns within and between participants. Preliminary Results: Wind, snow, rain, and ice, were among the metrics most commonly reported to determine land access and mobility within the community. However, participants identified that the intersection of conditions, and holistic interpretation of multiple metrics was integral to their decision-making process. Importantly, participants discussed individual- (e.g. age, and gender), household- (e.g. size), community- (e.g. available social networks), and regional-level (e.g. development) factors that modified their decision-making process. These socio-cultural factors were linked to transient thresholds for travel decisions, and changing measures of meteorological conditions. Significance: These findings will provide information on environmental-health indicators that are most critical to Rigolet community members, including how residents use that information in making decisions about their daily practices and wellbeing. These data will inform the ongoing development of the eNuk program, contributing directly to wellbeing and capacity-building in Rigolet, while serving as a learning opportunity for similar collaborative monitoring efforts across the Arctic. Importantly, critical metrics, thresholds, and modifiers identified here will enhance future research efforts, including improved empirical investigations as causal models are grounded in local knowledge. As such, this research will better inform adaptive policies and planning decisions in a time of rapid environmental changes.

INVESTIGATION OF SEASONAL INTERACTIONS BETWEEN MICROTOPOGRAPHY, SNOW COVER AND GROUND SURFACE TEMPERATURE IN A HIGH-ARCTIC AREA

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The strong interactions between the near-surface atmosphere and the underlying ground via heat exchange processes make the presence of snow a key component of the Earth system. The timing and duration of snow cover in mountain permafrost areas affect the ground thermal regime, mainly by reflecting incoming solar radiation and thermally insulating the ground from the atmosphere. In this study, the spatial variability of the ground surface thermal regime is explored in a small catchment on Bylot Island in the Canadian High Arctic. 95 micro-temperature loggers were deployed for two years in different parts of the landscape. The influence of microtopography resulting from cryoturbation processes was investigated by placing loggers at the top and bottom of earth hummocks and on the rim and center of polygons. Snow accumulation was measured at the end of winter at each site. The recorded ground surface temperature (GST) was used to compute snow thermal insulation and melt indices at each site. Analysis of these indices revealed large spatial variability in both the onset and duration of snow cover and in the computed snowmelt rate at the microtopographic scale (hummocks and polygons), and larger (slope) scale.

MICROPLASTICS IN THE BELUGA FOOD WEB

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Microplastics (<5mm) are a ubiquitous anthropogenic contaminant and it is now evident that microplastics are ingested by a wide range of marine biota. While several studies have quantified microplastics in arctic seawater and some polar species, the amount that is being ingested by animals within Canadian arctic foodwebs is largely unknown. This study examines the amount of microplastics within the beluga food web including Beluga Whales (Delphinapterus leucas), Arctic Cod, Arctic Cisco(Coregonus autumnalis), Saffron Cod (Eleginus gracilis), Capelin (Mallotus villosus) and Flounder (Liopsetta glacialis). Species within this food web comprise subsistence food for many northern communities hence the importance for understanding the role that microplastics may have in compromising the health of these ecosystems. Microplastics were isolated from digestive tracts through chemical digestion (10% KOH for 2 weeks) and filtered through a 20 μm polycarbonate filter. Using light microscopy, microplastics were quantified and characterized. Fourier-transform infrared spectrometry (FTIR) technology was used to confirm polymer identity. The results provide both a baseline assessment of microplastic contamination within the beluga food web and contribute to a larger understanding of plastic pollution within Canada's western arctic.

THE COMPLEXITIES OF COASTAL RETREAT IN A PERMAFROST ENVIRONMENT: A LONG-TERM GEOPHYSICAL STUDY

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Around the Arctic Ocean there are many stretches of coastline composed of ice-rich sediments. With the dramatic climatic, oceanic and terrestrial changes that are currently occurring, there is considerable concern over the stability of these coasts and how they will change. Unfortunately, there is still relatively little research that has been done in these environments. Hence being able to effectively model coastal erosion in a permafrost setting is highly desirable. With the complexity that permafrost conditions add to the coastal setting, modelling erosion involves a more detailed understanding of the physical and thermal conditions as well as the sedimentological and wave action processes. This research examines the role that the shallow water energy balance plays in preserving sub-bottom massive ice as the coastline retreats and the implications it has for secondary subsea disturbance once the water depth increases. The study area was Peninsula Point which is approximately 10 km west of Tuktoyaktuk, NWT. The massive ice and retrogressive thaw flows at this location are some of the more dramatic examples of the impact of ice-rich permafrost on coastal processes in the Arctic. By mapping coastal retreat and conducting repeat ground penetrating radar surveys (GPR) over a 33 year period, the long-term character of coastal retreat above, and below, the water line in an area where a massive ice body extends to depths below sea level were revealed. The GPR imaged the top and base of the massive ice body as well as providing a delineation of the subsurface sedimentary architecture. In winter, the GPR was pulled behind a snowmobile along transects on land, across the shoreline and out onto the near shore area of the Beaufort Sea. This provided the stratigraphic continuity between the terrestrial and sub-sea settings. The roles of erosion, re-sedimentation and shallow-water thermodynamics in the degradation and preservation of massive ground ice were revealed.

HAIR ELEMENT PROFILE AS A NON-INVASIVE INDICATOR OF WILDLIFE POPULATION DEMOGRAPHICS

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Element deficiencies cause adverse health outcomes in wildlife, and have been linked to population declines worldwide. Unfortunately, element deficiency is not easily diagnosed as wildlife populations often show no visible clinical signs. Consequently, practical methods are needed to integrate relevant measures of element status with population demographics. Here we evaluate the use of hair element profiles as an indicator of broad scale population health and demography. We show that the concentration and profile of 4-6 essential elements was associated with calf recruitment and adult mortality rates over a 12-year period in a high Arctic muskox population, with poor recruitment and elevated mortality coinciding with years of low hair concentrations. This suggests that hair element profiles constitute an attractive and practical tool in wildlife management for inferring population demography. We recommend that routine sampling, archiving, and analysis of hair could and should be an important component of wildlife conservation and management.

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. Accretionary mountain belts are geologically complex, long-lived features of the Earth's crust. They are sites of continental growth, and host the majority of Earth's orogenic gold and many other mineral deposit types. In these geological settings, gold is intimately related to major geological faults. Brittle fault zones facilitate fluid migration through rock and form conduits for metal-bearing fluids that are fundamental to many types of ore deposits. For this reason, the timing of movement on fault surfaces is critical information for building regional geological frameworks and understanding ore genesis. Therefore determining when faults were active is a critical step for building viable tectonic models for the Arctic Canadian Cordillera. However, there are few methods available for directly dating minerals formed during faulting. An exciting new technique has recently been developed to date calcite, a mineral that commonly crystallizes on fault surfaces during slip, using the U-Pb radiometric dating technique. The overall aim of the project is to provide timing constraints for movement on strategic faults within the Arctic segment of the Canadian Cordillera, Yukon Territory. Here, we use the newly-developed U-Pb calcite fault dating technique to explore the role of major faults for hosting and facilitating formation of economic gold-copper deposits in the Arctic Canadian Cordillera. The results of this study will provide the first direct constraints on the timing of strategic faults within the Arctic segment of the Cordilleran accretionary mountain belt.

MERCURY AND METHYLMERCURY MASS BUDGET IN THE HUSON BAY SYSTEM: AN UPDATE

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Freshwater inputs into the Hudson Bay marine system have changed in timing and composition due to impoundment of rivers for hydroelectrical production and rapid sub-Arctic climate change. Although mercury biomagnification in aquatic food webs is limited to its methylated mercury chemical species, inputs of total mercury to estuarine and marine systems can influence in situ methylated mercury production. We measured concentrations of total mercury in atmospheric, freshwater, estuarine, and marine reservoirs of the Hudson Bay System between 2016-2018. From these measurements, we update previous mass balance models of total mercury in Hudson Bay. Our results suggest that previous estimates have underestimated the relative magnitude riverine inputs of total mercury into Hudson Bay. Furthermore, prior measurements may have underestimated sediment burial of mercury. Together, measured water column concentrations suggest that Hudson Bay is not a net source of total mercury to the North Atlantic Ocean. However, our total mercury measurements emphasize a continued need to improve measurements of atmospheric deposition and exchange between surface water and the marine boundary layer. In combination with updates to the Hudson Bay carbon cycle, the presented dataset can inform the creation of our mass balance model of methylated mercury in the Hudson Bay System. The reevaluation of both the total and methylated mercury cycles in Hudson Bay will be used to distinguish the relative impacts of climate change and regulation in the future.

A NUNALIIT ATLAS OF THE INUIT LANGUAGE

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The Nunaliit Cybercartographic Atlas Framework is an open source, open standards data management platform for collecting, relating, presenting and preserving information using maps as a unifying framework (Hayes, et al. 2014). It embodies the principles of cybercartography, an approach to cartography that emphasizes the importance of land, culture, society and technology in the mapping process (Taylor 1997, 2003, 2005, 2010, 2014). Cybercartography is defined by the evolutionary and integrative process of atlas creation that highlights the centrality of the user in the design process, the incorporation of qualitative and quantitative data linked by location, the presentation of multiple perspectives of the same information without privileging any one view, interactive and multimedia technology, and a “bottom-up” approach that encourages all voices to be heard. The Nunaliit Framework has been used to create cybercartographic atlases encompassing a wide range of topics, from neuroscience research networks to Inuit traditional knowledge of sea ice and place names (Taylor and Lauriault, 2014, GCRC, 2018). In this paper we explore how Nunaliit is an ideal platform for language mapping, where linguistic information such as language varieties and linguistic forms are typically displayed on a geographical map (Girnth 2010, Kehrein et al. 2010). We present as a case study the Atlas of the Inuit Language in Canada, a cybercartographic atlas being developed by linguists and cartographers in collaboration with language specialists in Inuit partner organizations. The goal of the Atlas is to help protect and strengthen the vitality of Inuit dialects in Canada through an assessment of their vitality and the documentation of their words. Dialects are valuable in promoting regional identity, and as a symbolic and practical link to the past (Tulloch, 2006). Every dialect in the Atlas has equal privilege, accessibility and exposure, regardless of number of speakers or geographical location. This is especially important for regions where the language is most endangered, such as the Northwest Territories, western Nunavut, and Labrador. The Atlas database currently contains information on community names, dialects, and Inuit words and associated information such as English equivalents, semantic category, grammatical category and pronunciation. The interactive and modular technology of Nunaliit and its document-oriented database allow this information to be accessed in various ways and presented in separate modules, with each module highlighting different relations among the database components (e.g., communities and dialects, or word forms and categories). The base maps on which the linguistic data is displayed include both geographical and non-geographical maps, differentiating them from more typical language maps. Furthermore, with Nunaliit’s multimedia tools, the user’s experience is enhanced with links to audio and audiovisual recordings. The next stage of the Atlas project is the collection, analysis and presentation of data on the vitality of Inuit dialects, where we will further explore the innovative and creative capabilities of Nunaliit.

THE CANADIAN CONSORTIUM FOR ARCTIC DATA INTEROPERABILITY: CONNECTING CANADIAN ARCTIC DATA INFRASTRUCTURES

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The Canadian Consortium for Arctic Data Interoperability (CCADI) is a recent initiative to advance collaboration, both nationally and internationally, through the development of an integrated data management system that will facilitate information discovery, establish metadata and data sharing standards, enable interoperability among several existing Canadian Arctic data infrastructures, and provide accessible data to a broad audience of users (e.g. researchers, students, government, industry, northern community members, and the general public). The consortium is currently composed of six Canadian universities, two Canadian federal agencies, two Inuit organizations, and three non-profit partners. The CCADI aims to connect a broad variety of information types, ranging from bibliographic records to metadata to raw data sets. Connecting these variable data types will grant users the ability to build a holistic view of research, from inception and throughout the data life cycle. It will provide greater opportunity to re-create scientific studies and review them from different angles and to compare and link data, both quantitative and qualitative, across disciplines. The CCADI works with Inuit Tapiriit Kanatami and with regional Inuit organizations to ensure that Indigenous information is included ethically, with full Inuit involvement in the design of systems, and in the management and use of their data. This presentation will focus primarily on establishing interoperability between CCADI members' existing data structures.

NEMO MODELLING IN AND AROUND THE HUDSON BAY COMPLEX

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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 examine plans to use NEMO to examine historical and future trends in the Hudson Bay Complex (HBC) as part of the Hudson Bay System Study (BaySys) project. Bias corrected atmospheric forcing derived from CMIP5 scenarios chosen to bracket potential changes in temperature and precipitation over the HBC will be used to force the model for historical scenarios (1979-2010) and the future (2010-2070). The same bias corrected atmospheric forcing will be used to drive hydrological models (run by Team 2 in BaySys) that will provide appropriate river runoff scenarios (including the potential effect of regulation) for the HBC and the Arctic. A preliminary inter-comparison of ocean and sea-ice fields with Environment and Climate Change Canada's RIOPS system being used for the Year of Polar Prediction will be presented, as well as some model sensitivity analysis.

HIGH RESOLUTION NEMO MODELLING FOR THE NORTH WITH THE ANHA CONFIGURATION

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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 examine developments and advances for the Arctic and Northern Hemisphere Atlantic (ANHA) regional configuration for modelling in the Canadian North. As well as base ¼ and 1/12 degree resolution configurations, the system includes 1/12 degree nests for the Canadian Arctic, as well as for Greenland, using the AGRIF grid refinement package. Preliminary results with a 1/60 degree AGRIF nest for the Labrador Sea will also be shown. 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. Output from an experiment using Year of Polar Prediction (YOPP) forcing will also be presented. Finally, planned future developments and studies will be highlighted.

CAPTURING THE LANDSCAPE-CONTEXT OF LONG-TERM TUNDRA VEGETATION CHANGE

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Warming is causing rapid rates of ecological change and satellite observations indicate wide spread greening of tundra ecosystems, yet a scale mismatch makes direct comparisons between plot-based, long-term ecological monitoring and coarse-resolution satellite records difficult. Recent advances in drone technology allow for the quantification of the landscape context of observed ecological change. By collecting landscape-level data in the same locations as detailed monitoring records conducted at the plot scale, we can test the relationships among in situ and remotely-sensed vegetation change. In the summer of 2018, we collected drone imagery to create high-resolution digital elevation models and multispectral imagery in areas of long-term ecological monitoring in the Canadian Western Arctic (Qikiqtaruk – Herschel Island, Yukon) and in the High Arctic (Alexandra Fjord, Ellesmere Island, Nunavut). We used common protocols established by the High Latitude Drone Ecology Network (HiLDEN, http://arcticdrones.org/). Our preliminary findings indicate that plot-scale monitoring captures ecological changes that are also observable at the landscape scale. Changes include increased vegetation productivity and decreased bare ground cover likely resulting from a deeper active layer and increased soil moisture due subsidence from permafrost thaw. In addition, ecological responses to experimental warming and fertilization treatments are detectable in drone imagery, with treatment plot productivity being much higher than control plots and the landscape-level mean. Taken together, these results put long-term vegetation change and responses to experimental warming and fertilization detected at the plot scale into the context of environmental heterogeneity at the landscape scale. However, scaling of observations from focal research sites to the level of the tundra biome remains a substantial challenge. Common data collection protocols and synthesis across networks including the High Latitude Drone Ecology Network and International Tundra Experiment when combined with remote-sensing observations will help to fill this critical research gap and improve estimates of the current rates and future projections of tundra ecological change.

BRIDGING ARCTIC MARINE SHIPPING CONCERNS AND RECOMMENDATIONS WITH MANAGEMENT AND POLICY

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As a result of climate change, summer sea ice is on the decline and there are greater opportunities for industrial development, leading to an increase in shipping traffic in the Canadian Arctic. Through workshops with elders, active harvesters and youth, all six communities in the Inuvialuit Settlement Area have identified potential impacts of shipping traffic on cultural use areas and potential management strategies for the Low Impact Corridors. To operationalize and implement these recommendations, WWF-Canada is developing a Western Arctic Mariner's Guide - a visual aid intended for a ship's bridge that will help mariners identify marine mammals and reduce impacts on sensitive cultural and ecological areas identified by project participants. This guide will be used in combination with additional management measures based on community recommendations to engage with stakeholders and address other national tools, such as voluntary measures and policy changes. At an international level, the Western Arctic Mariner's Guide is an example of a tool which can be used to strengthen the implementation of Chapter 11 of the International Maritime Organization's Code for Ships Operating in Polar Waters (Polar Code).

MINDING THE GAP: USING COMMUNITY-BASED MONITORING DATA IN WILDLIFE CO-MANAGEMENT DECISION MAKING

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Community-based monitoring has emerged as an important approach to resource monitoring in the Arctic. It offers local communities the opportunity to contribute to the improvement of long-term monitoring by extending it to year-round record collection, expanding it spatially and documenting Indigenous knowledge. The Nunavut Wildlife Management Board is leading the way with its Community-Based Monitoring Network (CBMN), which was launched in 2012. Participating Inuit harvesters record data in handheld computers while in the field and transfer the information to a central database when they return to their communities. Between 2012 and 2017, 97 harvesters in six communities documented 8,687 harvesting events during 4,490 on-the-land trips. These include records of at least 50 wildlife species harvested during 2,088 harvest days. Here, we present a preliminary overview of the quantitative and qualitative data collected through the CBMN and explore the challenges and opportunities of integrating community-based monitoring data into cooperative management (co-management) decision making. We demonstrate the value of undertaking these efforts through assessing potential contributions that the CBMN data could have made to recent wildlife management decisions in Nunavut and explore avenues towards meaningfully incorporating the CBMN data into Nunavut's wildlife co-management system.

FULL YEAR WAVES RECORDS FOR TWO LOCATIONS IN HUDSON BAY/STRAIGHT, NUNAVIK

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Waves and especially storm waves have a major impact on sediment transport, coastal erosion, and damages to coastal structures. Information on wave climate is needed by coastal engineers to address these issues. A better knowledge of wave conditions is also useful for safe navigation. However, very few wave data exists in artic waters, because of the difficulty to install and maintain wave recorder with partial and full sea-ice cover. Two AWAC-AST 600-kHz were installed in August 2017 in 30-40 m water depth off Kuujjuarapik (eastern Hudson Bay) and off Quaqtaq (southern Hudson Straight). The instruments will measure during 3 years, with a yearly maintenance and data download. They will produce the first full-year wave records for the Nunavik coast, including the freeze up period in late fall. These instruments can measure wave between ice floes when there ice a partial ice-cover, and they can also determine sea ice thickness. First results show for Quaqtaq the presence of major storms in October-November and a reduction of waves due to partial sea-ice cover in December. For Kuujjuarapik this transition occurs later. During this project, waves will also be modelled in the two sectors using Delft3D, which will modified to take into account wave reduction in presence of partial sea ice cover. Additional wave recorder installed near the coast for August-October in 2018 will be used to calibrate the wave model. New bathymetric data were surveyed in 2017 to build better the model bathymetry. The modelling objectives are to obtain wave energy distribution along the coast during storms and to determine the evolution of wave climate during the 21st century, when the global warming will reduce the sea-ice cover.

RIVER INFLUENCE ON THE SALINITY OF THE EASTERN JAMES BAY

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Water salinity in the James Bay is between 15 and 30, the water becoming more brackish during the anticlockwise circulation in the bay due to the input of several major rivers. Along the east coast, the presence of numerous islands makes the water circulation more complex. We aim to better understand the circulation of water masses in order to characterize the habitat of eelgrass beds (Zostera marina), which have been declining in the 1990s. CTD casts were made between Old Factory River and Roggan River during five field campaigns in October 2017 and in March, June, August and September 2018. Isotopic composition for 18-O and 2-H were measured in surface water samples. In addition, eight moorings recording salinity, temperature and water level were installed during summer 2018. New bathymetry data were also collected in uncharted waters for future hydrodynamic modelling. Near river mouths, the surface water is stratified with a 1–4-m layer of low salinity and, in summer, warm temperature. The influence of most rivers is limited to 5-10 km distance. The well-known La Grande River has a much larger plume, with a 3 m layer of salinity (~5) up to 25 km from the river mouth. The plume shape and extent vary in time, depending on the discharge of La Grande River, which is regulated by a hydropower dam, but also the presence of large vortexes, the influence of the tidal cycles, and the coastal morphology with numerous islands. The extent of river plumes is smaller in fall, when the frequent storms mix the entire water column. On the opposite, water stratification is well-developed during winter under the sea-ice cover. The combination of in situ CTD and mooring data will allow us to have a better understanding of spatial and temporal variation of salinity in the eastern James Bay.

WALKING THE TALK ON INTEGRATING SUSTAINABLE TOURISM PRINCIPLES INTO AN ARCTIC-FOCUSSED CANADIAN FAMILY BUSINESS: THE CASE AND EXPERIENCES OF ADVENTURE CANADA

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Ecotourism and other forms of alternative tourism strive to differentiate themselves within the tourism sector, by adhering to, and following a well-defined set of sustainable business principles. These include paying attention to the protection of critically endangered ecosystems, sharing the benefits of the activity with local communities and respecting local cultures. Adventure Canada is a 31-year-old family expedition cruise business that runs ship-based expedition cruises in the Canadian Arctic, Greenland and the North Atlantic. Over the years, we have partnered with members of local communities, and provided both support and funding for researchers, students and educators. We also give back to the communities who allow us to visit them to learn about indigenous and other northern cultures. The large resource staff on Adventure Canada trips includes authors, musicians, artists, indigenous culturalists, climate change scientists and ecologists, university professors, journalists, and other experts. Many have a strong interest in life-long learning, citizen science, science communication and outreach, and environmental advocacy. Following the release of the Truth and Reconciliation Commission Report on the impact of residential schools in Canada, our trips included panels discussions on the report recommendations. Here, we reflect on the challenges of operating a for-profit Ecotourism business in a warming world, in locations off the well-travelled mass tourism routes, with the intention of keeping within a framework of sustainable business practices that include the consideration of ecological footprints, and strict ethical guidelines. We consider how collaboration in remote and sensitive regions affects this segment of the tourism market.

OBSERVATIONS AND INDIGENOUS KNOWLEDGE: THE VALUE OF MULTIPLE EVIDENCE BASED APPROACH TO ARCTIC SCIENCE PRODUCTION

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National and international Arctic Observing Networks benefit directly and indirectly from Indigenous Knowledge (IK). Yet, the social-environmental systems that produce this knowledge in the Arctic, primarily cultural continuity and development along with place-based learning, are under threat. The steep decline in Indigenous language holders, slow acceptance of IK within science education, variations in climate and weather patterns, and lack of economic valuation for IK contributions contribute to a net loss of a wide and deep network of IK spread across the Arctic. We argue that in order to conserve and grow arctic observational systems a concurrent multi-pronged policy approach to conserve Indigenous Knowledge must be made in the domains of compulsory schooling, employment, and science.

EFFECTS OF SPATIAL AND TEMPORAL VARIATION IN RESOURCE AVAILABILITY AND MICROCLIMATE ON THE GROWTH RATES AND SURVIVAL OF ARCTIC BREEDING SHOREBIRD CHICKS

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Asynchrony between the timing of breeding and peaks in food availability, or mismatch, has been one of the most commonly hypothesized impacts of climate change across many taxa. In birds, many species have been observed to lag behind these shifts in resource availability, making mismatch a possible cause for widespread population declines. Birds nesting in the Arctic experience condensed breeding seasons associated with short periods of abundant arthropod availability. Therefore, synchrony between hatch and arthropod peaks is vital for Arctic-breeding birds. As climate change accelerates, the potential for mismatch is increasing, which may negatively impact many species and ecosystems. Shorebirds are numerically dominant vertebrates of arctic ecosystems. Shorebirds are a common and diverse group of Arctic birds, with precocial chicks that are capable of tracking food resources after hatch. We hypothesize that shorebirds capitalize on this mobility to select the highest quality foraging habitats in order to maximize chick growth and survival, even in the face of mismatch. To test this hypothesis, we monitored temperature and arthropod biomass during the chick rearing period in Churchill, Manitoba to document spatial and temporal variation in insect biomass and temperature in relation to foraging effort. To determine whether broods preferentially occupy areas of high insect biomass or temperature we tracked movements of chicks to investigate whether shorebirds could respond to spatial and temporal variations in these hotspots to improve survival and growth of chicks. Preliminary results indicate there is spatial and temporal variation in food resources across habitats where brooding shorebirds are found. Despite asynchronies arising from climate change, the flexibility of foraging behaviour among Arctic-breeding shorebirds may contribute to the differential mismatch vulnerabilities among individuals or species.

EXAMINING THE STRUCTURE OF THE HUDSON BAY POLAR BEAR SUBPOPULATIONS: DO THE CURRENT BOUNDARIES CONTRIBUTE TO EFFECTIVE HARVEST MANAGEMENT?

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Polar bears (Ursus maritimus) are under threat from climate change and the resulting loss of sea ice habitat, with most subpopulations projected to decline in the coming years. Although climate change is the primary threat to polar bears, harvest could hasten declines if it exceeds sustainable levels. As harvest also is one of the few factors managers can influence, ensuring robust management decisions is critical for polar bear conservation, particularly in the near term. Polar bear harvest management decisions are made within the context of subpopulation units defined by the IUCN Polar Bear Specialist Group; polar bears are enumerated via surveys conducted within these boundaries and harvest and conflict mortalities are assigned to the subpopulation within which they occur. Thus, inference on population trends, and the sustainability of harvest depend directly on whether subpopulation boundaries capture consistent groups of individuals. For example, if polar bears are subject to harvest in different subpopulations than the one in which they are surveyed, then the influence of harvest on population dynamics could be obscured. We examined the potential for these dynamics in Hudson Bay. This region represents the southern extent of global polar bear distribution, and two of the three subpopulation units encompassing Hudson Bay appear to be in decline. Our objectives were to 1) assess the degree to which on ice movements of bears conform to current subpopulation boundaries using data from > 100 telemetered individuals, 2) examine variation in individual assignment to subpopulation units on land and ice, and 3) assess the degree to which bears assigned to one subpopulation unit are at risk of harvest in a different unit using harvest returns and research recaptures of previously marked individuals. Our results indicated substantial overlap among subpopulations, with regular movements of bear among units. Data from telemetered individuals indicated that the majority of overlap occurred in the middle of Hudson Bay, where no harvest occurs. However, there was substantial near-shore overlap at the interface of the Western Hudson and Southern Hudson Bay subpopulations, and bears were often harvested and recaptured in different units than those in which they were marked. These results refine our understanding of movement between subpopulations in the Hudson Bay complex and indicate that subpopulation estimates have the potential to vary as a function of this movement (though we note that current survey efforts occur simultaneously for the Western and Southern Hudson Bay units, alleviating concerns about movements influencing population estimates). Further, these results indicate that subpopulation level harvest estimates could be inaccurate, suggesting the need for a refined approach to harvest management in Hudson Bay.

INUIT NUNANGAT UNIVERSITY

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Establishing an Inuit Nunangat University Canada is the only Arctic country that does not have a university in its northern regions. This creates a barrier to Inuit pursuing post-secondary studies because of the expense and dislocation involved in attending universities in southern Canada or elsewhere, far removed from Inuit cultural realities and support systems. Inuit predominantly live in Inuit Nunangat and the Inuit population is relatively young and rapidly growing. A significant gap remains in post-secondary outcomes between Inuit and all Canadians. A university in Inuit Nunangat is part of the solution to improve educational attainment for Inuit and has been in discussion since the 1970s. It is expected that the presence of a university in Inuit Nunangat will help to improve student engagement and educational outcomes in the K-12 system across Inuit Nunangat as Inuit take ownership and responsibility for their own learning and as Inuit learners in higher education. ITK would like to deliver a 15 minute presentation on the background of establishing a University in Inuit Nunangat from the 2011 First Canadians, Canadians First National Strategy on Inuit Education; the Inuit Education Accord. The Strategy recommendations are based on extensive consultations with families, educators, researchers, and decision-makers from across Inuit Nunangat. The recommendations cover all aspects of education from early childhood to post-secondary and draw important connections between education, health and wellbeing, social and economic development, and Inuit self-determination. The document lays out a clear, comprehensive vision for an education system that reflects the priorities, needs, and aspirations of the people it is meant to serve. The creation of a university in Inuit Nunangat is a critical component of this vision. Included in the presentation is the strategic framework that has been developed which will guide the planning and development of through quality assessment process and governance structure that incorporates Inuit-identified educational issues, priorities, political engagement, funding, and programming among the necessary steps to take within the next five years leading to the opening of a University in Inuit Nunangat.

ONTOGENETIC SHIFTS IN CAPELIN DIET AND ISOTOPIC NICHE IN THE EASTERN CANADIAN ARCTIC

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Under warmer conditions and reduced sea ice in the Arctic, temperate species are able to expand their ranges and thrive in northern regions where they were historically rare or absent. Capelin (Mallotus villosus) is a typically sub-Arctic forage fish that has become abundant in some regions of the Canadian Arctic in recent decades. In Pangnirtung Fjord, Nunavut, capelin presence is now well documented, but its foraging ecology in this location is not yet well known. As such, the objective of this research was to use stomach contents and stable isotopes to examine inter-annual and size-dependant diet of capelin sampled in Pangnirtung Fjord. Results varied inter-annually and indicated that the diet of mature capelin is influenced by the timing of spawning in relation to sampling date. Generally, capelin up to ~140 mm, most of which were immature, appeared to specialize on small copepods (primarily Clausocalanidae), while larger capelin were more varied in their diet. With increasing size of adult capelin, the contribution of large prey types (primarily Calanus hyperboreus and amphipods) to the diet increased. In addition, capelin diet was broadly similar to the diets of forage fishes in other Arctic regions, suggesting high dietary overlap with other forage fishes in Cumberland Sound, such as polar cod (Boreogadus saida). This information begins to fill an important knowledge gap with regard to the trophic role that capelin play in the Canadian Arctic, and provides an important baseline against which future dietary studies of planktivorous fish in the Canadian Arctic may be compared.

SUPPORTING INUIT QAUJIMAJATUQANGIT IN SCHOOLS FOR STUDENT PERSISTENCE AND SUCCESS IN INUIT NUNANGAT

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The well-being of Inuit youth is a priority for families, communities, schools, boards of education, governments, and Inuit organizations. In this original research partnered with the Amaujaq National Centre for Inuit Education, we document the stories of Inuit students, parents, elders, teachers and community members that show how their schools are contributing to student wellness and success. Through case studies in communities from each of the four Inuit regions in Canada, we conducted over 100 interviews. Case studies were conducted in Pond Inlet and Taloyoak (Nunavut), Aklavik (Inuvialuit Settlement Region), Ivujivik (Nunavik) and Hopedale (Nunatsiavut). We discuss educational interventions, community supports and a range of promising practices to support academic success and well-being for Inuit youth, their teachers, and their communities. Thematic analysis reveals one of the keys to student persistence and well-being is Inuit identity development and the ability to navigate between Inuit societal values (Inuit Qaujimajatuqangit, IQ) and the expectations of the school system. We highlight promising practices in each community and successful programming that is occurring in all 5 communities.

INUIT SELF-DETERMINATION IN RESEARCH: IMPLEMENTING THE NATIONAL INUIT STRATEGY ON RESEARCH - A REGIONAL PERSPECTIVE

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On March 22, 2018, Inuit Tapiriit Kanatami released the National Inuit Strategy on Research (NISR), a pivotal document that outlines the coordinated actions required to improve the way Inuit Nunangat research is governed, resourced, conducted, and shared. The NISR was developed in coordination with the Inuit Qaujisarvingat National Committee made up of representatives of each of the members of the Inuit Tapiriit Kanatami Board of Directors. The document promotes a shared understanding of the legacy of Inuit Nunangat research and connects this legacy to current research practices, defines Inuit expectations for the role of research in our regions and communities, and identifies areas for participation and action between Inuit and the research community. For far too long, researchers and research institutions have tended to be the primary beneficiaries of Inuit Nunangat research, despite the present and ongoing need for Inuit-specific data and information that can be used to shape solutions to our most pressing challenges. Furthermore, Inuit Nunangat research is too often governed, resourced, and carried out in a manner that limits Inuit participation, marginalizing Inuit from the benefits of research. The NISR seeks to remedy these problems. It identifies five priority areas in which coordinated action is necessary to facilitate Inuit Nunangat research that is effective, impactful, and meaningful to Inuit. These five priority areas are: 1) Advance Inuit governance in research; 2) Enhance the ethical conduct of research; 3) Align funding with Inuit research priorities; 4) Ensure Inuit access, ownership, and control over data and information; and 5) Build capacity in Inuit Nunangat research. Implementing the NISR will require a coordinated approach based on partnership. The interrelated, interdependent nature of these five priority areas, as well as the number of stakeholders involved in Inuit Nunangat research, means that new relationships must be brokered between Inuit, government departments, and research institutions in order to implement the NISR. This session will showcase the NISR and its implementation plan by inviting individuals from within Inuit organizations, government, agencies, and academia to discuss how they are helping move towards Inuit self-determination in research.

TE(A)CH - COMPUTER SCIENCE, HEALTH AND WELLNESS.

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Technology is ubiquitous in Northern Canada, and Nunavut is no exception. Nunavummiut use their devices to work, play, connect, and share. However, computer science instruction is minimal in schools, so youth are not learning the skills to use these devices for their own creations. Te(a)ch (formerly "Code Club") started as a standalone technology literacy project by Pinnguaq Inc. in Pangnirtung, NU in 2014, and was expanded into a health and wellness pilot program in partnership with the Qaujigiartiit Health Research Centre in Arviat, NU in 2015. The program aims to teach youth the concepts and application of computer science in order to provide them with the skills to develop their own apps and games. A key focus of the program is to shift the relationship between youth and technology from one based solely on consumption, to one that includes creation. The method is embedded in Inuit Qaujimajatuqangit (Inuit Traditional Knowledge); especially the concepts of pilimmaksarniq (knowledge acquisition), piliriqatigiinniq (working together for a common purpose), and qanuqtuurunnarniq (being resourceful). The design of the program and the skills taught act to build agency and resilience in the participating youth, providing them with a creative outlet and coping skills to increase overall wellness.

LOCAL ADAPTIVE CAPACITY FOR AVALANCHE RISK AND INFRASTRUCTURE DISRUPTION IN TROMS, NORTHERN NORWAY

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The steep topography and weather conditions in Troms County create conditions for avalanche risks. This leads to road closures, disruption in transportation of people, goods and services and the potential isolation of communities. Climate change is altering the timing, frequency and spatial range of avalanche risks. The importance of reliable infrastructure for rural communities has increased as both businesses and social life are highly interconnected with other settlements in the region. Based on qualitative interviews with local residents, the paper presents findings on the adaptive capacity within two communities, yearly affected by avalanche risk and road closure. The paper discusses that key components of adaptive capacity relate to local preparedness, local knowledge, and closely knit social networks. Current adaptive capacities might be challenged under climate change and increasing societal demands related to safety and connectivity.

SHIPPING IN THE BARENTS AREA: LOCAL IMPACTS AND ADAPTIVE RESPONSES

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This paper explores local consequences of and community responses to increasing shipping in the Barents area. Compared to other Arctic regions, the climatic conditions in the Barents area are favorable for year-around navigation. For centuries, the Barents area has been one of the most navigable regions in the Arctic, where shipping included transportation, supply, mobility and subsistence needs. Presently, this area is characterized by growth in ship traffic (including new types of vessels and new trends of distribution). Consequently, several coastal and island communities in the Barents area are experiencing increasing shipping activities. Severe weather conditions coupled with the polar night, long distances, and limited Search and Rescue (SAR) capacity present the main limitation for safety operations in this area. Shipping activities has numerous impacts on communities' livelihoods and their local environment. Given the heterogeneous distribution of resources, different level of infrastructure development and diversity of local shipping governance' arrangements the impacts will be felt differently at the local level. At the same time, the local impacts and responses to mitigate the negative consequences are still understudied for the communities in Barents area. To fill this gap of knowledge, this study is designed to assess the way shipping shapes local adaptive capacity. This objective is addressed in the following research question: What are the consequences of increasing shipping in the Barents area on local adaptive capacity? The preliminary findings of this explorative study derives from qualitative interviews that were conducted in two island communities: the Norwegian community of Longyearbyen (n=36), on Svalbard, and the Russian community of Solovetsky (n=24) in the White Sea. The questions on the impacts from shipping development were discussed with representatives from public bodies, industrial stakeholders, NGOs and local population. Even though, shipping has been a crucial part for socio-economic development, since the beginning of the 21st century, case communities experience the dramatic growth in shipping activities (particular passenger vessels) that affect local economy and employment, community livelihoods and has an impact on natural environment. Using findings from interviews, the study identifies determinants that shape local capacity to adapt to growth in ship traffic. For Solovetsky, the following determinants and their interlinks are defined as salient: local involvement in the decision-making system, infrastructure, local values, the natural environment and economic resources. While for local community of Longyearbyen, local engagement in adaptive response is identified as a supportive mechanism that strengthens local adaptive capacity.

A TALE OF TWO HAMLETS – THE ROLE OF A TOURISM CHAMPION IN THE RELATIVE SUCCESS OF THE 2016 VISIT OF THE CRYSTAL SERENITY TO NUNAVUT, CANADA

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The summer of 2016 saw history made when the Crystal Serenity became the largest passenger vessel to transit the Northwest Passage. Carrying approximately 1,000 passengers and 600 crew, this maiden voyage made history in many other respects as well - setting a particularly high number of tourism records in the Canadian Arctic territory of Nunavut. Chief among these new records in Nunavut was the total impact that the ship had on the two community visits in the territory, in the hamlets of Cambridge Bay and Pond Inlet. Never before had either of these communities experienced the sheer number of visitors in one day as they did when the Crystal Serenity arrived, with the vessel temporarily doubling their population sizes. In the lead-up to the visit, numerous questions lingered as to whether these small remote communities where adequately prepared for an event of that magnitude. This research analyzes the relative successes and failures of Cambridge Bay and Pond Inlet with regards to the Crystal Serenity's visit. Results show that there were striking differences between the two communities in both preparations for and reception of the vessel, and that these differences can largely be attributable to the presence of a 'tourism champion' - or lack thereof. This analysis is situated within the overarching concepts of sustainable development, and more specifically community-based sustainable tourism (CBST). In other words, this research supports the idea that successful operationalization of CBST (particularly in small, remote communities) is strongly influenced by the presence of 'tourism champions'.

INITIATING A CONTINUOUS PLANKTON RECORDER SURVEY TO MONITOR THE GRADIENT OF CHANGE ACROSS THE WESTERN-CANADIAN ARCTIC

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The Continuous Plankton Recorder (CPR) survey is the longest running and geographically largest marine biological time series in the world, providing multi-decadal monthly data on a pan-oceanic scale, with taxonomic resolution necessary to assess changes in the plankton biomass, biodiversity, and community structure of the ecosystem. Long-running CPR surveys exist in the North Atlantic, Southern Ocean and North Pacific, and more recently around Australia, in the Mediterranean Sea, South Atlantic and off Southern Africa, but very few samples have been collected in the Arctic Ocean. In the summer of 2017, the CPR was successfully towed in the Labrador Sea and through the North West Passage by the Marine Institute of Memorial University of Newfoundland. This mission was a proof-of-concept demonstrating that the CPR can be towed in such regions, and represents the initiation of an important time-series that we hope to maintain in the Eastern-Canadian Arctic through this group. This bursary has supported the applicant to set-up a proof-of-concept CPR route through the Western-Canadian Arctic (towed by the Sir Wilfrid Laurier research vessel, Department of Fisheries and Oceans Canada), which complements and links to the new route on the Eastern side, providing comparable data for Pacific-Atlantic migrations and vice versa. There have been recordings of a number of Pacific Arctic species of plankton recorded in the Atlantic Ocean. For example, Neodenticula seminae, which is an arctic diatom normally found in the Pacific was detected within the CPR survey in the Atlantic (Reid et al., 2007). This diatom species had been absent from the North Atlantic for over 800,000 years, and was highlighted as the possible first of many non-native species to migrate. Trans-Arctic migrations are likely to become more prevalent as warming continues, and could have large impacts on the ecosystem and biodiversity. Such gradients of change need to be monitored over a large geographical area and using consistent time-series, in order to understand the implications within the marine ecosystem,

and any possible impacts on marine resources (ICARP III, 2015). Here we will present some of the initial outputs of these Continuous Plankton Recorder tows in Arctic waters, along with the preliminary analysis and findings.

HUMAN PERSPECTIVES ON CLIMATE VARIATIONS OF THE COAST OF LABRADOR, 1750-1950

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Sea-ice cover plays an important role in Arctic and Subarctic communities. Communication, transportation and hunting depend on the sea-ice extend and duration. His formation is driven by the atmospheric and oceanic conditions (temperature and circulation). To better understand the present changes in sea-ice cover and impacts on populations living on the coast of Labrador, a reconstruction based on discursive sources is proposed. The discursive sources are textual or iconographic products. They involve the human communication, sensibility to environmental stimuli and ability to adapt to environmental changes. They refer to critical human-environment relationship, where climate variations are visible through human vulnerability. Discourses also have a propensity to show extreme weather events, unpredictable and variable in strength, time and place. A large part of the study material we used is from the archives of the Moravian missionaries along with traveller and settler journals, Inuit life-stories and novels. Freeze-up and brake-up dates are extracted from Moravian journals to give an average number of months per year of sea-ice cover (quantitative values). First kayak and first dog-sled (komatik) trips and first hunt on sea-ice also serve as indicators of sea-ice cover. Arrival dates of the mission ship on the coast of Labrador, together with qualitative climate observations served as indicator of sea-ice severity. Other sources portrait sea-ice and winter conditions. For example, from an anonymous journal found in Battle Harbour dated of 1832, the day-to-day brake up is described. It is noted that the ice stays in the bay with a Northeastern wind (dominant wind) and floes out of the bay with South and Western winds. Interdisciplinary studies of the representations of climate and winter set bridges between discourses and cultures on one side, and territory and reality on the other. Coupled with proxy reconstructions, discursive data provide a holistic picture of climate and vulnerabilities.

USE OF PRE-INDUSTRIAL BASELINES TO ASSESS SOURCES AND PATHWAYS OF METALS IN SURFACE SEDIMENT OF FLOODPLAIN LAKES IN THE PEACE-ATHABASCA DELTA (ALBERTA, CANADA)

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Exploitation of natural resources in northern Canada and its effects on downstream aquatic ecosystems is a concern. The effects of industrial developments on aquatic environments therefore require comprehensive monitoring practices to better inform stakeholders and environmental stewardship. Here, we develop and apply a monitoring approach to assess the distribution and potential sources of metals in lake sediments of the Peace-Athabasca Delta (PAD), northern Alberta, Canada. Since the ecological integrity of the PAD is strongly tied to river floodwaters that are critical for replenishing the delta, and the PAD is located downstream of the Alberta oil sands, concerns have been raised over the potential transport of metal contaminants to the PAD via the Athabasca River. However, metals may be transported to the PAD by several pathways, including Athabasca and Peace rivers and atmosphere, but their origin and distribution remain unknown. To address this knowledge gap, surface sediment samples (top ~1-cm) were collected in September 2017 from 62 lakes across the delta, and again in July 2018 from 20 lakes that had received river floodwaters two months earlier, to provide a snapshot of metal (Be, Cd, Cr, Cu, Pb, Ni, V, Zn) concentrations that have recently accumulated in these lakes. To assess for pollution, metal concentrations were normalized to aluminum and then compared to baseline metal-aluminum relations for the Athabasca and Peace sectors developed from pre-1920 measurements in lake sediment cores. Apart from a few lakes in the delta that show a slight enrichment of zinc values, most metal concentrations plot consistently within the 95% prediction interval of the pre-1920 baselines including vanadium and nickel which are metals most commonly associated with oil sands production. Also, nearly all metals concentrations plot below CCME interim soil quality guidelines, with the exception of a couple of lakes that contain concentrations of cadmium and zinc higher than their guidelines; however, these metal concentrations are still well below probable effects levels. Further numerical analysis demonstrates no significant enrichment of these metal concentrations with respect to their pre-industrial baselines including measurements of river sediment collected by the Regional Aquatics Monitoring Program (RAMP) and the Joint Oil Sands Monitoring Program (JOSMP). Thus, results presented here show no clear evidence of recent oil sands derived metal pollution in sediment of lakes in the Peace-Athabasca Delta and also demonstrates the usefulness of these methods as a monitoring framework for floodplain lakes.

THE UNAAQ MEN'S ASSOCIATION OF INUKJUAK: DEVELOPING HUNTERS THROUGH INTENSIVE TRADITIONAL SKILLS DEVELOPMENT PROGRAMS

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The Unaaq Men's Association of Inukjuak, through its intensive traditional skills development programs, is directly supporting the traditional skills development of the young Inuit men of the community and building the next generation of hunters with skills, traditional knowledge and experience. By working closely with the elders and other experienced hunters of the community, the programs help build the skills of the young men, helping them set goals in line with their culture and to prevent social issues from interfering with their traditional achievements. The traditional skills programs are designed around the four seasons. Some of the programs include igloo-building lessons, dog team training, qajaq-making, hunting skills excursions as well as tool-making and other traditional skills. The association, in collaboration with the local and regional partners, develop programs to increase the traditional skills and knowledge of the young men of the community. By empowering the young Inuit men with the traditional knowledge of their ancestors, the Unaaq Men's Association of Inukjuak will ensure these cultural skills will not be lost and kept within the Inuit culture, to support the traditional development of the next generation of leaders and hunters.

LARGE WINTER INCREASES OF ARSENIC IN SURFACE WATERS OF SMALL SUBARCTIC LAKES IMPACTED BY LEGACY MINING POLLUTION NEAR YELLOWKNIFE, NT

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The early years of historical mining activities in the Yellowknife region resulted in the release of large amounts of arsenic (As), antimony (Sb), and metals to the surrounding area. Fifty years after the bulk of these emissions were deposited, surface waters of many local lakes continue to exhibit elevated levels of contaminants, particularly As and Sb. The seasonal variation in surface water As and Sb concentration was assessed in four small (< 1.5 km2) subarctic lakes impacted by emissions from legacy mining activities. Substantial seasonal variation in surface water As concentrations were measured in three of the lakes, including a four-fold difference in surface water As in the shallowest lake ([As]: 172-846 μg/L; maximum depth 0.8 m), but little variation was measured in the deepest lake ([As]: 27-40 μg/L; maximum depth 6.9 m). The development of an ice-cover enriched surface water concentrations of As in the three shallowest lakes (50-100%) through a combination of physical and biogeochemical processes. Early winter increases in As were associated with the exclusion of solutes from the developing ice-cover, whereas large increases in surface water As were measured following the onset of anoxic conditions by mid-winter due to increased sediment efflux. The increased flux of As from sediments was associated with large increases in iron (Fe) and manganese (Mn), suggesting coupling of As mobility with Fe and Mn cycling. In contrast, seasonal variation in surface water Sb was not associated with Fe cycling and anoxia. These observations highlight the contrasting geochemical behaviour of As and Sb in lacustrine environments and demonstrate the importance of considering winter conditions in evaluating the long-term fate of As and Sb in shallow lakes with a long ice-cover season. The annual remobilization of sediment As into overlying waters under ice may be a significant process inhibiting the long-term chemical recovery of mine-impacted shallow lakes in the region and should be considered when evaluating exposure of aquatic life to legacy As.

ARCTIC PLANT PHENOLOGICAL RESPONSES TO CLIMATE CHANGE: EVOLUTIONARY AND LIFE HISTORY TRAIT PATTERNS

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The Arctic is experiencing some of the most dramatic changes in climate with temperatures rising at double the rate of the global average. Phenology, the timing of natures seasonal events, is often sensitive to temperature and, as the climate warms, leaf out, flowering and fruiting times are generally advancing. The phenological response of a plant species to changes in climatic conditions can be measured through (a) change over time (days/decade), where a negative value represents an advance of the phenological event to an earlier date and (b) phenological sensitivity to temperature (days/°C), where a negative value represents an advance in the phenological event with rising temperature. There is evidence to support leaf out and flowering times of temperate and alpine plants are evolutionary conserved and related to life history traits, that is, closely related species or species with similar life history traits tend to leaf out or flower at similar times. Given that species tend to leaf out and flower in the same order from year to year and place to place, one would also expect phenological sensitivity to temperature to exhibit similar patterns. However, there is conflicting evidence for the later and little is known about patterns in the timing and sensitivity of Arctic plant phenology. My objectives are to identify evolutionary and life history trait patterns in the phenological timing and sensitivity of Arctic plants. That is, are there significant differences in the flowering and green up times and the flowering and green up time sensitivity to temperature among groups of Arctic plant species including evolutionary clades, pollinator syndromes, growth habits and Sørensen's over-wintering floral bud stages? To address these questions, I analysed the International Tundra Experiment (ITEX) 1992 - 2014 long-term phenological monitoring data set of flowering times, green up times and monthly temperatures from 19 sites across the Arctic. My findings indicate that flowering times and green up times of some growth forms and some plant families are more sensitive to temperature than others. Among growth forms and families, the flowering time sensitivity to temperature differed from green up time sensitivity to temperature. There was no significant difference in flowering time sensitivity to temperature of wind- versus insect-pollinated species. Flowering times of species with more developed over-wintering flower buds may be more sensitive to temperature than species whose over-wintering flower buds are less well developed. The difference in sensitivity to temperature among species' groups implies that groups of species will respond by differing degrees to climate change and thus has implications for Arctic plant ecological community structure.

NEW OPEN HIGH-RESOLUTION DIGITAL ELEVATION MODELS IN CANADA'S NORTH: LEVERAGING THE ARCTICDEM INITIATIVE

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For decades, NRCan's Canada Center for Mapping and Earth Observation (CCMEO) has offered elevation geospatial data that covers the entire country, including the Canadian Arctic. Given the changes in the North, users have been showing greater interest in getting accurate and up-to-date elevation data. To meet these needs, NRCan's CCMEO have deployed the National Elevation Data Strategy (NEDS). In the North, the NEDS leverage the highly accurate elevation products from the ArcticDEM initiative. Since April 2018, 75% of the Canadian Arctic (3 millions km^2) is covered through the NEDS by the new 5m resolution ArcticDEM tiles. This data is available on the federal Open Maps platform under the popular High-Resolution Digital Elevation Model (HRDEM) product. When integrating these datasets into the HRDEM product, enhancements were applied such as lake flattening, deletion of artefacts over rivers and delimitation of artefacts over land. Elevations were also converted to the Canadian Geodetic Vertical Datum of 2013. But that's not all! Given that NRCan's CCMEO constantly innovates and aims to provide state-of-the-art data, by spring 2019, up to 100% of the Canadian Arctic will be covered by the NEDS. More precisely, the final 2m resolution ArcticDEM tiles will be enhanced, transformed and will replace the current 5m resolution data available in the HRDEM product. This new coverage of high-resolution elevations in the North represents a new exciting era of open geospatial datasets and enormous possibilities of study for northern Canada.

IMPLEMENTATION OF THE ARCTIC REGIONAL CLIMATE CENTRE

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Climate change in the Arctic is affecting the entire Earth system. Indigenous Peoples and communities, Northerners, industry and wildlife are experiencing significant and direct impacts. Currently, climate products at a circumpolar/pan-arctic scale (i.e. International Panel on Climate Change and Arctic Council working group assessments) are not available in near-real time for Arctic decision-makers. To meet growing Arctic adaptation and decision-making needs, an Arctic Regional Climate Centre Network (ArcRCC-Network) has been established. The purpose of the ArcRCC is to provide biannual seasonal assessments and forecasts of temperature, precipitation and sea-ice conditions each October (for the upcoming winter season) and May (for the upcoming summer season). The ArcRCC-Network is based on the World Meteorological Organization (WMO) Regional Climate Centre (RCC) concept. Active contributions are from the meteorological and ice services of all Arctic Council member countries and are based on a mutually agreed upon structure of three sub-regional geographical nodes, namely, (i) North America Node, (ii) Northern Europe and Greenland Node and (iii) Eurasia Node. As part of the ArcRCC-Network implementation and ongoing engagement strategy, an inaugural user's forum was held in Ottawa, Canada, from 15 to 16 May, 2018, hosted by the Environment and Climate Change Canada (ECCC) and co-sponsored by the WMO. This first annual forum focused on meeting with Arctic Commercial Shipping users and Circumpolar Indigenous organizations to discuss initial ArcRCC climate products and user needs. This presentation will further expand on: the structure and objectives of the ArcRCC; initial climate products; feedback received from circumpolar climate users during its first face-to-face forum; and its follow-up on-line forum held in October 2018.

PRACTICES TO ENSURE ANIMAL WELFARE IN SÁMI REINDEER HUSBANDRY FAMILIES IN NORDLAND, NORWAY

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This presentation present preliminary result from my research. The objective is to understand and identify practices applied by Norwegian reindeer herders in order to ensure animal welfare, and to reduce risk of disease in their herds. People have always carried their diseases with them, and the movement and redistribution of diseases are as old as humanity itself but something has changed. Anthropogenic climate change have increased the speed and scale of these processes, and the affect it has on the worlds many ecosystems. This disruption of ecosystems is further driving the spread of, and increasing the numbers of disease causing pathogens and it is becoming evident that we need to increase our knowledge of how this will affect people and animals. In this context, the One Health approach represent the will to address the complexity and the interrelatedness that exist between humans, animals and ecosystems. Although there is no doubt that this is a fundamental change for medicine and veterinary medicine, I argue that there is still potential to improve One Health. At this stage, social science is insufficiently integrated into One Health. I argue that increasing the involvement of social sciences in One Health and thus becoming truly transdisciplinary can contribute to reframing how we understand health and health care. Like many other indigenous people in the Arctic, the Sámi have hunted wild reindeer for thousands of years. In the 1500s, they began domesticating reindeer, becoming the nomadic herders we know today. Reindeer herding differs from traditional farming in that Sámi reindeer are semi-domesticated, meaning they roam free in the wild for most of the year. In the wilderness, they can behave naturally in an environment to which they are genetically adapted, while their herders protect them from harm. Although the health conditions of today's semi-domesticated reindeer are generally good we know from earlier descriptions of epizootic disease outbreaks in domesticated and wild reindeer that new diseases can have devastating effects on animal populations. The good health we find in today's reindeer populations is, attributed to the reindeers' roaming range across large areas, permitted throughout most of the year. Currently, as a response to multiple stressors, herders in Nordland, Norway are implementing new animal husbandry practices, like increasingly using supplementary feeds, transporting their animals with trailers, and keeping the herd fenced for longer. These adaptive measures may facilitate the spread of disease and make the animals more vulnerable for new infections. My research aim, as mentioned above, to identify and understand how traditional knowledge and animal husbandry practices in Sami reindeer herding families are applied in a time of change, to ensure the welfare of animals and to prevent disease. My PhD project is part of the Nordic Centre of

Excellence Climate Change Effect on the Epidemiology of Infectious Diseases and the Impact on Norther Societies CLINF (www.clinf.org).

DETERMINANTS OF NUNAVIMMIUT POSTSECONDARY SUCCESS

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Background: Education is a key determinant of health. Historically, postsecondary institutions in Canada were not designed to support the unique needs of Indigenous youth, leading to the highest postsecondary dropout rates of any other cultural or ethnic group despite evidence of academic ability. In the current wave of effort to implement support services for Indigenous students it is important to study “what works” as presence of these services alone will not guarantee student success. Objective: To explore the determinants of Inuit postsecondary success in the context of first year students moving from Nunavik to Montreal for postsecondary studies. Methods: This study applies a qualitative research method, and a realist inductive thematic analysis of public facebook posts and one-on-one semi-structured interviews with students (n=14) having completed one or more years of postsecondary studies, as well as with relevant academic support staff (n=6) at John Abbott College in Montreal. This project was approved by the Research Ethics Committee of Nunavik’s school board, Kativik Ilisarniliriniq, McGill University, and John Abbott College. Results: Thematic analysis showed that values, skills and attitudes were key drivers of a successful first year student experience. Values referred to the characteristics of student services that students responded to and felt facilitated their success including an emphasis on student well-being in service delivery, the prioritization of trust and relationship building between students and support staff, and the personalization of support offered to students based on their unique circumstances. Skills which students found critical to their transition included leadership opportunities, setting and tracking goals- both personal and academic, resource mapping or knowing who to turn to for different types of problems, and the development of confidence in homework and study skills. Attitudes which were useful to students included gaining a balanced perspective on challenge- understanding that they were not isolated in struggling with adjusting to postsecondary, the development of a sense of belonging on campus, and a positive sense of identity. Conclusions: Values, skills and attitudes shape first year student success. This study showed that values facilitate positive interactions with student services, and the specific skills and attitudes past students have relied on to overcome challenges with the transition to postsecondary. Building on stories of past success, this study sheds light on how student services may strategize to better support Indigenous students and increase retention rates in the first year of postsecondary education through increased attention to the values being promoted in the delivery of student services and through supporting the development of specific skills and attitudes in first year students.

NUNAMIN ILLIHAKVIA: LEARNING FROM THE LAND

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The Nunamin Illihavia project in Ulukhaktok, NT represents a new way of conducting research in the Arctic. The project was designed by Inuit and is governed and administered by Inuit, including project finances. The overarching goal of the Nunamin Illihakvia project is to improve the ability of Inuit to adapt to the health impacts caused by climate change through the generation and sharing of traditional knowledge important for subsistence livelihoods. The project has three themes within the focus of knowledge generation and sharing: (1) subsistence hunting: hunter-mentorship program, equipment making, land camps; (2) fur preparation and sewing: traditional sewing projects; and (3) Inuinnaqtun language: local radio, learn Inuinnaqtun videos, language mentors. Research questions that will be asked during the course of the project include: how is sewing important to Inuit women and what contributions do women make to household and community through sewing? What are the implications of formal learning programs for traditional modes of knowledge sharing? What is the feasibility of a cultural school in Ulukhaktok? How do place names influence people’s perceptions and use of the land? The project is funded by Health Canada’s Climate Change and Health Adaptation Program (CCHAP).

LISTING THE POLAR BEAR AS A THREATENED SPECIES HAS RESULTED IN THE DEATH OF MORE BEARS

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In May 2008, the United States Fish and Wildlife Service (USFWS) listed the polar bear (Ursus maritimus) as a threatened species under the Endangered Species Act of 1973, based on projected losses of their essential sea ice habitat with climate change. Listing the polar bear as "threatened" prohibits the importation of polar bear trophies into the U.S., essentially ending the polar bear sport hunt in Canada. The listing, however, does not protect the polar bear from climate-induced changes to sea ice or from being hunted for Indigenous subsistence practices. A key question is what affect, if any, has listing the polar bear as threatened had on polar bear conservation? Here we show, from an analysis of polar bear hunting data from the Inuvialuit Settlement Region (ISR) of the western Canadian Arctic, that the number of polar bears killed in three polar bear management units has increased since the U.S. listed them as threatened. We found that although the number of sport hunts has decreased after 2008, the number of subsistence hunts has increased but still within the sustainable harvest quota. Our findings underscore the need to better understand Inuit motivations for hunting polar bear and approaches to conservation if we are to support polar bear in an era of rapid change.

PTEROPOD L. HELICINA AS A SENTINEL FOR OCEAN ACIDIFICATION IMPACT ON ARCTIC ECOSYSTEMS

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Pteropod L. helicina as a sentinel for ocean acidification impact on Arctic ecosystems. Shelled pteropods, otherwise known as sea butterflies, are frequently referred to as the "canary in the coal mine" when anticipating the potential ecological impact of ocean acidification. Dissolution of their fragile aragonitic shells is commonly predicted to occur as soon as the waters within which they live approach aragonite saturation. In 2017, L. helicina, a key component of the short Arctic foodweb, were found in waters which are perennially undersaturated with respect to aragonite. The occurrence of this species within conditions which would normally be considered inhospitable provides a unique opportunity to investigate the mechanisms that calcifiers use to mitigate undersaturated conditions. We are now developing a novel, cross-disciplinary approach, incorporating a time-series of shell-size distribution analysis, population genetics and geochemical fingerprinting of shell mineralogy to assess how this species came to inhabit these waters and whether they are successfully completing their life cycle there. Our findings will transform our understanding of the tolerances of polar pteropods to waters undersaturated with respect to aragonite and allow us to predict the impact of future ocean acidification on the Arctic ecosystem.

IMPACT OF OCEAN ACIDIFICATION AND MICROPLASTICS OF ECOSYSTEMS IN THE CANADIAN ARCTIC ARCHIPELAGO - ONE YEAR ON.

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The Arctic is one of the most environmentally stressed regions in the world owing to the rate of ocean warming, acidification and sea ice melt. The Arctic ecosystem will therefore be especially vulnerable to the additional stress of plastic pollution. A NERC (Natural Environment Research Council) UK-Canada bursary supported a BAS-ArcticNet sampling campaign on leg 2b of the 2017 Amundsen Expedition to assess the impact of ocean acidification and microplastics on Arctic ecosystems. Signs of dissolution damage to the microscopic shell of pteropod Limacina helicina, serves as a sentinel for ocean acidification impact. The BAS-ArcticNet initiative has established the first distribution map of L. helicina abundance and shell condition in the Canadian Arctic, establishing a baseline for the "health" of populations across a range of carbonate saturation states. In addition to investigating the impact of ocean acidification, surface water was sampled to assess the abundance and polymer-composition of microplastics in the same region. Building on the original 2017 field campaign, further collaborative sampling occurred on the 2018 Amundsen Expedition. We present a summary of our

findings todate and future plans for continued collaboration with will ensure a long-term legacy of the bursary.

TRACING FORAGING NICHE OVERLAP AND BREADTH BETWEEN NORTHWARD-REDISTRIBUTING TEMPERATE AND ARCTIC MARINE FISH ALONG A LATITUDINAL GRADIENT

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We evaluated foraging niche overlap and breadth among two northward-redistributing sub-Arctic marine fish species and 11 native marine Arctic fish and invertebrate species within the low, mid- and high Canadian Arctic regions. For that, we used trophic position (derived from nitrogen stable isotope ratios) and carbon source (derived from carbon stable isotope ratios), as well as fatty acid (FA) signatures. Across all species, hierarchical Ward's clustering analysis identified three "isotope niche" groups based on tropic position and carbon source, and four "FA niche" groups based on FA signatures, representing a diversity of foraging strategies including benthic, pelagic, and predatory species. This diversity in foraging behavior resulted in overall limited niche overlap among species, as measured by isotopes and FAs, averaging 5.4 % (range from 0.0 % to 91.2 %). The two sub-Arctic species, capelin (Mallotus villosus) and sand lance, (Ammonytes spp.) collected in the low Arctic had the highest isotope niche overlap (up to 91.2 %) and a considerable FA niche overlap (41.9 %). In contrast, the FA niche of capelin overlapped by only 0.2 % with that of the keystone native prey fish, Arctic cod (Boreogadus saida), while there was 0.0 % overlap between sand lance and Arctic cod. Similarly, the isotope niches of capelin and Arctic cod, and of sand lance and Arctic cod, did not overlap. In terms of niche breadth, capelin and sand lance had 3 to 8 times broader niches compared to Arctic cod. These results may be related to a higher reliance of Arctic cod on sympagic-derived carbon compared to capelin and sand lance, which were more associated with pelagic-derived carbon. However, regional variation in food sources seems likely to have also played a role in niche variation among species. We found higher content of sympagic-derived FA in Arctic cod collected in the high Arctic compared to conspecifics in the mid-Arctic, which we also verified for sculpin and gammarid amphipods in the high compared to low Arctic. Thus, the lack of foraging niche overlap between capelin, sand lance, and Arctic cod here could be partly related to latitudinal variation in seasonal sea ice extent. Still, a more generalist diet suggested by broader niches and lower reliance on sympagic primary production for capelin and sand lance indicates a potential ecological advantage for these species over Arctic cod under shifting Arctic marine conditions.

FEELING AT HOME AND BEING HOUSED IN NUNAVUT AND NUNAVIK: TWO DISTINCTS DETERMINANTS OF INUIT HEALTH

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Background/Objectives 'Sense of home' is broadly defined as having a safe place for identity development and family bonding, where people can be themselves and feel they belong. In 2014-2015 investments in social housing permitted the construction of more than 400 new social housing units in Nunavut and Nunavik, two of the four Inuit regions of northern Canada, with the result of reducing overcrowding, and improving sense of home among people who got to move into a new house. In the context of this population health housing intervention, the objectives of the presentation are to examine whether: i) sense of home is a predictor of lower psychological distress, and ii) improvement in sense of home lead to improvement in psychological distress over time. Methods A before-and-after study was designed in collaboration with Inuit organizations in twelve communities in Nunavut and Nunavik. Adults aged 18y and over, ranked at the top of the waitlist for social housing were recruited in each community. Questionnaires were administered 1-6 months before moving, and 15-18 months after. Sense of home was measured according to participants' perception of their house in relation to: space, identity, control, privacy, satisfaction, relationships, location, and safety. Psychological distress was assessed with the Kessler 6-item scale. Associations were tested with multilevel regression models for change, adjusted for age, sex, and region. Results 102 participants completed both baseline and follow-up questionnaires. At baseline, a higher sense of home score was associated to lower psychological distress score (p=0.001). Several sense of home items were strong predictors of lower psychological distress including "I can do what I want in my house"(p<0.001), "I have enough privacy" (p=0.015), "I feel safe in my house" (p=0.005), "My house is a good reflection of who I am" (p=0.013) and "I get along with people in my house" (p<0.001). Over time, improvement in sense of home score was associated to improvement in psychological distress (p=0.05). Discussion Housing has been identified as a promising entry point for health-promoting interventions because of its central place in everyday life patterns over the life course. Our results suggest that, over and above the physical integrity of a house, the meaningful aspects attached to 'having a place called home' are important contributors to mental well-being among Inuit in Nunavut and Nunavik.

AIR-SEA-ICE INTERACTIONS DURING THE GREAT ARCTIC CYCLONE OF AUGUST 2012

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The great Arctic cyclone of August 2012 formed on 2 August over Siberia, moved into the Beaufort Sea thereafter, and decayed in the Canadian Arctic Archipelago on 14 August. Its minimal central pressure was 966hPa, and it made substantial contributions to the record minimum of sea ice extent in September 2012. During this event air-sea-ice interactions were strong. To understand these interactions during the storm, we conducted two experiments using NEMO 3.6 ocean model and WRF 3.6 atmospheric model, with and without two-way atmosphere-ocean coupling. The coupling is done through OASIS-MCT3. The horizontal resolutions are ¼ degree for NEMO and 25 km for WRF. Compared to re-analyses data, our coupled system has a reasonable simulation of sea ice and the Arctic storm intensity and propagation characteristics. We first compare the two simulations to understand the role of the significant loss of sea ice in the Western Arctic Ocean on the intensity and storm track of the Great Arctic cyclone. Thereafter, we investigate the thermodynamic and dynamic impacts of this strong cyclone on the melting of sea ice from the perspective of anomalous cloudiness, ocean surface heat budget and winds. Finally, we diagnosed the melting processes in terms of the surface, bottom and lateral melting caused by the cyclone. Thus, in this study, we focus on the roles of air-sea interactions on the life cycle of the cyclone as well as on the record minimum of September sea ice extent.

CONNECTIONS OF SPRING ATMOSPHERIC PACIFIC-ARCTIC MODE WITH SUMMER BEAUFORT ICE

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We identify a spring atmospheric Pacific-Arctic mode (PAM) and investigate its connections to summer Beaufort Sea ice. PAM is the second EOF mode of seasonal sea level pressure poleward of 20N with a variance of 12%. A positive PAM has a negative anomaly in the subpolar Pacific and positive anomalies in the Beaufort- Chukchi region of the Arctic and the midlatitude Pacific, exhibiting an intensified Aleutian Low and North Pacific High, and a northward displaced Beaufort Sea High. PAM is associated with the distribution of cyclone activity and tracks and warm (polar) air advection due to modulation of the tropospheric circulation anomalies associated with the East Asian trough and the Pacific side of the polar vortex. PAM accounts for 16% of the internal variability of the following September Beaufort sea ice coverage. A positive PAD leads to increased open water days in the Beaufort Sea during spring and summer. During positive PAM, strong easterly winds in the Beaufort Sea enhance ice advection and reduce ice thickness, due to the associated intensified and northward extended Aleutian Low. Moreover, the increased solar radiation further accelerates ice melt, due to reduced cloud cover and water content associated with fewer cyclones in the Beaufort Seas. Thinner ice and increased open water foster a stronger summer ice-albedo feedback resulting in accelerated early-summer ice melt. PAM is a potential predictor for Beaufort Sea ice melting.

MAKING SCIENCE OUTCOMES ACCESSIBLE IN YUKON: A REVIEW OF CLIMATE CHANGE RESEARCH TRENDS

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The Yukon is one of the fastest warming regions on the planet, with climate change visibly impacting seasonal patterns, glacial melt, permafrost stability, traditional activities, and many other physical and social systems. Diverse research initiatives related to climate change in the region have been led by academic, government, and other researchers with results published in various formats and venues. While some results are widely shared, the majority of the research and associated datasets are not publicly available, with access limited to peer-reviewed journals. Climate change research is not coordinated, nor are there clear communication channels ensuring the climate change science happening in the region is disseminated to scientists, First Nations, policy-makers, and other Yukon stakeholders. Since 2013, the Northern Climate ExChange has been producing an annual Compendium of Yukon Climate Change Science, the first volume covering the 2003-2013 period. Collecting all climate change knowledge in Yukon in a single, easily accessible place, the reports compile brief descriptions of available research related to climate change including abstracts, keywords, and a section on local relevance. There is now fifteen years (2003-2018) of data available on climate change science in Yukon including scientific journal articles, government publications, and other publicly available research products, mainly focused on western scientific knowledge production, but also integrating traditional and local knowledge surveys. This study provides a systematic review of climate change science in Yukon over a fifteen-year period, offering an opportunity to better understand the breadth and focus of climate change science in Yukon. It highlights geographic and thematic trends in the work that has been done and identifies gaps for future scientific initiatives. The provided information can help Yukon and First Nation governments and organizations source the information they need and identify where to emphasize future research efforts. This work helps to bridge the governmental and academic research communities by bringing together knowledge from both peer-reviewed and grey literature and making them accessible to a wider audience.

BUILDING KNOWLEDGE AND CAPACITY IN THE NORTH: IS RESEARCH ADDRESSING NORTHERN PRIORITIES?

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Recent studies demonstrate poor alignment of science priorities, funding patterns, and recognized societal needs in the Arctic, suggesting that Arctic research is not meeting regional priorities. In Canada, northern governments, Indigenous organizations, and non-governmental organizations are articulating their research priorities and needs as they outline a path forward for a northern knowledge economy. With the release of the National Inuit Strategy on Research (ITK, 2018) and the Pan-Northern Approach to Science (GY, GNWT, GN, 2016) the discussion has grown beyond local and regional conversations into a national discourse about the Canadian North. A parallel pan-Arctic discussion is also happening through venues like the Arctic Council, the Arctic Observing Summit and the Arctic Science Ministerial meetings. Discussion of a new northern research paradigm, or a focus on collaborative, engaged research in the North, has been happening extensively over the past twenty years. This shift in how research is done has been influenced by both global and local shifts in Indigenous governance and leadership, rapid environmental change, and calls for research that is policy-relevant. However, in the quest for research that informs policy, we also need to address the policies that support research and science. Although currently in the early stages, our study aims to answer the question “is research meeting the community and organizational needs of northern regions?” In this presentation we will explore the policies that support scientific activity across northern Canada, along with northern discourses of research priorities and practices. We will discuss preliminary results of a case study of geographic and thematic research trends which will provide insight into the types of research that are supported in the North. GY, GNWT, GN, 2016. A pan-northern approach to science. 41p. http://www.anorthernvision.ca/documents/A16_Brochure_PanNorthernApproachtoScience_71402_English_WEB-Final.pdf ITK, 2018. National Inuit strategy on research. Ottawa, ON, 44p. https://itk.ca/national-strategy-on-research/

WINTERTIME DIEL VERTICAL MIGRATION UNDER SEA ICE IN HUDSON BAY

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A mooring equipped with two acoustic Doppler current profilers (ADCP) and a sediment trap was deployed in September 2016 in Hudson Bay at 59° 58.156’ N 91° 57.144’ W (~190 km north-east from the port of Churchill). The backscatter intensity and vertical velocity time series from the mooring ADCPs showed a pattern typical for the zooplankton diel vertical migration (DVM) under sea ice during winter. To correct for beam geometry, we derived volume backscatter strength from echo intensity. Actograms were built for the volume backscatter strength, vertical velocity and modelled lunar light. An upward looking ADCP was capable to record the ice thickness and periods of open water above the mooring. The sediment trap captured different types of zooplankton that allow identifying the scatters involved in DVM. From the acquired data we observed the interaction of vertical migration with lunar light, tides, water and sea ice dynamics. The presented data constitutes a first-ever observed presence of DVM in Hudson Bay during winter.

TRACKING THE MOVEMENT OF COASTAL FISHES ALONG THE DIAMOND-JENNESS PENINSULA, VICTORIA ISLAND

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Climate driven change in Arctic ecosystems includes the on-going northern range expansion of sub-Arctic and Boreal species of fish and the contraction of the distribution of common Arctic fishes. Recent observations indicate fish and Beluga whale behaviours are changing in the Western Arctic highlighting a need to better understand and monitor impacts. The unusual distribution of Beluga whale in the Western Arctic in 2014 is thought to be associated with a unique prey switch, yet information is lacking on the movement ecology of coastal fishes. Through community consultation meetings in Ulukhaktok, a plan was developed to track the movement ecology of coastal fishes using fixed telemetry stations. During summer 2018 we worked closely with the community to deploy 50 coastal moorings along the Diamond-Jenness Peninsula with telemetry receivers and habitat loggers (temp, salinity, current velocity, noise) programmed to passively record 24/7. Satellite tags (Wildlife miniPAT; 5) and internal telemetry tags (VEMCO; 102) were deployed on Arctic char (Salvelinus alpinus) and Greenland cod (Gadus ogac) to track the ranging behaviour and fine-scale habitat use of these subsistence and marine mammal prey fishes throughout the year. Multiple condition indices, including a novel method for determining lipid content of live fish (CQR meter), were matched with Traditional Local Knowledge to examine factors driving the selectivity of fishes for subsistence harvest. Habitat and bathymetry were mapped from FishFinder transects and food web sampling of fishes and invertebrates add to the suite of ecological data obtained to examine the drivers of focal fish movements. Here we present a project overview and initial findings on the Ulukhaktok ecosystem project.

THE MAKING OF BASELINES OF EPIBENTHIC COMMUNITIES IN THE HUDSON BAY COMPLEX

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Most benthic organisms living at the surface of sediment are either sessile or have low mobility and, therefore, could be highly susceptible to environmental changes. The Hudson Bay Complex is subject to salinity variation due to anomalies in ice melt and freshwater discharges from several rivers. According to the RCP 8.5 emission scenario, freshwater discharge along the coastlines will show notable increase in the southeastern portion of the Nelson basin. Salinity gradients control species richness and thus could have consequences on the structure of ecological communities (i.e specific richness

or species distribution). Based on recent biomass data of epibenthic organisms, the Hudson Bay complex harbors four distinct benthic communities. The most diverse group is found along the south coasts at a mean depth of 73m. This community is mostly composed of the mobile predators Hyas coarctatus and Crossaster papposus and sessile filter-feeders Porifera and Actineria. These organisms make up a large part of the total biomass of the group. The lowest diverse group is found along the eastern coasts and in Hudson Strait at a mean depth of 96m. The biomass of this community is dominated by the mobile deposit-feeder Ophiocten sericeum and the predator Hyas coarctatus. The coast of Hudson Strait, a rocky bottom area, shows a community mostly composed of the surface deposit feeder Strongylocentrotus sp and predators Echinodermata Gorgonocephalus sp. and Heliometra glacialis. The center of the bay, with a muddy bottom, is dominated by the deposit feeders Echinodermata Ophiura sarsii, Ophiacantha bidentata. Now, based on the presence-absence of species or on the abundance of organisms, does the Hudson Bay Complex show any differences in communities in term of community structures.

UNDERSTANDING THE NETWORKED STRUCTURE OF ARCTIC SCIENTIFIC RESEARCH: THE EVOLUTION OF A CANADIAN NETWORK OF CENTRES OF EXCELLENCE

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Sustainable northern development requires policy approaches that are capable of linking diverse actors (often in new configurations) to form coordinated networks in order to effectively address complex challenges. In the context of northern science, such networked approaches have long been promoted by government and communities. ArcticNet, a Canadian Network of Centres of Excellence offers an instrumental case study of this approach. Since its inception in 2003, ArcticNet has sought to draw together geographically disperse teams of researchers and partner organizations to study the impacts of climate change in the coastal Canadian Arctic and to inform the development of adaptation strategies and national policies. This presentation reports on the structural and relational evolution of actors in the ArcticNet network between 2003 and 2017. Network data were generated using social network analysis techniques to analyze publication records, project summaries and program reports, in combination with qualitative interviews with key network members. We identify the network attributes and properties of ArcticNet through time and across boundaries (e.g. organizational, jurisdictional and geographic) to examine the configuration of scientific actors in a multi-actor research network. Findings illustrate how transdisciplinary northern science networks develop, operate and evolve across boundaries in the Canadian North, offering important insights for northern research and innovation policy. Ultimately, this research presents an opportunity to inform ongoing efforts to enhance sustainable development in the Circumpolar Arctic through networked approaches.

IMPACT OF THAWING PERMAFROST IN SUBARCTIC REGION ON THE HG CYCLING IN THERMOKARST POND

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Recent findings suggested that a globally significant amount of mercury (Hg) may be content in permafrost, and was estimated about 800 Gg of Hg in Northern Hemisphere permafrost (Shuster et al., 2018). Thawing permafrost has the potential to release a large proportion of previously stored carbon and Hg that could alter the Hg cycling in permafrost zone and Arctic region, and potentially enhance the production of higher toxic species such as methylmercury (MeHg). The aim of this study is to evaluate the carbon and Hg levels in thermokarst ponds year round, and to compare the biogeochemical processes involved between the cold and warm seasons, as well as to compare two sites in the eastern Canadian subarctic region between sporadic permafrost (thermokarst ponds formed by the collapsed of peat mounds / palsas) and discontinuous permafrost (circular or crest thermokarst ponds formed by the collapse of frozen silt-clay mounds / lithalsas), in order to evaluate and to assess the potential transport towards the aquatic system. Concentrations of Hg and MeHg, as well as biogeochemical processes varied between sites and seasons, showing a strong link with oxygen level, organic matter and the geomorphology of the surrounding landscape. Quite higher concentrations of Hg and MeHg were observed in thaw lakes and exported downstream, which may potentially increase transfer to biota, cause a potential risk to native communities, and impact public health. Quantifying the Hg originating from perennial frozen soil and thawing permafrost in Arctic region in a changing climate is crucial of interest for the scientific community and policy makers to assess the fate of Hg and associated risk in northern regions.

HUMAN DISTURBANCE EFFECTS AND THEIR RELATIVE IMPORTANCE COMPARED TO NATURAL FACTORS IN EXPLAINING MIGRATORY CARIBOU SURVIVAL

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Predation, food limitation and climate are known to contribute to caribou (Rangifer tarandus) population declines. Recently, human disturbances have also been suggested to contribute to population declines, but their effects on survival remain to be investigated. Here, we assessed the effects of human disturbances and their relative importance in explaining individual variation in survival in two herds of migratory caribou, the Rivière-aux-Feuilles (RFH) and Rivière-George (RGH) herds, in northern Quebec and Labrador. We first identified individuals who died and those who survived through winter, calving and summer. We then assessed human disturbances effects on survival during these seasons by comparing proximity to industrial and non-industrial disturbances for dead and alive individuals. We finally assessed the relative importance of disturbances and other limiting factors in explaining caribou survival, by comparing habitat suitability, predation risk and climate conditions encountered by dead and alive individuals. For the RFH, proximity to disturbances decreased survival during winter, and proximity to industrial disturbance was the factor most related to the probability of dying during this season. During summer, additive effects of habitat suitability and temperature explained most of the variation in survival while human disturbances had no effect. Contrary to expectation, survival decreased when caribou used higher suitability habitat during summer. Using warmer areas also decreased survival. For the RGH, human disturbances did not impact caribou survival during winter, and no factor tested was particularly limiting during that season. During calving, caribou survival decreased when using areas near disturbances. Our results suggest that habitat suitability and proximity to villages or roads interact to explain most of the variation in survival during calving for this herd. During summer, caribou of the RGH survived better when using areas closer to industrial disturbances, and this appeared to be the most important factor for explaining variation in summer survival. Overall, our results indicate that habitat suitability and climate impacted caribou survival, but proximity to human disturbances may also represent an additional threat to caribou. We demonstrate that human disturbances have negative impacts on caribou survival, but whether this could translate into population decline remains to be investigated.

MOBILE LABORATORIES: BRINGING DIAGNOSTIC CAPACITY TO REMOTE NORTHERN COMMUNITIES TO IMPROVE TUBERCULOSIS DETECTION AND CONTROL

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Background Tuberculosis (TB) continues to be a significant health burden in northern and remote parts of Canada, exacting a disproportionate burden on First Nations, Métis and Inuit communities. In 2016, the general, non-foreign born Canadian population experienced an incidence rate of 0.6 cases per 100,000 per year. By comparison, the Métis population experienced 2.1 per 100,000 and First Nations rates were 14.5 per 100,000 (off-reserve) and 34.1 per 100,000 (on-reserve). Inuit populations experienced the highest rate at 170.1 per 100,000, similar that of high burden countries. A key challenges to TB elimination in the north remains limited access to diagnostics. Due to multiple issues, time from sample collection to detection can exceed one month, during which time an infected individual could transmit to others. As part of a community-wide screening effort in northern Canada, the National Microbiology Laboratory (NML) was able to bring diagnostics into the community to help reduce time-to-treatment. Methods The NML mobilised equipment along with several teams of two laboratorians into the community at the request of the community and the Government of Nunavut. The equipment, including a biocontainment tent, was set up within a closed off area in the mobile screening clinic. This was essential to safely process potentially infectious sputum samples. Sputa were directly tested using the Cepheid GeneXpert platform using MTB/RIF cartridges. All samples continued to be referred to the territorial laboratory system in agreement with Canadian TB recommendations (gold standard of 3 sputum for smear and culture). A project to perform Interferon Gamma Release Assay (IGRA) testing in-community was also piloted. Results Approximately 416 sputa were submitted for Xpert testing from 380 patients. Of these patients, six were laboratory confirmed cases: two being smear and culture positive, and four being smear negative but culture positive. Both smear positive cases were found positive by Xpert. Time to detection by smear vs Xpert depends on which sputum was received within the mobile laboratory; In one case, 1 of the 3 sputum collected was found positive by smear and culture, however, this particular sample was not received at the mobile lab. Of the smear negative cases, the majority of samples were also negative by culture, suggesting early-stage paucibacillary infections in an early stage. In addition, the IGRA testing platform was found to be operational in-community, however specimen numbers were too low to perform a meaningful assessment during this deployment. Conclusion Mobile laboratory platforms offering molecular testing provide an opportunity to enhance a mobile mass screening TB clinic by enabling rapid time to detection. The biosafety considerations of sputum handling were resolved using appropriate expertise and equipment. Culture is still needed in order to detect all infections within the population, but all smear-positive individuals were detected using this approach. These individuals are thought to be most infectious and rapid institution of treatment can reduce further transmission events. IGRA testing in community is a promising manner of reducing the number of visits needed for a mass screening clinic for LTBI detection but this will require further development.

ARCTIC INDIGENOUS WELLNESS FOUNDATION; URBAN ON THE LAND HEALING CAMP

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The Arctic Indigenous Wellness Foundation (a registered charity) Project is an urban land-based healing program targeting indigenous men and youth at risk of suicide and/or incarceration on the streets. Combining indigenous cultural education with traditional therapeutic interventions in a wilderness urban setting, our program will continue to improve the mental health of indigenous males who are most often left out of conventional support services by targeting factors that promote mental health and protect against suicide risk, including cultural identity, self-esteem, agency, ability to cope with stress, social support, positive role models, and a sense of community belonging. The Arctic Indigenous Wellness Foundation (AIWF) strives to ensure full access to our urban on-the-land cultural site for teaching, mentorship, and support with traditional ceremonies, traditional food preparation, language revitalization, traditional tool making, on-the-land teachings, medicine teachings, sweat lodges, traditional counselling, and cultural gatherings. Our primary objectives are to improve the mental health of at-risk Inuit, First Nation, and Métis peoples with collaborative, culture-specific, community-supported programs and to share program knowledge across the North. The AIWF's land-based urban healing site includes a traditional teepee and canvas tents with stoves in close proximity to the downtown homeless population and the local jail and hospital. The urban land site hosts traditional counsellors, healers, and cultural experts who provide one-on-one and group support services for at-risk men and boys. One-on-one support includes utilizing traditional indigenous male counsellors and indigenous traditional healers as per client request using culture as the lens for supportive care. Group support services also focuses on cultural identity and skill building for indigenous men and boys. Although the project site is located within the capital city of Yellowknife, the beneficiaries of the project are men and boys from across the NWT who end up on the streets. Specific programming on the urban land-based site also includes traditional-skills teachings, such as traditional harvesting and craft and tool making, ensuring an added economic benefit to at-risk men and boys who have a high rate of unemployment. This allows the men and boys to take advantage of learning new skills to enhance their ability to engage with, for example, local tourist markets in addition to building a sense of comradery among the men and boys while providing opportunities for engagement with culturally specific mental-wellness supports. The project has its focus on at risk men; however, we support any person who experience homelessness, addicttions, trauma and would like support on their healing journey.
I will be presenting PowerPoint slides and talking of our programs.

EVALUATING CONTAMINANTS LEARNING: THE EXPERIENCE OF THE NUNAVUT ARCTIC COLLEGE ENVIRONMENTAL TECHNOLOGY PROGRAM'S WILDLIFE, CONTAMINANTS AND HEALTH WORKSHOP

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Students in Nunavut Arctic College's (NAC) Environmental Technology Program (ETP), are being trained to help identify, understand, and address many environmental challenges confronting the North. They are often tasked with being critical knowledge translators, working between communities of scientists, resource users, industry and government. It is therefore critical that they have the appropriate skills and tools to engage with these issues, and to understand and communicate about them with a variety of northern audiences. To date, online courses, workshops, in-class presentations and on the land science camps have been conducted in Arctic communities to build local capacity to understand and take action on critical environmental issues such as the presence of environmental contaminants in the Arctic food chain. However, few of these training efforts have been documented and shared for others to learn from and even fewer have been evaluated to assess their impact on participant or student learning. For the past 12 years, a group of educators, scientists, hunters, community representatives and decision makers have come together to deliver the environmental contaminants training workshop to students of the ETP program at NAC in Iqaluit, NU. This one week workshop combines lectures, interactive labs, and group discussions to introduce and teach ETP students about contaminant sources and pathways, wildlife tissue sampling, contaminants monitoring programs and communicating about contaminants research to a variety of audiences. Bringing together science and Inuit Qaujimajatuqangit, the training modules draw upon scientists to introduce students to the lab environment and local experts to teach students traditional knowledge and skills pertaining to these topics. Through interactive sessions with researchers, hunters, community members and decision makers, students learn a variety of techniques to assess, manage and communicate about the potential risks posed by environmental contaminants in country foods. This presentation will be co-presented by an instructor and a student of the program.

INTERACTIONS BETWEEN PARASITES AND CONTAMINANTS IN NORTHERN EIDER DUCKS

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Arcticwildlife can be exposed to high mercury (Hg) levels, and are also naturally exposed to gastrointestinal parasites that can reduce condition and negatively affect reproductive output and/or survival in similarways. Importantly, both contaminants and parasites are increasing in wildlife in some Arctic regions. We studied the northern common eider duck (Somateria mollissima) to explore how Hg and lead (Pb) in association with both natural levels and experimentally reduced parasitic infections, affect reproduction and survival. Female eiders were measured, banded, and blood sampled to determine blood Hg burdens, prior to breeding. Propensity to nest, clutch size, nest survival, nest attendance, and return rates were assessed in relation to both Hg and Pb burden, and parasite treatment. Neither reproduction nor return rates of females varied with Hg concentrations, but females arriving late to the colony, or in low body condition, showed increased nesting propensity when given the anti-parasite treatment as compared to placebo treatment. Additionally, Pb and parasite showed an interaction in relation to survival rates the following year. Our results suggest that parasites can play a critical role in decisions to invest in avian breeding annually, particularly among individuals with a late onset to breeding, and in poor condition.

SEASONAL AND REGIONAL DIFFERENCES INFLUENCE THE GUT FAUNA OF NORTHERN COMMON EIDER DUCKS

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Environment and Climate Change Canada

Northern common eider ducks (Somateria mollissima) are widely distributed throughout the circum-Arctic region. Eider duck populations are known to be influenced by regional and local ice conditions and hunting pressures, but less is known about how regional wintering areas can influence gastro-intestinal fauna such as helminth parasites. To examine how eiders that use different migration strategies and different overwintering areas we examined the gastro-intestinal fauna in northern common eiders that all breed in Arctic Canada, but overwinter in three distinct regions; Hudson Bay, Newfoundland and Greenland. The eiders that overwintered in the Arctic had lower prevalence, abundance, and diversity of helminth parasites. We also detected parasite specific differences in the birds wintering in Greenland and Newfoundland, which suggests that the two wintering areas my lead to differential exposure of parasites to eider ducks. There is a need to understand current levels to understand how this might change for Arctic species given that climate change is predicted to change parasite burdens, and understanding current levels of 'healthy' populations is critical to understanding how any future changes may or may not affect individual and population level health.

SHARING LANGUAGE AND LEARNING: THE YUP'IK ENVIRONMENTAL KNOWLEDGE PROJECT AS A TEACHING RESOURCE IN ALASKA

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For the past ten years, Calista Education and Culture, a non-profit organization representing the 1,300 Yup'ik tradition bearers of the Yukon-Kuskokwim delta in southwest Alaska, has worked with elders from across the region to document Yup'ik place names. Because the elders wanted to make the place names broadly accessible, CEC collaborated with ELOKA (Exchange for Local Observations and Knowledge of the Arctic), to develop an online atlas, which currently holds almost 4,000 place names along with many associated digital audio recordings demonstrating proper pronunciation. More recently, the collaboration expanded to include teachers and students from the Lower Kuskokwim School District in Alaska. They are working to adapt the atlas as a teaching resource to support delivery of a newly developed curriculum focused on Yup'ik values, language and culture. Students are invited to contribute photos, video, audio, and text around three themes: families and communities; animals and plants; and "Our Yup'ik World and Weather". In this presentation, we share what we have learned about utilizing a web-based place names atlas in a formal educational environment as a tool for language learning and environmental knowledge documentation and dissemination.

'FEEDING OUR FAMILIES; THAT'S WHAT WE HAVE BEEN DOING FOR CENTURIES': INUIT WOMEN'S SHARING PRACTICES AND STRATEGIES

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Inuit families in the Canadian North use a mixed food system, combining country and store-bought foods. However, the Inuit food system is more complex than the combination of market and country food; it encompasses a whole set of socio-cultural relations. Using a socio-cultural and gender perspective, this presentation explores contemporary food-sharing practices focusing on access to market foods, the flow and the specific ways they are shared in the Baffin region, Nunavut. While results show that store foods are shared with extended family members and within the community, the sharing of market foods is not regulated through similar mechanisms as country foods and is not fully integrated in Inuit traditional resource sharing system (ningiqtuq). Also, women are shown to play a key role in accessing, transforming, and sharing southern foods. Through their wages, women are reproducing the normative sharing behaviour that underpins subsistence as a social economy, albeit through a novel medium. The presentation further suggests that modern Inuit food practice is articulated around a new gender dynamic that challenges traditional social configuration.

YOUTH BECOMING KEEN OBSERVERS OF THE LAND AND MESSAGE CARRIERS FOR THEIR COMMUNITIES – HOW, WHEN, AND WHERE?

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Knowing the land, the environment and stories tied to it are ways of life for Inuit, deeply grounded in and emergent from a holistic vision of the world. Naturally, stewardship of the land, water and ice are integral to ways of knowing and being Inuit. Inuit feel "physically, spiritually and culturally a part of 'nuna'" (Williamson, 1992, p. 133). The land, water, ice and well-being are interrelated within a holistic perspective and hence, "to occupy a place required that we be active in fellowship and stewardship with place" (Kalluak, 2017, p. 57). Today, stewardship of the land, water and ice are often discussed in the context of climate change and its multiple impats on northern communities. It has brought to the foreground the importance of training youth to be keenly observing their environment. It has put into perspective why monitoring and stewardship are that important, especially from an IQ perspective. Guided by insights gathered from the Young Hunters Program and the Environmental Monitoring Program in Arviat, Nunavut, we will address the two programs' contribution to the training of youth. We will also situate these programs within the larger landscape of community-based monitoring programs which have taken multiple forms across the Arctic in terms of their implementation (Johnson et al., 2016), and address what makes such Inuit governed programs like the two in Arviat particularly unique and important. We will show through the two programs what it means for youth to become strong message carriers to their communities and address the kinds of opportunities they need to then develop what it takes to enact such a role. We also discuss the challenges and possibilities the two programs made evident over time, in particular, in terms of ensuring that rich teachings make it into educational practices in ways that give true justice to the underlying holistic worldview. To do so, we rely on an analysis of twenty-four interviews of youth and adult participants in the two programs, collected over the past four years. Two members who have been involved in running the two programs in different capacities in the past, Shirley Tagalik and Megan Gavin, will also address issues tied to the practice of stewardship and speak to the evolution of the two programs over time, and the manner participation supported youths' educational pathways in ways to become key message carriers for their communities. We will conclude with some reflections about ways to make such opportunities more widely available to youth within their communities in Inuit Nunangat.

UNDERSTANDING FOOD, ENERGY AND WATER SYSTEMS ON SUBSISTENCE ACTIVITIES TO IMPROVE COUNTRY FOOD SECURITY IN NORTHERN INDIGENOUS COMMUNITIES: A NEW PARADIGM?

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Food, energy and water security is a significant challenge for Indigenous peoples in the Yukon. They depend on their land for survival; however, they are faced with a range of stressors that adversely affect the integrity of food, energy and water systems. Indigenous communities in the North are increasingly relying on store-bought foods to complement existing country/traditional food. Country food remains critically important to the Indigenous people, especially when faced with limited access and extremely expensive store-bought food. On the other hand, the methods of obtaining country food have been compromised due to the cumulative effects of climate change, extreme weather events, environmental dispossession, wildlife population and distribution, hydrology, and high cost of fuel, amongst other social-economic factors. A lot of attention is focused at the global and national levels of understanding food, energy and water systems approach but very little attention is given to the local and community level. Understanding food, energy and water systems can be seen as "a systems-based perspective that explicitly recognizes water, energy, and food systems as both interconnected and interdependent". However, many studies focused on food, energy and water systems and security independently, and little attention has been focused on connecting food, energy and water, as these systems are inextricably linked in subsistence activities. Thus, there is a need for a new paradigm to understand and assess country food security in Indigenous communities in the North. This presentation will discuss the framework of food, energy and water systems on subsistence activities to better understand country food security in the North. The interaction of food, energy and water is crucial as these system components have impacts among each other. Climate change, environmental degradation and social and economic changes can put a strain on these systems. In addition, population increase will exert more pressure on all three types of security; hence, the supply per person of land and resources produce food, energy and water is shrinking. The interaction of food, energy and water systems is rapidly expanding in the literature and policy settings to better understand complex interactions among multiple resource systems. This approach aims to maximize synergies and minimize trade-offs, thereby improving the efficiency of resource-use, and internalizing social and environmental impacts. The outcome of this approach is to improve food, energy and water security in the North.

THE ECOLOGY AND EVOLUTION OF METHYLOTROPHIC BACTERIA IN THE ARCTIC OCEAN

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With climate change greatly affecting the Arctic Ocean, it is important to assess genetic diversity and increased adaptability of microbial species to decreased salinity and low nitrate concentrations in the surface waters. Investigating the changes in bacterial community composition in association to various changes in environmental factors will allow us to determine how changes in the Arctic Ocean are directly affecting the microbes living there. Previous work has shown that genetically distinct geographic populations (ecotypes) of methylotrophic Beta-proteobacteria were found to be adapted to specific temperature and salinity, making methylotrophs an ideal indicator species to monitor species responses in the Arctic Ocean where salinity and temperature in the surface waters are changing at an extremely fast rate. In this study, metagenomic analysis of the Western Arctic Ocean revealed a distinct subclade specific to the surface waters and closely related to benthic freshwater methylotrophs. This novel clade of methylotrophs exhibits bipolar and estuarine distribution, providing evidence for a freshwater-marine transition zone species capable of adapting to increasing temperatures and decreasing salinity concentrations. Quantitative PCR approaches using a functional gene marker to determine abundance and mRNA expression levels showed that this novel clade was not only found in the surface waters but is transcriptionally active. The discovery of a polar estuarine ecotype will allow us to decipher patterns of adaptation and evolution to rapidly changing environmental conditions. And, further investigation of genomes from this clade will reveal specific metabolic traits and activities associated with shifting temperature and salinity in the Arctic Ocean.

LIGHT, MIXING AND THE PHYTOPLANKTON SPRING BLOOM AT THE RETREATING ICE EDGE AND INTO THE PACK ICE

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During summer, phytoplankton can bloom in the Arctic Ocean, providing the base of the pelagic food web. This happens both in open water and under ice, but is strongly linked to the retreating ice edge. There, the surface ocean responds to steep lateral gradients in ice melt, mixing, and light input. In 2016, we sampled a high-resolution grid of 135 hydrographic stations in Baffin Bay as part of the Green Edge project to study the ice edge bloom, including hydrographic and biogeochemical data, vertical mixing, under-ice light, nutrient levels, and the phytoplankton biomass. Here, we discuss horizontal and vertical length scales of the resulting upper ocean dynamics in a space-for-time model and link them to the phytoplankton bloom trailing the retreating ice edge. In a radius of 60 km (or 15 days) around the ice edge, the upper ocean was especially strongly affected by a freshened surface layer. Light climate as evidenced by deep isolumes, and vertical mixing as quantified by mixing layer depths, were permitting significant net phytoplankton growth more than 100~km into the pack ice at ice concentrations close to 100%. In fact, neither light nor vertical turbulent mixing seem to have constrained net growth during most of the sampled stations. Depth-integrated total chlorophyll a (0--80 m) peaked at approximately 70 mg chl-a m^(-2) around 10 days after ice retreat, potentially a result of the temporal evolution of the bloom unconstrained by light levels but with somewhat uncertain impact by grazing. As Arctic sea ice becomes more transparent and the annual ice edge retreat has accelerated in recent decades, we can expect a spring bloom that is spread wider in space and time.

ARCHAEOLOGY AND ALTERNATIVE TOURISM IN NUNATSIAVUT

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The Nunatsiavut Government's Tourism Strategy seeks to stimulate the economy in each of the five Nunatsiavut communities using cultural education and the celebration of Labrador Inuit culture and history as its platform. The strategy allowed each community to develop tourism goals specific to the local context. Two communities, Rigolet and Hopedale, identified archaeology as essential to their plans, anticipating both an increase in cruise-ship tourism, and short visits by tourists en route to or from the two national parks buffering Nunatsiavut. The Tradition &Transition Research Partnership between Memorial University and the Nunatsiavut Government has conducted archaeological research in both communities, in a manner consistent with the spirit of the Tourism Strategy. Academic researchers support locally determined tourism priorities, while helping Nunatsiavut communities to develop capacity to meet their goals, and assisting with the transfer of cultural knowledge between elders and youth. The archaeological research is therefore discussed as a microcosm of the Nunatsiavut Tourism Strategy, emphasizing the compatibility of economic sustainability with Inuit self-determination, cultural continuity and reconciliation.

MEASUREMENTS OF THE POLARIZED BRDF OF ARCTIC MACROALGAE WITH APPLICATIONS TO MODELLING UNDERWATER LIDAR

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The Arctic has been warming steadily for the past few decades causing a reduction in ocean ice-coverage. Consequently, the increased exposure to light has already begun to affect coastal Arctic marine primary productivity, and a regime shift has been observed in some Arctic macroalgal communities where species normally found in cold-temperate waters are seen to occur and survive in Arctic marine ecosystems. There is an urgent need to establish baselines and monitor change in the abundance and diversity of the Arctic marine phytobenthos. Using the absorption, inelastic scattering (fluorescence), and elastic scattering properties of macroalgae excited by lasers, we are developing a LiDAR to carry out surveys of coastal Arctic benthic environments from an autonomous underwater vehicle (AUV). The LiDAR will map the morphology (3-D surface) of the substrate and macroalgal canopy, as well as detect and characterize the macroalgal biomass. Important parameters in designing such a LiDAR are the elastic and fluorescent reflectance properties of Arctic macroalgal targets. Here we present the results of laboratory measurements of the polarized bidirectional reflectance distribution function (BRDF) measurements for both elastic and inelastic scattering (fluorescence), with a particular emphasis on the near-exact backscattering configuration of our LiDAR. Models and in-situ measurements demonstrate two competing approaches for laser detection of macroalgae at a distance: the fluorescent return from laser excitation at 532 nm versus differential absorption from two elastic laser returns (e.g., 473 nm and 532 nm). Spectrofluorescence properties of Arctic macroalgae and the value of using polarization optics are also evaluated.

INFECTION OF EASTERN CANADIAN SEALS WITH THE ZOONOTIC PROTOZOAN PARASITES TOXOPLASMA, NEOSPORA, AND SARCOCYSTIS

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Seal meat and organs are very important parts of the diet of the Inuit in Canada and elsewhere. Seal meat is also available at retail in Canada's Maritime Provinces, and it is offered in restaurants in metropolitan areas such as Toronto and Montreal. The meat is high in long chain Omega-3 fatty acids, which are important for the prevention of heart attacks and infant brain development, and they lessen the symptoms of post-partum depression. However, when fresh seal meat is eaten raw or undercooked, parasitic zoonotic infections of the animals may pose a health risk to consumers. Toxoplasma gondii is the most prevalent parasite infecting humans and other warm-blooded animals worldwide, causing the disease toxoplasmosis. In most healthy adults, the infection is either asymptotic or will not cause serious illness. Most susceptible to the infection are fetuses and immunocompromised individuals who both face potentially debilitating and life threatening consequences. Neospora caninum is closely related to T. gondii. In contrast to T. gondii with felines as the definitive host, dogs are the definitive host for N. caninum. While the parasite mainly leads to neurological diseases in dogs and cattle, N. caninum was found in 18% of patients with neurological disorders. Sarcocystis primarily infects muscles and lymph nodes of the intermediate host. Humans can serve as definitive hosts for S. hominis and S. suihominis, which are acquired from eating undercooked beef and pork, respectively. Humans can also serve as intermediate host for other Sarcocystis spp., likely acquired by ingesting sporocysts from contaminated food or water and the environment. Infections in humans cause the disease sarcosporidiosis, which is generally asymptomatic. Four seal species are harvested for seal meat in Canada: ringed seals (Pusa hispida), harp seals (Pagophilus groenlandicus), hooded seals (Cystophora cristata), and grey seals (Halichoerus grypus). While ringed seals are most commonly consumed locally by Inuit communities, the latter three seal species are commercially hunted and sold to restaurants. Seals are harvested in a government regulated sustainable manner and, as they are wild animals, seals grow up without the addition of growth hormones or antibiotics. In this study, 124 tissue samples from 81 seals comprising the four above mentioned species were collected from eastern Canada, more specifically from the Nunavik Region of Quebec and from the Maritimes. Twenty three ringed seal, 8 hooded seal, 21 harp seal, and 29 grey seal samples were tested for the prevalence of Toxoplasma, Sarcocystis, and Neospora using nested PCR followed by Sanger DNA sequencing. Toxoplasma was detected in 26% of ringed seals, 50% of hooded seals, 43% of harp seals, and 31% of grey seals. Sarcocystis was found in 4% of ringed seals, 13% of hooded seals, 14% of harp seals, and 3% of grey seals. Neospora was only detected in ringed seals from Nunavik, with a prevalence of 26%. Our results show that zoonotic protozoan parasites are prevalent in eastern Canadian seals, and that consumption of raw or undercooked seal meat or organ tissues may pose a risk of infection to consumers.

TRACKING THE EXTENT AND MAGNITUDE OF THE 2018 SPRING FLOOD IN THE PEACE-ATHABASCA DELTA (CANADA) USING WATER ISOTOPE TRACERS

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Hydrologic monitoring in complex, dynamic northern floodplain landscapes is challenging, but increasingly important in the face of growing multiple stressors. The Peace-Athabasca Delta (PAD) in northern Alberta, Canada, is a Ramsar Wetland of International Importance reliant on episodic river ice-jam flood events to recharge abundant perched lakes and wetlands. Improved monitoring of landscape-scale connectivity among freshwater ecosystems (rivers, channels, wetlands, lakes) is needed to guide stewardship decisions in the face of climate change and upstream industrial development. Here, we use water isotope tracers, supplemented by measurements of conductivity and field observations, from 60 lakes and 9 river sites in May 2018 to delineate the extent of spring ice-jam flood events on the Peace and Athabasca rivers. Lake-specific estimates of input water isotope composition were modelled after accounting for post-flood evaporative isotopic enrichment. Then, using the distinct isotopic signature of input water sources, we develop a set of binary mixing models and estimate the proportion of input to flooded lakes attributable to river water and precipitation (snow, rain). This approach allowed us to map areas of flooding to perched basins along both the Peace and Athabasca rivers that were not captured by other methods, including direct observations from flyovers, and to demarcate flow pathways in the delta. We demonstrate the effectiveness of water isotope tracers as a sensitive monitoring tool capable of capturing important hydrologic events and elucidating connectivity in the PAD, an approach that can be readily adopted at other floodplain landscapes.

SLED DOGS AS SENTINELS FOR PEOPLE LIVING IN RURAL ALASKAN COMMUNITIES

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For thousands of years dogs have lived side by side with people in rural northern communities, eating the same food, and, exposed to the same extremes of the environment. Due to their relatively higher metabolic rate it is often easier to see metabolic shifts associated with diet, exercise, exposure to contaminants, and daylight extremes in dogs than it is in the humans with whom they share their lives. We will show data on the potential risks and benefits of fish-based subsistence diets in dogs living along the Yukon river in Alaska. We will also show data from dogs living in areas exposed to smoke from forest fires and show the adaptive benefits of exercise in this situation. Finally we will present our year long study of diurnal plasma melatonin concentrations in dogs living at high latitudes. The implications of these findings for humans inhabiting the same environment will be discussed in a One Health context.

ILAGIILLUTA – "LET'S BE A FAMILY" PROGRAM, NUNAVIK

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Most health inequities between Inuit and other Québec families are the result of the cumulative effects of social determinants of health such as poverty, overcrowded housing and structural obstacles to socioeconomic development. Improving the health of Inuit families, therefore, calls for a multi-faceted approach addressing all the social determinants of health allowing the target population to take an active role in identifying issues and solutions. Ilagiilluta's main objective is to promote inuit families resiliency by offering supportive services which type and intensity depends on the family needs. The program aims to reach all pregnant women, and families with young children. It is largely based on similar family support approach developed in Québec Under the Services intégrés en périnatalité et petite enfance (SIPPE), for which there exist a vast evidence base demonstrating the efficiency of such apporaches in fostering children development and health in Indigenous populations around the world. Ilagiilluta is currently being implemented in a few pilot communities in Nunvik and aims to adapt to the Inuit cultural values and ways of working. In Inukjuaq for instance, the team is composed of 3 non-Inuit health care staff, and 3 Inuit family support workers and works closely with the local traditional midwives in reaching out to young families through home visits, drop-ins, and family wellness activities, such as community soup kitchen, traditional crafts and education related to child development. The program also partners with the local men's association and Hunter's Support Program to promote father-child activities. Cultural safety of the services essentially rests on Inuit workers providing most services, and indeed, families have appeared much more open to home visits when an Inuk staff member is present. Communications occurring in Inuktitut in a non-clinical environment have made assessment of the family needs more efficient, as well as programming more accessible to parents and children. It is hoped that such a culturally safe approach will contribute to reducing Nunavik referral rates to youthprotection services. Cultural safety of services often depends on the role given to local paraprofessionals, who, with adequate support and training can greatly increase the accessibility and quality of services provided to families.

THE EFFECT OF SCALE ON THE RELATIVE IMPORTANCE OF CLIMATIC AND BIOTIC VARIABLES INFLUENCING METHANE FLUXES FROM AN ARCTIC WET SEDGE MEADOW

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Arctic wetlands are important sources of methane, a potent greenhouse gas. As the climate changes rapidly in the north, a better understanding of the factors that influence methane emissions from these ecosystems is needed. Methane fluxes (FCH4) from an Arctic wet sedge meadow at Daring Lake, NT, Canada were examined during the growing seasons of 2008-2017 over several temporal and spatial scales. The largest methane emissions (seasonal averages of 118 - 277 mg CH4 m-2 d-1) were recorded at the plot scale mid-summer using manual chamber methods and were associated with wetter locations with more sedges. Plot-scale FCH4 were negligible where shrubby peat soils were raised above the water table. Ecosystem-scale FCH4 measured on a quasi-continuous basis employing an eddy covariance technique were roughly 50% of plot-scale FCH4. Moisture, temperature and vegetation-related variables explained up to 80% of temporal FCH4 variability ($p<0.001$), where variables were more or less important given their range and rate of change. Plot classifications, or 'microforms', and their characteristic differences in CH4 productivity, transport and consumption, drove significant FCH4 variability over space. The emergence of microform as an important variable suggests that these plot classifications can characterize more FCH4 variability than multiple environmental variables combined. Both magnitudes of FCH4 and relationships with driving variables were not consistent between scales and measurement techniques, demonstrating both the importance of scale in deducing all processes influencing FCH4 variability and the difficulties in upscaling FCH4 at this heterogeneous wetland.

HOUSING AND COMMUNITY PLANNING IN NUNAVIK: SOCIAL, ENVIRONMENT, AND DESIGN PERSPECTIVES.

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In their current form, Inuit communities are recent interjections on the Arctic landscape. These emerged out of colonial arrangements that saw the transformation of traditional subsistence and mixed trading economies of highly mobile Inuit family groups into more sedentary wage and transfer dependent lifestyles in fixed dwellings in contemporary towns. In most regions of Inuit Nunangat—the Inuit occupied regions of northern Canada—this shift has occurred in living memory beginning with the end of the Second World War and accelerating in the 1960s and 70s. The current housing market in Nunavik is largely subsidized, with over 90% in Nunavik living in social housing. The young and rapidly growing population is creating pressures for the construction of new housing. The annual residential construction, limited by the short construction season and the high cost of materials, does not keep up with the demand for housing. Community land use planning and housing construction are further under constraints by terrain morphology, permafrost and climate change. Design solutions more in line with cultural preferences are being explored. Building on recent scientific evidence from research projects conducted across Nunavik, this chapter explores these topics. In the first section, we provide a historical overview and policy context of housing construction and community planning in Nunavik. Section two describes the current housing conditions and housing needs across the region. Drawing from data from a recent study, it then explores the impacts of social housing construction on improving living conditions, health and well-being for Inuit who get to move to a new house. In section three, current issues of construction and land use planning in Nunavik communities are discussed, highlighting challenges posed by terrain morphology, permafrost and climate change, and presenting a novel permafrost mapping to support decision-making with regards to construction and land use planning in a changing climate. The fourth section of the chapter draws attention to a variety of design, construction and planning challenges as they relate to Inuit values and aspirations, housing expectations and needs, as well as sustainable development principles. The chapter concludes by discussing the implications of these issues for housing policies and regional development.

THE GREEN IGLU: THE SOCIAL, HEALTH AND ECONOMIC IMPACTS OF A GREENHOUSE IN NAUJAAT AND ARVIAT NUNAVUT.

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Food insecurity affects up to 68% of residents in Nunavut with women and children at highest risk while the Canadian average is 8% (Statistics Canada, 2016; Huet, Rosol, & Egeland, 2012). The study of food security provides insight into the political, economic and social context in which they exit (Knezevic, Hunter, Watt, Williams, & Anderson, 2013). However, there is very little research that focuses on Arctic Indigenous communities who historically depended on fishing, hunting, and gathering of traditional or country food as there main source of nutrition (M. Beaumier et al., 2015). The socioeconomic structures that have created serious health and economic failures in northern Canada begin with Colonialism and remain embedded in the social structure today (Grimwood, Doubleday, Ljubicic, Dondaldson, & Biangy, 2012). The Canadian government does not have a food security policy as of 2018. Recent studies suggest that at least one meal a day consisting solely of country foods is needed to be considered food secure in Canada's North (King, H, 2018). Research on food insecurity and the changes in the food systems are important to develop as baseline data to track the changes that occur (M. Beaumier et al., 2015) The blend of western food sources and traditional country food is the norm for most Inuit families with non-nutrient dense food the most affordable choices. Access to fresh healthy food is limited to the availability in retail stores and the ability to purchase high cost foods. There are many times when the store produce shelves are bare, and residents are reliant on highly processed foods to meet their needs. The introduction of a green house capable of growing throughout the year will increase access to fresh healthy alternatives at a lower cost. This paper examines the impact of greenhouses on Naujaat and Arviat Nunavut during 2018. It will explore the produce grown in Naujaat, the yield, and cost to produce the crops. A comparative analysis of food costs from local retailers and the farmers market will be used to assess the impact of the family economics. The paper will also examine the effect on the community with the key factors being the impact on the social structure of food sharing, an increase in health-conscious foods and influence on the ability to increase hunting and fishing due to a decrease in food costs.

THE POLITICS OF CONSENT : IA AND IBA IN THE CONTEXT OF CANADA NORTHERN LAND CLAIMS SETTLEMENT

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Indigenous peoples have gained considerable agency in shaping decisions regarding resource development on their traditional lands. This growing agency is reflected in the emergence of the right to free, prior and informed consent (FPIC) when Indigenous peoples and their traditional lands may be adversely affected by major resource development projects. While many governments remain ambivalent towards FPIC, corporate actors in the natural resource sectors are more proactive at engaging with Indigenous peoples in seeking their consent to resource extraction projects through negotiated Impact and Benefit Agreements. Focussing on the Canadian northern land claims context, this paper discusses the roots and implications of a proponent-driven model for seeking Indigenous consent to natural resource extraction on their traditional lands. Building on case studies, the paper argues negotiated consent through IBAs offers a truncated version of FPIC from the perspective of the communities involved. The deliberative ethic at the core of FPIC is often undermined in the negotiation process associated with proponent-led IBAs.

BIODIVERSITY AND ECOSYSTEM DYNAMIC

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The Nunavik and Nunatsiavut's recent history (deglaciation), their harsh climate as well as their relative geomorphological homogeneity contribute to their low plants and animals biodiversity. In spite of this low biodiversity, wildlife species and berry plants are of crucial importance for autochthonous populations. Indeed, they rely on them for their consumption but also for their well-being (Gagnon et al. 2018). Because of polar amplification, the magnitude of climate change is greatest in the Arctic (McBean et al. 2005). Moreover, these northern regions are strongly structured by snow, ice, and phenology of growing seasons (Berteaux et al. 2017). The ongoing and projected increase in annual temperature will therefore strongly influence northern ecosystems, in terms of ecosystem functioning, species composition and abundance. In this context, ecosystems and animal populations monitoring is necessary to detect ongoing changes (Christensen et al. 2013) and a good understanding of the different ecological mechanisms that govern the dynamics of ecosystems and populations is essential to interpret the variations observed (van der Putten et al. 2010, van Oudenhove et al. 2014). In addition, our ability to project these dynamics into the future is a major issue. Ecological scenarios are one of the most effective tools to help mitigate or adapt to climate change (Berteaux et al. 2014) In this chapter of the second edition of the Nunavik and Nunatsiavut IRIS, we present the most up-to-date status of important wildlife population and plant communities in the Nunavut/ Nunatsiavut region. This section is meant to provide new information on these subjects and will not resume information already given. We also present the results of an exhaustive modelling exercise that aims to build scenarios of future arctic tundra biodiversity facing climate change as well as a portrait of the national and federal protected areas.

HOW RESEARCHERS REPORT ON THE ROLE OF INDIGENOUS KNOWLEDGE IN WILDLIFE MANAGEMENT: THE "ROLE IN THEORY" VERSUS THE "ROLE IN PRACTICE"

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For many years it has been an expectation, and in some cases a written requirement, among Indigenous and state governments that Indigenous Knowledge (IK) play a role in wildlife management. However, little critical attention has been directed to the role of IK and the impact of its inclusion. To learn about the role IK has played in wildlife management scenarios, researchers and wildlife managers often turn to the peer-reviewed literature for this reporting and insight. Researchers may seek evidence for the "application" of IK that they can reference in their studies, and managers may look for lessons relevant to their own systems. Our study aimed to explore the roles that IK has played in theory and in practice, as reported in the published literature. We conducted a systematic literature review of key online bibliographical databases of peer-reviewed literature and identified 16 articles concerning the role of IK in wildlife management with case studies in northern North America where a formal wildlife management program exists. In their writing, authors provided the "role in theory" of IK based on theorizing, existing case studies, or their own perspectives. We identified 14 distinct categories of this theoretical role. Authors also reported the role that IK actually played in their case study (the "role in practice") which we categorized in 13 ways, all of which were matched with categories for "role in theory". Further, in the authors' descriptions of the role of IK in practice (e.g. IK was presented, incorporated, documented, and/or used) we found frequent use of the passive voice and lack of precision. We draw three conclusions. Firstly, most researchers' writing appears to lack the specificity needed to advise managers on the role of IK in wildlife management. Secondly, the inconsistency between how authors describe the role in theory and the role in practice of IK suggests a discrepancy between its hypothesized and realized roles. Thirdly, authors' use of the passive voice when reporting their case studies suggests that power is held by unnamed actors rather than IK or IK-holders, which contradicts many authors' language choices which suggest that, ideally, IK shares power in management. We argue that IK "playing a role" in management is currently a vaguely-described ideal yet an expectation. By categorizing IK's various roles and comparing researchers' case study reporting with their own descriptions of the role in theory, our study highlights the disparities between the presentations of IK and its actual role in wildlife management.

PARTNERSHIP WITH VUNTUT GWITCHIN FIRST NATION FOR THE OLD CROW SOLAR PROJECT

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The Vuntut Gwitchin First Nation is pursuing a large-scale solar project that would position them as the largest solar independent power producer in the arctic, in addition to being fully indigenous owned and operated. However, the local utility (ATCO Electric Yukon) is concerned about stability issues with the Old Crow electrical network when integrating a high amount of renewable generation, and they have been conservative with how much solar generation they can allow on their system as they do not want to risk having additional power outages. The role of Northern Energy Innovation (a research program at the Yukon Research Centre, Yukon College) in the project was to determine how much renewable generation the electric power system could host without affecting stability or reliability. The first step of the project was to partner with the Vuntut Gwitchin First Nation to ensure open communication and that the results meet the needs of the First Nation as well as the local utility. This presentation highlights the success story of the partnership between the Yukon Research Centre, Vuntut Gwitchin Government, and ATCO Electric Yukon to ensure a successful project that will benefit the Old Crow community. By partnering with the community and local First Nation government, we were able to direct the project in a way that was meaningful and valuable for the community throughout the project's development. Knowledge dissemination wasn't about reporting back about the final results, it was an ongoing process from conception, through design, early results, project development, final reporting, and ongoing follow-up. This included biweekly meetings with the community representatives and the local utility, site visits in the community where the research team met the community to understood the context and value of their work, knowledge dissemination and presentations at community gatherings and meetings, and local school visits to meet and educate the children on the benefits of the project. The engagement ensured that the communities' values were reflected in the final design, which was met with pride in the community due to ownership of the project, decisions and results; the role of the research results was to provide insight to support informed decisions made by the community. Furthermore, the partnership and openness led to a trusting relationship between the community and utility. The discussion went from the utility saying "no", to "no, and here's why not" to "let's work together on solving the why not". In the end, everyone found common ground of wanting to reduce as much diesel consumption as possible while ensuring that the lights stay on. The Old Crow Solar Project is currently being constructed, and the success of this project is rooted in the partnership with the local First Nation community. To the research team, the partnership meant fostering a healthy relationship through engagement and transparency throughout the project from idea to follow-up. Through the words of Dana Tizya-Tramm, a Councillor with the Vuntut Gwitchin Government, "Northern Energy Innovation clearly understands the role of science and technology at the community level."

MONITORING THE LENA RIVER SPRING BREAKUP FLOOD IN 2013 WITH TERRASAR-X IMAGERY AND THE TANDEM-X DIGITAL ELEVATION MODEL

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River runoff is the single largest contributor to the Arctic Ocean's freshwater budget. The Lena River in Eastern Siberia is one of the major rivers flowing into the Arctic Ocean. More than 50% of the total runoff from the mainland originates from the four large rivers Ob, Yenisei, Lena and Mackenzie. Global warming is expected to significantly influence the amount and temporal dynamic of river. The average annual discharge of fresh water from the six largest Eurasian rivers into the Arctic Ocean has already increased by 7% over the last century. It has been demonstrated, that the timing and magnitude of discharge of Arctic rivers is strongly linked to snow mass storage during the winter and the subsequent melt. The melting of the accumulated snow during spring leads to extreme flooding that represents the major hydrologic event of the year. About 40% of the Lena River's annual discharge is released during this few weeks lasting spring flood. Studies of the spring flood process mainly rely on hydrological modelling and sparsely available in situ gauge measurements. Also remote sensing techniques are applied to map and monitor the spatial and temporal evolution of the event. We present a new approach to delineate water levels during spring flood events that solely relies on the evaluation of high resolution SAR data provided by the TerraSAR-X and TanDEM-X satellites. The German Earth Observation satellite TerraSAR-X was launched in 2007. It provides SAR data in different modes and resolutions. Operationally single and dual polarization is possible. Since 2010 it is flying together with its twin satellite TanDEM-X in close formation enabling single pass interferometry. Here, the primary mission goal is the generation of a global digital elevation model (GDEM) in outstanding quality and resolution that allows classifying the shoreline and land's topography at an unprecedented level of detail. The spatial resolution is 12.5 meters with a vertical accuracy of 2.5 meters. Our test site covers the central part of the Lena River Delta where the main channel diverges into its major distributaries, the Trofimowskaya, Bykowskaya and Olenekskaya channels. The spatial extent of the flooding is derived from 22 TerraSAR-X images acquired between end of May and mid of July 2013. The satellite's footprint pattern allows observations on three consecutive days, followed by a three days gap. The GDEM product of the TanDEM-X mission is utilized to refine the water mask and to derive the bathymetric 3d information of the flooding. The high spatial resolution of three meters and the dual polarization of the TerraSAR-X data acquired in the StripMap mode, allow for a fine delineation of the water line and an improved separation of open water, ice cover and land, respectively.

MULTI-ANNUAL ANALYSIS OF THE GREENLAND ICE SHEET BETWEEN 2010 AND 2017 BASED ON TANDEM-X DEM DATA

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The Greenland ice sheet represents the world's largest ice mass outside Antarctica covering an area of approximately 1.7 million km2. During the last decades, observations reveal dramatic changes, which can be attributed to anthropogenic induced global warming with considerable implications for environment and human society. The melting of the entire Greenland ice sheet would raise global mean sea level by 7.36 m. In view of this, it is crucial to understand spatial and temporal glacial dynamics for determining the contributions to sea level rise and predicting responses to climate change. Interferometric SAR based Digital Elevation Models (DEMs) are powerful techniques to collect information on glaciers and ice sheets worldwide, particularly in polar regions located in high latitudes. To date, multi-date DEMs at high spatial resolution is lacking for entire Greenland. Existing DEM products are either outdated or show low spatial resolution, often mono-temporal. The German TanDEM-X satellite mission offers great potential for monitoring of the Earth's polar regions at unprecedented spatial resolution due to the global availability of consistent and precise interferometric data. However, so far TanDEM-X data have been mainly used on local scales. The first goal of this study is to provide a novel change detection analysis for the entire Greenland ice sheet at 12 m spatial resolution using TanDEM-X interferometric acquisitions between 2010 and 2017. One major issue with X-band SAR data is related to penetration of the signal into the snow and ice surface, which influences significantly the height accuracies of the delineated DEM. Therefore, we defined a second goal, which aims to investigate the X-band penetration over different snow and ice characteristics to correct possible elevation bias. As a reference, we used IceBridge ATM L2 Elevation data from spring 2012 to analyze the penetration depth over different snow zones, which are determined by specific physical parameters (grain size, snow density, stratigraphy, surface roughness, and water content), which influence the SAR backscatter. Our results reveal penetration depths up to ten meters and a high correlation between penetration depth and backscatter intensity as well as interferometric coherence and height of ambiguities. This information can help to improve vertical accuracy of TanDEM-X data over the Greenland ice sheet to obtain more reliable elevation change from different time spans.

METHANE CYCLING ARCHIVES FROM WARMING ARCTIC LAKES: RETRIEVING THE GENOMIC BLUEPRINTS OF ANCIENT MICROBES

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Arctic landmasses and lakes release significant amounts of methane (CH_4), a greenhouse gas with an atmospheric warming potential 25 times higher than CO_2 that contributes heavily to global climate change. Yet the effect of rapid warming in the Arctic on the fate of natural CH_4 emissions from lakes is poorly understood. We use a metagenomic approach on ancient environmental DNA from Holocene lake sediment cores to determine the impact of long-term climate change on microbial CH_4 cycling in Arctic lakes. We present preliminary results from the Godthåbsfjord region, Southwest Greenland. We used a 'shotgun' sequencing approach to acquire the microbial community profiles. This method yielded ecologically relevant information on the diversity and function of major groups of both CH_4 producers (Archaea) and consumers (Bacteria: methanotrophs Type I and Type II), as well as other groups of microbes (Cyanobacteria) and higher organisms including zooplankters (Copepods, Ostracods and Cladocerans), plants (aquatic and terrestrial) and fish (Atlantic salmon, Three-spined stickleback). Changes in community structure effectively reflected major environmental changes that occured at the sites over the Holocene. This baseline study will be expanded to a Holocene sediment collection from Greenland and Svalbard encompassing major environmental gradients and lake ontogenies. To test the influence of long-term climate change on CH_4-related microbial dynamics, our paleogenomic approach will be supported by targeted analysis of other long-term biological and biogeochemical changes affecting the elemental carbon reservoirs in the watershed and its aquatic network. For the first time, ancient metagenomics will be applied on multiple sites across the Arctic and over extended timescales to determine the effects of long-term climate change on this important yet understudied greenhouse-related biogeochemical process.

LESSONS LEARNED FROM MAPPING PERMAFROST VULNERABILITY IN NORTHERN COMMUNITIES

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Northern communities across Canada are concerned with permafrost thaw and its potential effects on hunting and gathering areas, habitat, trails and traveling routes. These communities has been traveling, hunting, trapping, fishing, gathering and living on these traditional lands for generations. Now, community members are worried that landscape change will impact their ability to access traditional foods and interact with their land. Over the years, many landscape vulnerability classification studies have emerged as useful tools in the assessment of landscape-scale vulnerability to climate change. They integrate science into decision-making by merging and classifying geoscience data and traditional knowledge to create an easily interpretable ranked representation of vulnerability to potential future change. Here we present in form of case studies good examples of community based permafrost vulnerability mapping project in Old Crow, Yukon and Jean Marie River, NWT. We hope these projects will serve has tools and examples for researchers and early career researcher who work with northern communities to have a fruitful experience and increase resilience in northern communities.

"IT DEPENDS…:" CONSIDERING INUIT-IDENTIFIED METRICS IN CONTEXT FOR MONITORING AND RESPONDING TO CLIMATE CHANGE IN THE CIRCUMPOLAR NORTH

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Climate change and associated environmental shifts continue to occur at unprecedented rates across the Circumpolar North. Northern communities, governments, researchers, and public health professionals have identified the need to develop new approaches for monitoring and measuring the impacts of climate change on population health to inform public health research and practice that is linked with broader climate change adaptation strategies. Within this context, many Inuit communities across the North have called for the development of Inuit-determined climate- and environment-related metrics to use in monitoring and response systems that are grounded within Inuit-specific definitions of and priorities for living and thriving within changing environments. The goal of this research was to characterize how climatic and environmental metrics are understood, developed, and used by Inuit in Rigolet, Nunatsiavut, Canada to guide and enhance monitoring of and responses to the impacts of climate change on Inuit wellbeing. In addition, this research sought to explore and describe socio-cultural factors, personal preferences, and other contextual considerations that influence how Rigolet Inuit interpret and use metrics for decision-making related to enhancing and sustaining wellbeing amidst increasing climate change. In-depth, semi-structured interviews were conducted by community research leads with community members in Rigolet between January and November 2018 to identify characteristics of Inuit-determined climate- and environment-related metrics in relation to Inuit wellbeing. Qualitative data from the interviews and debriefs were gathered, co-analysed using thematic analysis methods, and co-interpreted using iterative, collaborative team-based approaches to ensure emergent findings and interpretations were grounded in the perspectives and lived experiences of Rigolet Inuit. Metrics were conceptualized by Rigolet Inuit as any environmental and climatic observations that were important for "capturing information" related to one or more of the following: 1) assessing current conditions in the surrounding ecosystem, or “the land;” 2) understanding changes, patterns, and trends in observations; and 3) informing decisions based on these observations to keep themselves and each other “safe and secure” amidst dramatic and rapid climate change and variation. The ways in which these metrics were interpreted and used depended on a variety of personal, socio-cultural, economic, and technological considerations. Rigolet Inuit emphasized the importance of understanding the interconnectedness between metrics when assessing and monitoring the impacts of climate change and associated environmental shifts on wellbeing and ways of living. The pathways through which climate change can impact population health are often context-specific. It follows, then, that priorities and strategies for monitoring and responding to climate change impacts on Northern communities and environments will also vary depending on socio-ecological contexts. Findings from this research offer deeper understandings of how community-led development of relevant metrics can inform the design of appropriate, effective actions for climate change adaptation. In turn, these understandings can help guide the development of climate- and environment-sensitive public health indicators that are reflective of and responsive to community needs and priorities.

THE EFFECT OF AN UNUSUAL SUMMER STORM ON BELUGA WHALE HABITAT USE AND THE TRADITIONAL BELUGA HARVEST

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With accelerated warming in the Arctic, the frequency and intensity of storms is expected to increase. This has been cited as a cause for concern among Inuvialuit hunters who suggest high-speed wind events are a primary reason for missed harvest days. Each summer, Inuvialuit hunt beluga whales (Delphinapterus leucas) which form large summering aggregations in the warm, fresh waters of the Mackenzie Estuary. This aggregation has been hunted by the Inuvialuit for centuries and the hunt remains important today as it provides a nutritionally superior alternative to store-bought products, and an opportunity to pass on traditional hunting and land-based skills to younger generations. In July 2016, an unusually large storm occurred in the estuary while hydrophones (to record beluga vocalizations) were moored with oceanographic sensors (measuring water temperature, salinity, depth, waves, and turbidity) in Kugmallit Bay, providing a rare opportunity to study the effects of an extreme weather event on the beluga aggregation. The storm lasted a total of 88 hours; historical weather data revealed a similar length storm had not occurred in July in at least the past 28 years. The storm surge caused a significant decrease in water temperature, along with increased wave height and water depth, and beluga were not detected for the duration of the event. Cold oceanic influxes and increased wave height were shown to alter beluga distribution within the estuary in other years. Hunters were unable to land whales for 10 days, due to the combination inaccessibility (due to high-speed winds), and the absence of whales, resulting in the lowest beluga harvest in Kugmallit Bay between 1978-2017. This suggests stresses affecting food security, as well as changes to land-based skills, may be exacerbated by increased storm activity in the future.

HATCHING TIME OF BOREOGADUS SAIDA IN HUDSON BAY; FURTHER TESTING OF THE FRESHWATER WINTER REFUGE HYPOTHESIS

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The eggs of Arctic cod (Boreogadus saida) hatch in spring under sea-ice cover in time with ice-breakup. The length of B. saida at hatching time is 4-8 mm, the larvae feed on zooplankton in the surface layer until they grow to 30-35 mm. At this size they descend to become fully pelagic species. If larvae are larger at ice break-up they are better able to avoid predation from birds and other fish, a larger size also enhances winter survival. It is to be expected that individuals that hatch earlier and have a longer growing season would be selected for and that there is an evolutionary push for cod to spawn earlier if environmental conditions allow. While the temperature in saline waters falls below freezing, the temperature in under-ice river plumes stays around 0C thus providing good environmental conditions for egg survival, fast development and eventually feeding success. The theory that arctic cod spawn in brackish water to enhance larval survival is called the freshwater winter refuge hypothesis. This hypothesis has been tested for arctic cod in several arctic seas and results supported this hypothesis most strongly in Hudson Bay. However, data in previous studies was collected in mid to late summer and therefore there was little evidence to show whether arctic cod use under-ice brackish water in winter for spawning. In this study we look at spawning time of arctic cod captured in early spring on the 2018 CCGS Amundsen BaySys mission to further test the freshwater winter refuge hypothesis.

EXTRACTIVE INDUSTRIES AND ECONOMIC DEVELOPMENT IN THE EASTERN SUBARCTIC

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The Eastern Subarctic has several active mining operations. This report assesses the social and economic impact of major extractive industries such as the Voisey's Bay mine in Nunatsiavut and the Raglan and Nunavik Nickel mines is Nunavik. Both Nunatsiavut and Nunavik have forms of self-governance that are evolving towards more regional autonomy. Sustained and sustainable economic development will be an important component to pursuing this autonomy. While these mines have generated major revenues, their impacts on economic development outcomes of individual communities is still not very well understood. The presence of these mines has changed the social fabric of the communities close by, has provided new training and employment opportunities, business development but also has caused migration to major training centres or cities outside of the region. In this report we examine revenue generation and distribution in each of the two Eastern Subarctic regions, the economic development impacts, employment, migration and training, environmental and social impacts and socioeconomic impacts. In addition, we examine the Impacts and Benefits Agreements (IBAs) process in the Eastern Subarctic, the experiences with the implementation of the IBA, the use of royalties and transfer payments by communities and regional governments, the Impact Assessment processes and the cumulative social impacts of development. This report concludes with recommendations to improve the benefits realized by Inuit governments, communities, businesses and employees, and a discussion of the future role of extractive industries in the region.

THE IMPACT OF MAJOR MINING PROJECTS ON INUIT EMPLOYMENT AND RESIDENCY IN THE EASTERN CANADIAN SUB-ARCTIC

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This paper analyzes the impacts of major extractive industries, particularly the Raglan Mine in Northern Québec and the Voisey's Bay Mine in Labrador on employment numbers in Inuit businesses, at the two mining sites and in public administration. In addition, we evaluate the quality of employment and employment dynamics at the two mine sites. Our data is based on a comprehensive business survey that we conducted with 96 businesses in Nunatsiavut and Nunavik in 2016-2017 and on employment data that we acquired from the Raglan Mine (Nunavik, QC) and Voisey's Bay Mine (Labrador). We assess the percentage of Inuit employment at the mining sites, in Inuit owned businesses and turnover rates at the mines. We also distinguish between the proportion of employees that reside in their home community and the ones that have moved elsewhere to fly in and out of the mine. We conduct statistical analysis to explain employment by sector and type of Inuit business, and how employment is linked to revenues generated from mining and partnerships with non-Inuit businesses. We identify a trade-off between the likelihood of partnership formation and the proportion of Inuit employees in Inuit owned businesses. Inuit businesses that have a partnership tend to receive a larger proportion of revenues from mining but also tend to employ less Inuit employees than similar businesses that do not partner up. We suggest an alternative set of metrics to assess the merits of mining activities for Inuit employment, human development and the viability of local communities. We conclude with considerations and best practices for Inuit employment, training and business development practices related to Inuit employment and human development.

CONSULTATION, DISCUSSION, AND PARTNERSHIP: AN ANALYSIS OF OF THE BAFFINLAND CONSULTATION MEETING TRANSCRIPTS

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Following the release of the Federal Court of Appeals' decision on Tsleil-Waututh Nation v. Canada (Attorney General) on August 30, 2018 concerning the Trans Mountain Pipeline proposal and the analyses that stem from this decision, this paper does a close reading of the transcripts from the Baffinland Mary River Mine review process consultations. Specifically, the paper examines the content of the dialogue and the dynamics between the Proponent, intervenors, and NIRB. The research objective is to assess who responds and what responses are given when community members pose questions at the consultation meetings. The discussion focuses on the distinction identified by Papillon (2018): are indigenous community members treated like stakeholders or partners?

SEA ICE CONCENTRATION ESTIMATION USING DEEP LEARNING: RECENT WORK AND FUTURE PROSPECTS

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Historically, sea ice concentration has been measured through use of passive microwave sensors, as well as human interpretation of synthetic-aperture radar (SAR) imagery. Although several algorithms have been developed to estimate ice concentration from passive microwave data automatically, these data suffer from poor spatial resolution for the low-frequency channels, and are sensitive to atmospheric moisture for the higher frequency channels. While this is typically not a significant problem in the winter period over consolidated ice, in marginal ice zones and during freeze-up and melt, atmospheric moisture can result in reduced accuracy for passive microwave retrievals. This talk will give an overview of recent work to estimate sea ice concentration automatically from synthetic aperture radar (SAR) data taking advantage of significant developments in the area of deep learning. SAR data has the advantages of high spatial resolution and insensitivity to atmospheric moisture, but images are difficult to interpret automatically. Deep learning has demonstrated its ability to perform complex, accurate, analyses of images in other fields, and is being increasingly used for remote sensing data. We will give an overview of the method for the non-specialist, and present results applying deep learning to the problem of sea ice concentration from SAR. Our results were found to be competitive with other methods, and in some cases remarkably better. For example, comparing against human generated ice analysis charts, we achieved an error of 0.21%, competitive with passive microwave (error of 0.19%) for the Canadian Arctic Archipelago, while for the Gulf of Saint Lawrence region, we achieved an error of 0.27%, significantly better than the passive microwave result (error of 0.36%).The impact of the training data on the sea ice concentration estimates, and the ability of deep learning to overcome some of the challenges visible in the training data will be demonstrated. Finally, prospects for deep learning in other sea ice recognition problems will be discussed.

SYNTHETIC APERTURE RADAR REMOTE SENSING BASED SEA ICE ROUGHNESS MAPPING TO INFORM SAFE TRAVEL IN THE KITIKMEOT REGION OF NUNAVUT

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Consultations with residents in Kugluktuk and Cambridge Bay in Nunavut's Kitikmeot Region revealed that locals are interested in having access to remotely sensed image data, enhanced image products, and ancillary information to help plan travel and subsistence activities on sea ice. We report on results from interviews over three field seasons in 2017 and 2018 regarding safe travel and the importance of sea ice surface roughness as a physical parameter that impacts community travel, as well as the ability of widely available synthetic aperture radar (SAR) remote sensing data to map surface roughness regimes. A technique for mapping surface roughness regimes from the Sentinel-1 SAR missions is given, followed by validation studies using ancillary remote sensing data and attestations by locals in the Kitikmeot Region. Validation is conducted using fine-scale roughness measurements from high-resolution airborne LIDAR terrain data collected in Victoria Strait in April 2017, and a normalized difference angular index (NDAI) that is sensitive to surface roughness at a slightly coarser resolution (275m), collected by the optical Multi-angle Imaging SpectroRadiometer (MISR) sensor with varying camera angles. Ultimately, as SAR data from the Sentinel-1 sensor are collected independently of cloud cover and sunlight and data are freely available, we are working to make image products available to sea ice users via the Google Earth Engine platform. Hard copy maps and products are also being made available via northern partnerships (e.g., the local Hunters and Trappers Office, the Wildlife Office, etc.).

STABLE POPULATION SIZE IN THE FACE OF A NOVEL PREDATOR - WHY POLAR BEAR PREDATION ISN'T DRIVING DECLINES IN COMMON EIDER POPULATIONS

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Climate change is leading to the loss of Arctic sea-ice and increases in polar bear predation of seabird nests. How this changing predator-prey relationship will impact polar bear and seabird populations is unclear. We have been conducting field studies and building predictive models to understand the impact of polar bear predation on populations of northern common eiders (Somateria mollissima borealis) in northern Hudson Bay and Hudson Strait. Our studies suggest that polar bear predation of common eider nests will increase as sea-ice continues to decline. In response, eider hens will nest in smaller, more dispersed colonies to avoid polar bear predation. Additionally, we find that common eider population sizes should remain stable over the next 25 years because climate-driven increases in breeding propensity should compensate for increased nest predation. Together, these results suggest that northern common eider populations may be resilient to increasing polar bear predation, however changes in the spatial distribution of nesting females may make it harder for northern people to harvest eggs and down from eider colonies.

REGULATING MARITIME OCCUPATIONAL HEALTH AND SAFETY IN THE CANADIAN ARCTIC GATEWAY

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The Canadian Arctic Gateway is vital to the country's long-term economic future. With climate and environmental change in the Arctic, a dramatic decline in sea ice has been observed. The opening of the Arctic is expected to significantly increase maritime traffic, as well as expanding access to fishing resources in this area. The increased maritime activities in polar waters will increase occupational health and safety risks for both seafaring and fishing communities. Environmental sensibility and challenging navigation conditions require special safety and environmental standards in Canadian polar waters. Ice and low temperatures in Arctic waters also impose threats to navigation safety and the health and safety of maritime workers. Extended hours of darkness and daylight also disturb human biological rhythms and affect crews' health and performance. The lack of infrastructure restricts safety communication and emergency response, making both navigational safety and crew members' lives even more vulnerable. In the current Arctic governance structure, occupational health and safety involved in the Arctic shipping and fishing are regulated through four layers: international, regional, national federal and national provincial. At the international level, the International Code for Ships Operating in Polar Waters (IMO Polar Code), promotes standards for maritime safety and the prevention of vessel-source pollution in polar areas. The IMO has also adopted standards for the training of merchant seafarers and has received proposals for model training courses. Following the adoption of the Polar Code, the IMO is now considering extending its reach to vessels that do not fall under the International Convention for the Safety of Life at Sea (SOLAS), including fishing vessels. However, in the context of Canada, maritime occupational health and safety regulatory power is shared by both of the federal and provincial governments. Safety of vessels, equipment, training for certified seafarers and fishers fall into federal jurisdiction. Seafarers occupational health and safety issues are regulated federally, but fishing occupational health and safety issues are subject to different provincial standards. Different scales of fishing, ranging from indigenous artisanal fisheries to large commercial fisheries, may also impose potential regulatory challenges to ensure health and safety of Arctic maritime activities. This presentation draws on a research program adopts socio-legal interdisciplinary methods, including legal doctrinal analysis of statutes and case law, and qualitative interviews with key informants from federal and provincial governments, representatives of industrial stakeholders, indigenous communities and seafarers and fishers with Arctic maritime experiences. The research program explores occupational health and safety challenges faced by Canadian maritime workers involved in Arctic shipping and fishing activities. This presentation focuses on the findings from the analysis of current occupational health and safety standards applicable to Canadian Arctic shipping and fishing activities, and inquires whether functional equivalence of health and safety protection for seafarers and fishers is a desirable and a feasible choice for Canadian Arctic governance,

taking into accounts of the next stage development of international maritime safety standards, including Polar Code Phase 2 and related amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW).

CHALLENGING PHAEOCYSTIS POUCHETII AGAINST DIATOMS DURING THE SUMMER BLOOM OF PHYTOPLANKTON IN LABRADOR FJORDS (EASTERN CANADA)

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Labrador fjords are nursery areas for a large number of fish stocks and consequently they are important feeding grounds for seabirds and marine mammals. Despite this ecological importance and growing sampling efforts, their microbial communities still remain understudied. The central objective of our project was to determine the taxonomic composition of protist communities in four Labrador fjords (Nachvak, Saglek, Okak and Anaktalak) during summers 2007 and 2013. We also investigated the potential impacts of a bloom of the prymnesiophyte Phaeocystis pouchetii on the whole microbial community. During summer 2007, the community was dominated by a diatom bloom (1.8 x 106 cells L 1) and a mixed assemblage of flagellates. In summer 2013, flagellates clearly dominated the community and an important bloom of P. pouchetii (18 x 106 cells L 1) was observed. By combining our results to those from the literature, we were able to suggest the following annual succession in Labrador fjord protist community: (winter) dinoflagellates and other flagellates — (spring) Fragilariopsis spp., Chaetoceros spp., Thalassiosira spp. and Phaeocystis pouchetii — (summer) Chaetoceros spp., P. pouchetii and Chrysochromulina spp. — (fall) flagellates, Gymnodinium/Gyrodinium spp. and Chrysochromulina spp. We also drawn the very first list of planktonic protists in Labrador fjords. With more than 200 taxa reported, it is without contest the most complete list of protists identified in polar fjords. Our findings also suggest that the large bloom of P. pouchetii during summer 2013 may have entailed possible inhibitory effects on the growth of other phytoplankton species through the production of polyunsaturated aldehydes. Besides we noted an inhibitory effect on bacterial growth, likely due to the production of acrylic acid by P. pouchetii. Indeed, the proportion of bacteria with high nucleic acid content decreased by more than half from summer 2007 (85%) to summer 2013 (37%) while the abundance of P. pouchetii was 10 times higher. Another issue addressed in our study is the influence of P. pouchetii on microzooplankton (MZP) grazing rate, as previous studies indicated that bioactive metabolites released by P. pouchetii such as polyunsaturated aldehydes, could be deleterious for herbivorous grazers. The relatively high MZP grazing rate (0.69 d-1) we estimated at Nachvak fjord, where the intense bloom of P. pouchetii was observed, does not support such conclusions.

CONTAMINANTS AND HEALTH MONITORING IN RINGED SEAL NEAR POND INLET, NUNAVUT

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As a resident of Mittimatalik (Pond Inlet) all my life, I have been noticing changes in weather, sea ice, marine mammals, land wildlife and fish. There are some changes that we cannot tell just by our "naked" eye and that we, as Inuit, need to seek more to find out the unnoticeable things impacting our environment. With our country food we especially need to know if the animals that we hunt or fish are being affected. There is a pressing need to do more testing of our food in the North, the scientific way. However, I usually say that "there can't be any science done in the North if you don't have any indigenous knowledge". In my home community of Pond Inlet, there are more and more cruise ships coming up each year causing more disturbances to marine mammals. In regard to industrial shipping (mining), ships are constantly moving back and forth to the iron ore mine port in Milne Inlet. The mine and the port can also release contaminants to the land and the sea. Through the oceans, the Arctic is also connected to all other regions of the world and can carry and bank contaminants that can be absorbed by wildlife and Inuit. In this research project, I wanted to test the contaminants concentration in and the health condition of natik (ringed seal), our primary country food. I've been working with research mentors from ARCTIConnexion, University of Prince Edward Island and Environment Canada to address my research questions. In the spring and fall of 2017 and 2018, I hunted with my assistants and mentors and collected morphometric measures and samples (liver, blubber, muscle, blood, fur, and others) on about 50 seals with more to come. We did not waste the meat that we took samples from. We shared it to the community and whatever we don't keep like the guts, we gave it to the dog team owners and we used the skin for clothing. We looked at body condition, concentration of mercury, trace metals and Persistent Organic Pollutants, as well as the presence of infectious agents (Brucella, Leptospira, Toxoplasma, and others) in the tissue of the seal. We also ran a series of interviews in Inuktitut with the Chair of the Mittimatalik Hunters and Trappers Organization, active hunters, and elders including a group of women. The interviews involved discussion and mapping of the seal habitat and migration patterns. We documented seal uses in the past, changes in population and numbers, meat, fur and blubber quality, contaminants sources, and the potential causes of change such as climate, shipping and mining. In this presentation, I will show the results of the contaminants and health monitoring as well as the highlights of the work conducted with community members. I am grateful to the people who helped me in my community and to my mentors.

INTRODUCING THE INUIT FIELD TRAINING PROGRAM IN THE CANADIAN ARCTIC

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For nearly 100 years, biologists of the Canadian Government have worked alongside Inuit to monitor the Arctic, drawing on their knowledge and experience. In an effort to interest the next generation of Inuit environmental monitors, Environment and Climate Change Canada (ECCC) recently launched the Inuit Field Training Program (IFTP) based out of an existing ECCC field station on Southampton Island, Nunavut. The East Bay Field Station was recently expanded to accommodate a larger group through an Infrastructure Improvement Grant from POLAR Canada intended to enhance research and education in the Canadian Arctic. Importantly, the training program immediately established a community-based northern steering committee in Coral Harbour, Nunavut, that co-designed the curriculum and selected both the Inuit leaders and youth participants. In the first year, 32 young people applied and the Steering Committee selected 8 youth participants (2 women, 6 men; aged 22-34). In August, 2018, the program provided the young people with a chance to experience life and work in a northern research camp, learn about research and monitoring techniques, understand the historical and modern contributions of Inuit to environmental monitoring, and gain career information intended to help them consider whether they might like to pursue a job in Environmental Monitoring. The 10 day field component of the program was delivered by a senior Inuit leader, a senior ECCC scientist, two junior Inuit leaders, and a graduate student. As the long-term program develops over time, we will be better positioned to interest and recommend young people for employment and education opportunities within government, northern industry, community-based environmental monitoring initiatives, existing college programs (e.g. Nunavut Arctic College), and youth leadership initiatives.

HYPERABUNDANT ARCTIC GEESE ARE AFFECTING TUNDRA HABITATS AND SYMPATRIC BIRDS

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Shorebirds are the most diverse and abundant group of birds in many Arctic locations. However, more than 60% of shorebird populations breeding in Arctic Canada are believed to be declining and many to such an extent that they could qualify for status as Species at Risk. This proportion of declining species is higher than for shorebirds breeding elsewhere in North America, and higher than many locations around the globe. These declines could arise from a variety of factors such as climate change or anthropogenic habitat loss in shorebirds' temperate and tropical non-breeding areas. However, overabundant geese are a less widely recognized agent of change and are having a pronounced effect on tundra habitats in several regions of the North American Arctic. We show that intensive foraging from geese reduces the availability and quality of nesting habitats important for shorebirds, forcing shorebirds to select suboptimal nest-sites or forgo nesting in areas where habitats are impacted by geese. We also demonstrate that the abundance of generalist predators is higher, and nest survival lower, near goose colonies, particularly when other prey such as lemmings are scarce. Finally, we explore behavioural responses of shorebirds to the presence of geese, such as direct antagonistic interactions and alterations to incubation behaviour, to describe the more subtle impacts of the relationship between hyperabundant geese and sympatric shorebirds. Presumably because of these and other effects, the densities of cover-nesting shorebirds are depressed near areas used intensively by geese, with significant reductions in abundance extending out up to 30 km from colony boundaries at sites distributed widely across the Canadian Arctic. Collectively, these results show that the ecosystem changes from overabundant geese could be contributing to shorebird declines at local or regional scales. A more thorough understanding of abundant geese as a potential ecosystem stressor and agent of biodiversity loss is urgently needed in order to develop population and harvest objectives for geese that acknowledge the needs of other ecosystem components.

MIGRATION AND OVERWINTERING HABITAT OF ANADROMOUS ARCTIC CHAR (SALVELINUS ALPINUS) NEAR KUGLUKTUK, NUNAVUT

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Isostatic rebound and climate change are impacting stream hydrology in many coastal areas of the Canadian Arctic. This can create stress and barriers for migratory fishes such as anadromous Arctic char (Salvelinus alpinus), which travel from their spawning and overwintering habitat in freshwater systems to the ocean in the summer to feed. Many Inuit communities rely on char as a key food source. The Coppermine River has historically supported an important subsistence fishery for the community of Kugluktuk, Nunavut. In recent years, the Kugluktuk Hunters and Trappers Organization and community members have observed a sharp decline in the number of migratory char harvested during the fall run, changes in the timing and location of fish runs, and instances of fish stranding. The cause of these changes is unknown, as neither local fishers nor scientists know where char overwinter. In the summer of 2018, to determine critical char habitat and migration routes, we implanted acoustic transmitters in forty-eight mature, anadromous Arctic char, captured in common harvesting areas near Kugluktuk. We deployed an array of thirty-three acoustic receivers in the Coppermine River, as well as other suspected char migration corridors in the Coronation Gulf and adjacent char-supporting streams. We present preliminary telemetry results from the 2018 fall migration of these tagged char towards their freshwater overwintering habitats. Gaining an understanding of critical char habitat and impacts to migratory patterns in Kugluktuk and other areas will be important in the adaptation of northern communities to climate change and help ensure the sustainability of traditional food sources and subsistence harvesting practices.

CHARACTERIZING FACTORS INFLUENCING STAND AGE AFTER FIRE IN THE NORTHWEST TERRITORIES

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Wildfire is the main form of disturbance in North American boreal forests. These fires have important implications to many aspects of the boreal system, and play a key role in regeneration of many boreal tree species. Warming and drying of the boreal forest is altering the fire regime, resulting in more severe fires and a shorter fire return interval (increased frequency of fires). However, it is not known how the species composition or edaphic conditions of a forest stand influence the fire return interval. In the Northwest Territories, the Government of the Northwest Territories (GNWT) has maintained a dataset of the historical fires from 1965 – present. These fires were identified using a combination of techniques (GPS, MODIS, and Landsat), giving us coarse estimates of the boundaries of fire scars but little information variation in stand age within these burn complexes or how that varies across the landscape. As a part of a large-scale wildfire study in the Northwest Territories that was initiated in response to the unprecedented 2014 fire season, an extensive network of plots was immediately established in these 2014 fire scars. Sites were selected to capture variability in time since fire (from the GNWT fire history records), different land cover classes, and spatial distribution across the region. One method for determining the date of forest re-establishment after wildfires is to use dendrochronology to determine the stand age. Taking tree core samples allows us to investigate finer-scale patterns in both the degree of stand disturbance within these known burn complexes and forest regeneration post-fire than is currently available in this region. In this study, we aim to characterize factors driving the stand age in forests across the NWT – do we see a longer time since fire in wetter forest stands than dry? Are there stand age differences between the Taiga Plains and Taiga Shield ecozones that comprise much of the land surface of the NWT? Are there differences in stand age amongst different land cover types? How variable is stand age within a burn complex, and is this linked with forest stand structure, land cover type, ecozone, or moisture conditions? The data we have collected from the 2014 NWT fire plots paired with the fire history records will allow us to answer these questions and contribute to the understanding of land-cover change in the NWT.

MAKING ROOM - THE IMPACT OF CREATIVE TRADITIONS OF MAKING AND PROBLEM SOLVING ON STUDENT MOTIVATION AND PERSISTENCE

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The investigators and participants contributing to this research have been involved in a two year project examining the factors that impact student persistence and success in Inuit Nunangat (Inuit Homelands). Inuit Nunangat is the collective term used by the Inuit residing in the four land claims regions of Canada which geographically include, the Inuvialuit region in the Northwest Territories, Nunavut, Nunavik in northern Quebec and Nunatsiavut in Northern Labrador. Observations made from comments and activities in this project suggest that the integration of making modern and traditional crafts support cultural resilience in students and foster personal and professional success in their teachers. The data informing this research was gathered from participant comments at the Inuit Education Forum (held in Nain, February 2017) and five community case studies conducted across Inuit Nunangat in 2017-2018. The suggestion arising from narratives and observations of participants is that there is a greater need for the seamless integration of traditional making and skills in the formal education spaces because learning of these skills leads to greater Inuit identity development for youth, supports positive self-esteem, educational attainment and reduces gender barriers. This paper explores the relationship between traditional making and schools as a means to bridge the distance between Inuit and southern traditions of education. Embedded in this discussion is the concept of Pilimmaksarniq (the development of skills through observation, mentoring, practice and effort) as resistance to formal industrial format curriculum.

BEYOND THE GALLERY: FULL SPECTRUM ARCTIC BOTANY OUTREACH AT THE CANADIAN MUSEUM OF NATURE

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Despite being a northern nation, most Canadians live along the southern edge of the country, and many southerners do not have the opportunity to visit the over 40% of Canada's landmass that lies north of the treeline. As a result, many Canadians are unaware of environmental issues in the Northwest Territories, Nunavut, and Yukon, and may not have a personal connection to place that can spur action to mitigate environmental pressures. The Canadian Museum of Nature, in the heart of Canada's capital city, is an internationally-recognized institute holding more than 14 million natural history specimens and hosting seven permanent galleries, including our newest, the Canada Goose Arctic Gallery. Our mandate is "to increase throughout Canada and internationally, interest in, knowledge of, and appreciation and respect for the natural world", and with nearly a century of research activities in the north, the museum is uniquely positioned to tell compelling stories about biodiversity in the Canadian Arctic. The botany team within the museum's Centre for Arctic Knowledge and Exploration leads ongoing research programs focused on the diversity and distribution of Arctic plants and lichens. The National Herbarium of Canada - the museum's preserved plant collection – documents Arctic plants through time with vouchers from museum collecting expeditions, exchanges with other institutions, and specimen donations. Digital and physical versions of these specimens serve research and education worldwide. These activities provide our team with a rich foundation for engaging with the public about Arctic plant and lichen diversity. through various in-person experiences including traditional exhibits (such as the Canada Goose Arctic Gallery and the Art of the Plant), ongoing public demonstrations (including public plant mounting sessions), an outreach presence at various museum events (the Science by Night festival, our annual Research and Collections Open House, Nature Nocturne and Nature Tastes), experiential education in partnership with the Students on Ice Foundation, and two-way dialogue in northern communities. The team also provides education via multimedia storytelling including popular science writing in magazines and blogs, a dynamic social media presence, in-house video production and liaising with traditional media. In addition to providing an overview of these outreach activities, we will share tips and tricks for effective biodiversity communication and techniques for tailoring messages to various audiences.

NORTHERN YOUTH BRIDGING RESEARCH AND COMMUNITIES: THE GROWTH AND EVOLUTION OF IKAARVIK

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Ikaarvik: Barriers to Bridges works with northern Indigenous youth to be a bridge between research and their communities. Youth explore the strengths of both Indigenous Knowledge and science as ways to understand the natural world and work with their communities to identify and act on local research priorities. The youth present their ideas to their community (Elders and other leaders, as well as other interested community members) to form a consensus on local research priorities. Projects that address one or more of the research priorities are co-developed by the community and a Research Mentor with the youth acting as co-researchers on behalf of their community. Now in its 5th year since being awarded the Arctic Inspiration Prize, Ikaarvik has grown and evolved according to the interests and needs of its northern youth participants and their communities. Projects in 2018 included a partnership with the Arctic Corridors and Northern Voices shipping impacts study (University of Ottawa) and an invasive species workshop (DFO) in Salluit, Nunavik, implementation of a Coppermine River health monitoring program (University of Waterloo) and microplastics workshop (Ocean Wise/Oceans North) in Kugluktuk, Nunavut, research priority-setting workshops with the Kluane and the Champagne and Aishihik First Nations in Burwash Landing and Haines Junction, Yukon, SIKU Traditional Knowledge social platform workshop (Arctic Eider Society) in Gjoa Haven, Nunavut and a subtidal marine ecology biodiversity study (Ocean Wise) in Cambridge Bay, Nunavut. As a special project following from Ikaarvik workshops, youth from five Inuit communities met in Cambridge Bay, NU to further explore the relationships between Inuit Qaujimajatuqangit (IQ) and science and between researchers and communities. The result was a draft "ScIQ" Framework with youth perspectives on how IQ can inform the ways researchers and communities work together and how IQ can be better integrated into scientific research. This presentation will discuss the Ikaarvik projects undertaken in 2018, successes and lessons learned from the perspectives of Ikaarvik program staff, mentors, youth and community members. We will also provide an initial preview of the key recommendations in the youth ScIQ Framework.

FEASIBILITY OF ACHIEVING NEAR-NET ZERO CONSTRUCTION IN CANADA'S NORTH

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This study assesses the feasibility of achieving Passive House and near-net zero levels of energy performance for residential buildings (Steps 4 & 5 of the BC Energy Step Code) within Canada's challenging northern climate including climate zones 7a to 8. Under the Pan Canadian Framework for Clean Growth and Climate Change, the federal government has committed to working with the PTs to ramp up building codes to move towards net zero ready levels of performance by 2030. However, recent experience in BC on the development of its "Energy Step Code" found that the net zero ready target could not be feasibly achieved in the colder climate zones of the Province given existing practices and technologies. Changes to the geometry and fundamental design principles of housing may be required to reach the targeted levels of performance and the costs and benefits must be better understood before trying to introduce a "step code" approach to housing in the North. This study examines limitations and opportunities for reaching Step 4 and 5 in Northern Canada – including enclosure and mechanical system requirements, technology and capacity feasibility, and associated costs. Three building archetypes have been chosen for energy modelling including a single family dwelling, multi-unit residential complex, and a 5 unit plex rowhouse. Modeling tools using in the analysis include HOT2000 version 11.5, OpenStudio version 2.3.0, and Passive House Planning Package version 9.6a.

CO-OPERATIVES, EQUITY-AWARE POLICY, AND INTERMEDIARIES: FACTORS IN RENEWABLE ENERGY ADOPTION IN ALASKA WITH IMPLICATIONS FOR NUNAVUT

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Anthropogenic greenhouse gas (GHG) emissions are the primary driver of global climate change and need to be curtailed in order to avoid near certain climate catastrophe. Fossil-fuel based energy systems are a major source of GHG emissions and reducing the carbon intensity of energy systems is imperative for climate change mitigation. Rural Alaska and Nunavut are both dotted with diesel-dependent microgrids in small, remote communities spread over a large area. Both jurisdictions are subject to the pressures of volatile oil prices and climate change. While their relative GHG emissions are minute on a global scale, a transition away from diesel is paramount for energy security and the long-term sustainability of remote communities in both Alaska and Nunavut. Co-operative utilities serve the vast majority of electricity customers in Alaska while Nunavut is served by a government-owned utility. Over the past two decades, renewable energy projects have been deployed in 70 of Alaska's nearly 200 rural communities while Nunavut's 25 communities continue to be entirely dependent on diesel. The convergence of the Canadian government's attention to climate change, clean energy, energy infrastructure in remote and Indigenous communities, and reconciliation with Indigenous Peoples, as well as the dubious fortune of the territory's aging diesel generation infrastructure, has created a window of opportunity for a sustainable energy transition in Nunavut - a chance to widen the circle of actors involved in energy policy and practice in the territory, to decrease the territory's dependence on diesel and associated environmental impacts through greater adoption of renewable energy, and to increase energy security. This research draws on a case study of Alaska electric co-operatives informed by the Multi-Level Perspective (MLP), an analytical framework for the dynamics of sociotechnical transitions. MLP seeks to understand sociotechnical change through an examination of the interactions between: niches, or sources of social and technical innovations; the regime, or the dominant sociotechnical system; and the landscape, or slow-changing, macro-level exogenous factors. This research examines the adoption of renewable energy in remote communities in Alaska through the following research questions: What role, if any, did the presence of co-operatives as niches of innovation have in fostering an energy transition in rural Alaska? What role did policy design play? And given Nunavut's limited window of opportunity to transition away from diesel, what can Nunavut learn from Alaska? The findings suggest that a combination of a community energy niche, transition intermediaries, and equity-aware policy facilitated renewable energy deployment in Alaska. These factors are missing but not out of reach for Nunavut, yet the window of opportunity is not eternal.

BOOTS ON THE GROUND - TRADITIONAL KNOWLEDGE CARIBOU MONITORING PROGRAM

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The Boots on the Ground traditional knowledge caribou monitoring program started in 2016 and completed it's third program this summer. The Tlicho Government - a self governing First Nations government - sends it's teams to Contwoyto Lake which sits on the Northwest Territories/Nunavut border. Teams consist of a Tlicho Elder, Tlicho safety officer, Tlicho field guide and Tlicho researcher. By staying small scale the team is able to easily follow the caribou by walking which results in no disturbance to the caribou. The team follows a 'we watch everything' methodology which involves recording observations on caribou health, population, behaviour and herd dynamics in addition to weather, vegetation, predators and other wildlife.

SNOWMELT MONITORING IN SMALL ARCTIC CATCHMENTS WITH TERRASAR-X - A CASE STUDY FROM QIKIQTARUK (HERSCHEL ISLAND)

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The timing of snowmelt is an important turning point in the seasonal cycle of small Arctic catchments. Currently, in Arctic regions there is no operational product available that captures snow cover in simultaneously high temporal and spatial resolution needed for small catchment analysis. The TerraSAR-X (TSX) satellite mission is a synthetic aperture radar system (SAR) with high potential to measure the high spatiotemporal variability of snow cover extent (SCE) and fractional snow cover (FSC) on the small catchment scale. We investigate the performance of multi-polarized and multi-pass TSX X-Band SAR data in monitoring SCE and FSC in small Arctic tundra catchments of Qikiqtaruk (Herschel Island) off the Yukon Coast in the Western Canadian Arctic. Following the approach of Nagler and Rott (2000), we applied a threshold-based segmentation on ratio images between TSX images with wet snow and dry snow reference. We further explored the method by testing the performance of a positive and negative threshold. We quantitatively compared TSX- and Landsat 8-derived SCE maps using confusion matrices and analyzed the spatiotemporal dynamics of snowmelt from 2015 to 2017 using FSC derived from TSX, Landsat 8, and in situ time-lapse data. Results showed that the quality of SCE maps from TSX X-Band data is strongly influenced by polarization and to a lesser degree by incidence angle. VH polarized TSX data performed best in deriving SCE when compared to Landsat 8. TSX derived SCE maps from VH polarization detected late lying snow patches that were not detected by Landsat 8. Results of a local assessment of TSX FSC against the in situ data showed that TSX FSC accurately captured the temporal dynamics of different snowmelt regimes that were related to topographic characteristics of the studied catchments. Both in situ and TSX FSC showed a longer snowmelt period in a catchment with higher contributions of steep valleys and a shorter snowmelt period in a catchment with higher contributions of upland terrain. Landsat 8 had fundamental data gaps during the snowmelt period in all three years due to cloud cover. The results also revealed that by choosing a positive threshold of 1 dB, detection of ice layers due to diurnal temperature variations resulted in a more accurate estimation of snow cover than a negative threshold that detects wet snow alone. We find that TSX X-Band data in VH polarization performs at a comparable quality to Landsat 8 in deriving SCE maps when a positive threshold is used. We conclude that TSX data polarization can be used to accurately monitor snowmelt events at high temporal and spatial resolution, overcoming limitations of Landsat 8, which due to cloud related data gaps generally only indicated the onset and end of snowmelt.

SPATIAL AND INTERANNUAL VARIATION IN SURFACE OFFSET NEAR LAC DE GRAS, NORTHWEST TERRITORIES, FOR 2015–16 AND 2016–17

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The fine scale-spatial variability of vegetation, snow cover and topography is responsible for wide variations in local ground thermal regime. In the context of climate change, predicting and mapping permafrost state and change is often undertaken by using coarse-scale climate models that cannot explicitly resolve sub-grid fine-scale surface characteristics. Understanding the controls and effects of this fine-scale variation is important for (a) distinguishing classes and their observed behavior in sub-grid modeling schemes, (b) interpreting or testing model results, and (c) locally extrapolating field measurements without the help of models. In this study, two years of ground surface and air temperature data from an area near Lac de Gras, Northwest Territories, is analysed in relation to vegetation, soil characteristics, topography and snow cover. These characteristics are surveyed at the plot (15 m x 15 m) and subplot (1 m x 1 m) scale. Forty-five plots have been instrumented with four ground surface temperature sensors each. The effect of surface characteristics is evaluated with surface offsets, which are the difference between mean annual air temperature and mean annual ground surface temperatures. Within the study region, surface offsets range by more than 9 ºC. Variations in vegetation height at the plot-scale, drainage tendency at the subplot-scale and snow cover duration are the main predictors of surface offsets in this study area. These predictors and their effects, however, are highly variable within and among plots and across the two years of study. This fine-scale spatial and temporal variability suggests that the use of single point ground surface temperature measurements to represent a larger area and greater length of time can be an important source of error when running or testing permafrost models.

MAPPING THE CANADIAN ARCTIC SEAFLOOR

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Since 2003, the CCGS Amundsen has been collecting information on the bathymetry, the quality of surface sediment and the stratigraphy of sub-surface sediment of the Canadian Arctic seafloor using a multibeam echosounder (MBES) and a sediment profiler. Although incomplete, the resulting dataset offers immense potential to support and enhance a wide variety of projects, ranging from safe navigation to paleoclimatology. The main objectives of this talk are 1) to present the available dataset to the scientific community, 2) to discuss future upgrades of the MBES system and improvements of the data portal, and 3) to stimulate collaborations amongst seabed data users and Amundsen Science.

USE OF AUTOMATED SYSTEMS FOR THE STUDY OF OCEANIC DIMETHYLSULFIDE DYNAMICS IN ICE-COVERED AND ICE-FREE WATERS OF THE ARCTIC

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The sources and strength of oceanic dimethylsulfide (DMS) emissions, a climate-active biogenic gas, could be modified in the Arctic as a result of reductions in snow cover, sea ice extent and thickness. Understanding the impacts of climate change on DMS dynamics is crucial since DMS-derived sulfate is thought to be the key precursor to secondary marine aerosol that lead to cloud formation and therefore contribute to moderate solar energy input in the Arctic. Using a novel automated instrument (ACT-MIMS), DMS samples were collected at high frequency in the surface waters of the Canadian Arctic Archipelago (CAA) during the summer of 2017 (July-August) and 2018 (July) aboard the Canadian Coast Guard Ship Amundsen. More than 3500 DMS observations were collected alongside ancillary measurements of salinity, temperature, fluorescence (chlorophyll a proxy), light, ice concentration and the algal precursor of DMS, dimethylsulfoniopropionate. DMS concentrations ranged from ca. 1 to 32 nmol L-1 (average of 6 nmol L-1) in 2017 and from ca. 1 to 55 nmol L-1 (average of 14 nmol L-1) in 2018 over an area covering a wide range of contrasting marine environments from coastal to open ocean ice-free waters, as well as under-ice waters. These values are comparable to previous studies conducted in the CAA during the summers of 2015 (ca. 1 to 18 nmol L-1) and 2016 (ca. 1 to 30 nmol L-1), using similar high-frequency measuring systems and challenge the representativeness of the existing DMS climatology by showing that average summer surface DMS in this part of the Arctic and time of year may be twice as high. Surface water DMS hotspots were measured in association with thermohaline oceanographic features in high productivity coastal waters, as well as with the presence of ponded first-year sea ice (FYI). Nighttime increases and daytime decreases of DMS concentrations were also observed in productive areas of the Labrador Sea and Davis Strait continental shelf. The association of DMS concentrations with diurnal variations of solar radiation suggests the involvement of photobiological processes. Overall, our results strengthen the view that aqueous DMS cycling in the Arctic is intimately linked with sea ice dynamics and physiological responses to light. As such, future changes in the seasonality of the Arctic cryosphere will likely play an important role in shaping DMS emissions, although the sign and magnitude of the change remain highly uncertain.

DIVE BEHAVIOUR OF BEAUFORT SEA BELUGA WHALES (DELPHINAPTERUS LEUCAS) IN RELATION TO SEAFLOOR DEPTH, ICE COVER, AND PREY DISTRIBUTION

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The Beaufort Sea is thought to be an important summer foraging ground for one of the largest populations of beluga whales (Delphinapterus leucas). Recent effects of climate change including alterations to the date of sea ice freeze-up, total sea ice extent, and a shift in the prey assemblage may be impacting the movements and dive behaviour of this population. Satellite-linked transmitters have been used to monitor the horizontal movements of this population during the 1990s and mid 2000s;

however, there is little high-resolution information on dive behaviour available despite this being an important factor to determine the energetic consequences of diving for beluga whales. Recent improvements in the technology of satellite-linked transmitters now enable fine-scale questions about habitat-use, diving, and physiology to be answered. In July 2018, satellite tags were deployed on 10 beluga whales in the Mackenzie Estuary. Tags were programmed to collect time series data on dive depth and water temperature every 75s, and location (Fastloc-GPS) during surfacing events. This high resolution data enables in depth analysis of dive profiles, including time spent at each depth layer, on the surface, and ascent and descent profiles in relation to geographic location, bathymetry, and sea ice cover. Initial analyses indicate that depths between 400 and 600 m were targeted most frequently. Whales were diving almost exclusively to the seafloor in shelf and slope habitats, and to the mid-water column over the deep Arctic basin. These results will be evaluated in context with results from a summer fish survey to identify potential foraging activities on key species. Viscount Melville Sound, part of the Northwest Passage, appeared to be an important feeding ground for several of the whales between late-July and mid-August. The information from this study will be important in contributing to our understanding of the ecological significance of the various habitats used by beluga in summer through fall. The data provided here will also be used in habitat suitability- and bioenergetic modelling of Beaufort Sea beluga; which will allow prediction of their response to climate change.

METHYLMERCURY CYCLING AT THE AQUATIC-TERRESTRIAL INTERFACE: EXAMINING SPATIAL AND SEASONAL VARIATION IN A HIGH ARCTIC FRESHWATER SUB-CATCHMENT

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Methylmercury (MeHg) is a toxin which bioaccumulates and biomagnifies through food webs. In the Arctic, elevated concentrations of MeHg in freshwater fish are a potential health concern for Indigenous peoples. Understanding seasonal, and spatial, variation in sources of MeHg at the terrestrial-aquatic interface is increasingly important to predict how climate change will alter cycling of MeHg in Arctic freshwater systems. This research, carried out in a High Arctic freshwater sub-catchment (Ellesmere Island, Nunavut, Canada) aims to determine where MeHg production and degradation hotspots occur along a continuum that includes permafrost seeps, a lake, a series of ponds, a wetland and a stream, and to examine how MeHg cycling differs between the ice-on and ice-free seasons. To address these objectives, field-based experiments were used to quantify Hg methylation and MeHg demethylation and were combined with spatiotemporal surveys of MeHg and total Hg concentrations. Preliminary data indicates MeHg is produced in the lake and pond sites, but wetland soils act as a sink for MeHg reducing its export to downstream ecosystems. Interestingly, during the ice-on period (2017), Skeleton Lake had MeHg concentrations over eight times higher than during the previous summer (2016), suggesting that timing of peak methylation in Arctic lakes may differ from temperate lakes as a consequence of prolonged ice cover. This research will allow us to understand how predicted reductions in ice cover and increased permafrost thaw, for example, will impact MeHg exposure in Arctic ecosystems.

AUDITING THE FEDERAL GOVERNMENT'S RESPONSIBILITIES IN THE ARCTIC

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We would like to propose a topical presentation on the work of the federal Commissioner of the Environment and Sustainable Development (CESD) at Arctic Net's December 2018 Conference. This presentation by a member of the CESD executive team, George Stuetz, would include a broad overview of the Commissioner's mandate, with particular focus on aspects that directly relate to Arctic and Northern issues and how the work of the CESD may have impacted federal policies and programs in the Arctic. On behalf of the Office of the Auditor General of Canada, the Commissioner of the Environment and Sustainable Development (CESD) plays an important role in providing objective, independent analysis and recommendations on the federal government's efforts to protect the environment and foster sustainable development. The work of the CESD involves many issues with direct or indirect implications for the Arctic, both in the audits we carry out and the environmental petitions we receive from individuals and groups in Canada. For example, the Fall 2014 report contained a chapter on Marine Navigation in the Canadian Arctic and the October 2018 audit on marine mammals discussed key artic species. (The Auditor General also serves as the auditor for the three Canadian Territories and the March 2018 report to the Legislative Assembly of Nunavut looked at the Government of Nunavut's efforts to prepare for and adapt to the impacts of climate change.) The federal environmental petitions process, a civic engagement tool managed by the CESD on behalf of the Auditor General, also includes numerous examples involving Arctic issues. The Auditor General Act which governs the environmental petitions process, permits Canadian residents ask Federal Ministers to respond to questions or suggestions for action on environmental issues that concern them – and requires Ministers to provide a response. For example, petition 348 proposed expanding boundaries for a National Marine Conservation Area in Lancaster Sound to include the beluga breeding area grounds in Cunningham inlet – a recommendation that the Government has accepted. Other Arctic related petitions include petition 374 entitled "Federal actions on climate change adaptation in Canada's North" asking multiple federal ministers about actions being taken to help the region adapt to the effects of climate change and on steps to support the adaptation to changes in Arctic Ocean.

PATHOGENS AND HEAVY METAL CONTENT IN RINGED SEALS IN IQALUIT, NU.

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The nattiq, or Ringed seal (Pusa hispida) is a very important contributor to the diets of the Inuit people, such as on Baffin Island, in northern Canada. The abundance of seals, their nutritional value, and high costs of other food sources in the north keep this cultural practice thriving. Monitoring health parameters of the nattiq in northern regions is particularly challenging, and little has been done. Yet, these regions are currently experiencing rapid environmental changes, particularly associated with climate change, such as the movement of wildlife pathogens from southern regions. This movement of pathogens has been associated with the northward movement of other seal species, which are moving north with the continually receding ice, and has already been observed in northern Europe, Greenland, and Canada. In some cases, these pathogens can be zootonic and be transmitted to humans. In addition, northern Canada has the highest self-reported cases of enteric illnesses globally, making this staple food item essential to study to keeping Inuit informed of potential health risks that may be associated with seal products. The goal of this project is to get a picture of the current health status of the nattiq population in Frobisher Bay, Nunavut, through close collaboration between project investigators and community members. Aim 1: To identify current concerns of Iqaluit community members related to Ringed seal health. This includes collecting baseline information on the health of Ringed seals in the region of Frobisher Bay to understand and address potential health issues that may occur now and in the future, associated with environmental changes. Inuit Qaujimajatuqangit (IQ) will be collected and analyzed through open-ended semi-structured questions relating to Ringed seal abundance, health and changes they may have noticed. Aim 2: Determine levels of four heavy metals (total arsenic, cadmium, lead, total mercury) in ringed seal muscle and liver. Because of the Ringed seal's high trophic level, heavy metals bioaccumulate in the body, and may be exceeding safe consumption levels according to the Canadian Food Inspection Agency's (CFIA) regulations. Aim 3: Determine the level of exposure in 60 Ringed seals to some infectious agents. Other regions in the north have reported cases of infectious agents, which may have detrimental effects on wild animals and pose potential significance for the health of people who consume products from them. This mixed method approach will study the health status of the Ringed seals in Frobisher Bay. With the ultimate goal of getting a snapshot of Ringed seal health through the combination of IQ and western science.

CONSTRAINTS ON CLIMATE CHANGE COMMUNICATION IN THE CENTRAL ARCTIC

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The Arctic experiences some of the most visible effects attributed to global climate change. Across the polar regions, inhabitants manage their livelihoods and other daily activities amid increasing uncertainty about sea ice conditions, wildlife populations and unusual weather. While Inuit in the Central Arctic are wary of these ecological shifts, research in two settlements in the Kitikmeot region of western Nunavut suggest that Inuit in these parts are wrestling with communicating openly and consistently about suspected climate change. Constraints on climate change communication are related to the social complexities of how Inuit engage with each other and the outside world, and the harsh realities in living in an economically deprived Nunavut. Constraints to climate change communication are related to indirect Inuit conversations about activities on the Land, a common reliance on Elders to speak as 'experts' that causes younger Inuit to censor their own insights, a degree of 'climate conversation exhaustion, and the immediacy of other social challenges.

HOUSING DESIGN FOR THE INUIT NUNANGAT COMMUNITIES, A TWO TIER APPROACH: FAST PACED (ADDRESS THE HOUSING SHORTAGE CRISIS) AND SLOW PACED (RESEARCH AND DEVELOP SUSTAINABLE HOUSING SOLUTIONS)

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Numerous studies and reports have documented the housing shortage crisis in Inuit communities. With population growth well over the national average, and inadequate federal and provincial funding, Inuit communities are unable to keep up with their advancing needs. The effects of this crisis are wide-spread and promote overcrowded houses, deterioration of housing stock, family tensions, social tensions, education problems, as well as health and security issues. Without effective solutions and added funding the only foreseeable future is further decline. EVOQ architecture has been designing housing projects for the Inuit Nunangat communities for the past 20 years. Our team has developed over 15 different housing models and has overseen the construction of over 500 housing units in Nunavik, Nunavut and Nunatsiavut. We have helped our clients develop housing amid the ongoing housing crisis with the objective of building as much housing as possible. This faced pace approach is essential to counteract the housing shortage crisis. Through our sustained relationship, and thanks to the communities' sharing and mentoring, over the years, we have developed a unique understanding of the constraints of building in these remote communities and we were also able to develop insight into the specific housing needs of these communities. The knowledge acquired through these ''in the trenches'' experiences led, in time and as trust grew, to discussions about long term goals and possible improvements to ongoing projects. This slow paced approach is a true and sincere dialogue that has evolved through meetings, design charettes and public consultations. This dialogue process has led to the design and construction of two pilot projects in Nunavik and Nunatsaivut that are meant to serve as a benchmarks to future housing development. The lessons learned over the years have confirmed our belief that sustainable building design must strive to achieve more than efficient housing construction systems and energy efficiency targets. Protection of cultural diversity is as important, if not more so. This means that the ideal house for the Inuit Nunangat does not exists. A one shoe fits all approach is not sustainable even if it simplifies, in appearance, management of housing development. The multiple housing models developed attest to the variety of housing needs. These shared experiences, where local communities are heavily involved, speak loudly to the responsibility of Sustainable Building Design in Inuit communities to go one step further and to support cultural reappropriation and empowerment.

RAPID CO2 RELEASE FROM ERODING PERMAFROST COASTS AND NEARSHORE WATERS

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The warming of the Earth results in substantial permafrost thaw in the Arctic region. With thaw, large amounts of organic carbon (OC) become available for turnover into greenhouse gases (GHGs). Whereas recent projections in Earth models focus on the gradual vertical deepening of the seasonal unfrozen layer, little is known about the GHG emissions from rapid lateral thermo-erosional events. As such, coastal erosion mobilizes large amounts of OC, potentially being mineralized into GHGs during transport into or within the nearshore waters. We mimicked this erosion process by incubating permafrost sediments with and without seawater at ambient Arctic temperatures (4°C) for the length of an open-water season (~4 months). Permafrost and seawater were taken at Qikiqtaruk - Herschel Island (Yukon Coast, western Canadian Arctic) and the adjacent coastal waters (southern Beaufort Sea). We show that during the course of an open water season substantial amounts of carbon dioxide (CO2) are rapidly produced within weeks during lateral transport from the land into sea. The rates are comparable to emissions from vertical permafrost thaw on land and are most likely caused by the quick turnover of the labile OC pool. Thus CO2 emissions from eroding coastlines and its nearshore waters are neglected sources of GHGs into the atmosphere. With warmer air and water temperatures, and longer open water periods in the future, eroding permafrost coasts have the potential to become a key source of GHGs in the Arctic.

BUILDING A WEATHER-READY ALASKA

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Timely and accurate weather forecasts do not always result in a good outcome. The U.S. National Weather Service (NWS) learned this difficult lesson in late April 2011 when a tornado outbreak over two days in Mississippi and Alabama as well as neighboring states resulted in over 350 lives lost. Thus, success cannot be measured solely by the accuracy of forecasts. A successful forecast must account for societal response and, ultimately, the societal outcome. The April 2011 storms drove home for the NWS that more had to be done. These events set in motion a new strategic direction for the NWS -- an effort to build a Weather-Ready Nation (WRN) where communities across the country are ready, responsive, and resilient to weather, water, and climate threats. A critical component of this WRN initiative is the development and valuation of partnerships and collaboration with external partners of all kinds in innovative and more meaningful ways. Societal needs for weather, water, and climate information are only increasing. Communities' vulnerabilities to extreme events are increasing as well. This is all too evident in Alaska where we are seeing, first hand, the changes occurring across the state and the impacts being seen. Consequently, the NWS in Alaska is evolving to enhance meaningful partnerships across all sectors as we endeavor to build a Weather Ready Alaska. This presentation will describe some of those efforts. This includes the Sea Ice for Walrus Outlook, the River Watch program, engagement with the State of Alaska Division of Geological and Geophysical Surveys and the Alaska Institute of Justice to increase storm-surge readiness in vulnerable coastal communities, our engagement with the Bering Strait School District teachers on how to integrate science and native knowledge in the classroom and our partnership with the state Division of Homeland Security & Emergency Management and the U.S. Coast Guard, among others. NWS Alaska Region must work collectively with multiple stakeholders across diverse communities to ensure forecasts and warnings result in positive societal outcomes.

INUIT MARINE MONITORING PROGRAM

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Driven by community concerns over increasing vessel traffic in recent years, Nunavut Tunngavik Inc undertook to develop an innovative, Inuit-led approach to improving information on shipping activities and supporting greater invovlement of Inuit in shipping management. The Inuit Marine Monitoring Program, intiated in 2017, pairs on-the-land Inuit Marine Monitors with land-based Automatic Identification System (AIS) infrastructure in key areas that are of particular concern to communities. Marine Monitors are active during the shipping season recording observations of vessel activity as well as asociated observations of environmental conditions and marine wildlife. The AIS receivers, a number of which are deployed in remote areas, provide reliable and complimentary information to that collected by the federal government. Importantly, Marine Monitors collect informaiton on the increasing number of small vessels, such as yachts and sailboats, who are not required to carry AIS or report under NORDREG, filling a critical information gap. The information collected by the program is shared with participating Hunters and Trappers Organizations (HTOs) and a low-bandwidth website (currently under development) will make this information readily available to community members, improving safety and awareness. Information will also be used to improve the understanding, policy development and management of vessel traffic in Nunavut. Finally, NTI hopes to continute to build on the role of monitors in the future to undertake other critical activities that support safe and responsbile marine use, and to improve available information and understanding of the marine environment in Nunavut and the impacts of increasing shipping activity.

ICEBERG FRACTURE PROCESSES AND MODELLING

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The brittle fracture of ice is a highly important process for a variety of geophysical and engineering applications. During the calving and break-up of icebergs and ice islands, fracture is a dominant failure mechanism and it is an important consideration when modelling interactions of such ice features with ships and engineered structures. During ice-structure interactions, in addition to influencing global ice loads, fracture processes also play a vital role in the localization of contact into high-pressures zones through which intense local pressures are transmitted to the structure and which must be appropriately accounted for in design. Despite the conceptual simplicity of fracture, it is very complex to model in practice. Classical fracture mechanics analyses typically focuses on a single flaw or pre-exisiting crack in a specimen, with known size and geometry, well-defined boundary conditions and known material properties. Modelling fracture in natural ice poses challenges to nearly all aspects of such an analysis. Ice as a geophysical material contains many flaws and cracks whose size, shape, orientation and spatial distributions are not known a priori and no technology exists to date for adequately collecting such data in the field. Moreover, the boundary conditions can be challenging to define for floating icebergs and ice islands due to the dynamic nature of environmental driving forces and interaction loads, which is further complicated by their often irregular and evolving shape. In addition, ice fracture toughness and other material properties are known to exhibit considerable variability and may be influenced by factors such as loading rate, temperature and scale. Despite these challenges, recent progress has been made and new techniques for modelling different aspects of fracture are promising. In this presentation, a discussion of ice fracture processes over multiple scales will be provided, along with an overview of different modelling approaches and some associated limitations, as well as new techniques which are presently under development.

1981 TO 2070: AN ANALYSIS OF CLIMATE CHANGE'S EFFECT ON 90 YEARS OF SIMULATED, REGULATED ENSEMBLE DISCHARGE TO HUDSON BAY

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This work will focus on the presentation and discussion of the trends, trend significance and spectral analysis of the ensemble discharges from the regulated basins draining into Hudson Bay, 1981-2070. The inter-disciplinary BaySys group of projects aims to separate the relative impacts of climate change and regulation on Hudson Bay. To do so, discharge simulations using the HYPE hydrological model (Lindstrom et al., 2010) of the Hudson Bay Drainage Basin (HBDB) have been run at a daily time-step from 1981 to 2070 using a climate ensemble from CMIP-5. Ultimately, these hydrological simulations will be used as the input to the NEMO sea-ice model (Ridenour et al., submitted) used to quantify climate change's and hydroelectric regulation's joint and individual effects on sea-ice in Hudson Bay. Since the hydrologic calibration of the overall HBDB land-mass (MacDonald et al., 2018), particular attention has been paid to development of new regulation routines in the Nelson-Churchill River Basin (NCRB) (Tefs et al., in prep), operated by Manitoba Hydro and other provincial and inter-jurisdictional water boards. The combination of these regulated discharges to Hudson Bay from the NCRB with discharge from the La Grande Rivière Complex (LGRC), modelled by Hydro-Québec (Guay, 2016) allows for the complete analysis of the regulated discharge to Hudson Bay. These two hydroelectric complexes together account for 57% of the gauged drainage area (1,778,000 km2) and 41% of the gauged discharge (200 km3/year) (Déry, 2011) to the bay. Changes in the flows are analyzed for the full simulation period and compared between three climatic periods: 1981-2010, 2021-2050 and 2041-2070. This analysis examines the seasonal and overall changes of discharge using trend and significance tests as well spectral wavelet analysis.

STORIES FROM TŁĮCHQ LANDS: DEVELOPMENT OF A SUCCESSFUL NORTHERN PARTNERSHIP FROM AN EARLY CAREER RESEARCHER'S PERSPECTIVE.

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The Tłı ̨chǫ Agreement, signed in 2003, is a precedent setting land claim and self-governance treaty between the Tłı ̨chǫ People and the governments of the Northwest Territories and Canada. Implemented in 2005, the Tłı ̨chǫ Government have full surface and subsurface rights of 48,000 km2 of traditional Tłı ̨chǫ Lands. The Tłı ̨chǫ, who are comprised mainly of the four communities of Behchokǫ`, Whatì, Gamètì, and Wekweètì, have long been leaders in the North, maintaining a strong cohesive identity, and have taken a strong position in historic legal negotiations with the federal and territorial governments to maintain their independence and traditional land rights. Fueled by the ethos of protection of Lands and preservation of culture, the Tłı ̨chǫ Government, led by community elders and members, set forth to establish policy and programs aimed at protecting and educating the Tłı ̨chǫ community's natural and cultural heritage. As leaders in the North, the Tłı ̨chǫ Government and community have recognized the importance of embracing and integrating science into wildlife, water, and forestry monitoring programs and to function in a modern western legal framework regarding pollution and resource management. Building on this approach, science is welcomed as an important element of education. Tłı ̨chǫ community members, especially youth, are encouraged to gain both traditional Tłı ̨chǫ knowledge as well as modern science knowledge to build a resilient informed community. Through many yearly on-the-land programs involving youth, elders, community environmental monitors, and members of the scientific community, academia and government, the Tłı ̨chǫ government has strived to create opportunities for knowledge exchange across age and expertise while simultaneously undertaking valuable scientific monitoring and northern research. The Marian Watershed Stewardship Program (MWSP) is a primary example of this type of initiative. To address community concerns regarding climate change and the potential development of the NICO mining project in the central Marian Watershed, the Tłı ̨chǫ Government established the MWSP in 2013 to monitor fish, water, and sediment in the central watershed above and downstream of the mine site. During the past four years, this ECR has participated in the MWSP yearly field sampling trips collecting sediment cores to establish long-term baseline conditions from multiple locations throughout the watershed, and led the design of water and sediment sampling programs. Sample site selection has been done through consultation with Tłı ̨chǫ community members and focused on traditional fishing and hunting sites. Sample collection has involved community members, which has created excellent opportunities for knowledge sharing among elders and scientists. This community-driven approach has enriched the science and the experience of the scientists through meaningful relationships with those that call Tłı ̨chǫ Lands home. This successful northern partnership has created a positive environment, fostered trust, and has established the basis for developing new collaborative research opportunities. This presentation will provide an overview of the evolution and development of this partnership, its major successes, challenges, and future direction from the researcher's personal experience working on Tłı ̨chǫ Lands.

CORPORATE SOCIAL RESPONSIBILITY STANDARDS IN THE ARCTIC CRUISE TOURISM INDUSTRY? THE ROLE OF THE ASSOCIATION OF ARCTIC EXPEDITION CRUISE OPERATORS IN SUSTAINABLE TOURISM GOVERNANCE

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The Association of Expedition Cruise Operators (AECO) is an industry association that has implemented environmental management on a voluntary basis to ensure safe tourism in what we refer as the Euro-Russian Arctic. AECO members must operate in accordance with national, international laws and regulations and agreed, in addition, to follow an extensive set of guidelines to ensure operations are conducted in a safety and environmentally friendly manner. The Canadian Arctic region, while mentioned in most of AECO conferences and reports, suffer from the absence of such guidelines. Many operators in the Euro-Russian arctic seems not to be members of the Association (Hall et al. 2010), and very little is known on the conduct of its members and the norms they adhere to. This being said, this paper first aim to determine, if any, the international corporate social responsibility ISO norms the AECO as a private actor of the Arctic governance is following. Secondly, what are the ISO norms its members in the Canadian cruise tourism market - Adventure Canada, The Ponant Company, Quark Expedition, National Geographic Lindbald Expedition, Silversea and One Ocean Expedition – are adhering to? Discussion will focus on the international standards those cruise operators follow, the role of the AECO and its members in the promotion of a sustainable tourism governance, the perceived challenges associated with the implementations of these guidelines in Canada and the need for central permitting body or office and how block chains technologies could increase the efficiency of government permit issuing processes by enabling multiple government departments to maintain a single shared source of reliable information.

CANADIAN ARCTIC LEADS GLACIER AND ICE CAP CONTRIBUTIONS TO GLOBAL SEA LEVEL RISE IN NEW 2006-2016 MASS BALANCE ASSESSMENT

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Four glaciers and ice caps in the Canadian Arctic Archipelago located on Meighen, Axel Heiberg, Melville, and Devon islands host continuous/near-continuous surface mass balance records that span >50 years in length. These official reference glaciers, as designated by the World Glacier Monitoring Service under the auspices of the United Nations Environment Program, provide in situ measurements critical to validating and cross-calibrating satellite-based mass change estimates and informing our understanding of the key processes driving glacier response. While these field based observations are the only means of capturing the interannual variability of glacier fluctuations prior to the satellite era, estimating global glacier sea level rise contributions from these observations is complicated by the challenge of scaling geographically sparse point-data to regional scales. A World Glacier Monitoring Service working group focused on the regional scaling of mass balance observations has developed a new methodology to estimate sea level rise contributions from glaciers and ice caps for the 2006-2016 period using the combined strengths of the high-temporal resolution of field-based surface mass balance observations with the high-accuracy of multi-year geodetic mass balance calculations. With the addition of several new datasets from previously under represented regions, the new estimates significantly improve upon previous methodologies used in the IPCC to derive sea level rise from surface mass balance observations. The results show that the Canadian Arctic (north and south sectors) continues to be the largest global contributor to sea level rise from glaciers and ice caps.

THIN SECTION ANALYSIS OF A MARINE CORE FROM M'CLINTOCK CHANNEL, NORTHWEST TERRITORIES: MICROMORPHOLOGICAL EVIDENCE FOR MASS FLOWS AND ICE SHELF GROUNDING EVENTS

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Thin-section analysis of sediment micromorphology, structure, and microfabric is a commonly used approach in the investigation of soils and terrestrial glacigenic materials. However, within the scope of Arctic marine deposits recovered via sediment coring, it is a relatively new practice despite the potential the technique has for assisting in the determination of the environment and mechanisms of deposition in glacially-influenced marine settings. Recent work in the Canadian Arctic Archipelago (CAA) has suggested that marine-based deglaciation following the Last Glacial Maximum (LGM) was marked by the formation of extensive ice shelves in the inter-island channels, with further deglaciation resulting in a series of large ice shelf readvances. Despite the importance an understanding of deglacial ice shelves has for comprehending and predicting ice sheet retreat dynamics, the geomorphic and stratigraphic signature of these systems remains often ambiguous and difficult to interpret. Therefore, this project seeks to apply thin section analysis to multiple samples from a marine sediment core originating from M'Clintock Channel to facilitate a more nuanced identification of sedimentological structures diagnostic of deglacial marine and ice shelf dynamics with the aim of further developing the methodology for glaciomarine applications. M'Clintock Channel is a waterway within the CAA that was home to a series of fast ice flow readvances and ice shelves flowing into Viscount Melville Sound (VMS) during the period following the LGM as evidenced by well-developed ice shelf moraines and sea-floor megascale glacial lineations. Sediment core 2016805-0041GC from basin at the northern end of M'Clintock Channel exhibits units of heavily disturbed laminations bordered by units of undisturbed bedding based on X-ray imaging and macro-scale sedimentological description making it ideal for further inspection via thin section. Micromorphological analysis suggests that following the retreat of grounded ice, the northern slope of the basin was subject to a series of mass flows related to possible episodic grounding of an ice shelf on the sill at the channel's northern entrance to VMS. This investigation confirms the utility of thin section analysis as a tool in studies of glaciomarine sediments and permits the identification of possible ice shelf events in otherwise ambiguous sedimentary sequences.

TRACKING CLIMATE-DRIVEN LANDSCAPE CHANGES AND ASSOCIATED IMPACTS ON LAKES AND RIVERS IN OLD CROW FLATS, YUKON, CANADA

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Lake-rich permafrost landscapes occupy vast northern regions and represent ecological hotspots that provide important resources for northern communities. Changing climate conditions have induced widespread, yet variable responses across many of these landscapes including drastically fluctuating lake water levels (e.g., increased lake drainage frequency), increasing shrub growth, permafrost thaw slumping, and fire. We are investigating these processes and associated consequences on lakes and rivers in Old Crow Flats, Yukon where members of the Vuntut Gwitchin First Nation are concerned that climate and landscape changes are negatively affecting their traditional lifestyles. Results presented here focus on changes in lake and river shoreline areas where we have tracked: 1) the hydrological response of a drained lake basin to rapid shrub vegetation encroachment, and 2) the development of a relatively large retrogressive thaw slump and its influence on the drainage network. Inter-annual and seasonal changes in lake surface water area were determined for Zelma Lake following its drainage in June 2007. Surface water areal coverage, calculated using the normalized difference water index (NDWI), was highly variable (min = 2.7 km2, max = 7.9 km2) among the 46 scenes during the 12-year period. Water level data collected during 2009 strongly correlated with NDWI-derived surface water area due to the low-slope of the former lakebed. Water isotope tracers and chemistry parameters suggest that the drained lake basin received increasing snowmelt input upon establishment of shrub vegetation. High-resolution multispectral mapping of the shoreline area was conducted using a fixed-wing unmanned aerial vehicle (UAV) during 2018 to evaluate the utility of the Landsat data for identifying shoreline areas more recently. UAV surveys were also used to track volumetric export of sediment from the retrogressive thaw slump into the Old Crow River. The slump experienced 39% volume loss (29,200 m3 to 40,600 m3) of sediment during the first two years since it initiated during June 2016. Export of the thawed sediment had a greater influence on downstream river water chemistry and carbon isotope values during wet conditions. These studies are providing key insight of how hydroecological conditions respond to drastic landscape transitions including lake drainage events, shrub proliferation, and thaw slumps, which are expected to intensify with changing climate.

SIMULATION OF ECOSYSTEM CARBON CYCLE IN NY-ÅLESUND, NORWEGIAN HIGH ARCTIC UNDER ENVIRONMENTAL CHANGE

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The recent environmental change, an especially climate warming trend which is widely observed in the Arctic, is likely to profoundly influence ecosystem carbon cycles. Quantitative investigation of carbon pools and flows are essential to predict the impact of climate warming on Arctic ecosystems. Since 1994, we have clarified the pattern of ecosystem carbon cycle and the factors controlling the cycle in Ny-Ålesund, Svalbard, High Arctic Norway. At first, we investigated major carbon pools and flows within the glacier foreland of Austre Brøggerbreen (East Brøgger Glacier) in Ny-Ålesund. Vegetation cover and soil carbon pools tended to increase with the progress of succession though development of vegetation cover and accumulation of soil carbon appeared to be very slow. However, a non-negligible amount of organic carbon is distributed in soils of the latter stages of succession (Yoshitake et al. 2011). Photosynthesis of vascular plants such as polar willow (Salix polaris), was the major pathway of carbon fixation. In contrast, cryptogams (mosses and lichens) contributed the major proportion of phytomass in the latter stages but their net primary production was much smaller than that of the vascular plants because of available water limitation (Nakatsubo et al. 2005). Using observations of carbon cycle processes, we constructed a simple process-based model to assess how the carbon balance will be altered by ongoing climate warming and possible biological changing factors. Model analysis indicated that rising temperature did not always have positive effects on carbon sequestration because of enhanced respiration in the later part of the growing season under low light condition (Uchida et al. 2016). I will also discuss other factors which could affect carbon cycle.

SEA SURFACE TEMPERATURE VARIABILITY IN THE NORTH WATER POLYNYA

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The North Water polynya (NOW), situated between Greenland and Ellesmere Island in northern Baffin Bay, is a region of the polar ocean that does not freeze completely during winter. The northern extent of the NOW is demarked by an ice arch that typically forms across Smith Sound in fall or winter. Winds and current advect ice southward from the arch, allowing the formation of new ice. The ice arch normally breaks down in June or July, allowing ice floes from the Arctic Ocean to enter northern Baffin Bay via Nares Strait. The formation and dissolution of the Smith Sound ice arch has shown good predictability since the advent of satellite imagery, but there have been anomalies in recent years. In 2007 the ice arch did not form, leading to unprecedented transport of multi-year ice from the Arctic Ocean and warm water anomalies in the NOW. In 2009 a northern ice arch at the junction of Nares Strait and the Arctic Ocean precluded the formation of the Smith Sound ice arch and resulted in record-high sea surface temperatures (SSTs) in Baffin Bay. Conversely, in 2018 the ice arch persisted until mid-August, resulting in very cold SSTs in the region. This study examines the recent variability of the Smith Sound ice arch and its impact on sea surface temperatures in northern Baffin Bay.

ENVIRONMENTAL DETERMINANTS OF ADULT SURVIVAL IN MIGRATORY TUNDRA CARIBOU

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Most caribou and reindeer herds are in decline in the North, including migratory caribou herds in northern Quebec and Labrador. The pressure of current environmental disturbances justifies the need of wildlife conservation for both habitat and population, in order to maintain natural resources. As migratory caribou are a key economic, ecologic and social element of the North, Inuit and Cree communities are concerned about its future. In may 2017 COSEWIC assessed migratory caribou in eastern Canada as endangered. It is essential to understand the causes of ongoing declines to efficiently conserve these populations. Reliable estimates of survival and reproduction are needed for conservation and for modelling population dynamics. In large mammals, changes in the survival of adult females have drastic consequences for population growth rates. We investigated adult survival in relation to environmental and demographic parameters for two declining migratory caribou herds: the Rivière-aux-Feuilles Herd (RFH) and the Rivière-George Herd (RGH) of northern Quebec and Labrador. We analyzed data from more than 800 adult caribou marked with satellite collars since 2000. We used known-fate models to quantify adult survival rate, considering multiple environmental variables to assess the possible impacts of climate, vegetation quality and availability, predation and hunting. Annual adult survival was highly variable for both herds, ranging from 0.396 (RG, 2010) to 0.923. These results revealed that adult female survival for the RFH was insufficient to explain the decline and that no population growth was possible for the RGH considering low adult female survival. Male survival was always on average 14% lower than female survival regardless of the temporal scale. Three critical biological seasons were shared by adult caribou from both sexes and herds: summer, fall migration and winter. We identified direct and carry-over effects of climate and resources on annual and seasonal survival, and observed different effects for the two herds. Low survival for both sexes in winter may be explain by the energetic costs of the fall migration, increased energy expenditures during winter and lower resource availability. Severe winters led to lower survival the following summer for female. Our results will serve as guidelines to improve the collective effort of efficient management of these populations and their habitats.

VASCULAR SYNPHENOLOGY OF ARCTIC PLANT COMMUNITIES IN SOUTH-EASTERN VICTORIA ISLAND, NUNAVUT: A COMPARISON OF 2015 AND 2018 GROWING SEASONS

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Phenology is the study of the timing of life cycle events, and the phenological development of plant species is strongly dependent on seasonal variations in environmental factors, especially temperature. Phenological records of entire plant communities—synphenology—over periods of many years can serve as invaluable proxies for interannual changes in temperature due to climate change and global warming. While the synphenology of temperate ecosystems has been fairly well researched, phenological observations in the Arctic are comparatively fewer, and synphenological work has never been performed in these high-latitude regions, which are most affected by global climate change. The phenology of the most representative vascular plant species in a seashore ecosystem near Cambridge Bay has been recorded during the growing seasons of 2015 and 2018, from mid-June to beginning of September. Vegetative (leaf) as well as generative (flower and seed) development in shrubby, herbaceous and graminoid plant species have been assessed at weekly intervals using a phenological key with 12 phenological stages, from the development of the first leaf/first floral bud to leaf death/seed dispersal. Additionally, the different phenological stages of plants were documented also by digital photographs taken at the time of phenological assessment. This phenological data has been assembled into synphenological diagrams, and an overview of the phenological development of the entire plant community, as well as the comparison between the two years, as related to the local weather, is discussed.

CONTAMINANTS IN SALMONIDS FROM THE KITIKMEOT REGION, NUNAVUT: COLLABORATIVE EFFORTS WITH BETWEEN KING WILLIAM ISLAND RESIDENTS AND SOUTHERNERS

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Knowledge gained through community understanding and practices integrated with scientific methods and analysis can result in important findings. Gjoa Haven community members urged university-associated researchers to investigate contaminants in their subsistence catches, targeting traditionally-fished sites on or near King William Island. Consultations with the community concerning fish consumption revealed that Arctic char (Salvelinus alpinus, iqaluk), lake trout (Salvelinus namaycush, ihok) and lake whitefish (Coregonus clupeaformis, kakkiviaqtuuq and pikugtuuq) were preferred by different families and at different times of the year. Two species of cisco (Arctic cisco, Coregonus autumnalis, kavihilik, and least cisco, Coregonus sardinella, anaaqtiq) were less preferred. Accordingly, muscle samples (n= 22-68, depending on species) were analyzed for 60 metals, polychlorinated biphenyls (PCBs), and with a subset assayed for nitrogen and carbon isotopic signatures (δ15N, δ13C). Sampling at subsistence fishing sites is ongoing, as guided by community fishers, caregivers and elders. Lake trout showed mercury concentrations that were significantly greater than in all other study species, and exceeded Canadian consumption guidelines (0.5 μg/g) by the time the trout had reached an age of 8 years, or only 13% of the maximum sampled age (62 yr), and 1.0 μg/g, by a mean age of 17, or only 27% of maximum age. Levels in lake whitefish did not surpass the lower guideline until more than 66% of the maximum sampled age (47 yr), with a pool of both cisco species not significantly different. All Arctic char levels remained lower than Canadian health advisory levels. Bioaccumulation was the greatest contributory factor for lake trout contamination, suggesting that their fresh water habitat, their slower growth compared with char, and their long lifespan may contribute to trout mercury contamination and not to biomagnification, linked to trophic status. Community and southern researchers are working together to sample additional fish, partially supported by a joint researcher-community funding from the Northern Contaminants Program. Acknowledgements: We thank Gjoa Haven community residents, the Hunters and Trappers Association (HTA), the Northern Contaminants Program, and a Genome-Canada Project, Towards a Sustainable Fishery for Nunavummiut.

MICROBIAL ECOLOGY OF TRADITIONALLY IMPORTANT ARCTIC SALMONIDS IN KITIKMEOT, NUNAVUT

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The Towards a Sustainable Fishery for Nunavummiut (TSFN) project is a partnership with with Nunavummiut communities to increase the understanding of fishery resources that are becoming more accessible due to climate change in the lower Northwest Passage (LNWP). As part of this project, we are using microbial community analysis to help inform the health of Arctic char (Salvelinus alpinus), and lake whitefish (Coregonus clupeaformis). Questions of interest relate to how gut microbial communities interact with the host's environment and include: 1) do char and whitefish harbour different gut microbial structures when living in their saltwater and freshwater phases? 2) does gut microbial diversity vary with fish genetic diversity? and 3) does gut microbial community composition and diversity impact population fitness and fish growth rates? More generally, study goals include the characterization of gut microbiomes from these wild populations, and identification of a core gut microbiota as a baseline for future conservation initiatives. Working with Inuit fishermen, we collected water samples and over 1200 fish from sites around King William Island, in the LNWP. On-site sampling of multiple tissues was followed by DNA extraction and Illumina sequencing of bacterial and archaeal 16S ribosomal RNA genes. Preliminary results show a difference in gut microbial community composition between char sampled from freshwater and those caught in the sea within the same migration route. The largest contributor to this difference are members of the Vibrionaceae, a bacterial family containing many important fish pathogens. Taken together, gut microbial communities may well play an important role in fitness of these populations in a changing Arctic. Acknowledgements: The fishers of Gjoa Haven NU, the Hunters and Trappers Association, TSFN, a Genome-Canada project, the Government of Nunavut, and others as listed.

TRACE ELEMENT AND STABLE ISOTOPE ANALYSIS ELUCIDATE STOCK STRUCTURE IN A NARWHAL (MONODON MONOCEROS) POPULATION WITH NO GENETIC SUBSTRUCTURE

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The chemical composition of tissues can act as a biological tag to discriminate among groups of animals that inhabit different environments or geographic areas. In the Canadian Arctic, narwhals (Monodon monoceros) are hunted for subsistence and for sustainable management they are subdivided into stocks based on their summer aggregations. However, narwhals are a highly mobile species and any information that can help decipher the stock origin of individuals is needed. Stable isotope analysis of carbon (δ13C) and nitrogen (δ15N) and trace element analysis of 31 elements was conducted on narwhal skin tissues from five previously defined narwhal stocks in the eastern Canadian Arctic: Somerset Island, Eclipse Sound, Admiralty Inlet, East Baffin Island, and Jones Sound. To capture signatures reflective of the narwhals summering grounds we evaluated samples collected in August and September, and samples from April through June were defined as spring samples; we anticipated less distinction among stocks for spring samples since narwhals from all stocks are known to overwinter in Baffin Bay. Principal axes from a principal component analysis on trace elements that varied among stocks and stable isotopes of δ13C and δ15N were input into a discriminant analysis. Discriminant analysis showed there was a significant difference between the Admiralty Inlet and Eclipse Sound stocks in the summer and both differed from Jones Sound and Somerset Island. In the spring season, there was more overlap among stocks. Signatures from whales hunted in Eclipse Sound overlapped those from Admiralty Inlet and East Baffin Island, but whales from Admiralty Inlet were distinct from East Baffin Island, and Jones Sound narwhals. In both spring and summer, 75% of narwhals were classified correctly to their defined stock. When used in combination, stable isotope and trace element analyses may be useful for delineating narwhal stocks, and could be used to complement other stock discrimination techniques.

ASSESSING PERMAFROST-SHRUB INTERACTIONS IN THE TORNGAT MOUNTAINS NATIONAL PARK, NORTHERN LABRADOR

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The Torngat Mountains in northern Labrador comprise the southern limit of the Arctic in Canada and are predicted to undergo considerable ecosystem modification due to long-term changes in the region's climate. As a coastal low-Arctic mountain range, the Torngat Mountains are also near the threshold for upright tree growth and could serve as a useful proxy for future changes expected to occur in other coastal Arctic mountainous environments in Nunavut and Greenland. Rapid shrubification since the beginning of the satellite era has been observed at low elevation throughout the region and has intensified in recent years with potentially direct and indirect impacts on permafrost, local hydrology, plant communities and wildlife. To support ecological integrity monitoring and assessment initiatives, collaboratory research between a team of permafrost scientists and ecologists was undertaken in the Torngat Mountains through a joint Nunatsiavut Government - Parks Canada – Weston Foundation funded initiative. This research opportunity enabled the first ever examination of permafrost conditions and environmental conditions in the Torngat Mountains National Park and adjacent areas (TMNP). Here we report preliminary results from three years of field investigations on permafrost-shrub interactions in TMNP collected across a variety of ecozones ranging from high Subarctic low erect shrub tundra to low Arctic Dwarf shrub tundra. Field investigations included geophysical surveys using DC electrical resistivity tomography (ERT), topographic profiling, active layer probing, ground surface temperature monitoring and aerial photography generated using an unmanned aerial vehicle. Along each ERT profile, shrub cover and height were characterized directly in the field and remotely using drone stereophotogrammetry. Field surveys showed that tall shrubs were associated with warmer ground temperatures and thinner permafrost (inferred from ERT and instantaneous ground temperatures). In contrast, prostrate shrubs were correlated with higher near-surface resistivities and detectable permafrost. Permafrost was likely present in 17 of 20 transects with inferred thicknesses exceeding 15 m at several locations. Permafrost was inferred to be absent in the upper 5 m beneath streams and tall (> 1.5 m) shrubs at some sites. However, contrary to other recent studies, in TMNP active layer thicknesses were not directly correlated with shrub heights at all sites. Instead active layer thicknesses were most clearly related to surficial material type and local geomorphology implying that permafrost may not always limit upright vegetation growth in TMNP. These data highlight the role of geomorphological factors (e.g. surficial materials, hydrology) in mediating shrub-permafrost interactions and challenge simplified modelling frameworks that infer direct causal associations between these systems. Further this study shows the importance of using an integrated geosystems-ecosystems perspective for predicting the impacts of climate change on northern shrub-tundra environments in the discontinuous permafrost zone.

TEMPORAL AND SPATIAL TRENDS OF MARINE TOURISM IN THE CANADIAN ARCTIC: RISKS AND OPPORTUNITIES

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A changing climate and reduction in sea ice has made the Canadian Arctic more accessible to maritime traffic through increases in open water and total season length. Over the past 25 years shipping traffic in Arctic Canada has more than tripled. Marine tourism (both passenger ships and pleasure craft) has become popular over the past decade, and it is speculated that because of the allure of the Northwest Passage and the growing interests in "last chance" tourism, the demand will continue. 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, two recent incidents, the grounding of a passenger vessel (Akademik Ioffe) along the Northwest Passage and the sinking of an 11-metre sailboat that was trapped in ice in Nunavut's Bellot Strait, are a reminder of the hazards and risks associated with marine tourism in the Arctic. This study uses a recently developed geospatial database of ship traffic from 1990 to 2016 to provide an overview of the spatial and temporal variability of marine tourism vessels in Arctic Canada. To supplement this, a comprehensive database of cruise ship itineraries from 2006 to 2016 was analyzed to understand the specific locations (communities, protected areas, etc.) cruise ships are visiting. The findings enhance our understanding of the potential risks and opportunities associated with marine tourism and the potential impacts on coastal Arctic communities. This is vital for the management and planning of a sustainable tourism industry that ensures both respect of northern ecosystems and rights and traditions of Indigenous northerners.

PERMAFROST (RESEARCH) IN CANADA 2018, A SYNTHESIS OF OBSERVED CHANGE

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In line with ongoing efforts to structure research networks and promote a more comprehensive understanding and monitoring of permafrost systems, we have worked as a multi-disciplinary team of collaborators to synthesise recent permafrost change in Canada. As the impacts of permafrost degradation can be severe on both local and global scales, there is an increasing need to link different aspects of permafrost research and provide a clear interface to connect with stakeholders. We have developed a structure differentiating between determinants and drivers of change vs. changing permafrost landscapes and phenomena. More or less long-term factors determining the present state of permafrost, such as geologic, glacial, and climatic legacies were condensed into key permafrost regions. Trends in climatic and other drivers were assessed from the early 80's up to present. Observational data, categorised as ground-thermal, geomorphologic, and hydrologic, were then aggregated and superimposed on the driving factors and trends. Specific methods vary per section depending on the type and availability of data, taking into account quantitative as well as semi-quantitative data. Due to the complexity and inherent connectedness within permafrost systems, ongoing discussion can incrementally refine the synthesis framework. By working collectively towards interdisciplinary dovetailing and standardising methods to report permafrost change, we aim to support the assessment, adaptation, and mitigation of environmental and societal impacts of permafrost change. Considering the extensive knowledge in academia as well as in northern indigenous communities, local observations and expert opinion can provide invaluable insights for permafrost syntheses. This project emphasises the readiness within the (Canadian) permafrost community to collaborate on key issues. Building on this, national and international research networks can provide the structure and continuity necessary to optimise practices to monitor permafrost and report observed change.

COLLABORATIVE RESEARCH IN THE INUVIALUIT SETTLEMENT REGION (WESTERN CANADIAN ARCTIC): BUILDING THE EVIDENCE-BASE FOR AN INUIT FOOD SECURITY STRATEGY

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While Inuit face significant food security challenges across the Canadian Arctic, there has been limited focus on understanding regional-scale governance structures and needs. In the Inuvialuit Settlement Region (ISR), Northwest Territories, 46% of households experience some level of food insecurity—a rate far exceeding the Canadian average. The Inuvialuit Regional Corporation and a team based at the University of Ottawa are working collaboratively with the six ISR communities (Aklavik, Inuvik, Paulatuk, Tuktoyaktuk, Ulukhaktok, and Sachs Harbour) to build an evidence-base to guide decision-making about future programming and the development and implementation of a regional Food Security Strategy. Here, we report on a community engagement process that took place in winter 2018. Drawing on our previous research and relevant literature, we developed a participatory process to identify community assets, gaps, priorities, and relevant actors and resources to support food security. Five community-based research assistants (RAs), one in each remote community (excluding Inuvik), provided vital support with on-the-ground logistics. Each RA planned and implemented the process in her respective community (e.g. room booking, recruitment, catering) and publicized the engagement opportunity through local communication mechanisms (e.g. radio messaging, community Facebook Group). The RAs now act as local points of contact who share updated information within their communities as the project evolves. The community engagement process involved 12 focus groups (n=91) and 19 interviews (n=22) with participants in all six ISR communities and with representatives involved in commercial food procurement and transportation within the region. Community-based focus groups and interviews with were framed around eight goals determined through previous research, each of which was associated to one aspect of the food system: country food (5 goals), store-bought food (2 goals), and locally-produced food (1 goal). Interviews with commercial representatives focused on opportunities and challenges related to market food procurement and transportation. Focus group notes and interviews were transcribed, then coded using Dedoose qualitative data analysis software. Results tend toward a reasonably consistent prioritization of overarching goals across communities; however, there are clear local differences in how programs, initiatives and gaps are assessed. Next steps involve verifying results with each ISR community through public presentations and discussions with key leaders. While the research outcomes will contribute to improved understandings of Inuit food system security and governance, they will also 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 of organization. Importantly, the research will build a foundation for a regional Inuvialuit Food Security Strategy and help improve the degree to which ISR food security programs and policies complement each other. It will also provide clear direction for food security programs both internally within Inuvialuit entities and externally with relevant government and not-for-profit organizations.

COASTAL DYNAMICS IN TUKTOYAKTUK – COMPLEX ISSUES, COMPLEX IMPACTS AND COMPLEX SOLUTIONS

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Tuktoyaktuk is a community of change, a community facing severe threat from the ocean and thawing of permafrost. This is not a secret to the community or the surrounding region. Located along the Beaufort Sea in the western Canadian Arctic within the Inuvialuit Settlement Region, Tuktoyaktuk (pop. 900) has faced the challenges of dealing with coastal erosion for many decades. Climate driven change (thawing permafrost, increased storminess) has exacerbated the problem such that current shore protection measures are not working and the shoreline continues to disappear. In the face of this inexorable erosion, community residents would like to see action taken to stabilize the community of Tuktoyaktuk and several possible adaptation measures are being considered. For this reason, continued research to better understand the nearshore coastal dynamics in this rapidly changing environment is critical to making accurate projections of the future change. The complex understanding of how the frozen coast reacts to ocean and thaw is not so clear cut. Natural Resources Canada in partnership with the Hamlet of Tuktoyaktuk is leading this innovative research to develop a complex understanding of these change processes, their impacts, and their implication on possible adaptation measures. In Tuktoyaktuk there is one clear fact, that large waves have the ability to move considerable amounts of material impacting both the coastal infrastructure, the water column, and seabed habitat. The summer of 2018 was unusually cold, with a late ice break-up and cooler temperatures insuring that thaw failures were not as prevalent. This presented a unique opportunity to observe the direct impacts of the ocean waves on the coast. On August 17th 2018, the region experienced yet another significant storm (the fourth of the season) with NW winds exceeding 65 km/hr, surging water levels upwards of 1.1 m, and generating wave heights exceeding 1.5 m. The use of new innovative technology has presented an opportunity to monitor the impacts of the storm in a way that has not been done before. A detailed look at the thermal impact of the warm water on the coast (through thermal imaging camera), combined with the use of Ground Penetrating Radar (GPR) to validate and monitor the presence of buried ice under the town will help to evaluate how existing infrastructure and landscape react to increased waves. Detailed digital elevation models from unmanned aerial vehicles (UAV) and water column data from an acoustic Doppler current profiler (ADCP) will not only help to highlight the dramatic sediment loss, but also give us an idea of where the sediment goes after erosion from this event. Climate driven change in the Arctic has had a dramatic affect on the community, now is the time to work together with the community, partners, and governments to facilitate knowledge exchange and action to help better prepare. As Tuktoyaktuk gets closer and closer to the ocean, the community continues to be faced with important decisions on not only the short term future of some homes but on the long-term future of the community.

THE EFFECTS OF CLIMATE CHANGE ON TERRESTRIAL ECOSYSTEMS IN THE HUDSON BAY LOWLANDS

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The impact of climate warming in Canada's Subarctic is no longer an abstract concept. Warming air and surface temperatures reveal strong evidence for changes in the composition and productivity of the subarctic terrestrial landscape. These changes, while significant on their own, create a domino-effect ultimately influencing other aspects of the environment. This study provides a synthesis of current research centred within the lake-rich western Hudson Bay Lowlands, specifically the region surrounding Churchill, Manitoba. Over the past decades, this area has experienced some of the greatest warming in the Circumpolar North and is considered one of the most sensitive regions in Canada to permafrost thaw. Climate models have predicted that this warming pattern will continue with a corresponding increase in the duration of ice-free periods on the Hudson Bay and therefore, less extreme winter temperatures and increased growing season evaporation. Our research has focused on three main drivers of environmental change within the Churchill region in response to these warmer temperatures and longer ice-free seasons: thawing permafrost, treeline alteration, and increases in freshwater lake and pond productivity. We used a case study approach to illustrate the influence climate warming is having on the terrestrial subarctic environment. The Churchill region is located at the southern edge of continuous permafrost and contains the transition between discontinuous and continuous permafrost, making this region particularly vulnerable to change. Permafrost degradation has far reaching consequences, including the potential to significantly reduce polar bear denning habitat. Additionally, a period of treeline advance occurred during the first half of the 20th century within the Churchill region and due to low mortality rates and an abundance of seedlings, this advance is likely still occurring. However, much of the treeline advance and growth trends within this region are more dependent on-site specific drivers (i.e. snowpack, proximity to Hudson Bay, granivore abundance) rather than regional climate warming. Understanding changing snowpack dynamics is therefore critical to understanding how the treeline and vegetation within this region respond to the changing climate. Finally, 25-40% of the Churchill region/Hudson Bay Lowlands land surface is covered by shallow freshwater lakes and ponds that are extremely vulnerable to climate change. Increasing temperatures and nutrient inputs are two of the main drivers of primary productivity for these freshwater ecosystems. Warmer water temperatures can increase development rates of amphibians in the larval life history stage, at the lower expense of reduced size at metamorphosis. While wood frogs have shown some capacity to respond to environmental changes individually, some populations might not be capable of mounting a large enough response to overcome environmental change, and extreme changes may prove to be beyond adaptive capacity. Terrestrial ecosystem responses to climate warming are complex and multifaceted especially since interactions between subarctic organisms and their environments can be both directly and indirectly affected by rising temperatures. Therefore, understanding relationships between climate drivers and ecosystem processes is critical for predicting the impacts of climate change within this vulnerable region.

MARINE ARCTIC ECOSYSTEM STUDY (MARES): MOORING DEPLOYMENTS ON THE BEAUFORT SEA SHELF

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The overarching scientific goal of MARES is to increase our understanding of the impact of physical drivers (ocean and ice) on the trophic structure and function of the marine ecosystem on the Beaufort shelf.

To support this goal, we deployed five moorings across the Canadian Beaufort Sea shelf west of Herschel Island, between 10 and 440m depth. This part of the project, funded by BOEM under the auspices of the National Ocean Partnership Program (NOPP), has been a collaboration between Stantec, ASL, the Woods Hole Oceanographic Institution, the University of Alaska Fairbanks, SeaStar Biotech, and the University of Washington. Consultations with the local Hunters and Trappers Committees in Aklavik, Inuvik and Tuktoyaktuk, and presentation to the Inuvialuit Game Council provided needed and valued input, and resulted in Inuvialuit Final Agreement Environmental Impact Screening Committee approval and Northwest Territories Scientific Research License. Moorings during this first year (Oct 2016-2017) were equipped with sensors to measure fluorescence, conductivity, temperature, depth, current velocities, ice thickness, ice velocities, nutrients, pCO2, abundance of zooplankton and fish, and passive acoustics. During this presentation we will illustrate some of the biophysical and chemical characteristics gained from this unique year-long multidisciplinary data set. Particularly, we focus on under-ice dynamics, cross shelf processes, the influence of the Mackenzie River plume in this region, the distribution patterns of zooplankton and fish in association with physical forcing features, and the presence of marine mammals.

ASSESSING THE HYDROLOGICAL VARIABILITY OF LAKES BETWEEN INUVIK AND TUKTOYAKTUK

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The Arctic's changing climate is influencing hydrological inputs into lakes, which cover large areas of ice rich permafrost-underlain regions. Warmer air temperatures are leading to longer ice-free periods and greater evaporation, precipitation is more often falling as rain rather than snow, and deeper frost tables are reducing runoff into lakes. While past research has detailed the general behaviour of lake water balances, little is known about the range of hydrological variability in Arctic lakes. Initial research has shown that hydrological behaviour is affected by multiple landscape elements, such as lake area – catchment area ratio (LACA), catchment vegetation cover, and snow storage. To assess hydrological variability of lakes, we combined direct and indirect measurements of lake water balance components at multiple spatial and temporal scales across a variety of influential landscape elements. This study focuses on the lake rich uplands to the east of the Mackenzie Delta. Lake water balances were calculated at two adjacent lake basins with different LACA's using direct measurements of water level, lake outflow, evaporation, precipitation, and end of winter basin snow storage. Differences in residence time and lake level between the two lakes directly corresponded to their LACA; the lake with a larger catchment relative to its size had a shorter residence time and more variable water levels. Delineation and analysis of 7500 lake catchments between Inuvik and Tuktoyaktuk showed a large variation in LACA, regardless of lake size. Based on this, we expect a large range of hydrological variability in this region. To assess this, over 120 lakes were sampled for stable water isotopes across a 2000 sq km area ranging from boreal forest to shrub tundra in April 2018. A subset of 62 lakes were resampled multiple times through the summer at strategic times so that the effect of snowmelt recharge, hot and dry periods, and rainfall recharge may be quantified. Isotope samples will be used to calculate multiple hydrological indicators including evaporation inflow ratio, the amount of snowmelt recharge, the mixture of water input sources, and residence time in each lake. These hydrological indicators will then be compared to multiple landscape and lake elements, such as LACA, vegetation cover, latitude, and lake depth, among others, using multivariate analysis techniques. From this, the main controls on lake hydrologic behaviour can be interpreted and used to predict the hydrological behaviour of lakes based on their catchment characteristics.

SCALING ARCTIC GLACIER MASS BALANCE USING SATELLITE OPTICAL ALBEDO

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Field measurements of glacier mass balance in the Canadian Arctic Archipelago (CAA) are sparse, despite the extensive ice cover and large potential for contribution to sea level rise. Current mass balance measurements are focused at a few locations, but a major question is how to extrapolate these across the entire region? Remote sensing provides one potential solution, but existing gravimetric satellite measurements have coarse spatial resolution, while laser and radar altimetry provide limited coverage that does not well represent changes on small glaciers. This lack of a high spatial resolution method of determining mass balance across the CAA precludes any high spatial resolution climatological analysis of mass loss. Here we report on the correlation of MODIS minimum albedo to annual mass balance for two glaciers and three small ice caps in the CAA. We find statistically significant ($p<0.05$) correlations between summer minimum MODIS Terra MOD10A1 albedo and mass balance for these diverse ice masses, which are experiencing predominantly negative mass balance. The R2 values for the correlation between mass balance and minimum averaged albedo are 0.40 for Grise Fiord Glacier, 0.87 for White Glacier, 0.85 for Melville South Ice cap, 0.78 for Meighen Icecap, and 0.74 for Devon NW Glacier. The inclusion of melt season average daytime cloud cover does not improve the correlation values. These results indicate that unmodified moderate resolution MODIS Terra daily snow albedo can reproduce glacier mass balance for Arctic glaciers and ice caps without additional adjustment. Although all the results presented here are statistically significant, glacier size and location does impact the efficacy, where the mass balance for the smallest glacier analysed (2.0 km2) produced much poorer correlation with minimum albedo than the next smallest (21.0 km2).

MOBILIZING INUIT QAUJIMAJATUQANGIT FOR SEA-ICE SAFETY: A SIKUMIUT CASE STUDY TO SUPPORT INUIT SELF-DETERMINATION IN RESEARCH

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The purpose of this project is to support Inuit self-determination in research through a case study in Mittimatalik (Pond Inlet), Nunavut. The goals of the project are to advance Inuit research leadership, decision-making, knowledge, approaches and capacity building. Sikumiut means “people of the sea ice” in Inuktitut, and is the name of the 12-person management committee in Mittimatalik that governs the SmartICE community-based sea-ice monitoring program (see www.SmartICE.org). At a recent meeting, Sikumiut identified the need to document their Inuit Qaujimajatuqangit (IQ) of sea-ice to support safe sea-ice travel, assess the impacts of climate change and resource development, and to share this knowledge with the community and future generations. Sikumiut would like to: • Gather and utilize Mitimattalik sea-ice IQ that has been collected in previous projects by southern researchers; and • Use both reclaimed and newly documented sea-ice IQ along with satellite imagery to develop products that document the history and changes to sea-ice conditions around Mittimatalik. Sikumiut governs this project and will evaluate progress according to their IQ principles and extensive experience with sea-ice. To build research capacity, local Inuit youth will be hired and trained to conduct the research and the equivalent of 2 full-time youth will be hired for 6 months of the year (October to March) for the next 3 years. Youth will learn how to facilitate workshops, document sea-ice IQ, interpret satellite imagery, and create sea-ice maps to enhance local capacity for Inuit-led research. This presentation and poster will provide an overview of the initial work of this collaborative case study, and how it was developed to respond directly to Sikumiut’s research needs. At the same time we aim to operationalize a research approach that reclaims Inuit leadership, builds Inuit youth capacity to conduct the research, and evaluates the research according to Inuit principles.

AN UNMANNED AERIAL SYSTEM TO MONITOR A SOLAR-CELL FARM AND ITS POWER GRID IN REMOTE LOCATIONS

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This paper describes an experiential-education project involving the design and development of an unmanned aerial system (UAS) to monitor a solar-cell farm and its associated power grid for any visible physical damage through a visible-range camera, as well as for detecting invisible hotspots on the grid through an infrared camera. The system is designed for beyond visual line of sight (BVLOS) flight. The UAS is intended for the next Unmanned Systems Canada student UAS competition, 3-5 May 2019 at the UAS Center of Excellence, Alma, Quebec [1]. The second reason for this development is to establish a cooperative educational framework for UAS development and testing between the Nunavut Arctic College (NAC), Rankin Inlet, Nunavut, and the University of Manitoba (UoM) team through IEEE Collabratec and other means. Our preliminary discussion with NAC on a possible cooperative effort to develop an observational polar nano-satellite started in 2017. The UAS cooperative framework could be used to provide a basis for students interaction with well defined tasks not only in this project phase, but also future projects. The following UAS subsystems will be described in this paper: (i) the first person view (FPV) system, (ii) the real-time thermal video (RTTV) processing module based on a RT GPU-accelerated image processing unit, (iii) the RT conventional video (RTCV) processing module, and the amended map report generator (AMRG). The data collected in flight will be transmitted to ground through separate channels for further analysis and reporting. References [1] Unmanned Systems Canada, 11th Unmanned Systems Canada 2019 Student UAS Competition: Concept of Operations (CONOPS) and Rules. Ottawa, ON: Unmanned Systems Canada, 2018, 24 pages. Available as of Sep 27, 2018 from USC at: https://www.unmannedsystems.ca/wp-content/uploads/2018/09/2019-USC-Student-Compeition-CONOPS-and-RULES-v1-7-Sept-18-2.pdf https://www.unmannedsystems.ca

EVERYTHING IS CHANGING SO MUCH: AKLAVIK'S SHIFTING BELUGA WHALE HARVEST

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Everything is changing so much: Aklavik's shifting beluga whale harvest The aim of this research is to improve our understanding of human-beluga whale relations over time and the implications of change for subsistence livelihoods through a case study of Aklavik, Northwest Territories. A dramatic decline in the community's beluga whale harvest was noted by local residents and is supported by the Fisheries and Oceans Canada Science Stock Status Report (2000); from 31 landed whales in 1990, to only 8 landed whales in 1999. More recently, in the last decade, the number of whales harvested by Aklavik hunters has remained near or under five per year. At the 2016 Beluga Summit in Inuvik, a group of knowledge holders from Aklavik presented and shared on various reasons why fewer beluga whales were being harvested, and proposed that a project be conducted to address these concerning changes. In response to these suggestions, this project was developed with combined input from both the researcher and the Aklavik Hunters and Trappers Committee. The research objectives are: (1) characterize historical relations between community members in Aklavik and Beluga; (2) document and describe how these relations have changed over time, including the drivers of change (e.g. social, cultural, economic, political, environmental); and (3) assess the implication of these changes for subsistence livelihoods. The research has been conducted in collaboration with community members in Aklavik and is guided by considerations for community-based participatory research and decolonizing research methodologies. Varying culturally appropriate research methods were utilized including: semi-structured and open-ended interviews (n=32), experiential learning, and verification of results through conversation, sharing and presentations in summer 2018. Results demonstrated that Inuvialuit from Aklavik have maintained how to hunt and prepare beluga whale due to intergenerational knowledge transmission and on-the-land education. However, constraints to hunting beluga, falling under a continuous spectrum of social and environmental change, have altered present dynamics so that fewer people can hunt successfully. Climate change is causing reduced access to historically preferred whaling camps and social dynamics at the current coastal camp are not conducive to the whale harvest. Shifting Inuvialuit values, resulting from the passing of Elders and the ever-increasing influence of southern lifestyles, are drawing people away from hunting and consuming whales. While some Inuvialuit remain active beluga harvesters, their numbers are dwindling in Aklavik, and knowledge is not widely passed on to the next generation. Youth are often not receiving critical experiential learning to establish a connection to the beluga whale harvest, and many adults do not consider themselves experienced enough to confidently engage in the harvest without Elders to guide them. Dangerous hunting conditions resulting from climate change create further difficulties in Despite these changes, the level of interest in the beluga hunt is high. It is hoped that this improved understanding of the changes affecting human-beluga relations will help identify opportunities to support sustainable livelihoods in Aklavik, including the creation of on-the-land programs and/or community hunts to revive the beluga whale harvest.

A MULTI-VEHICLE DRONE TESTBED FOR SPACE SYSTEMS AND REMOTE SENSING VERIFICATION

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This paper presents an easily accessible multi-vehicle drone testbed, which will enable the development, validation, and qualification of new drone or satellite control hardware and algorithms without the need for costly launches, microgravity emulators or the need to obtain airspace permission to fly outside. The drone testbed consists of several copter-style drones and gimbals below each to allow six-axis control. By programming drones with a nested feed-forward control loop, a simulated dynamic environment is achieved, which will provide sufficient abstraction needed for independent spacecraft or drone control. Using this architecture, any type of dynamics can be emulated, including different gravity levels and/or air viscosities. For multi-spacecraft control investigations in Earth orbit, multiple vehicles and Hill's Equations can be used to represent the relative motion of one spacecraft with respect to another in neighboring orbits, which is difficult to replicate on Earth. This testbed will enable rapid development and verification of remote sensing technologies for the Arctic to be deployed on either drones or spacecraft.

ECOLOGICAL APPROACH OF THE IMPORTANCE OF SEA ICE ALGAE AS A CARBON SOURCE TO THE DEEP SEA BENTHIC FOOD WEB USING SEA ICE PROXY BIOMARKERS AND STABLE ISOTOPE ANALYSES IN BAFFIN BAY, CANADIAN ARCTIC.

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High atmospheric temperatures affect concentration, thickness, and dynamics of the sea ice, influencing variations in time, quantity, quality, and geographical distribution of primary production in the Arctic Ocean. Disparities in vertical fluxes of organic matter produced in surface waters may compromise the pelagic-benthic coupling due to the high dependence of benthic organisms to the shallow organic carbon sources. In an attempt to enhance understanding of how the Arctic benthic community respond to changes in sea ice coverage and carbon supply, we conducted a detailed field investigation of marine macrobenthos in Baffin bay. A total of thirteen sites were sampled between June and July 2016 in Baffin Bay near the marginal ice zone. Stable isotope analysis (SIA) and ice proxy biomarkers (HBI) were used to characterize the benthic trophic structure, carbon transfer pathways, diets of bottom organisms and origin of carbon in the deep seafloor. Regardless of depth, taxonomic group or feeding guilds, this study shows the great importance of ice algae as a food carbon source for deep benthic communities and benthic food webs in Baffin Bay.

A DECREASE IN THE SEA ICE CARBON PATHWAY OF BENTHIC FAUNA IN A WARMING ARCTIC: ATLANTIC WALRUS (ODOBENUS ROSMARUS ROSMARUS) AS A BIOINDICATOR OF SEA ICE ECOSYSTEM VARIABILITY

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Climate change has been altering ecosystem structure and function across the globe but is most pronounced in the Arctic which now experiences longer open water periods through a continual decline of sea ice extent. These environmental changes have been altering both the feeding relationships between Arctic species and the contribution of sea ice algal- (i.e. sympagic) and phytoplankton-derived carbon to Arctic food webs over time. Although sympagic and phytoplanktonic carbon fuel benthic food webs during the spring and summer, little is known about how the contribution and coupling of these disparate carbon energy pathways by benthic fauna have been changing over multiple decades. Here, we used Atlantic walrus (Odobenus rosmarus rosmarus), who rely on bivalves and other benthic fauna for food, as a bioindicator of Arctic sea ice ecosystem variability over time (1982 to 2016) at two locations with differing sea ice regimes and phenology (Jones Sound/Grise Fiord: 76.42, -82.89 and Foxe Basin/Igloolik: 69.376, -81.80). We coupled novel biochemical approaches of H-Print and compound-specific isotope analysis of individual amino acids of δ13C and δ15N from walrus tissues collected during summer and autumn months (July to October) to quantify: 1) decadal changes of the phytoplankton-derived carbon contribution to walrus diet, and 2) latitudinal variation in the phytoplankton-derived carbon contribution to benthic fauna associated with differing sea ice phenology. Atlantic walrus from Foxe Basin exhibited a substantial decrease in source-δ13C (i.e. phenylalanine) from -26.15‰ to -28.73‰ associated with a six-fold increase in phytoplankton-derived carbon (10% to 60%) over the study period. Furthermore, summer sea ice concentration decreased by nearly half (36% to 20%) in Foxe Basin. In contrast, there were no significant long-term changes in source δ13C or phytoplankton-derived carbon of Atlantic walrus from Jones Sound – an area where summer sea ice concentration decreased by only 8% (59% to 51%). Our results indicate that the contribution of sympagic carbon to benthic invertebrates and their predators have dramatically decreased at lower latitudes but remain similar in the typically ice-covered seas of the High-Arctic over a 34-yr period. These results suggest that walrus are powerful bioindicators of Arctic sea ice ecosystem variability. Overall, a restructuring of carbon sources utilized by the benthic community are occurring and will likely intensify with continued climate change with unknown consequences on Arctic ecosystem structure and function.

ENHANCED CAPACITY FOR OIL SPILL SITUATIONAL AWARENESS AND RESPONSE IN NUNAVUT (ECOSAR)

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In an effort to address community concerns regarding the consequences of oil spills in Nunavut waters, the C-CORE team in partnership with Marine Institute is working to develop local capacity for oil spill monitoring and response. Emphasis of project, called ECOSAR, is placed on field-based oil spill response, the exploitation of satellite reconnaissance for oil spill monitoring and assessment, and the development and implementation of a community-based spill response strategy. Technical research activities are focused on improved detection of oil slicks using Sentinel-1 radar imagery, the characterization of slicks using Sentinel-2 and Landsat-8 optical imagery, and the development and implementation of satellite-based shoreline sensitivity mapping methodologies adapted for Nunavut. ECOSAR is supported by the Nunavut Research Institute to enhance the capacity for oil spill situational awareness and integrate traditional knowledge. Existing pre-spill mapping methodologies will be modified for the Nunavut context and applied to pilot sites in Nunavut selected in close collaboration with Nunavut stakeholders. The development of highly qualified personnel is an essential project goal. Participants in the training have a strong interest in capacity-building at the community level. The project also offers an opportunity for students to pursue graduate studies in remote sensing related to oil slick characterization and shoreline sensitivity mapping. Training in oil spill response and geospatial information processing and analysis using a train-the-trainer model is ongoing activity of ECOSAR.

MEASUREMENT OF SEA ICE, ICEBERGS AND ICE ISLANDS TOPOGRAPHY USING SATELLITE IMAGERY

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Sea ice topography represents geospatial information on the three-dimensional geometrical attributes of the ice surface including height and shape of various ice features. The features interest consist of deformed (pressure ridges, rubbles and hummocks) and level sea ice as well as glacial ice. Sea ice topography is important for scientific research and climate studies because it helps characterise ice volume and thickness and it influences the near-surface atmospheric transport by impacting the drag coefficients. It also represents critical information to marine operational applications, such as ships navigation and risks assessment for offshore infrastructures. The several methods were used to measure sea ice topography from a single satellite image as well as multiple images. The techniques based on the single image, acquired by optical or synthetic aperture radar (SAR) satellites, derive the height and shape information from shadow and shading. Optical stereo images acquired by very high resolution (0.5 m) satellites were used to extract highly detailed digital elevation model

(DEM). SAR imagery allowed extraction of DEM using stereo-radargrammetry and interferometry. The images from optical satellites WorldView, Pleiades, GeoEye, Spot, and Landsat-8 were used to measure topography of sea ice deformation features and glacial ice including icebergs and ice islands. These features were mapped in regions of the Central Arctic, Baffin Bay and the coast of Greenland. SAR imagery including interferometric TanDEM-X data and full polarimetric Radarsat-2 were used to extract ridge frequency and measure spatial parameters of glacial features. The accuracy was evaluated by the inter-comparison of the results from different methods demonstrating their strengths and limitations.

VARIATION IN DIET AND WEANING AGE AMONG NARWHALS (MONODON MONOCEROS) USING STABLE ISOTOPE ANALYSIS OF DENTINE FROM EMBEDDED TUSKS

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Northward expansions of sub-Arctic species facilitated by continued Arctic warming may affect Arctic top predators both directly via diet and indirectly via weaning. Traditional knowledge and accumulating scientific studies on narwhals (Monodon monoceros) make them a promising indicator species to evaluate the impact of a warming environment on Arctic marine mammals. Male narwhals have one large erupted tusk on the left and one tusk that remains embedded in the jaw on the right, while females often have two embedded tusks. Tusks are metabolically inert since dentine laid down in annual growth layer groups (GLGs) do not alter once formed, and therefore can provide a chronological archive of dietary information throughout the animal's life. In this study, we use stable isotopes of dentine from narwhal embedded tusks to investigate whether narwhal diet and weaning age differ between sexes and among individuals over the past 30 years. Narwhal embedded tusks were collected near Pond Inlet, Nunavut, from 1982-1983 (n=31) and 2015-2017 (n=25). Isotopic profiles of carbon and nitrogen were constructed for each individual to compare feeding habits among narwhals over time. Weaning age was estimated through an abrupt decline in nitrogen isotopes over the first few GLGs. Results suggest the majority of narwhals are weaned between age one and two with some individuals being nursed until age three. Post-weaning, narwhals of the same sex show varied degrees of dietary overlap ranging from high to none, suggesting diverged feeding strategies are adopted by different sub-groups. Meanwhile, variation in isotopic niche widths indicates some whales are more generalized than others. Isotopic results across dentine GLGs also show clear cyclic patterns, potentially reflecting seasonal changes in diet and feeding intensity. Future analysis will explore variation in feeding habits and weaning over time and in relation to sex, growth, and individual. This study provides insight on how narwhals have been impacted by climate-induced resource shifts, and the potential for narwhals to adapt to food web changes in the future.

COLLAPSING PERMAFROST AS A SOURCE OF TOTAL MERCURY AND METHYL MERCURY TO DOWNSTREAM ECOSYSTEMS

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Retrogressive thaw slump (RTS) features are thermokarst disturbances that can mobilize thousands of cubic meters of permafrost-derived sediments over multiple decades. However, the effect of these features on the mobilization of total mercury (THg) and methylmercury (MeHg) stored in permafrost into fluvial networks is yet unknown. We found that RTS features on the Peel Plateau (NWT, Canada) increased stream concentrations of THg up to 400-fold, and MeHg up to 5-fold, a trend which persisted at least 3 km downstream. While the concentrations of THg and MeHg in these streams – upwards of 1,200 and 7 ng L-1 for THg and MeHg respectively – are the highest ever measured in uncontaminated sites in Canada, the increases in THg and MeHg were almost entirely particle-associated. In contrast, dissolved THg and MeHg concentrations actually decreased downstream of RTS features, suggesting that the particles released by slumping may provide adsorptive surfaces that sequester Hg. Material eroding from some RTS intermittently impounded streams, forming natural reservoirs which may have enhanced MeHg production. While collapsing permafrost released substantial THg and MeHg into modern biogeochemical cycles, efforts to study the bioavailability of this Hg are needed to further our understanding of its possible effects on northern ecosystems.

Poster Presentations

POST-GLACIAL CLIMATIC AND ENVIRONMENTAL CHANGES IN THE FURY AND HECLA STRAIT REGION BASED ON BIOLOGICAL AND GEOCHEMICAL PROXIES

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Located between the Melville Peninsula and northwestern Baffin Island in the Canadian Arctic, the Fury and Hecla Strait region has experienced major environmental shifts since the end of the last ice age followed by glacial retreat (7000 cal. BP approx.). Triggered by post-glacial processes (including marine inundation and glacio-isostatic uplift), geomorphological changes and climatic fluctuations (that shaped the region throughout the Holocene) have been recorded in marine and lake sediments. By analyzing sediment cores of different lakes in the region using a multi-proxy approach, our study provides a high-resolution reconstruction of the region's paleoclimates and paleoenvironments and their evolution over time. We use sedimentological (grain-size analysis, LOI and magnetic susceptibility), geochemical (elemental geochemistry) and biological (marine and freshwater diatoms) methods in order to understand and recreate post-glacial conditions and dynamics at different stages during the Holocene, including past oceanographic and limnologic conditions. Various radiometric dating methods (210Pb, 137Cs and 14C) were used to establish a detailed chronology for the inferred changes. All data combined will help us gain more detailed insights into post-glacial environmental dynamics in northwestern Foxe Basin and enable us to predict Arctic ecosystem responses to global warming.

CARBON POOLS AND STABILITY OF ORGANIC MATTER OF PERMAFROST-AFFECTED SOILS OF YAMAL REGION, RUSSIAN ARCTIC

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Chemical composition of SOC determines its decomposability and may affect soil microbial activity. This is very important for understanding variability in SOC pools in context of changes in plant cover or climate. This paper is aimed to characterize existing carbon pools and molecular organization of the humic acids, isolated from various permafrost-affected soils of Yamal region and to assess the potential vulnerability of soils organic matter in context of possible mineralization processes. Soils for most of studied sites were characterized predominantly by acidic to strong acidic pH. Profile distribution of carbon, nitrogen and C:N ratio showed non-gradual changing with the depth due to manifestation of cryopedogenesis in soil profiles which lead to cryogenic mass transfer. for study area were 7.85 ± 2.24 kg m-2 (for 0-10 cm layer), 14.97 ± 5.53 kg m-2 (for 0-30 cm), 23.99 ± 8.00 kg m-2 (for 0-100 cm). Analysis of soil organic carbon stocks among predominant soil types (Russian soil classification system) revealed relatively high variability of values in 0-10 cm (from 4.50 kg m-2 in Peaty Gleyzem underlain by permafrost to 9.59 kg m-2 in Peaty Podzol underlain by permafrost) and 0-30 cm layers (from 9.90 kg m-2 in Cryic Podbur underlain by permafrost to 24.15 kg m-2 in Eutrophic peat soil underlain by permafrost). Results of solid-state 13C-NMR spectrometry showed low amounts of aromatic fragments in studied soils. All studied soils are characterized by predominance of aliphatic structures, and also carbohydrates, polysaccharides, ethers and amino acids. High content of aliphatic fragments in studied humic acids shows their similarity fulvic acids. Low level of aromaticity reflects the accumulation in soil of lowly decomposed organic matter due to cold temperatures. Our results provide further evidence of high vulnerability and sensitivity of permafrost-affected soils organic matter to Arctic warming. Consequently, these soils may play

a crucial role in global carbon balance under effects of climate warming.

ON THE DESIGN OF AN OPTICAL SENSOR TO MEASURE IN SITU SEA-ICE NITRATE CONCENTRATION AT SMALL SCALE

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Blooms of microalgae in the ocean require abundance of both light and nutrients. After the polar night, ice algae start growing as soon as enough light reaches the bottom of sea ice. Because of climate change, the Arctic icescape is getting thinner and largely dominated by first year ice, which likely results in earlier ice algal blooms. An early bloom, however, does not necessarily imply an increase in annual ice algae net primary production in the Arctic. The intricate balance between nutrients, specifically nitrate in the Arctic ocean, and light availability have been shown to control annual primary production. The amount of available nutrients for ice algae depends on the nutrient flux from the upper ocean to sea ice, and transport within sea ice. Both processes are difficult to quantify because they take place at small space and time scales. Traditional sea-ice sampling methods hardly allow capturing such variations. To better understand how the flux of nutrients from the upper ocean to sea ice and their transport within sea ice are controlled by the physical properties of the two media is especially important in a context where the Arctic icescape is profoundly changing together with sea-ice biology. This research project aims at developing an optical sensor to measure in situ sea-ice nitrate concentration at small scale. This sensor will be integrated onto a Sea Ice Endoscopic (SIE) platform, a non-destructive multimodal probe which will be used to characterize sea ice radiative transfer and brine biophysical systems. Multiple optical spectroscopy techniques (DRS, Raman, SERS, Photoacoustic) are explored. Preliminary results will be presented to highlight the best approach to monitor sea ice nitrate dynamics.

WHAT POLAR DATA DO YOU NEED, AND HOW WOULD YOU LIKE TO ACCESS AND USE THEM?

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The Polar Data Catalogue (https://polardata.ca) is one of Canada's primary online sources for data and information about the Arctic and Antarctica. With over 2,600 metadata descriptions of projects and datasets and almost 3 million data files, the PDC contains data on physical, social, and health science and other research in Canada and globally, including significant collections from the ArcticNet Network of Centres of Excellence, the International Polar Year, satellite imagery from the RADARSAT-1 and RADARSAT-2 missions of Arctic Canada and Antarctica. The overall goal of the Canadian Cryospheric Information Network/Polar Data Catalogue (CCIN/PDC) is to facilitate the understanding of ongoing polar environmental and societal changes. Preserving and providing access to valuable data via our websites and interoperable metadata sharing with other polar data portals enhance public awareness and reuse of data in repositories around the world. The PDC is a member of the World Data System and is Canada's National Antarctic Data Centre. Using examples from Canada's polar research and data community and the PDC at the CCIN, this presentation will highlight a selection of users' evolving expectations regarding polar data and some of the challenges to making curated data collections truly conform to the FAIR principles of findability, accessibility, interoperability and reusability. We will describe issues with providing effective access to datasets resulting from disparate collection and recording methods, designing a friendly user interface for both novice and advanced users, providing streamlined access to complex datasets containing Terabytes of files, protecting sensitive data, providing access to the PDC for low-bandwidth communities and stakeholders, and other challenges. We will present incentives to simplify the work of funded researchers and ensure proper data stewardship of the resulting data by unifying data management requirements and providing support during the process of archiving data. There will be a brief demonstration on the three

areas of the PDC (Search, Lite, and Input) to highlight the functionality of the services, but also to open lines of communication to improve our offerings based on evolving needs. We will provide an opportunity for direct feedback from the audience on functions and interfaces which serve the needs of the polar research community and other targeted users. CCIN is currently in the process of updating the PDC Search, and any feedback we receive from this session will be considered in further development of this online tool. Additionally, we will discuss improvements to the CCIN/PDC infrastructure, particularly protocols that increase interoperability and harvesting of our metadata by national and international data repositories.

BACTERIA ENERGY RECOVERY SYSTEM FOR VERY LOW POWER SENSORS.

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In this project we present a first architecture of the system that we call “Bacteria Energy Recovery System” (BERS). BERS is mainly dedicated for very low energy applications such as low power sensors in the project Sentinelle Nord at Québec to monitor environmental parameters in the north of Canada. Indeed, environmental conditions in the north are very severe and energy transportation is very expensive in addition to a very limited human resource. Thus, fully autonomous system is a highly critical to sense environmental conditions in such hard climate. Our proposed BERS is able to collect 45 uW from a two bacteria-based battery cells. Each battery cell dimensions are 350 cm3. Cell dimensions cannot be reduced as it is related to the quantity of available soil. The recovered energy is 100% green energy. It is extracted only from bacteria growing in natural soil conditions without any additive. Bacteria used in this system are naturally available in soil. Their properties, concentration depends on several environmental conditions. BERS does not only recover energy from soil bacteria but also it provides a voltage regulation in order to power all sensors with constant voltage. In this presentation, we will introduce our system, its performances and we will show how BERS can be used to power low power sensors. This work is part of Sentinelle Nord project, Photnonic Ultimate Sensing (PULSE) and monitoring of permafrost environments. BERS is designed to power a low power consumption sensor network to evaluate the north environment which is “evolving rapidly under the pressure of social and economic development in a context of accelerating climate changes. To improve our understanding of these dynamics, we propose novel photonic platforms to monitor parameters critical to the sustainable development of the north, namely permafrost degradation below ground and at the surface, greenhouse gas emissions, and water properties.”. More particularly we focus on, water quality monitoring with self-powered sensors: Autonomous energy sources based on benthic microbial fuel cells to power up microfluidic and silicon photonic sensors. These sensors will find application in thermokarst ponds and wells.

THE EFFECT OF SIMULATED CDOM ON EELGRASS

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Colored dissolved organic matter (CDOM) reduces light penetration in water and can alter water’s natural color spectrum, potentially affecting marine plants such as eelgrass, Zostera marina L. For a study on declining eelgrass in Québec’s eastern coastal James Bay, we tested the effects of CDOM and light levels on the growth of Zostera marina in mesocosm tanks at the University of New Hampshire. Twelve tanks were planted with eelgrass seedlings from Great Bay, NH and randomly assigned one of four treatments simulating conditions observed in James Bay: 34% light and amber tint, 50% light and yellow tint, 50% light with no tinting, and 100% light at ambient conditions. Tinted light was achieved using acrylic panels; the 50% light no tint, with neutral density screening. Each treatment had three replicate tanks. The experiment was conducted from June to November 2017. Eelgrass shoot density, leaf height, leaf width, rhizome length, and plant weight were measured in September and October. Water color from simulated CDOM affected eelgrass growth characteristics. Eelgrass canopy height increased under all CDOM conditions, but canopy height was lower than the color treatments under both 50% light (without tinting) and the control. Eelgrass reproductive growth, number of spadices and shoot density were greater under both ambient conditions and reduced light without simulated CDOM.

HABITAT SELECTION BY SHOREBIRDS BREEDING ON THE YUKON NORTH SLOPE

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During the summer months, the Yukon North Slope hosts more than 100,000 nesting shorebirds of 18 different species, making this one of the most species-rich regions for shorebirds in the North American Arctic. Protecting shorebird habitat across their annual range has been recognized as one of the most important actions for shorebird conservation. The objective for this study was to identify which habitat and landscape characteristics breeding shorebirds are associated with on the Yukon North Slope. We use these habitat associations to develop predictive maps of suitable shorebird breeding habitat, and combine these maps to create a spatially-explicit index of potential shorebird species-richness. We modelled shorebird habitat suitability with maximum entropy methods, using the program MaxEnt. 3100 km2 of habitat was identified as suitable breeding habitat for at least one of the modeled shorebird species and a core area of 780 km2 was identified as suitable habitat for 5 species. 88% of suitable shorebird breeding habitat was in the lowland plains region. Our results demonstrate that many of the key areas for shorebirds occur within the boundaries of Ivvavik National Park, illustrating the importance of this protected area for these species of international conservation concern. These models will contribute to a wildlife conservation decision support tool being developed by Round River Conservation Studies for the Yukon North Slope wildlife Management Advisory Council.

INVESTIGATION OF GROUNDING LINE DYNAMICS AND THINNING OF MILNE GLACIER, NUNAVUT USING IN-SITU AND SATELLITE DATA

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The most pronounced mass loss in marine terminating ice sheets and glaciers is where ice is in direct contact with warming water masses. The line where glaciers transition from grounded to floating is particularly susceptible to changes. Grounding line retreat is a good indicator of ice thickness reduction due to increased ice melt or dynamic thinning associated with enhanced ice discharge. Comprehensive records of glacier motion in the Canadian High Arctic show an increase in their discharge dynamics. Milne Glacier located on Ellesmere Island, Nunavut, is a surge-type glacier which is subject to cyclical flow instabilities. In addition, Milne Glacier rests on a retrograde slope and it is grounded below sea level for ~20 km from its terminus; therefore, it is prone to marine ice sheet instability and it will likely retreat rapidly in the coming decades. In order to better understand and predict these processes, the location of the current grounding line and the glacier's thinning rate need to be determined. This study shows preliminary results of mapping the current position of the Milne Glacier grounding line by using the double-difference interferometry technique with spaceborne synthetic aperture radar (SAR) RADARSAT-2 and TerraSAR-X data acquired over the Milne Glacier in winter 2018. Information derived from SAR is compared with ice-penetrating radar (IPR) data collected on the Milne Glacier in summer 2016 and 2018 along a 6 km transect over the assumed grounding line.

LIMNOLOGY OF THE GREINER LAKE WATERSHED LAKES AND PONDS, CAMBRIDGE BAY - NUNAVUT

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Arctic lakes and ponds provide ecosystem services for Inuit communities, and more broadly as part of the hydrologic cycle, act as indicators of climate perturbations. Lakes are essential in the life cycle of Arctic and lake charr and other resident fishes that are important parts of the Inuit culture and diet. Lakes are also a source of clean drinking water. Lakes and ponds that are highly connected in these low elevation and gradient Arctic landscapes have abundant fish populations that depend on a food web based on photosynthetic and other microbes that are fed on by small zooplankton that feed larger zooplankton, which in turn provide food for fish. Although an increasing number of studies have focused on High-Arctic lakes, the diversity of Arctic freshwaters is still poorly understood and very little information is available about the limnological characteristics and productivity of the lakes in many northern regions. We present an overview of the main characteristics of 25 lakes and ponds in the Greiner Lake Watershed (Cambridge Bay, Kitikmeot, Nunavut). Four lake chains were sampled in August 2018, each starting from a headwater pond draining through a series of rivers and lakes to Greiner Lake, which is important for the nearby Ekaluktutiak Inuit community. We investigated lake limnology recording size, depth, nutrient concentrations, organic carbon content, temperature, oxygen, pH, and conductivity. In addition, we investigated a suite of biological characteristics: chlorophyll a, primary production, bacterial production, and zooplankton production. Preliminary results show that there were considerable differences among lakes and ponds and between headwater lakes and downstream lakes in temperature, nutrients and production. These results are the first step towards understanding how watershed size and connectivity can define the diversity and production of the whole trophic chain within a given lake or pond, from microorganisms to zooplankton and the availability of prey for downstream fish.

PHYSICO-CHEMICAL PROPERTIES OF MINERAL DUST COLLECTED FROM A REMOTE SITE IN THE CANADIAN NORTH

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Airborne mineral dust emitted from Arctic and sub-Arctic sources can greatly impact the northern atmosphere and environment, transport minerals to local ecosystems, and alter the atmospheric energy balance by interacting with solar radiation. The chemical composition of ambient dust emitted from northern dust sources is significant in determining the effect the dust will have on the atmosphere and environment in these regions. We have collected air samples near the Ä'äy Chù (Slims River), a site in the Canadian Yukon where dust storms frequently occur, and have utilized several techniques to characterize the chemical and micro-physical properties of the particles collected. Due to the remoteness of our sampling sites, we employed low-volume air samplers powered by lithium-ion batteries to increase the energy efficiency of sample collection. Using Raman microscopy and scanning electron microscopy coupled with energy dispersive x-ray spectroscopy (SEM/EDS), we have determined the mineralogy of the particles collected. We have also employed a new, quantitative method for analysis of trace metals in mineral dust via inductively coupled plasma mass spectrometry (ICP-MS), and have successfully validated our chosen methodology using certified reference materials. Our approach permits the analysis of relatively small amounts of sample (approx. 25 mg) without the use of dangerously strong hydrofluoric acid. Finally, from SEM imagery we have observed variation in the shape and sizes of the particles with respect to their composition. Our results indicate that the majority of minerals emitted from the exposed streambed are aggregates composed of silicates, carbonates, and sulphides, in non-spherical forms.

SHIFTING OUR LENS: ENGAGING INUIT YOUTH IN OCEANS RESEARCH THROUGH PARTICIPATORY VIDEO

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Researchers across academia are increasingly using video to mobilize their research to larger audiences. However, in Inuit Nunangat, there are requirements and expectations that research be inclusive of community knowledge, and participatory video methodologies can help amplify community voices through co-creation and dissemination. Drawing from the experiences of an early career researcher working in Panniqtuuq, Nunavut, this presentation will highlight the results of a three-year participatory video project integrating capacity building, community engagement and filmmaking regarding Inuit Qaujimajatuqangit of climate change and oceans. As a team of scientists, community-based researchers, and filmmakers, we collaborated with youth, elders, fishermen, and hunters to document, visualize and mobilize local knowledge about social-ecological change. This research co-created a dynamic portrait of local knowledge, community resilience, important linkages between Elders and youth, and because of the unique qualities of video these findings were shared extensively online and through academic conferences and film festivals. This multimedia presentation will explore the challenges and opportunities of participatory video research as well as suggestions for how to evaluate impact beyond scholarly publications. By engaging communities in high impact, hands-on research, participatory video allows for local perspectives to be shared with global audiences and supports greater awareness and ideally action to address complex issues like climate change.

MULTI-YEAR ANALYSIS OF THE RELATIONSHIP BETWEEN SEASONAL RUNOFF AND CHANGING CLIMATE CONDITIONS IN THE APEX RIVER WATERSHED

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The city of Iqaluit, Nunavut has been facing the threat of drinking water shortages for several years due to the increasing water needs of Iqaluit's rapidly growing population. Iqaluit's sole water supply reservoir, Lake Geraldine, has total sufficient volume to support a population of 12,300. However, with water quality and treatment limitations, the population the reservoir can support is estimated as 8,300. With a rapidly increasing population and continued urban growth, the City's demand will soon surpass the maximum population the reservoir can support. Due to this pending insufficient capacity, the City has been required to seek alternative water sources, to supplement the Lake Geraldine reservoir. The Apex River watershed that runs through the city has been identified as one of these alternative water sources. Studies on Arctic climate have observed rapid changes in precipitation and temperature that are predicted to continue over the next century. The Eastern Arctic has seen decreases in snow cover and increases in precipitation which are expected to continue. By 2050 it is predicted that there will be increases in precipitation up to 15-20% with that majority of the change occurring in the fall and winter. Snow cover extent is predicted to shorten by a month with large reduction in snow accumulation in the spring and autumn. However, discharge and precipitation records in Iqaluit are sparse leading to inconsistent records with significant temporal gaps, resulting in differing conclusions on the how the Apex River watershed has responded to climate. The aim of this study is to determine the primary source of run off (precipitation, snow melt, baseflow) into the Apex River and how discharge is affected by changing climate conditions. The study will also assess spatial variability in the response at different locations in the watershed. The study will use discharge and stable isotope records spanning the summers of 2013-2018 and at various sites across the Apex watershed (West tributary, East tributary, Confluence and the Apex River mouth) to conduct graphical and isotopic hydrograph separation analysis to identify the inter-annual and spatial variation in the relative contributions of snowmelt, rainfall and baseflow to runoff. The data will be analysed in the context of air temperature and precipitation records for Iqaluit (Environment and Climate Change Canada) to assess the sensitivity or response of the system to climate variables. Based on recent studies in the area, it is anticipated that snow melt will be a major contributor to runoff in the early spring while rainfall will be dominate later in the season. It is anticipated that this analysis of the Apex River watershed will provide the City of Iqaluit a greater understanding of the seasonality and spatial variations in major components of runoff, and of the sensitivities of the Apex River watershed to climate change, to inform their decisions around alternative drinking water sources.

OCEAN COLOR VARIABILITY IN THE HUDSON BAY SYSTEM: IN SITU OBSERVATIONS AND SATELLITE VALIDATION

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Satellite and in-situ bio-optical measurements are analyzed in the Hudson Bay System, the largest inland sea of the world. The quality of satellite ocean colour retrievals such as the water-leaving radiance, chlorophyll-a concentration and diffuse light attenuation coefficient in the HBS was evaluated to ensure the data quality. This study is part of an effort to develop a satellite bio-optical model to better monitor and understand how phytoplankton dynamic is adapting to climatic and anthropogenic. In June 2018, above-water radiometry data were collected using a Satlantic's Hyperspectral Surface Acquisition System (HyperSAS, Satlantic Inc.) aboard the Canadian Research Icebreaker CCGS Amundsen in the scope of the BaySys expedition. A total of 30 days of continuous measurements along the ship track of above-water radiometric data are used to evaluate multi-satellite 8-days composite obtained from the Globcolour Project. In addition, in-water radiometric profiles are measured by the submersible spectroradiometer Compact Optic Profile System (C-OPS, Biospherical Instruments Inc.). A total of 83 light profiles were acquired in a total 27 stations across the HBS. Light profiles were analyzed to derive diffuse attenuation coefficient of downwelling irradiance (kd) and remote sensing reflectance (Rrs). The in-situ observations span a wide range of bio-geographic and bio-optical domains encountered in the Hudson Bay: landfast ice in the southern bay; mobile, fractures and compressed sea-ice; leads; the northern Hudson Bay polynya; marginal ice-edge zone; open water; river-influenced coastal zones; Hudson Strait; and Ross and Welcome sound.

MODELLING GLACIER MELT WITH HIGH-RESOLUTION UAV DATA: A CASE STUDY ON FOUNTAIN GLACIER, NU

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Glacier surface melt models are a widely-used tool for quantifying glacier mass balance changes and glacier runoff. It can be difficult, however, to measure the performance of these models in two dimensions due to lack of validation data. This problem is particularly acute for Arctic glaciers, where data is scarcer than in Southern regions. Glacier-wide and regional datasets are available from satellite imagery, but the timing of these datasets is dictated by satellite repeats rather than driven by scientific questions. The use of unmanned aerial vehicles (UAVs) presents an opportunity to collect distributed data on demand. In July 2016, a series of UAV surveys over a 4-day period were used to measure ablation near the toe of Fountain Glacier, located on Bylot Island, NU. In addition to calculating surface change, the UAV surveys were used to produce digital surface models at 10 cm resolution, and an albedo product also at 10 cm resolution. A radiation-temperature melt model was fit using data from a weather station situated in the ablation zone and applied over the UAV-derived digital surface model, using the UAV-derived albedo product to determine absorbed incoming solar radiation. The UAV-measured ablation was used as validation data for the melt model. This study compliments regional studies of daily surface mass balance in the Canadian Arctic (e.g. Noël et al, 2018), which have shown accelerated melt on Bylot Island in recent years. A more detailed insight into surface processes through the integration of UAV data products will help to further constrain the rapid changes taking place on the glaciers in the area.

OCEAN ACIDIFICATION AND BIOLOGICAL ACTIVITY IN THE CANADIAN ARCTIC: INSIGHTS FROM THE CARBONATE SYSTEM

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Ocean acidification is an important yet often disregarded outcome of anthropogenic CO2 emissions and the consequent rise in atmospheric CO2 levels. Roughly a third of the CO2 released to the atmosphere since the industrial revolution has been absorbed by the world's oceans, resulting in a decrease in seawater pH, carbonate ion concentration and saturation state of seawater with respect to the calcium carbonate minerals aragonite and calcite (ΩA, ΩC). The Arctic Ocean is particularly vulnerable to acidification due to the weak buffer capacity of its cold waters and its steadily decreasing sea-ice cover, exposing a gradually larger area of surface water to gas exchange with the atmosphere and decreasing carbonate saturation states in surface waters through mixing with sea-ice melt. These ongoing changes in seawater chemistry constitute a threat for the health of marine ecosystems, particularly to calcifying organisms whose ability to secrete calcium carbonate skeletons and tests might be hindered by a decrease in pH and Ω. The direct effect of acidification on the productivity of marine ecosystems of the Canadian Arctic has, however, been poorly quantified. To address this issue, we use a vast dataset constructed from various expeditions of the CCGS Amundsen to examine the current state of the carbonate system in and around the Canadian Arctic Archipelago, document areas which have crossed the critical threshold of surface undersaturation with respect to aragonite and estimate the relative change in biological activity over the last decade through its contribution to the surface pool of dissolved inorganic carbon.

FINE-SCALE HABITAT SELECTION OF FEMALE CARIBOU IN SUMMER USING CAMERA COLLARS

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Migratory caribou (Rangifer tarandus) are socioeconomically and culturally important for Quebec, and its populations are experiencing a sharp decline. Although these caribou herds have been studied for several years, our knowledge of the amount of habitat that must be protected to ensure the persistence of these populations is limited. In this context, the study of habitat selection is a useful tool. It is known that female caribou are directly dependent on the availability of summer habitat resources given the high costs associated with lactation, but also the need to accumulate reserves for other seasons, when resources are less abundant. However, we do not know how these females select resources and the different habitat types at a fine spatial scale. This is what will be determined in this project with the objective of evaluating the summer habitat selection (June to September) of female caribou in the Rivière-aux-Feuilles herd at a fine spatial scale. Specifically, we will focus on habitat selection at the feeding sites. Because biotic and abiotic factors may influence habitat selection, we will also evaluate the effects of weather conditions, insect harassment, and vegetation type diversity on female habitat selection. To do this, we used camera collars to capture the images in front of the animal equipped with such a collar. These devices were deployed on female caribou each year from 2016 to 2018. The videos were analyzed, and each component (e.g. weather, type of resources, behavior, insect abundance) of the video was recorded. We categorized the selection of feeding sites as whether a female fed in the habitat or did any other activity (e.g. travelling, resting, standing). Our results will provide information on the selection of summer habitat by female caribou at a fine spatial scale. They will bring knowledge on the critical habitats of females and contribute to the collective management and conservation of the migratory caribou and its habitats.

ASSESSING DYNAMIC THICKNESS CHANGES OF DEVON ISLAND ICE CAP, CANADIAN ARCTIC

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Over the past three decades, strongly negative mass balances have been observed for glaciers and ice caps in the Canadian Arctic, with a notable increase since 2005. A major uncertainty in assessing sea level rise is how glacier dynamics are changing under a warming climate, and whether glaciers are speeding up (which might result in enhanced thinning) or slowing down (which might result in reduced thinning or even thickening). Traditionally, regional mass balance estimates have been based on in-situ glaciological measurements, which do not account for dynamic processes. Geodetic mass balance measurements obtained from remotely sensed surface elevation datasets can better account for the effects of changing glacier motion by capturing thickness change over whole glacier systems. This study forms part of a recent effort initiated by the World Glacier Monitoring Service (WGMS) to validate long-term glaciological mass balance series with geodetic mass balance measurements. Our focus is the Devon Island Ice Cap (DIC), one of the largest ice masses in the Canadian Arctic, where glaciological mass balance has been measured on the northwest basin since 1961. In this study, we calculate thickness change and geodetic mass balance for DIC over the past 50+ years from various surface elevation datasets including TanDEM-X, the Canadian Digital Elevation Model and NASA airborne altimetry. The glaciological and geodetic mass balance time series over the northwest basin are being compared. If statistically significant deviations are found, corrections will be applied to the glaciological time series following the reanalysis methodology approved by the WGMS. This independent validation will be used to assess how representative the glaciological mass balance record for the northwest basin of DIC has been for the entire ice cap. Results from this study will improve understanding of the inter-relationships between ice dynamics and surface mass balance on DIC, and their control on its contributions to non-steric sea level rise since the 1960s.

MICROPLASTICS COLLECTED FROM NUNAVUT'S LOWER NORTHWEST PASSAGE AND IMPACTS ON MODEL CONSUMERS

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There is an increased awareness of the emerging consequences of plastic waste on the health of aquatic environments. Microplastics research seeks to understand how ecosystems are impacted by the presence of small plastic pieces (0.3-5 mm), derived from macroscopic plastic waste or directly discarded from manufacturing facilities and consumer products. Free-floating microplastics are found in freshwater and marine environments and are easily ingested by zooplankton and fish. This research focuses on the collection and characterization of such plastics from Nunavut's Lower Northwest Passage (LNWP) for comparison of type, composition, and microbial community structure. Microplastics in ecosystems can vary, and often have associated biofilms with algae, microbes, and adsorbed industrial chemicals. This pilot study shows evidence of microplastics, with microbial community analysis continuing. The effects of microplastics as both a consumable and an environmental stressor were tested using Drosophila melanogaster larvae as a model aquatic organism. Survivorship (egg to adult development), developmental time, and fitness (pupation height) were tracked with initial results suggest a delay in developmental time when plastics are consumed, as well as some transfer of bio-contaminants from the plastics. Further research into the transfer of contaminants to an ingesting host would allow for a greater understanding of how microplastics impact ecosystems, including the Arctic Ocean.

UNDERSTANDING POLAR BEAR (URSUS MARITIMUS) ADULT SOCIAL PLAY USING NON-INVASIVE MEASUREMENTS OF BODY CONDITION

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Social play is uncommon among adult mammals but has been documented among male polar bears (Ursus maritimus) in the Churchill, MB region. During the fasting period of the summer and autumn months, sub-adult and adult male polar bears aggregate into groups as they wait for the ice to reform on Hudson Bay. This time is when they have not typically fed for several months and blubber resources are at the lowest point for the year. Polar bear habitat in the Western Hudson Bay is changing due to global warming and the time spent on land without resources is extending. However, polar bears still devote time and energy to nonaggressive social play. Previous studies have found evidence of decreasing body condition in polar bears in Hudson Bay. Therefore, environmental changes may create a situation where polar bears need to modify social behaviours in order to maintain body condition. We predict that factors such as body condition and the timing of sea-ice breakup will influence the duration and extent of polar bear social play. Scored video footage of play from 1994-1995 and 2001-2005 was analyzed to determine the mean duration of play among pairs of polar bears. Body condition of each bear was measured non-invasively and converted into an index from 0-1. We found that body condition, with sea-ice breakup dates as a covariate, did not significantly influence the rate of social play between dyads of adult male polar bears. This suggests that either social play is an important life event and will be maintained as body condition declines, or that body condition has not decreased to the point where it is influencing social play.

ENVIRONMENTAL GRADIENTS AND MICROBIAL BIODIVERSITY IN THE GREAT WHALE RIVER AND ITS MAJOR TRIBUTARIES: IMPLICATIONS FOR CARBON CYCLING

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Watersheds of arctic and subarctic rivers are undergoing profound transformations in response to climate change and the associated impacts such as shifting hydrological patterns, permafrost thawing and changes in vegetation cover. One of the consequences of these landscape changes is that a large pool of organic carbon is becoming more available, however its ultimate fate is uncertain. Rivers are likely to play a substantial role in the transport and transformation of carbon, from terrestrial to marine ecosystems, and in the emission of greenhouse gases into the atmosphere. Microbial activities dominate these biogeochemical processes, but community structure and function (the aquatic microbiome) are still poorly understood in river ecosystems in general, and particularly at high latitudes and during the winter. This project focuses on the Great Whale River, a large subarctic river discharging into southeastern Hudson Bay with a watershed characterized by heterogeneous landscapes, including sporadic permafrost areas in an advanced stage of thawing and erosion. Our objectives are to characterize spatiotemporal gradients in the Great Whale River, its major tributaries and the river plume into Hudson Bay, specifically: physico-chemical properties, including organic carbon and greenhouse gas concentrations; microbial cell populations; and microbiome structure and function via molecular analysis. The information gained during this project will yield new insights into how seasonality influences the microbiome and how higher latitude river ecosystems will respond to the ongoing transformation of their watersheds in the warming northern climate.

DEVON SUBGLACIAL LAKES PART 1: NEW OBSERVATIONS FROM AN AIRBORNE GEOPHYSICAL SURVEY OVER THE HYPERSALINE SUBGLACIAL LAKES BENEATH DEVON ICE CAP, CANADIAN ARCTIC

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Subglacial water systems beneath glaciers and ice sheets on Earth provide terrestrial analogs for icy habitats that may exist on other planetary bodies across the solar system. A recent study revealed geophysical and geological evidence for the existence of two subglacial lakes underneath the Devon Ice Cap, in areas where basal ice temperatures are expected below -10.5 °C. The subglacial lakes are hypothesized to consist of brine-rich water, with their salinity being derived from a salt-bearing evaporite unit outcropping underneath the ice. Due to their hypersaline nature, these subglacial lakes represent particularly tantalizing analogs for a brine body inferred to exist beneath the Martian South Polar Layered Deposits and brine pockets that may prevail within Europa's ice shell. Here, we present new results from a detailed airborne geophysical survey conducted over Devon Ice Cap in spring 2018. The survey was designed to examine the subglacial lakes' hydrological and geological contexts and includes radio-echo sounding (RES), laser altimetry and magnetics measurements. We use radar derived basal reflectivity and specularity values to identify the full extent of the subglacial lakes and their surrounding hydrological characteristics. Subglacial hydraulic potential gradients and water routing models are used to assess the lakes' hydrostatic equilibrium and to identify potential subglacial drainage pathways. Furthermore, ice thicknesses and laser altimetry derived surface elevations are combined to generate a new, high resolution bed DEM, which highlights previously unknown topographical features around the subglacial lakes. Finally, we use magnetic field anomalies to improve the previously hypothesized geological context beneath Devon Ice Cap, and in particular, to better constrain locations where salt-bearing rocks may outcrop underneath the ice. A combined analysis of our results leads to an improved hydrological and geological characterization of the Devon subglacial lakes and their surrounding environment.

DIET OF APEX PREDATORS IN NORTHERN QUÉBEC-LABRADOR: THE COMPLEMENTARY USE OF HARD-PARTS IDENTIFICATION, DNA BARCODING AND STABLE ISOTOPES ANALYSIS.

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Assessing predator diet is crucial to the understanding of predator impacts on the population dynamics of their prey. Traditionally, information on the diet of terrestrial predators has been gathered through the identification of hard parts present in scats and/or stomach contents. More recently, molecular tools are starting to replace the use of visual identification of remains to reconstruct the diet of predators using scats. While such tools achieve higher detection rates of prey species than the identification of hard parts, both approaches only provide a short temporal insight into the food habits of predators. The use of stable isotopes analysis allows the determination of the diet of predators over longer timescales, but must rely on some minimum a priori information on animal foraging patterns. We evaluated the outcomes of using hard-parts identification, DNA barcoding and stable isotopes to determine the diet of wolves and black bears in northern Québec-Labrador. Using the three approaches of diet reconstruction we achieved a more robust description of predator diet, both at short- and longer timescales, that would have been possible through the use of a single approach. Our results are a first step toward elucidating the role of predators within the tundra food web and foster the use of a combination of approaches for diet reconstruction of predators.

PHYSICAL STUDY OF THE LAST ARCTIC EPISHELF LAKE

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Milne Ice Shelf is the last intact ice shelf of Ellesmere Island. Located at the mouth of Milne Fjord (82°, -80°), this floating ice dam stops freshwater from flowing to the ocean creating an epishelf lake. Because of the fracturing of all other ice shelfs in the northern hemisphere, Milne Fjord has the last epishelf lake in the Arctic. This system, composed of a freshwater lake floating on top of the seawater experiences variations on many different time scales. On an annual basis, the lake thickens during the summer because of surface runoff and then thins during the rest of the year. Field campaigns have been held at least every year since 2009. In order to measure lake temperature and conductivity year round, a mooring has been installed in the middle of Milne Epishelf Lake in May 2011 and is still recording. Time series of water temperature and conductivity show a slight decrease of the annual minimum as well as maximum thickness of the lake over the years. Summer meteorological conditions are linked to melting and hence to the deepening of the bottom of the lake. On the other hand, thinning is due to discharge of lake water to the ocean by a channel in the ice shelf and by mixing at the interface between the lake and the seawater. Time series of the lake temperature and thickness as well as meteorological parameters from May 2011 to July 2018 are presented. This poster aims to give the reader an overview of the physical changes happening in the last remaining epishelf lake of the arctic.

COMING TOGETHER FOR CARIBOU: USING COMMUNITY-LED AUDIO-VISUAL METHODS TO EXPLORE RELATIONSHIPS AMONG INUIT AND CARIBOU IN LABRADOR.

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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, without insight from Indigenous knowledge. Through research-based, community-led, participatory audio-visual methods, this research works in partnership with Nunatsiavut and NunatuKavut to explore the ways in which changing caribou populations and hunting bans impact Inuit in Labrador. A combination of qualitative and visual research methods – including participatory video, PhotoVoice, focus groups, and community engagement events – will be used to explore how changing caribou populations and a hunting ban in Labrador have impacted Inuit communities, lives, and wellbeing. Through this process, this research will focus on highlighting the significance of caribou for Inuit; examine how changes in caribou management and populations may be impacting this historic relationship, while highlighting how this connection has and continues to persist through time; demonstrate the ways in which participatory audio-visual methods can co-produce knowledge and share Inuit wisdom related to caribou; and advance our understanding of how participatory audio-visual methods can be used for social and wellbeing inquiry. Through the production of community-based, research-oriented, participatory documentary film, photography, and art-making, this project brings together two diverse Inuit groups for caribou, for culture, and for conservation, and represents an exciting partnership among Labrador Inuit to 'work together' on telling the deep and enduring story of people and caribou. This presentation will share preliminary findings and filmings, and discuss the potential value and ability of visual research methods to both celebrate and enhance relationships between and among Inuit and caribou in Labrador.

MONITORING ECOSYSTEM DYNAMICS IN THE BEAUFORT SEA USING STABLE ISOTOPES IN POLAR BEARS (URSUS MARITIMUS)

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Longitudinal studies on the diets of apex predators can be used to understand the effects of environmental changes within a system and to monitor shifts within the community. Using nitrogen and carbon stable isotopes in polar bear (Ursus maritimus) guard hairs, we examined their diet in the Beaufort Sea from 2004 to 2012. We investigated how stable isotope values were related to population demographics, sea ice dynamics, climate indices, and ringed seal (Pusa hispida) ovulation rate. Bayesian stable isotope models were implemented to determine annual variation in diet proportions and niche widths. The main component of the polar bear diet was ringed seal and the contributions from bowhead whale (Balaena mysticetus), beluga (Delphinapterus leucas) and bearded seal (Erignathus barbatus) varied by age, sex, reproductive status, and year. Sea ice dynamics, summer Arctic oscillation, and air temperature were related to polar bear diet, suggesting that polar bear forage adaptively in response to environmental changes, and availability and accessibility of prey. Polar bear diet proportions and niche widths fluctuated with ringed seal productivity, highlighting the biological link between these species and the potential role polar bears can play in monitoring changes in Arctic marine ecosystems.

FINDING RECRUITS: BOREAL TREE REGENERATION POST-FIRE AND FUEL WOOD HARVESTING IN COASTAL NUNATSIAVUT

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Post-fire recruitment of boreal tree species has been examined at length across much of western North America, yet our understanding of recruitment under consecutive disturbances remains limited. Few data exists on how forest fire followed by post-fire (burned woods) fuel wood harvesting impacts boreal tree recruitment, particularly in the eastern Canadian subarctic, despite known differences in forest fire regimes (i.e., more infrequent and lower in severity) from western forests. In coastal Nunatsiavut, where our research was conducted, post-fire fuel wood harvesting also represents an important fuel source for coastal communities. Under continued climate warming, novel fire regimes are anticipated for much of the circumpolar North; therefore, a better geographic understanding of the relationship between fire disturbance and post-fire fuel wood harvesting is warranted. Our study examines three separate forest fires in the coastal boreal forests of Nunatsiavut. Each stand burned within the past 25 years and experienced varying levels of post-fire harvesting. Data on pre-fire stand density, harvesting intensity, and functional group composition of post-fire ground vegetation were used as predictive variables for tree recruitment at each site. Early findings suggest that boreal tree recruitment is low across all sites and tree species, despite differences in pre-fire stand density and harvesting intensity. We speculate that low recruitment is a result of low fire intensity, which created unsuitable germination conditions and facilitated increased resource competition with rapidly establishing shrub species. Results from this study will add to our limited understanding of boreal tree recruitment following multiple disturbances and will increase our ability to predict fuel wood availability for Nunatsiavut communities under global change.

ROLE OF CLIMATE CHANGE ON EFFECTIVENESS OF MINE WASTE MANAGEMENT IN THE NORTHERN CANADA

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Mine site reclamation is the part with the longest lifetime expectation for a mine project, as it is expected to last for an almost infinite time horizon. The goal of reclamation is to control acid mine drainage (AMD) generation and metal leaching in the environment. The AMD results from a chemical reaction between sulphide minerals contained in mine waste, water and oxygen. Various reclamation methods exist and they are all dependent to the climate. In subarctic and arctic climates, one of the main reclamation method suggested in closure plan are insulation covers. It considers burying reactive mine waste into the permafrost using an inert cover that will interact with the atmosphere (the active layer must be less than the thickness of the cover). The integration of the reactive mine waste into the permafrost will control the chemical AMD reaction by freezing water and reducing mine waste temperatures. Actually, most of the design process, using parameters such as material properties and layers thickness, used historical climate data. Northern Canada undergoes climate changes, which could have consequences on insulation cover designs. One of the most known effects of climate change in Northern Canada is the permafrost degradation and the active layer thickning. Geochemical instability could occur if the reclaimed tailings thaw; reaction with water and oxygen, and temperature rise could lead to AMD generation. The existing designs and future ones need to integrate climate change in their design for a minimal period of 100 years. Even the few mines developed in the 90s that integrated climate change in their design have to reinvestigate their reclamation scenario because changes are larger than expected. This study introduces a methodology including the impact of climate change in the effectiveness of reclamation methods in this region.

SEDIMENTARY DYNAMICS OF THE BELCHER GLACIER (DEVON ICE CAP, NUNAVUT) DURING THE LAST CENTURIES

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The Devon Ice Cap on the Devon Island in the Canadian Arctic has an area of 15 000 km2. Over the last decades, instrumental data have demonstrated that the area of the ice cap has diminished by 600 km2 (4%) as a result of climate warming. However, to place this reduction of the ice cap into perspective, it is necessary to know its past variability and dynamics. Thus, sedimentary sequences extending beyond instrumental records could provide a critical link to study the long-term natural glacier variability. In this context, the purpose of this study is to compare the sedimentological, mineralogical, geochemical (elemental and isotopic), and magnetic properties of a short sedimentary sequence (43 cm) collected in the proximity of the Belcher Glacier in order to document its glacier dynamics over the last centuries. The Belcher Glacier is the principal tidewater outlet glacier calving up to 30% of the total iceberg volume from the Devon Ice Cap. The core chronology was assessed from 210Pb measurements and indicates that the sediment core extends back to ca. AD 1300, with sedimentation rates ranging between 0.062cmyr-1 at the base and 0.145cmyr-1 in the uppermost part of the core (last 8 cm). C/N, δ13Corg., and δ15Ntotal indicate a dominant marine algae origin for the sedimentary organic matter, reflecting the inputs of sea-ice algae from the tidewater glacier. Sedimentation rates and most of our detrital proxies (notably, plagioclase, magnetite, total clays, Ti/K, Al/Ca, and δ15Ntotal) show an increase since the mid-19th century compared to the pre-industrial period (1300 to 1800 AD), likely related to a greater retreat of the Belcher Glacier. The variations observed in almost all detrital proxies measured in this study are synchronous with other regional records from the northern Baffin Bay, supporting the hypothesis that the recent retreat observed in the Belcher Glacier is mainly driven by changes in the intensity of the West Greenland Current.

ASSESSING THE LEVEL OF CONTAMINANTS IN 25 LAKE CATCHMENTS SURROUNDING IQALUIT, BAFFIN ISLAND

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The long-range transport and deposition of atmospheric contaminants onto Arctic ecosystems has caused great concern regarding their fate and environmental impacts. Contaminants, such as heavy metals, are a threat to human and environmental health due to their ability to bioaccumulate and biomaginify in Arctic flora and fauna. This poses a risk to northern communities, due to their reliance on traditional foods. Further, microplastics, which are plastic debris < 5 mm in size, are an emerging contaminant in the Arctic that have the ability to accumulate in lower trophic biota, e.g. zooplankton and fish. Lakes and ponds, which are recognized as 'sentinels of change' owing to their ability to reflect internal and external (catchment) processes, are one of the most common components of Arctic ecosystems. Quantifying pollutant loadings to Arctic lake catchments will further our understanding regarding the fate of atmospheric contaminants, and the potential for human exposure. The objective of this study was to assess the level of contaminants [arsenic (As), cadmium (Cd), mercury (Hg), lead (Pb), and microplastics] in lake catchments (n=25) surrounding the Iqaluit Region, Baffin Island. During September 2018, surface water and surface sediment were sampled from each lake, while vegetation [moss (Hylocomium splendens and Pleurozium schreberi), Emetrum nigrum (crowberry), Vaccinium uliginosum (blueberry), and Rhododendron tomentosum (Labrador tea)], and surface soils (0–10 cm depth) were sampled from their surrounding catchments. Microplastics were measured in surface waters, while As, Cd, Hg, and Pb were analyzed in surface waters, surface sediment, vegetation, and surface soils.

RECENT ICE COVER CHANGES ON LARGE ARCTIC LAKES

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Lakes comprise a large portion of the surface cover in the Northern Hemisphere, forming an important part of the cryosphere. Recent studies have demonstrated that ice break-up dates, in particular, have been occurring earlier in many parts of the North over the last 50 years in response to warmer climate during the winter and spring. Lake ice break-up and freeze-up dates were extracted from the 4 km Interactive Multisensor Snow and Ice Mapping System (IMS) dataset for the last 14 years (2004 - 2017) and examined for recent trends and spatial patterns. Lake ice break-up trends show a mix of earlier break-up (primarily in northern regions) and later break-up (primarily in the southern regions), with an average trend of 1.3 days per year ($p < 0.05$) earlier break-up north of 60°. A strong regional pattern can be seen in the central Canadian Arctic of 1-2 days per year earlier break-up, with a slight tendency for later break-up dates in the eastern Canadian Arctic, and a mix of trend directions through Scandinavia and Russia. Freeze-up dates for the large lakes across the Arctic show a shift towards predominantly later dates (average trend, 1.3 days later per year, $p < 0.05$), with some lakes in the range of 1-1.5 days later per year through the Canadian Arctic mainland, and stronger trends upwards of 2 days per year later in southern Finland. The combined ice cover duration shows a shorter ice-covered season with an average of 2 days per year ($p < 0.05$), primarily clustered in the coastal regions of mainland Nunavut, but with a cluster of lakes in Nunavik showing a trend towards a longer ice-covered season. Including the temporal patterns from all large lakes examined shows a tendency towards longer ice cover durations in the eastern Canadian Arctic, compared to the central/western Canadian Arctic and Scandinavia where the dominant direction is towards shorter ice-covered seasons. The 14-year record now available from the IMS dataset provides an interesting overview of the variability observed in the recent lake ice record and highlights regions where the recent patterns in ice phenology differ from the long-term trends.

ROLE OF THE NEST FLEA, CERATOPHYLLUS VAGABUNDUS VAGABUNDUS, AS A POTENTIAL BRIDGE VECTOR FOR BARTONELLA HENSELAE TRANSMISSION BETWEEN NESTING GEESE AND ARCTIC FOXES, VULPES LAGOPUS, IN NUNAVUT, CANADA

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Vector-borne disease in the Arctic may be of increasing wildlife and public health significance in a warmer and more globally connected Arctic. Previously, Bartonella henselae (the causative agent of cat scratch fever) was detected in blood collected from live-trapped arctic foxes, Vulpes lagopus, in the region of Karrak Lake, Nunavut. This bacterium is generally associated with cats and fleas, neither of which are widespread in Arctic ecosystems. Arctic foxes in the region opportunistically feed on migratory geese, their eggs, and their goslings. The Karrak Lake colony of lesser snow (Chen caerulescens caerulescens) and Ross's (Chen rossii) geese is infested with a nest parasite, the flea, Ceratophyllus vagabundus vagabundus. However, there have been no publications that have identified C. vagabundus vagabundus as a suitable vector for B. henselae. Due to the common landscape use between arctic foxes and migratory geese, we theorized that the nest fleas may serve as a potential vector for B. henselae. The objective of this study was to determine the prevalence of DNA of B. henselae in nest fleas collected from arctic fox den entrances and goose nests in 2014. Using polymerase chain reaction analyses, B. henselae was identified in 39% of pooled flea samples (n=51). This study provides supporting evidence that B. henselae occurs at low levels in the Karrak Lake ecosystem, and that nest fleas may serve as a potential vector for transmission. Further testing is being done to identify whether Ross's and lesser snow geese in the Karrak Lake colony may serve as a reservoir for B. henselae transmission, vectoring this parasite from temperate regions to the Arctic.

ECOCHIP: AN AUTONOMOUS SENSOR PLATFORM FOR IN SITU ANALYSIS OF ENVIRONMENTAL BACTERIA

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The EcoChip is an autonomous sensor platform designed for the monitoring of in situ bacterial growth in the natural environment. It is constituted of 96 individual wells allowing the continuous monitoring of bacterial growth through a multichannel electrochemical impedance monitoring circuit. In addition, environmental parameters such as luminosity, humidity, and temperature are continuously recorded. A wireless communication device is embedded in the platform for transmission of sensor data from the onboard memory. Laboratory tests revealed that this system is ready to be used in the field. We report here the use of the system in the natural environment of northern Canada. We deployed the EcoChip in 2 separate locations of northern Québec, near the Lac à l'Eau Claire and near the Boniface river. Soil samples were diluted 1 million-fold in order to seed each well with a potentially one single bacterial cell, and the diluted solution was sealed with semi-permeable membranes and installed in contact with the soil to provide the nutrients necessary for bacterial growth. Environmental data and bacterial growth were recorded repeatedly for several days. Overall, the EcoChips were functional and data were recorded for 48 hours in the first device and for 8 days for the second one. Bacterial growth could be recorded in 20 of the 192 available wells on the 2 EcoChips, with some growth curve similar to those observed in the lab. Current steps are the extraction of the bacterial DNA from the wells where a bacterial growth could be measured, and from the soil samples used for analysis. Sequencing libraries are prepared using the NexteraXT protocol, and sequencing of the bacterial genomes will be performed using paired-end 125 nucleotides reads on the Illumina HiSeq platform. Genomes will then be assembled using the Ray Meta software developed in our lab, which will allow the determination of the taxonomical characteristics of studied samples. We shall then be able to draw the functional profile of isolated bacteria. Ultimately, this device will provide information for the understanding on how the disruption of ecosystems affects microorganisms in Arctic soils. It shall allow to identify sentinel bacteria and investigate how spatiotemporal features affect these microbial consortia. Using analytical approaches based on integrative genomics, bioinformatics, geolocation and machine learning, we shall be able to quantify the health of Northern ecosystems and follow its evolution over time. In situ analysis of microorganisms will also allow to develop high performance metabolomic models to assess the Nordic molecular diversity and to discover new compounds with potential medical applications.

UK-CANADA ARCTIC RESEARCH COOPERATION - PAST, PRESENT AND FUTURE

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The United Kingdom and Canada have a strong history of research cooperation in the Arctic and across the High North. The Natural Environment Research Council's Arctic Office is working closely with Canadian colleagues to further develop and deepen these connections wherever it can. The Bursary Programme in 2017 and 2018 has been a key part of this approach. This session will provide an overview of the programme, place it in the context of wider work, outline the next steps for the programme and identify further upcoming opportunities for joint working.

NUTRITIVE QUALITIES OF MARINE MICROALGAE IN NUNAVIK

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In marine arctic ecosystems, phytoplankton and ice algae are generally the principal sources of primary production, which then transfers to the pelagic food web, the benthos and the sediments. Due to Global change, the physico-chemical characteristics of the water column in the Arctic Ocean are changing, including temperature, pH, salinity, nutrient availability and light. These alterations are expected to affect microalgal production and the quality of the organic matter it synthesizes, which may have important repercussions since essential molecules such as omega-3 fatty acids and carotenoids can only be synthesized by plants. These molecules are crucial for the marine food web and the Inuit populations who harvest these ressources. This project is part of the BriGHT program and its goal is to evaluate the variability in the composition of the particulate organic matter and the connections between this variability and the environment in Nunavik. Results show a strong gradient in physico-chemical parameters across the different coastal areas of Nunavik, especially for temperature and salinity, with warmer and fresher water in Hudson Bay, whereas colder and saltier waters are found in Hudson Strait and Ungava Bay. The impact of these differences on the quality of organic matter will be presented and discussed.

ICECUBE: A NANOSATELLITE CONCEPT FOR CANADIAN ARCTIC MONITORING

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The adverse effects of global climate change require new and innovative solutions to monitoring and combatting the issue. Given its latitude and environmental sensitivity, changes to the Arctic regions are indicative of the state and progress of global warming. The growing severity of climate change increases the cost and resource demand for monitoring efforts. New and economical methods need to be explored to adequately document changes for northern communities. Nanosatellite technologies allow for versatile and cost-effective applications. Existing technology allows for nanosatellites to provide services such as climate change monitoring, safe methods for scouting areas of interest and Arctic weather sensing. The continued development of nanosatellite technologies improves the accessibility of space, allowing for smaller organizations to benefit from valuable satellite services. These technologies empower communities with first-hand knowledge of the Arctic region to execute their own research missions. This paper presents a conceptual design for a nanosatellite in a polar and sun-synchronous orbit that will provide monitoring capabilities to Arctic communities. The satellite's earth observation camera has multi spectral imaging capabilities in the visual, infrared and red edge wavelengths. Imaging in these bands will enable data collection for Arctic agriculture such as generalized vegetation indices. Using this data, researchers will be able to evaluate and track the progression of climate change. Additionally, the satellite design will demonstrate novel and innovative technologies currently under development at the University of Manitoba Space Technologies and Advanced Research (UMSTAR) Lab, including a polar orbit communication system, thermal control technologies and an attitude and determination control system.

SPATIAL ECOLOGY OF RINGED SEALS ACROSS A LATITUDINAL GRADIENT IN THE EASTERN CANADIAN ARCTIC

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The ringed seal is especially vulnerable to the rapid climate-driven decline of sea ice given its dependence on ice for birthing lairs, molting, and for prey derived from these sympagic ecosystems. Ringed seals occupy a broad latitudinal range that experiences high variation in ice conditions from the transient coverage of the sub-Arctic Hudson Bay, to the substantial year-round coverage of the high Arctic in the Lincoln Sea. Therefore, ringed seals as a species likely vary in their ability to adjust their seasonal sea ice habitat use to varying regional sea ice conditions. The well-studied southern end of their range in Hudson Bay will likely be the first to suffer from sea ice recession via demographic shifts, diet changes, and range contraction, but how ringed seals will respond over their entire range remains poorly understood. The objective of this study is to investigate the habitat selection of ringed seals along this heterogeneous latitudinal gradient of sea ice to identify differences in ringed seal occurrence that could be linked to sea ice conditions. We will use aerial survey data from the low Arctic (≤65° N Churchill, MB), mid-Arctic (>65° N to ≤75° N Pond Inlet, NU), and high Arctic (>75° N Alert, NU), and relate density to differences in remotely sensed sea ice data. We hypothesize that latitudinal variation in ringed seal density will reflect availability of preferred landfast first-year ice habitat, with density decreasing with increasing latitude. Preliminary results indicate ringed seal densities of 0.46-2.05 seals/km2 in Churchill, 0.24-1.40 seals/km2 in Pond Inlet, and 0.05 seals/km2 in Alert. Future work aims to link density to sea ice conditions and to the feeding ecology of ringed seals along a similar latitudinal gradient. To assess ringed seal feeding, we will measure carbon and nitrogen stable isotope ratios to indicate trophic position and food web dynamics, and highly branched isoprenoids (HBIs) to identify the relative source of primary production using ringed seal tissues collected from the low Arctic (≤65° N Arviat, NU), mid-Arctic (>65°N to ≤75°N Pond Inlet, NU), and high Arctic (>75°N Grise Fjord, NU and Qaanaaq, GL). We predict that at high latitudes, ringed seal diets will exhibit carbon and nitrogen values more representative of complex sympagic food webs, and HBIs characteristic of sea-ice derived production rather than pelagic signals. Results from both habitat selection and feeding ecology will inform us about how ringed seals adjust to regional sea ice conditions and provide baseline data to compare with as ice conditions change.

MODELING THE EFFECT OF ENVIRONMENTAL CONDITIONS ON THE AVAILABILITY OF ARTHROPODS FOR INSECTIVOROUS BIRDS IN THE ARCTIC

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For shorebirds and songbirds nesting in the Arctic, terrestrial arthropods are an essential food source. With Arctic summer's constraints, the availability of this resource is limited, as there is only a short period of high abundance and activity of arthropods. It can therefore be critical for Arctic insectivorous birds to synchronize their reproduction with the arthropod availability peak, to ensure as much resources as possible for raising their chicks. Arthropod development and activity being temperature-dependent, these processes are likely to be affected by climate change. As many Arctic shorebirds populations are declining, we need to improve our understanding of food availability on their nesting grounds in order to anticipate climate change consequences on these birds demography. Addressing these concerns, the objective of this study is to create a pan-arctic model for arthropod availability in relation to weather conditions that will provide a largescale perspective on food resources available for birds. In order to create that model, we link arthropod abundance time series with daily local weather data for several sites across the Arctic. Arthropod data included in the analysis come from various sites used by shorebird for breeding, such as Bylot Island, Alert, Herschel, Igloolik and Churchill. Meteorological conditions such as daily temperature and radiation are extracted from ERA Interim, a global atmospheric reanalysis model providing weather data from 1979 to present for every study site included in our analysis, without the limitations of historic databases. The global model built from these datasets will allow us to compare parameters such as the timing and amplitude of maximum arthropod availability between the study sites, in order to get a global perspective on these important parameters for shorebirds reproduction. This global model will also allow us to hindcast the same parameters, increasing our understanding of arthropod dynamics under a changing climate. This study will therefore provide a unique tool to improve our general understanding of arthropod availability for insectivorous birds nesting in the Arctic in a climate change context.

HYDROLOGICAL ANALYSIS OF POND FORMATION AND SEASONAL RESPONSES IN THE HIGH ARCTIC

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Climate change and subsequent changes to permafrost have large potential impacts on Arctic land and water. These effects are often most apparent during the melt season, when seasonal active layer thaw changes the availability of surface water, subsurface water flow pathways, and alters water quality. Long-term investigations of two lakes at the Cape Bounty Watershed Observatory (CBAWO), Melville Island, Nunavut indicate substantial hydrochemical changes have occurred during the past decade in response to changes in climate and permafrost, but little is known about how smaller water bodies on the land will respond to these changes. Ponds represent the majority of fresh water by surface area, and are therefore also important to study. Initial pond sampling conducted in 2017 indicates considerable variation in water balance, hydrochemistry, and turbidity among the smaller water bodies at CBAWO. Our research aims to expand upon this knowledge to better understand the variation in water sources for ponds at CBAWO catchments. Nineteen ponds were sampled weekly from mid-July to mid-August 2018 for water stable isotopes, ions, dissolved gases, electrical conductivity (EC), temperature, and turbidity. The ponds were selected to represent a range of catchment conditions, including different vegetation and terrain types, permafrost disturbance settings, and the presence of permanent and ephemeral hydrological conditions. Our study will contribute to our understanding of pond water quality in this region of the High Arctic and provide insights into how seasonal thaw and ground ice contributions impact surface water quality.

DOES SEA ICE STRUCTURE CONTROL THE DISTRIBUTION OF ICE ALGAE IN FIRST-YEAR AND MULTI-YEAR ICE, NORTH OF ELLESMERE ISLAND?

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The Last Ice Area (LIA), north of Ellesmere Island, is of high ecological significance because it is the only Arctic region expected to retain summer sea ice until 2050. The presence of first-year and multi-year sea ice in this region provides a unique opportunity to study both ice types under similar environmental and oceanographic conditions. In this context, water column, first-year and multi-year sea ice were sampled during a 30-day ice camp, set up in the coastal region of the Lincoln Sea, at 9 km of CFS (Canadian Forces Station) Alert. In this study, we present results from 45 first-year and 72 multi-year ice cores collected between May 3rd and May 23rd. During this period, sea ice temperature profiles of first-year and multi-year ice evolved from typical cold winter conditions to spring warming. Chlorophyll a (chl a) concentrations were measured using the fluorometric method and autotrophic protist abundances were estimated by flow cytometry. Sea ice brine volume was calculated using salinity and temperature measured in 10 cm core sections, to assess the potential habitat for protist within the sea ice. Overall, the ice thickness varied between 1.37 and 1.76 m and between 2.08 and 4.58 m for first-year and multi-year ice, respectively. Chl a concentrations were ≤ 0.1 mg m-3 in the water column and ranged from < 0.01 to 2.56 mg m-2 and from < 0.01 to 1.29 mg m-2 in first-year and multi-year ice, respectively. In both ice type, chl a concentrations were significantly higher ($p<0.01$) in sections where brine volume was higher than 5 % compared to sections where brine volume was < 5 %. This shows the importance of sea ice habitat space availability for the distribution of algal biomass within the sea ice in the LIA. Nanoalgae (2 – 20 μm) dominated ice algal and phytoplankton communities. In the ice, the highest contributions of picoalgae (0.2 – 2 μm) were observed in the bottom sections. These results highlight sea ice structure as an important controlling factor for the distribution of ice algae in the LIA ecosystem and, more broadly, in first-year and multi-year Arctic sea ice.

SEISMO-ACOUSTIC SIGNATURES OF LATE HOLOCENE MARINE TRANSGRESSION IN HERSCHEL BASIN (YUKON COAST, WESTERN CANADIAN ARCTIC)

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Abstract Herschel Basin is a 160 km2 sedimentary basin of glacial origin, located southeast of Herschel Island along the Yukon Coast (Western Canadian Arctic). This area has recently received attention to examine the role and impact of coastal erosion and its associated release of sediment and organic carbon (OC) on the Arctic carbon cycle, which may act as positive feedbacks in future climatic scenarios. On the other hand, the burial of OC in nearshore sediments and within littoral basins remains overlooked. To address this issue, the exploration of Herschel Basin is required to: (1) track the recent evolution of Western Canadian Arctic coastlines; (2) understand the impact of the Beaufort Sea transgression on sedimentary dynamics, sedimentary infills, and lateral transport of sediment and OC; and in (3) assess volumetric estimates of sediments and OC stock. Recent acoustic subbottom profiles acquired using a Knudsen CHIRP system (12 kHz) provide high-resolution images of sediment infills down to 15 m below the seafloor, when applying a sound velocity of 1500 m.s-1. Gentle slopes characterize the nearshore areas while mounds and troughs are evidenced in the deep basin. Acoustic facies are related to the water depth and can be divided as follow: (1) transparent to chaotic facies with limited reflectors between 10 and 18.5 m water depth (U1, interpreted as littoral facies); (2) laminated facies with draping reflectors between 18.5 and 85 m water depth (U2, interpreted as postglacial mud); and (3) laminated facies with parallel reflectors (U3, interpreted as recent marine mud) on-lapping the facies U2 inside an isolated perched basin. This basin is settled in the axis of the Workboat Passage, which is a narrow and very shallow (1-2 m) littoral corridor separating the Herschel Island from the mainland. Seismic-to-core correlation between high-amplitude reflector in U2 and the age-depth model of a 5000-yr sedimentary record (Pfalz et al., 2017) indicates the overlying facies U3 in the perched basin is recent (maximum ca. 2-3 kyrs), and may have been developed since the opening of the Workboat Passage and the establishment of a longshore current. Future work should focus on the investigation of the sedimentary record in this basin, and on the seismic-to-core correlation between acoustic units and the core dataset to assess the sediment stock and OC pool at the basin scale. Reference Pfalz, G., 2017. Lateral transport of sediment and organic matter, derived from coastal erosion, into the nearshore zone of the southern Beaufort Sea, Canada. MSc thesis, Technische Universitat Dresden, Alfred Wegener Institute, Potsdam, 86 pp.

EDNA IN THE FIELD: IDENTIFYING FACTORS THAT INFLUENCE THE DETECTION OF BENTHIC MACROINVERTEBRATES USING ENVIRONMENTAL DNA IN NORTHERN FRESHWATER HABITATS

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Environmental DNA (eDNA) analysis is a new method to non-invasively detect organisms and has the potential to help us gain insight on a broad range of taxa with less sampling effort than traditional methods. Surveying arthropods using eDNA is especially interesting since they are a historically underrepresented taxa in arctic ecology due to the effort and expertise needed to identify specimens. During August 2018 we sampled caddisflies (Trichoptera) in Churchill, Manitoba in the context of a multi-year study on their phylogeny and habitat choice. Caddisflies are widely used as bioindicators due to their sensitivity to pollution and therefore would benefit from a more standardized sampling method like eDNA surveys. Due to the historical data we have on the distribution of caddisfly larvae around Churchill, this system is ideal to validate eDNA-based assays for these benthic macroinvertebrates in a novel environment. For this study we targeted a particularly widespread and abundant species (Philarctus bergrothi) and sampled 24 coastal ponds for their presence using both eDNA and traditional sampling methods (i.e. kicknetting and rock washing). Species-specific primer and probe sets were designed, and targeted real-time quantitative PCR (qPCR) tests were run on the extracted eDNA sample from each pond. Using a portable and minimal lab setup we were able to obtain presence/absence data at a field station shortly after sampling (in under 3 hours in some instances). By comparing the

proportion of positive qPCR replicates between samples and considering the variation in water chemistry and abundance of target organisms between ponds, we can determine which factors most affect the detection of macroinvertebrates using eDNA in northern freshwater systems. Here we will discuss how the results from this experiment have the potential to change how we conduct arthropod sampling and the considerations that must be taken into account when using eDNA-based methods in the North. We will also review the experimental setup which allowed us to obtain results without having to bring samples back to the South. In sum, with this work we hope to gain a better understanding of what impacts species detection with eDNA since the successful development of standardized, validated eDNA assays will drastically enhance our ability to detect invasive species, track shifts in distribution due to climate change and survey a greater portion of Arctic biodiversity.

COMMUNITY-DRIVEN CAPACITY IN HEALTH RESEARCH IN THE NWT: HOW HOTIÌ TS'EEDA CAN HELP

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Most health-based research in the Northwest Territories is conducted by non-resident academics and is highly dependent on Indigenous knowledge holders, community-based staff and Elders. Generally, communities are funded on a project basis for health research, rendering local jobs in health research short-term or unsustainable. In the NWT there is a strong need to foster and support Indigenous researchers conducting and co-leading research projects in communities. The success of health research in the NWT is dependent upon meaningful collaboration between southern academic institutions and researchers and local Indigenous organizations in every stage of the research process: from project planning, data collection and interpretation to knowledge dissemination. Hotıì ts'eeda, the NWT Strategy for Patient Oriented Research (SPOR) SUPPORT Unit, was created in part to build health research capacity within NWT communities. The vision of Hotıì ts'eeda is to support health research and training that is rooted in Dene Naowo, Inuvialuit and Metis knowledge and methodology and that responds to the needs of patients, communities and governments. Hotıì ts'eeda exists to revitalize and celebrate culture, improve capacity for individuals and families and support taking an evidence-based approach to policy. It is about moving control and ownership of research back to Indigenous peoples and communities. We aim to foster connections between researchers and communities, build capacity and contribute to a culturally competent health system and, ultimately, improved health for NWT residents. We do this by acting as a connector: connecting researchers with communities, Indigenous organizations, and NWT health research priorities. Hotıì ts'eeda works with researchers and community stakeholders to ensure success of research projects and that research has a positive impact on communities. Hotıì ts'eeda's capacity and training initiatives aim to support informed participation in health research, including a focus on career-building and supporting a new generation of northern health researchers and research-clinicians. This talk will focus on capacity building initiatives by Hotıì ts'eeda, including targeted health-research scholarships, on-site embedded training partnerships, mentorship networks, and how researchers and Hotıì ts'eeda can work together. Current Hotıì ts'eeda demonstration projects and collaborative research projects will be highlighted to demonstrate capacity building successes.

EFFECTS OF TUNDRA FIRE SEVERITY ON ECOLOGICAL RECOVERY IN THE BEAUFORT DELTA REGION.

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Temperatures in the Arctic are warming at twice the average global rate and increasing the frequency of high latitude wildfire. Shifting fire return intervals are altering the structure and function of subarctic ecosystems, and an increase in the number of tundra fires is expected to have similar consequences in the Low Arctic. Recent research in Alaska and Canada shows that ecological recovery after tundra fire can follow multiple trajectories, but additional research is required to identify the factors that are facilitating recovery to pre-fire conditions in some regions, and driving alternative ecological trajectories in other areas. In this study we explored the impact of burn severity on ecological recovery at six tundra fires that burned in 2012 in the Tuktoyaktuk and Anderson River Coastal Plains. Using Landsat imagery, the burn severity of each fire was classified into areas of moderate and severe burn by calculating pre and post-burn Normalized Burn Ratio (NBR). These burn severity maps were used to establish 180 plots, which were surveyed in July 2018. Field sampling measured differences in plant community composition, vegetation structure, thaw depth, and soil chemistry among severe and moderate burned areas and unburned control sites. Unmanned Aerial Vehicle (UAV) surveys were used to measure vegetation height, green vegetation fraction, and char index at the landscape-scale. Six years post-burn, the impacts of fire on vegetation structure and soils were still visible at all six fires, but there was considerable heterogeneity within and among each disturbance. Ongoing analysis focuses on understanding the relative influence of topography, burn severity, and soil properties on the nature and rate of ecological recovery. By identifying the factors that control ecological recovery, this study will improve our ability to predict how more frequent tundra fire will affect the long-term structure and function of Arctic ecosystems.

THE SPATIAL DISTRIBUTION OF ICE-WEDGE POLYGONS IN NUNAVIK

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The Arctic regions are experiencing a rise in surface temperatures at a higher rate than the rest of the planet. Ice wedges in polygonal terrain are one of the dominant features of permafrost that are affected by the deepening of the active layer and the thawing of permafrost provoked by climate warming. 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 ice-wedge polygons. Furthermore there is paucity of knowledge of the surface geological and ecological conditions where active (i.e. currently cracking under a propitious cold climate) and inactive (or fossil; i.e. non-cracking) ice wedges are distributed. For permafrost cracking and ice-wedge formation to occur, the ground temperature must in fact drop to temperatures at least below -10 °C and abrupt cold spells have to happen during the winter. If the temperature does not decrease rapidly enough, the material may contract without cracking (Lachenbruch, 1966; Mackay, 1984; Sarrazin and Allard, 2015). The objective of this project is to assess the activity of frost-cracking, ice-wedge polygons and tundra polygons across the bioclimatic zones of Nunavik. Since frost-cracking is a temperature-controlled process affecting materials with different rheological properties, it is assumed that polygon activity is related to surface climate conditions, soil materials, vegetation type and snow cover. We analyzed thousands of georeferenced aerial photographs (MFFP: 42 474/ CEN: 37 500) to make a thorough inventory of tundra polygons across Nunavik; in total 1073 tundra polygons sites were inventoried. For each identified site, the probable type of ice or soil wedge, the form of the polygons (e.g, open, closed, flat, high-center, low-center, nested networks), the surficial geological material and the vegetation cover type was recorded in a database. We also dug dozens of soil pits near Akulivik and Salluit to find out the degree of frost-cracking of the ice-wedge polygons under current different climate conditions and ground temperatures at the potential boundary between active and inactive ice wedges. Mapping the results indicates that ice-wedge polygons occur in a variety of sedimentary environments. The results also show that currently active ice wedge polygons in Nunavik occur only above 62°6'.0623'' Lat N, in the herbaceous tundra and principally in organic-covered raised beaches and sandy fluvial terraces. The vast majority of polygons in the shrub tundra occur on top of drumlins and in sand deposits. Since their furrows are often colonised by shrubs, they appear to be currently inactive and, therefore they formed under colder past climates. The next step of the research will consist in using the TTOP model to define more precisely the ground temperature conditions that regulate ice-wedge activity in Nunavik under current and past climates.

USE OF COMPACT SURVEILLANCE RADAR TO DETECT POLAR BEARS (URSUS MARITIMUS) IN AREAS OF HUMAN ACTIVITY

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Climate-driven declines in the duration and extent of annual sea ice have reduced the primary habitat of polar bears (Ursus maritimus) through much of the circumpolar Arctic. Habitat loss has had negative consequences on polar bear foraging success, reproduction, survival, and abundance, especially in southern portions of the species' range. Where polar bear distribution overlaps with human activity, a longer ice-free season has been associated with increased human-bear interaction, driven by both increased spatial overlap and by nutritional stress motivating bears to seek out anthropogenic foods. Polar tourism and other commercial activities also provide increasing opportunities for human-polar bear conflict. Improved understanding of polar bear space use and responses to human activity will improve safety for both bears and people. Compact surveillance radar (CSR) systems are capable of detecting and tracking multiple objects simultaneously, regardless of weather or lighting conditions. CSR is thus a potentially powerful tool for detecting polar bears before they enter human activity areas, giving managers an opportunity to respond proactively. We aimed to use CSR (Spotter RF, Orem, UT) to detect and track polar bears near human activity, with the goal of 1) quantifying polar bear movement and behaviour, 2) examining polar bear response to deterrents, and 3) testing the efficacy of novel deterrent methods. Initial testing began with the deployment of two Spotter RF C40 C radars and a surveillance camera (Axis PTZ) on the municipal complex building in Churchill, MB in the fall of 2017, with planned continued operation in 2018 and 2019. To test the system in an area with higher bear density, we also mounted the CSR on a tourism lodge (in partnership with Frontiers North Adventures) positioned in a polar bear staging area during the bears' fall migration in 2018. In both locations, the system reliably detected and tracked moving objects within its range (ca. 400 m). We used characteristics of bears (e.g., size, movement rate) to set parameters to detect bears and filter out other objects (e.g., motorized vehicles). We estimated detection rates using video and ground-truthing (e.g., snow tracking). Ongoing work will aim to test deterrent methods (e.g., strobe lights, sounds, cracker shells) when bears need to be displaced for tourism operation and to quantify bear responses to deterrent methods. Our preliminary results suggest CSR technology has a wide range of potential applications for autonomous or semi-autonomous polar bear detection and hazard mitigation. Use could be targeted at fine scales to detect bears at potential attractant sites (e.g., landfill) or deployed more broadly to detect bears approaching human settlements. CSR also has to potential to provide long-term quantitative insights into polar bear migration, space use, and local density. Understanding the behaviour and distribution of polar bears in relation to human activities will be crucial for effective polar bear management and human safety in an age of rapid sea ice loss.

SEA ICE DRAFT MEASUREMENTS COMPARISON BETWEEN MULTIBEAM SONAR AND GROUND ELECTROMAGNETIC SURVEYS

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Sea ice plays a major role in the Arctic climate as it represents the interface between the Arctic Ocean and the atmosphere, but it is also important for the whole global energy budget. During the last decades climate change has caused a drastic rise in air temperature that has led to a rapid sea ice decline. Until now, sea ice retreat and thinning are underestimated and poorly represented by climate models as many processes are not well understood yet. Further observations of sea ice thickness and extent are required to understand the key processes leading sea ice transformations in both space and time. In this pilot project the sea ice thickness of three different areas northeast of Svalbard is investigated during the 2016 freeze-up period. Sea ice draft measurements are conducted using an upward-looking multibeam sonar and a pressure sensor mounted on a remotely operated vehicle for under ice surveys. The data collected are processed using the hydrographic system "CARIS Hips". A new processing flow was developed to analyse the upward-looking sonar and pressure sensor data, and directly compute sea ice draft. 3D topographic images of the sea ice underside are produced together with the respective sea ice thickness maps. Also, the sea ice thickness dataset collected by the sonar system is compared to that collected by an electromagnetic induction sounding based instrument during the same surveys. Finally, the "Freezing-degree days" model is used to assess sea ice thermodynamical growth on the data collected during the field campaign. Snow cover is taken into account in the model using snow depth measurements conducted on the same areas with a Magna Probe. It is found that the two instruments for measuring sea ice thickness give similar sea ice distributions and have the same vertical resolution. However, the multibeam sonar gives a better lateral resolution and it is more accurate in measuring sea ice ridges than the electromagnetic system. The assessment of sea ice thermodynamical growth is hindered by the high spatial variability of the three areas of this campaign, but the model predictions are found to be consistent with the formation of a few centimeters of new ice from open water during a survey period of four weeks. This work also suggests some improvements to the navigation of the underwater vehicle and to the script for sea ice draft calculation from multibeam sonar data. The results of this project show that the new processing flow implemented in CARIS Hips allows for a reliable, efficient, and high resolution retrieval of sea ice draft measurements collected by an upward-looking sonar mounted on a remotely operated vehicle. The methods presented in this project can be adopted for a future year-round spatial and temporal study, necessary to fill the existing data gap during winter time in the Arctic. The use of the multibeam sonar together with the many interdisciplinary sensors mounted on the remotely operated vehicle allows for a complete overview of the sea ice underside environment and contribute to the improvement of climate models.

DISTRIBUTION AND ORIGIN OF MAJOR AND TRACE METALS AND POLYCYCLIC AROMATIC HYDROCARBONS IN SURFACE SEDIMENTS FROM THE CANADIAN ARCTIC ARCHIPELAGO

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In Arctic, because of the continual diminution of the summer sea ice coverage during the last four decades, it has been speculated that the North West Passage within the Canadian Arctic Archipelago (CAA) could open to cargo transportation, which is a shorter route between Asia and North America compared to Suez or Panama. This new shipping route could allow the maritime industry to reduce their navigable distances by up to 40% and reduce consequently the fuel consummation and CO2 emissions. However, an increase in maritime transportation in the CAA is suspected also to enhance the releases of inorganic (such as water-soluble inorganic salts and mineral elements) and organic (such as polycyclic aromatic hydrocarbons or PAHs, polychlorinated biphenyls or PCBs) pollutants derived, e.g., from fuel and oil leaks and hydrocarbon combustion. In this context, the purpose of this project is to characterize the baseline spatial distribution patterns of major and trace metals (Al, Ti, Fe, Mn, Li, V, Zn, Cu, Ni, Cr, Pb and Cd) and PAHs (phenanthrene, fluoranthene, pyrene, benzo[a]pyrene, chrysene) across the CAA. To achieve this goal, several box cores (96) distributed over a large area covering the Canadian Beaufort Sea to the Baffin Bay were sampled during the 2016, 2017 and 2018 ArcticNet expeditions aboard the CCGS Amundsen. Three acid extractions will be performed on sediment samples and analyzed by inductively coupled plasma mass spectrometry to evaluate the distribution and potential bioavailability of major and trace elements. While, PAHs will be extracted using a solvent accelerated extraction system and quantified by gas chromatography mass spectrometry. Overall, the data obtained, combined with normalized enrichment factors and multivariate statistical (notably principal component and fuzzy c-means clustering analyses) will allow to provide a baseline of major and trace metals and PAHs, determine their associations and specific sites within the CAA with possible anthropogenic influences.

DEVELOPMENT OF A POLYNYA CLIMATOLOGY IN THE CANADIAN ARCTIC ARCHIPELAGO USING RADARSAT IMAGERY FROM 1997 TO 2018.

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Arctic temperatures increase up to 1.9 times faster than the rest of the globe. This is mainly due to a series of positive feedbacks contributing to the Arctic Amplification. This amplification leads to negative trends in spatial distribution of glaciers, snow and sea ice. Of particular relevance, the reduction of sea ice extent, which in turn increases the length of the open water period, drives the sea ice albedo feedback. Consequently, sea ice has decreased at a rate of 13.5% per decade since the latter half of the 20th century. Moreover, during wintertime some areas stay clear of sea ice while conditions are cold enough to sustain sea ice formation. These areas are known as polynyas and are caused by dynamic and thermodynamic processes naturally occurring in Polar Regions. As of yet, there has not been any long-term study focusing on polynya spatio-temporal trends despite the fact that an increase in polynya occurrence and size could lead to early ice break up, thus contributing to the Arctic Amplification. Numerous studies used remote sensing approaches to characterize polynyas over a wide range of wavelengths, from infrared to microwaves. Methods in the lower end to the wavelength spectrum (visible, infrared, thermal), have the disadvantage of being highly dependant of meteorological conditions and daylight while longer wavelengths (passive micro-waves) have coarse spatial resolutions rendering quite difficult the detection of small polynyas. Thus, active microwave sensors (i.e. radar) represent a promising avenue given their high spatial resolution coupled with a low sensitivity to meteorological and daylight conditions. Hence, the main goal of this project is to develop a polynya climatology over the Canadian Arctic Archipelago (CAA) from 1998 to 2018 using RADARSAT satellite data. First, an analysis of open water spatial and temporal trends for different sub-regions of the CAA has been conducted using sea ice charts produced by the Canadian Ice Service (CIS). Open water anomalies for the first 4-months of the year were calculated for each sub region between 1980 and 2015. Preliminary results highlighted significant anomalies located between Baffin Island and Greenland. These anomalies suggest a decrease in open water regions prior to 1995 and an increase in the following years going to 2015. Lastly, a detection algorithm developed by Nemer et al. (2016) using fuzzy logic and discrete wavelet transform will be used to segment and classify the radar images and develop the polynya database. After testing the algorithm, the main issue using this method seems to be the inability to properly classify agitated water as open water given the sensitivity of the backscatter signal to increased roughness.

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

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As climate change reduces the extent and shortens the duration of ice coverage in the Arctic, new regions will open to potential opportunities for oil exploration and marine shipping. With such increased industrial activity, the probability of accidental oil or fuel spills will also increase. Microorganisms are nature's first responders in a hydrocarbon spill scenario or other pollution event. Understanding the microbial hydrocarbon degradation potential in Arctic marine environments is therefore critical to preparedness for an oil spill in Canada's cold northern seas. Related to this, characterizing the Arctic marine microbiome in the Canadian Arctic is an important objective towards establishing baseline data in the face of rapid climate change. 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 in August, 2018. Visual observation of an active gas seep near Scott Inlet was made using the Amundsen's Super Mohawk II remotely operated vehicle (ROV). Video surveys using the ROV at the hydrocarbon seep site revealed microbial mats morphologically resembling sulfide-oxidizing Beggiatoa, with many shrimp (Eualus belcheri) observed to be associated with the mats. Two additional ROV dives 1 and 5 km away from the seep in the northeast direction along the fault line revealed a patchy distribution of numerous bacterial mats, none of which were associated with active emigration of gas bubbles. Collectively, these microbial mats present visual evidence of a microbial ecosystem where hydrocarbon biodegradation is coupled to sulfate reduction, producing sulfide that is subsequently oxidized aerobically in overlying surficial sediment or bottom water. Aerobic methane oxidation in the water column is likely also occurring. A sampling program was undertaken to examine the distribution of psychrophilic hydrocarbon-degrading bacteria and other microbial communities in the vicinity of this cold natural hydrocarbon seep ecosystem where bottom waters ranged from –1 to +1°C. Water sampling followed a three-dimensional transect that included several depths within the water column down to bottom water (<10 m above the seabed) overlying the active seep, and four additional bottom water transects 1 and 5 km away from the seep. Surface sediment was collected using silicone spatulas from some locations. Within this sampling radius, oil slicks at the sea surface were observed during a subsequent expedition to Scott Inlet in September 2018 aboard the RV Nuliajuk, and surface water was sampled using a zodiac. Overall samples were preserved for hydrocarbon measurements, microbial community diversity surveys, microbial cell counts, and other analyses. Results will assess the relevance of the Scott Inlet site for developing a stronger understanding of indigenous marine microbial communities in the High Arctic and their potential for (i) oxidation of methane prior to its atmospheric release, and (ii) hydrocarbon biodegradation that may need to be relied on following an accidental oil spill.

SYSTEMATIC REVIEW OF FACTORS RELATED TO FOOD (IN)SECURITY STATUS IN NUNAVIK, QUEBEC

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Food insecurity is an urgent public health issue as it has been 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 Nunavik, Northern Quebec. Many large-scale and longstanding interventions have been implemented in Nunavik to address food insecurity, such as the Nutrition North Subsidy program and the Hunter Support Program. Despite these, and many other interventions, the most recent reports of food insecurity estimate that more than 50% of Inuit in Nunavik 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. In retrospect, it often becomes clear that more effective impact could have been achieved if the intervention had been 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 in Nunavik, we conducted a systematic literature review, following PRISMA guidelines, to identify all known direct and indirect factors that affect food (in)security status among Inuit in Nunavik. The following databases were searched for primary and grey literature: Web of Science, Medline, Academic Search Elite, Bibliography of Native North Americans, International Bibliography of the Social Sciences, PubMed, CINAHL, Érudit and PsycINFO. The keywords used included the terms Nunavik, food (in)security and several of their respective synonyms. To further retrieve relevant primary and grey literature unobtained by the database searches, we hand-searched the reference lists of included studies. Using a two-step screening process, all primary and grey literature, written in English or French, that quantitatively or qualitatively analyzed a direct or indirect relationship between one or more factors and food (in)security status among Inuit in Nunavik were included in the review. Data were systematically extracted from each study using a custom data extraction form. Content analysis was used to categorize sections of the full-text in sources and all identified direct and indirect factors related to food (in)security in Nunavik. This systematic literature review is the basis of a Master's research project proposal to statistically explore how 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 proposed project are expected to support the consideration and development of new interventions to address food insecurity in the region.

HOTSPOTS IN THE ARCTIC: CAN THEY GET ANY HOTTER?

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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, i.e., estimates of the incorporation of organic matter, provides a synthesis of local mortality, growth rates, individual body mass, recruitment, population density and community biomass. Functional traits represent life history characteristics of species, and the effects and responses of organisms on their environment. Therefore, secondary production and functional traits 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 t he distribution of species, will definitely modify secondary production and functional diversity in the Arctic. The objective of this study is to identify present and possible future hotspots of diversity using benthic secondary production and functional traits analyses in the Arctic by i) identifying sources of variability in secondary production and functional traits (i.e. annual variability and variations attributed to environmental drivers); and ii) creating predictive maps of spatial distribution of hotspots based on benthic secondary production and functional traits under present conditions and future scenarios of global change. Benthic secondary production estimates and functional diversity estimates derived from studies of community composition, abundances and distributions, will be used as a tool to assess the health, productivity and ecosystem functioning of Arctic benthic communities.

IMPORTANCE OF ROCK FLOUR TO CARBON CYCLING IN GLACIAL RIVER SYSTEMS OF THE LAKE HAZEN WATERSHED

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Northern freshwater and marine ecosystems have garnered keen interest from the scientific community based on their susceptibility to climate induced change. Canada's high Arctic contains heavily glaciated terrain that has succumbed to widespread glacier ice cover and mass losses over the past several decades. Consequently, seasonal pulses of glacier melt water to downgradient aquatic systems have also increased, thereby implicating hydrologic mass budgets and biogeochemical cycling. Dissolved inorganic and organic carbon (DIC and DOC) are key components of the global carbon cycle and require greater understanding in glacially-impacted freshwater systems. Lake Hazen is Canada's most northern large lake (75 x 12 km; max depth ~ 265 m) and is fed by seven (7) rivers dominated by glacial runoff, making it an ideal sentinel for change in the Canadian high Arctic. In this study, we discuss findings from an interannual dataset (2016 to 2018) comprised of intensive sampling sites for glacial river transects spanning headwaters just below glacier termini, mid-river, and river deltas discharging to Lake Hazen. Whereas findings thus far highlight biogeochemistries as changing aggressively along glacial river continua, the processes responsible for dictating these changes require greater resolution. Theoretical stable carbon isotopes of DIC (δ13C-DIC) were calculated using [DIC], pH, temperature, and pCO2 for a model system assuming equilibrium conditions and no additional sources of DIC for comparison with actual laboratory measured values. To explain departure of measured δ13C-DIC from theoretical values and to assess the importance of rock flour in these systems particulate phase δ13C-PC, PIC, and POC were interpreted in tandem with radiocarbon signatures (Δ14C). DOC composition was assessed using absorbance (aλ, Sλ-λ, SR), fluorescence excitation emission matrix spectra (EEMS), size exclusion chromatography (SEC), and stable carbon isotopes (δ13C-DOC). This research aims to deconvolute interplaying processes intrinsic to carbon cycling in glacial river systems, posit how this may be impacted by future changes in regimes of glacier melt water fluxes, and to approach a better understanding of what the implications could be for receiving aquatic systems in the Canadian high Arctic.

GENOMIC TOOLS TO DEFINE MANAGEMENT UNITS AND UNDERSTAND LOCAL ADAPTATION IN ARCTIC CHAR (SALVELINUS ALPINUS) ACROSS NUNAVIK

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The Arctic Char (Salvelinus alpinus) is an anadromous salmonid of great importance for traditional fisheries in the Inuit communities of Northern Canada. In this project, this fish's genetic structure will be studied in its area of distribution in Nunavik, Quebec. The size of the study area and limited dispersion capacity of the species lead us to emit the hypothesis that Arctic Char populations are distinct on a regional scale. It is therefore possible to predict that a statistical comparison of populations would provide significant FST values. In migratory salmonids, populations from multiple rivers tend to share off-shore habitats, making it difficult to attribute specific marine conditions to a population. Arctic. In contrast, the marine habitats occupied by Arctic char during the summer are near the mouth of the river where they spawn and overwinter. This peculiar pattern of migration makes it a perfect subject to study the impact of marine and estuarine environments on local adaptation, which contributes to the originality of this study. Samples will be gathered from a dozen rivers in Nunavik during fieldwork and via the collaboration with local and regional administration. Genetic markers will be genotyped on a subset of samples in order to design a genomic tool allowing genotyping of the rest of the samples with better efficiency and lower costs. Genetic structure of populations will be assessed using discriminant analysis of principal components (DAPC) and bayesian inferences in ADMIXTURE. Correlations between allelic frequencies and environment will analysed with redundancy analysis (RDA). Preliminary results show differentiation between Arctic charr populations in Nunavik and those in outgroup regions (Cambridge Bay, Baffin, Labrador and Southern Quebec). Data from four rivers across western Ungava bay show signs of differentiation at a smaller geographical scale. The results of this study will serve as a base of knowledge for a more integrative management of Nunavik's halieutic resources, while also improving the understanding of the impacts of oceanographic conditions on local adaptation in salmonid fish.

MONITORING ICEBERG DRIFT PATTERNS IN CANADIAN WATERS

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Tidewater glaciers drain a significant proportion of the Greenland Ice Sheet and the ice caps of the Canadian Arctic, and provide the primary source of icebergs and ice islands in Canadian waters. The Canadian Ice Service produces charts which identify the presence of icebergs, but currently has little knowledge about the sources and sinks of icebergs in Canadian waters. Using the CCGS Amundsen from 2016-2018, a total of 39 iceberg tracking beacons were deployed to monitor the movement of icebergs from northern Baffin Bay through Canadian waters. Helicopter-deployed satellite tracking beacons were used to monitor the near real-time (hourly) movement of these icebergs. Initial results show that the most active iceberg travelled >3300km over a span of ~9 months from Talbot Inlet on SE Ellesmere Island in August 2017 to near Makkovik on the east coast of Labrador in 2018. Results from this work illustrate patterns of iceberg movement, including common areas where icebergs become grounded in relation to bathymetry and the interactions between iceberg drift patterns and primary shipping routes along the east coast of Canada.

GEOGRAPHIC AND VERTICAL DISTRIBUTION OF THE CALCIFYING PTEROPOD LIMACINA HELICINA IN THE CANADIAN ARCTIC WATERS UNDER THE THREAT OF ACIDIFICATION

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With the increased melting of sea ice and freshwater input, waters of the western Arctic at the periphery of the Arctic Ocean are acidifying, resulting in aragonite undersaturation. Aragonite undersaturation areas are expanding northward following decline in sea-ice coverage and this ocean acidification is bound to spread in the Canadian Arctic under the effects of climate change, with potential harmful effects on marine organisms and the marine ecosystems. For instance, organisms building calcium carbonate shells in the form of aragonite are at risk of experiencing shell dissolution faced with such acidified waters. The polar zooplankton pteropod Limacina helicina is among the calcifiers that are expected to be impacted by declining aragonite saturation state. Limacina helicina is quite common among the Arctic zooplankton assemblages. This holoplanktonic mollusc is the unique prey of another mollusc, the shell-less Clione limacina, and an important dietary component of vertebrate predators such as fish and birds. The objective of this work is to (1) characterise the biogeography of Limacina helicina at the scale of the American Arctic, from the Chukchi Sea to Hudson Bay, based on a water-column integrated zooplankton abundance dataset collected over the ArcticNet annual expeditions from 2005 to 2018; and (2) describe the vertical distribution and seasonal dynamics of this species based on plankton collection in a sediment trap in the Queen Maud Gulf and on water-column stratified plankton net sampling during 2 overwintering expeditions in the southeastern Beaufort Sea. Limacina helicina was more abundant in the Canadian Arctic Archipelago (CAA) and the North Water polynya in northern Baffin Bay than in the deep waters (>1000m) around the Canada Basin and the shallow waters of the Hudson Bay complex. The sediment trap collected Numerous small L. helicina in January 2016, indicating that this species reproduces in the Queen Maud Gulf area in the central CAA. We interpret the observed spatial patterns based on information on bathymetry and temporal variability in hydrography, sea ice cover, and biomass of pelagic algae.

LINKAGES BETWEEN SEA ICE, SNOW COVER, AND TEMPERATURE IN THE CANADIAN ARCTIC FROM 2000 – 2017

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Arctic temperatures have been increasing at an accelerated rate since the early 2000s, resulting in reductions in sea ice extent and snow cover duration, as well as earlier melt onset. Detailed investigations are limited in the Arctic as most studies focus on assessing components of the cryosphere at the pan-Arctic or continental scale. Additionally, the use of coarse-resolution satellites (i.e. passive microwave) further limit the spatial scale of analysis, particularly in Arctic regions characterized by multiple islands and narrow channels (i.e. Canadian Arctic Archipelago). This study investigated sea ice, snow cover, and temperature conditions from 2000 – 2017 in the Canadian Arctic. As there is now a 14-year record available using the 4 km Interactive Multisensor Snow and Ice Mapping System (IMS), a more detailed look at changes to the recent snow and ice conditions is possible (2004 – 2017). IMS and 8-day Moderate Resolution Imaging Spectroradiometer (MODIS) snow and ice products (500 km) were used to examine changes in sea ice and snow cover in conjunction with ERA-Interim gridded climate data (80 km) and weather station observations. Significant annual warming was identified from 2000 – 2017 in the Beaufort Sea (2.5˚C, $p < 0.05$), western Parry Channel (1.8˚C, $p < 0.05$), Baffin Bay (2.5˚C, $p < 0.05$), and north of the Queen Elizabeth Islands (3.0˚C, $p < 0.05$). During the melt/freeze seasons, significant regional differences in sea ice break-up and freeze-up were identified from 2004 – 2017. Results show that sea ice break-up is shifting earlier in the eastern and western regions of the Canadian Arctic (Baffin Bay and Beaufort Sea), while sea ice in the south-eastern Arctic (Davis Strait and Hudson Strait) shows trends towards later ice break-up. Delayed freeze onset and complete freeze-over was also identified in Baffin Bay and Beaufort Sea, while trends towards earlier freeze were observed in the Foxe Basin and Hudson Strait. Understanding the interactions of sea ice and snow cover in the context of a warming climate is essential for identifying patterns of variability and change and can be used to understand changes to the global climate system, effects on terrestrial and marine ecosystems, and to reduce the vulnerability of northern residents to risks associated with climate change.

THE IMPORTANCE OF THE PERENNIAL ICY-SNOW PATCHES IN THE HYDRO-MORPHOLOGICAL DYNAMIC OF SLOPES IN A HIGH ARCTIC POLAR DESERT (WARD HUNT ISLAND, ELLESMERE, NUNAVUT)

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Common in alpine and polar environments, perennial icy-snow patches consist of superimposed ice accumulations overlaid by firn which could persist for several centuries and millennia. This cryospheric component is generated by local snow drift over-accumulations which gradually metamorphose into firn and then perennial ice. In non-glaciated polar desert settings, such as in the High Arctic regions and in the Antarctic dry valleys, melt water delivered by perennial icy-snow patches through the summer represent the major source of water input into the hydro-morphological system of catchments and generally favour the development of local wetlands with freshwater ecosystems. Due to their general upslope position, the icy-snow patches are the driver of several hydro-morphological processes along the polar toposequences. They affect water storage and flowing, geomorphic processes, soil moisture, weathering, biological activity, active layer thickness and permafrost cryofacies. As whole cryospheric components, icy-snow patches are highly sensitive to climate fluctuations, making them a good indicator of climate change. The shrinkage of the icy-snow patches in polar deserts as response to the recent climate warming is expected to trigger major disequilibrium in the whole hydrological, geomorphological and biological geosystems of polar regions. Ward Hunt Island is home to the northernmost CEN research station. The site is of great interest due to its extreme high latitude, its polar arid climate, the presence of the northernmost lake in Canada, a pronounced relief and a great diversity of periglacial landforms and processes. The island is non-glaciated but multiple perennial icy-snow patches lay in topographic depressions, breaks-of-slope and leeward sides of hills, which provide an ideal setting for my researches. The project provide the first detailed

knowledge about the role of the icy-snow patches on the evolution of slopes in a polar desert environment and to evaluate the magnitude of the potential environmental changes induced by the actual and future shrinkage of ice patches. The overall objective is to bring baseline data on the icy-snow patches characteristic and dynamic, and to qualify and quantify the significance of hydro-morphological processes driven by icy-snow patches in the evolution of the topo-sequences and of the lake in Ward Hund Island. First observations support the hypothesis that the meltwater delivered by the icy-snow patches during the short thaw season lead to an hydrological and sedimentary connectivity between the upper portion of the toposequences and lower slopes. This dynamic interaction between icy-snow patches, slopes, permafrost and the lake is major in the control of the landscape evolution in Ward Hunt Island. On the slopes, meltwater flows are expected to be main driver of soil denudation, sediment transfer/ deposition and downslope soil creep. That create specific landforms and environments along the toposequences such as water tracks, blockstreams, wetland, solifluction sheet flows and gelifluction lobes. On the lower portion of the slopes, the input of sediments, water and nutrient brought by the meltwater may have a great importance on active layer development, permafrost structure, biochemistry and sediment budget of the lake.

DIET COMPOSITION OF RINGED SEALS (PUSA HISPIDA) IN HUDSON BAY REVEALED USING STABLE ISOTOPES

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Understanding the dietary changes of a single species provides essential insights into trophic interactions within an ecosystem. Ringed seals (Pusa hispida) are opportunistic and generalist feeders consuming various fish and invertebrate species; making them an important link in the Arctic food web, as well as an important component of Inuit subsistence and culture. Previous diet studies have documented differences in ringed seal diets. However, few studies have been able to quantify temporal changes in diet. Stable isotopes (δ13C and δ15N) are useful tools for quantifying diets of predators and measuring population-level diet composition. The objective of this study was to examine the spatial and temporal diet variation of Hudson Bay ringed seals using Bayesian mixing models. Inuit hunters sampled tissues from seals harvested during the open-water period from 2003-2017 in three Nunavut communities: Arviat, Naujaat and Sanikiluaq. We used liver and muscle isotopic composition of approximately 1200 tissues collected from seals of both sexes and age-classes (juveniles and adult) to determine diet composition. Our preliminary results confirm temporal and spatial differences in ringed seal diet. For instance, average Arviat ringed seal isotopic signatures in 2003 of δ15N were 14.8 ‰, which increased to 16.4 ‰ in 2017. Diet composition determined using mixing models revealed that this was likely reflected by a decrease in common invertebrate prey (mysids, euphausiids, and amphipods) and increase in capelin (Mallotus villosus), and sandlance (Ammodytidae Spp.). The same increase in δ15N signature was observed in Sanikiluaq over the same time period, initially 14.9 ‰, which increased to 15.8 ‰ in 2017. Spatial differences were also observed, in 2017 average δ15N signatures were 17.5‰ in Naujaat, the northern most community in the study area. Ringed seals in Naujaat are likely consuming fewer invertebrates and more fish species compared to the seals in southern Hudson Bay, a consequence of shifting prey distributions. Both Sanikiluaq and Naujaat had similar δ13C signatures around -18.5‰ and were less depleted compared to Arviat, -21.3‰. These differences suggest that seals in Arviat are foraging in more coastal and benthic areas. Diet models will quantify prey proportions in the seal diets and will be used to explain the isotopic signature differences observed. Understanding factors affecting ringed seal populations will be essential for the development of co-management strategies, and to provide accurate predictions of the status of the Arctic ecosystem throughout this period of environmental change. This project will expand on previous work conducted in the Hudson Bay marine ecosystem to better understand current ringed seal foraging ecology and implications for seal health.

FOOD SECURITY FROM A LOCAL PERSPECTIVE: ELDERS AND YOUTH IN GJOA HAVEN, NUNAVUT

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We examine the meaning and challenges of food security in the local context of the Hamlet of Gjoa Haven, Nunavut. We conducted three different focus groups with a range of residents and food consumers. The first focus group (in May 2017) included 10 elders (seven women and three men), the second group (August 2017) included nine youth at the Gjoa haven High School, and the final group (August 2018) took place at an Elder-Youth Workshop on the land, and included four elders and a middle-aged interpreter and participant . We asked participants about their food preferences, access to favourite food items, concerns about contaminants in country food, and the availability and distribution of food in general in the community. We also consulted participants about opinions concerning the development of a commercial fishery in their Hamlet and potential measures and policies to improve food security. Insights from our focus groups indicate that food security perceptions differ by age. Elders still desire and report a strong reliance on country food supplemented with some store-bought food that is currently not subsidized by Nutrition North (e.g. baking goods). They experience a disruption in country food supply from January to March when it is too cold and costly for many others to hunt and fish. In contrast, youth desire a combination of country food staples (Arctic char, caribou and muskox meat) with store bought food staples typical of a southern diet. The sharing economy is reported to go through cycles. It peaks in the spring when many active hunters first go out and actively share, but is less pronounced in summer and winter months. In summer, many harvest for themselves as everyone has access to the land, while not enough food is harvested in the winter. Some country food is now being sold door to door, over the radio, to the local Hunter Trapper Association, or on Facebook. Approximately 25 % of people reported difficulty to go out to hunt or to manage to receive country food from others. Generally, participants reported concerns about contaminants if they are visible. We noticed a number of coordination problems in the matching of youth and elders and educational and training deficits that prevent both elders and youth from going fishing and hunting as often as they desire. Recommendations by focus group participants include a country food store and country food bank, a commercial fishery plant, a revision of Nutrition North subsidies that is based off of community consultations, as well as more training and capacity for maintenance and repair of hunting equipment.

BIOGEOCHEMICAL MODELING OF COUPLED PELAGIC AND SYMPAGIC ECOSYSTEMS IN A RAPIDLY CHANGING HUDSON BAY

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The Arctic is warming at a rate three times higher than elsewhere on the planet. Major consequences include (among others) changing freshwater distribution and budget and recent and profound changes in sea ice – properties and dynamics, the combination of which will lead to unpredictable perturbations of Arctic marine ecosystems. Hudson Bay (HB) is one of the southernmost Arctic ancillary seas, and changes to sea ice, weather (e.g. warming, storms' paths) and local hydrology (e.g. watershed dynamics, human regulation of freshwater runoff) will affect its oceanography and ecosystem dynamics. The base of Arctic marine ecosystems is supported by unicellular algae that fix inorganic carbon to provide organic matter and energy throughout the trophic networks. Primary production depends on light coming from the surface and nutrient availability at depth. These requirements restrict microalgal production to the few months of daylight, within the bottom of sea ice, where ice algae support the sympagic ecosystem, and the upper water column, where phytoplankton supports the pelagic ecosystem. The study of nutrient cycling within the water column and the ice cover (while it lasts) is essential to better understand the biogeochemistry and ecology of HB; among the nutrients, nitrogen (N) is required by all primary producers and it is one of the most limiting. Our objective is to better understand how the high seasonal and interannual variability of the extreme environmental conditions in HB influences the phenology and amplitude of primary production dynamics, as well as its nutrients and carbon cycling. Biogeochemical modelling is a powerful tool that can tackle such complex research questions. We present a description of the Sibert et al. 2010 biogeochemical model of the HB including both pelagic and sympagic components, coupled to a regional implementation of the NEMO v3.6 circulation model and the LIM2 sea ice model. The model horizontal resolution is 1/4th degree and it is run from 2002 till 2016, a short time span that nonetheless showed a range in environmental regimes and ecosystem responses that form the basis of preliminary results relayed in this presentation.

DYNAMIC ENERGY BUDGET MODELING OF MUSKOX: A NEW MECHANISTIC TOOL FOR THE STUDY OF WILDLIFE POPULATION HEALTH

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The muskox (Ovibos moschatus) is a species of high importance in the Arctic. Muskoxen are the largest herbivores in the circumpolar Arctic, and as such play important roles in tundra ecosystem structure and function. In addition to their ecological significance, the muskox is an important cultural and dietary item for many indigenous communities. As year round residents in the Arctic, muskoxen face some of the harshest conditions on Earth, characterized by extreme temperature, light, and precipitation fluctuations over the year, resulting in marked seasonal variation in food availability for this herbivore. Furthermore, rapid climate change is putting northern ecosystems under severe pressure. Sustained conservation of muskoxen and better predictions of climate change impacts requires a deeper understanding of the physiology and ecology of the species, particularly the metabolic processes governing important functional life history traits and population performance, such as growth and reproduction. Dynamic Energy Budget (DEB) theory provides a useful generalized, individual-based, energetic framework that follows the acquisition and use of energy throughout the full lifetime of the animal. DEB models describe the physiological processes of feeding, growth, maintenance, maturation, and reproduction based on first principles. The aim of this study was therefore to develop an individual based DEB model for muskoxen that describes the full life-history of this important mammalian species. Our model accurately captured life-history traits, such as age and weights at birth, weaning, and puberty, as well as reproductive performance of a reference muskox population in Fairbanks, Alaska. The model also accurately predicted lifetime growth curves and seasonal changes in body weight, condition, and food intake associated with reproductive costs and foraging dynamics. Finally, we apply the model to a wild muskox population in Victoria Island, Northern Canada, to further validate the model. Given the importance of energy dynamics in muskox for breeding and survival, our DEB model is an invaluable tool to study environment-behaviour interactions and their influence of population dynamics of muskoxen.

A BIODIVERSITY MANAGEMENT PLAN FOR CANADIAN FORCES STATION ALERT (NUNAVUT, CANADA)

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Although the Arctic tundra is still largely undisturbed by direct human activities, thus offering unique opportunities to preserve its ecological integrity, the intensification of human impacts is clear and will generate the need to develop Biodiversity Management Plans (BMPs) wherever valued ecosystem components, such as Species at Risk, need to be preserved. Such plans have been proposed in many locations around the planet, but few exist in the tundra and methodologies still need to be developed. A BMP aims to define the actions needed to conserve or increase local biodiversity, and it should be site-specific. The implementation of a BMP relies on (1) the synthesis of existing background data; (2) the acquisition of new field data; (3) the establishment of biodiversity targets such as habitats or species protected under the Species at Risk Act; (4) the specification of actions to protect the biodiversity targets; and (5) the establishment of a monitoring program to evaluate the effectiveness of the BMP. Here we present the first steps for the production of a BMP at Canadian Forces Station Alert in Nunavut (Ellesmere Island, 82°N), the northernmost permanently inhabited place on Earth. Given the paucity of existing biodiversity information from Alert, we have started in 2018 an inventory of local wildlife using camera traps, observation transects, and reports by Station residents. We have also started to map wildlife habitats through analysis of satellite images and field survey of plant communities. In addition, we have initiated the mapping of trails used by off-road vehicles since this is a potential source of local habitat and wildlife disturbance. The poster presents our methodological approach together with preliminary results, including data on wildlife habitats and wildlife Species At Risk at Alert, namely Peary caribou, Red knot, and Ivory gull.

INVESTIGATION INTO THE GEOMETRY AND DISTRIBUTION OF OIL INCLUSIONS IN SEA ICE USING NON-DESTRUCTIVE X-RAY MICROTOMOGRAPHY

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Sea ice is a heterogeneous porous media consisting of an ice matrix in which is embedded liquid brine inclusions and air bubbles. The presence of a brine network and air inclusions strongly influence the electromagnetic properties of the ice, thus impacting detection capability, and are often sites of biological activity. Furthermore, the abundance, distribution, and structure of brine and air inclusions are strongly dependent on the temperature and salinity of the sea ice. As sea ice has the potential for oil entrainment, the inclusion of oil inside the ice matrix will influence the temperature and salinity of the ice and therefore the morphology of the brine and air inclusions. In order to properly establish detection technologies and mitigation potential, a better understanding of the movements and interactions of oil in a sea ice environment on a microscopic scale is required. To this end, we present a methodology employing computed microtomography X-ray imaging for analyzing the microstructure of oil-contaminated sea ice. Micro-Computed Tomography (μ-CT) is a non-destructive radiographic technique which examines materials by creating a three-dimensional image of density contrast. Denser materials and higher atomic numbers result in greater X-ray attenuation. The resultant image is represented in grayscale whereby darker tones indicate a material of lower density (e.g. air) and lighter tones indicate higher density materials or phases (e.g., brine). Since μ-CT is capable of offering a high-resolution three-dimensional characterization of the internal features of porous media, it has been advantageous for examining the brine and air components of sea ice microstructure. Little X-ray work, however, has been conducted on oil-contaminated sea ice. Oil and ice have similar densities producing little contrast in the resultant μ-CT-image. Furthermore, small volume fractions of oil relative to the ice can also hinder the distinction between the two phases. Herein we introduce a novel method for the enhanced imaging of oil in sea ice in which we evaluate its qualitative and quantitative capabilities for assessing the oil inclusions and its implications for both remote sensing and bioremediation of oil-contaminated sea ice.

SAFE PASSAGE: A POLAR KNOWLEDGE CANADA PROJECT ON SEA ICE TO IMPROVE ARCTIC MARINE TRANSPORTATION

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“Safe Passage: Sea-Ice Research for Arctic Resource Development and Northern Communities” was a three year (2015-2018) project funded by Polar Knowledge Canada to study and quantify sea-ice conditions in Canada’s Arctic environments as it relates to marine transportation for both industry and communities. The project supported research at 6 Canadian institutions, lead by eight principal investigators. The research objectives included assessments, observations, model forecasts and studies across numerous regions in the Arctic, including Cambridge Bay and Dease Strait, Deception Bay and Hudson Strait, Baffin Bay, and the broader Canadian Arctic Archipelago. Several project elements included direct measurements of the marine and sea-ice conditions, including meteorology, ice cover, sea-ice thickness, and inter-annual variations, others included studies of satellite imagery of ice islands, and still others involved modelling the marine environment and simulating oceanographic and sea-ice dynamics. In all cases, the focus was on improving our knowledge and understanding of marine sea-ice, glacial ice hazards and how varying ice conditions affect transportation in Arctic marine corridors. The presentation will summarize the project objectives and findings.

CREATING A SUSTAINABLE FISHERY IN NUNAVUT: CONSERVATION GENOMICS OF LAKE WHITEFISH

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Fish play a significant role in northern peoples' diets and are key components of Arctic food webs. Accelerating melting of sea ice in Nunavut is opening the lower Northwest Passage (LNWP) to shipping, providing the opportunity to establish a commercial fishery in the area. Inuit-driven, commercial fishing of common species could alleviate economic and food insecurity of Nunavut communities. Development of a sustainable fishery requires multiple inputs for sound management, including diagnosing discrete stocks. Moreover, an important metric for the health and sustainability of a fishery is the genetic diversity of harvested species. Diminished genetic diversity decreases the ability of populations to respond to environmental stressors, thus limiting their chances of persistence when faced with anthropogenic impacts including climatic change. The lake whitefish (Coregonus clupeaformis) is a potential focal species for commercial fishing in the LNWP with many already-established fisheries in other parts of Canada. As lake whitefish in the LNWP are under-exploited, there is an unprecedented opportunity to manage harvest in a scientifically-informed manner. Here we use Next-Generation Sequencing to obtain genome-wide panels of Single Nucleotide Polymorphism markers (SNPs). We will quantify patterns of genomic diversity, and determine the number and distribution of genetically-distinct populations in the area. Understanding how the genomic diversity of lake whitefish varies spatially in the LNWP will help managers establish harvest limits that will ensure the persistence of this renewable resource for the people of Nunavut.

DEVON SUBGLACIAL LAKES PART 2: FUTURE EXPLORATION OF THE DEVON HYPERSALINE SUBGLACIAL LAKES

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A recent study revealed geophysical and geological evidence for the first isolated hypersaline subglacial lake complex discovered on Earth, and the first subglacial lake system discovered in the Canadian Arctic. The cold, hypersaline, permanently dark and isolated nature of these lakes make it a rich scientific opportunity to further our understanding of the foundations of biological life, the potential for life in icy environments beyond Earth, and the nature and extent of biogeochemical cycling beneath glaciers. The discovery of these subglacial lakes has garnered widespread international interest. We are building a Canadian-led research program aimed at exploring the physical, chemical, and biological characteristics of this unique environment and potential microbial habitat. Here, we present our initial ideas and plans to maximize scientific exploration of the lakes while maintaining the integrity of the water body and any organisms that inhabit it, including airborne and ground-based geophysical campaigns and modeling exercises, and eventually clean-access sampling and in situ measurements of the lake water and sediments.

TERRASAR-X AND TIME-LAPSE PHOTOGRAPHY FOR SNOW ON SEA-ICE MONITORING IN DECEPTION BAY, NUNAVIK

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Snow is an important element of safety on the land for Inuit living in the Arctic; land users may be stranded on bare rocks for lack of snow on the ground. Snow is necessary for snowmobile transport on sea ice trails, and is closely tied to the thickness ice may reach on average in a given winter. While an observation of less snow in recent years was reported by salluimiut (J. Tuniq, ArcticChange 2017), climate projections for 2071-2100 feature an increase in precipitation over Nunavik (Ouranos, 2018). In this context, the Safe Passage research project (Polar Knowledge Research Program), which included Ice Monitoring in Salluit, Deception and Kangiqsujuaq, also focused on snow on sea ice. This presentation will report on snow information derived from three years of monitoring in Deception Bay, Nunavik (Hudson Strait). Time-lapse cameras have been taking hourly pictures of the bay since December 2015 as well as measuring air temperature. This database was used to develop a proxy for estimating snow accumulation on the bay. TerraSAR-X high-resolution satellite images have been acquired every 11 days since December 2015 and were analyzed to identify seasonal trends in backscattering from snow over sea ice. Fieldwork was done twice per winter since 2016 and includes snow and ice thickness measurements. Time-lapse camera pictures (N ~ 26 000) were filtered by view (four different views are acquired each hour) and visibility using machine learning (python-Tensorflow). The foreground in the field-of-view is highly exposed, and the wind-swept rocks are regularly almost snow-free. Ground pixels were classified as either snow or no snow using computer vision (python-openCV) and an average of snow cover fraction was computed daily. Daily snow accumulation was modeled as the increase in snow pixels from one day to the next, or as zero in the absence of a snow cover increase. TerraSAR-X images were processed by the German space agency (DLR). Backscattering statistics were computed for land pixels and water-ice pixels seperately. This presentation will show how the snow accumulation proxy compares to snow thickness measurements and discuss the winter and spring trends seen in the X-band backscattering from snow on sea ice. This project is a collaboration with the Kativik Regional Government and is supported by Polar Knowledge Canada and the Raglan Mine.

EVALUATION AND SPATIO-TEMPORAL MODELLING OF THE CANADIAN ARCTIC MEGABENTHOS DIVERSITY BASED ON ENVIRONMENTAL DRIVERS.

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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. These global changes allow the increase of many anthropogenic activities, including the shipping traffic through the Northwest Passage. Benthic invertebrates play important roles in nutrient cycling, sediment oxygenation and decomposition and are very good indicators of changes. The Canadian Archipelago megafauna is poorly studied compared to others Arctic region. Nevertheless some of the collected results propose that diversity is higher in that area that might be an ecotone between the Beaufort Sea and the Baffin Sea. This project aims to evaluate benthic diversity based on significant environmental drivers and then develop spatial predictive explanatory models of benthic communities in the Canadian Arctic. The first hypothesis is that faunal benthic diversity is generally higher in the Canadian Archipelago than it is in the Baffin Sea and the Beaufort Sea. The second one is that primary production, depth and substrate type are the most influential drivers of the megabenthic community's spatial distribution. Results from the Kitikmeot area indicate that chlorophyll a (primary production proxy) and depth are the main explanatory drivers of the infauna composition (explain 20% of the distribution). As for the epifauna, temperature, salinity and organic matter are significant (explain 36% of the distribution). A clustering tree analysis revealed that the epifaunal composition seems to follow a West-East gradient in the Queen-Maud Gulf and its vicinity. This gradient follows the direction of the main currents coming from the North Pacific and flowing through the Canadian Archipelago. Those kinds of results, collected over the last 11 years, along with generalized linear models will be used to create a diversity distribution model across the Canadian Arctic and to identify the areas with greater temporal diversity. A predictive spatio-temporal model based on climatic scenarios will be used and will allow the identification of biodiversity hotspots and potential transitional areas in the near future.

POST-FIRE GROUND VEGETATION COMMUNITIES IN HARVESTED BURNT WOODS OF COASTAL NUNATSIAVUT (LABRADOR)

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Fire is the main large scale natural disturbance driving much of the continental boreal forest; however, little is known as to how northern coastal forests regenerate after fire, due to different weather conditions. Considering the ongoing climate change and the predicted increase in fire frequency, understanding the current vegetation dynamics after fires is crucial in predicting the future of coastal environments, but also of fuel and food resources for the Inuit of Labrador. Nunatsiavut's population relies on various forest resources for subsistence, including firewood, berries and game, some of which are specifically or preferentially harvested in recent burns. This study examined the impact of forest fires on ground vegetation's community structure, including mosses and lichens, at the site of three recent fires near coastal Nunatsiavut communities: Webb's bay (WB) and Tikkoatokak (TK) near Nain, and Beaver River (BR) near Postville. The fires were respectively 14, 17 and 23 years-old and were lightening generated. Community consultations were held prior to the study, and semi-structured interviews were conducted to document Inuit knowledge and land use related to fires. Species cover and environmental variables (soil temperature and moisture, shrub cover and organic layer depth) were assessed along 40m or 80m transects from the burnt to the unburnt forest. Multivariate spatial analysis showed differences in ground vegetation community between burnt and unburnt sites, decreasing with the age of the burn. Species most strongly associated with burns include fireweed (Chamaenerion angustifolium), as well as Cornus canadensis and Equisetum sylvaticum. Fires were also beneficial for some of the berry-producing plants, notably Rubus chamaemorus, Vaccinium boreale, V. uligunosum and to a lesser extent V. vitis-idaea. However, Empetrum nigrum was among the species most strongly associated with unburnt plots. Moss communities where strongly negatively affected with most species associated with unburnt plots (most importantly feathermosses such as Pleurozium shreberi). However, Polytrichum species were strongly associated with burns. The cover of Cladonia lichens, including reindeer lichens (ex-Cladina), increased in burnt plots, although other lichens such as Peltigera were more abundant in the forest. Biodiversity (Species richness and Simpson's Diversity Index) was significantly ($p<0.05$) reduced in the younger burn (WB), but increased in the two other sites, compared to the forest. Among the environmental explanatory variables, shrub cover (primarily Rhododendron groenlandicum) was the most consistently associated with burnt sites, and soil temperature was also higher after the fires in TK and WB. Fire-induced community changes observed here are similar to what was recorded in the maritime forests of south-eastern Labrador, and do not differ greatly from the general patterns in the boreal forest found in other studies. They have strong implications both for the environment and the populations relying on forest resources. Notably, a changing fire cycle should cause shifts in the abundance of important berry species, and variations in lichen cover could influence caribou populations. This study is part of the project Food, fire and ice along with studies focusing on tree regeneration (Lucas Brehaut) and permafrost (Yifeng Want), also presented at this ArcticNet meeting.

INDIVIDUAL VARIATION IN ENERGETIC PHYSIOLOGY AND FORAGING FLEXIBILITY AS PREDICTORS OF COLONY SUCCESS IN AN ARCTIC SEABIRD FACING CLIMATE CHANGE

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Environmental variability is increasing in the Arctic and is predicted to have a multitude of direct and indirect ecosystem effects. Long-lived seabird species such as thick-billed murres (Uria lomvia) are dependent upon ice-associated pelagic and benthic prey (fish and invertebrates). As such, for murre populations to successfully respond to these changes, individual seabirds must be flexible enough in their foraging strategies to respond to these rapid changes in the predictability of ice conditions within and across years. The goal of this study is to examine the link between foraging flexibility at multiple scales - within and between individuals and between breeding colonies - with measures of foraging success (via energetic physiology and stable isotopes) to predict how individual fitness and population demographics might be impacted by climate change.

We will examine foraging flexibility (via GPS tracking) in response to intra and inter-annual variation in sea ice concentrations at two Canadian Arctic colonies - Digges Island (2014-16) and Coats Island (2017-19). We will combine these measures of foraging behaviour with static measures and changes in energetic markers of foraging success (e.g., baseline corticosterone, energetic metabolites, stable isotopes, body condition). We predict that individuals with greater foraging flexibility will have higher energetic payoffs after a foraging bout, which should result in higher fitness and stronger positive subsequent impacts on colony success. Preliminary data from Digges Island suggests that when faced with lower ice concentrations (2014 field season) murres made shorter, more frequent foraging trips and had higher baseline corticosterone levels compared to a year with regular ice conditions (2015). These results suggest while birds do respond to low-ice conditions with a change in foraging strategies, the result is nonetheless an increase in energetic demand which may have negative consequences for individuals and the populations they contribute to. By examining foraging flexibility at multiple locations and across multiple scales - from within the individual to across colonies – our aim is to determine whether this sentinel Arctic seabird has the adaptive capacity to persist in the face of major climatic changes.

AMINO ACID AND SULFUR STABLE ISOTOPES IN THICK-BILLED MURRE PREY: RELATIONSHIPS TO PREY DIET AND CONTAMINANT SIGNATURES

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Contaminant biotransformation and biomagnification are processes that affect contaminant burdens in wildlife. To interpret variation in contaminant levels in seabird eggs, used as bioindicators in the Arctic, it is important to understand how contaminants biomagnify through the food web. We evaluated the use of δ34S, along with other commonly used stable isotope signatures (δ15N and δ13C), for the determination of possible sources of contaminants in an Arctic food web (56 individuals of 15 species of fish and invertebrates). Hg correlated with δ34S ($R2 = 0.72$). When the combined effects of δ34S and δ15N were considered in mixed-effects models, both δ34S and δ15N together described Hg patterns in Arctic food webs better than either isotope alone. Legacy (PCB and DDE) but not emerging (PBDEs and PFCAs) correlated with trophic level (δ15Nphe-glu). Our results demonstrate the usefulness of δ34S and amino acid-specific analysis to account for variation in contaminants among marine animals. We also use these stable isotopes to identify potential diet of fish and seabird species.

BIOGEOGRAPHY OF ARCTIC WHITE HEATHER (CASSIOPE TETRAGONA)

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The last major ice age ended approximately 11 000 years ago. As the ice retreated species' range expansion is believed to have occurred rapidly. During this time, many tundra plant species may have dispersed out of Beringia and recolonized the Arctic. Understanding how organisms responded to climatic changes in the past could help us investigate how organisms will respond to the current rapidly changing climate. Cassiope tetragona is a diploid (2n=26) circumpolar plant commonly known as Arctic White Heather. At sites on Ellesmere Island, there are entire communities of plants that have been frozen under the glaciers for the last 400-2000 years. At Alexandra Fiord and Sverdrup Pass, C. tetragona has been well preserved under the glacial ice and, in 2017, ancient C. tetragona DNA was extracted from samples found there. The genomics of these plants can provide a window into the past and help us better understand how populations change and move across space. C. tetragona samples were also collected across its range: the Canadian Arctic, the Rocky Mountains, British Columbia's Coastal Mountains, Greenland, Svalbard, Northern Europe and Russia. At each site, thirty individual plants were sampled. Researchers at 35 different sites sent samples back to UBC in the fall of 2017. We investigated the genomes of both the ancient and present day C. tetragona populations using genotyping by sequencing (GBS). This technique uses next generation technology to sequence thousands of matching DNA segments for many individuals. Comparing genetic diversity within and between populations, we can begin to investigate the rate of gene flow between today's populations. Using this high-resolution data, we will be able to test the hypothesized recolonization patterns and glacial refugium using population structure analysis. As the climate continues to warm and increase in variability, questions of species responses to this change continue to arise. Estimating the amounts of gene flow between current populations could help us determine the dispersal limitations of some Arctic species. Using this information we may be able to better understand how or if Arctic plant species are limited by dispersal. Understanding what limits species range expansions is essential to help predict where species can survive in the future.

DIRECT VISUALIZATION OF MELATONIN AND SEROTONIN IN LIVING PLANT TISSUES AND THEIR POTENTIAL ROLE IN PLANT ADAPTATION TO CHANGING CLIMATES

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Melatonin and serotonin are important phytochemicals enabling plants to redirect growth in response to environmental stresses. Despite much research on their biosynthetic routes, localization of their biosynthetic enzymes and recent identification of a phytomelatonin receptor, localization of the molecules themselves has to date not been possible. Elucidation of their locations in living tissues can provide an effective tool to facilitate indoleamine research across systems including both plants and animals. In this study, we employed a novel technique, quantum dot nanoparticles, to directly visualize melatonin and serotonin in axenic roots. Melatonin was absorbed through epidermal cells, travelled laterally, and accumulated in endodermal and rapidly dividing pericycle cells. Serotonin was absorbed by cells proximal to the crown with rapid polar movement toward the root tip. Thermal stress (heat or cold) disrupted localization and dispersed melatonin and serotonin across cells. These data demonstrate the natural movement of melatonin and serotonin in roots directing cell growth. Additionally, they suggest that plants have a mechanism to disperse the indoleamines throughout tissues as antioxidants in response to environmental stresses.

IMPROVING RESOURCE MANAGEMENT USING TK AND COMMUNITY-BASED MONITORING

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Despite best intentions and the availability of resources, Indigenous community researchers, analysts, and regulatory boards in the Northwest Territories (NWT) struggle in their efforts to meet policy commitments to incorporate traditional knowledge (TK) into resource monitoring and decision-making. Barriers to meaningfully including TK persist, due in part to differences in needs, worldviews, methodologies, and understanding among knowledge holders, researchers, and regulators. This presentation will explore the results of a two-year GNWT-funded research project into effective TK inclusion in resource management. The project sought to understand when TK is currently used in resource management and decision-making in the NWT, and how decision-makers (e.g., Mackenzie Valley Land and Water board, Wek'eezhii Land and Water Board, Wek'eezhii Renewable Resources Board, Mackenzie Valley Environmental Impact Review Board [MVEIRB], and GNWT Department of Environment and Natural Resources [ENR]) consider, interpret, and incorporate TK currently attempt to consider, interpret, and incorporate it. The project followed a three-pronged approach that included review of scholarly literature on TK integration and/or community-based monitoring (CBM), interviews with regulators and research practitioners, and structured reviews of major environmental assessments (EAs) in the NWT.

INTERANNUAL VARIATION IN THE TIMING OF THE UNDER-ICE SHIFT FROM NET COMMUNITY RESPIRATION TO PHYTOPLANKTON OXYGEN PRODUCTION AS MEASURED FROM 6 YEAR TIME-SERIES FROM A CABLED COASTAL OBSERVATORY IN CAMBRIDGE BAY, NUNAVUT.

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Ocean Networks Canada has operated a fixed-point cabled, shore and sub-tidal (6 m depth) observatory in Cambridge Bay, Nunavut, since September 2012. All data are freely available in real-time at oceannetworkscanada.ca. The observatory measurements include standard weather parameters, downward irradiance, above and below surface cameras, as well as ice thickness, water

temperature, salinity, dissolved oxygen, chlorophyll fluorescence, turbidity and most recently, PAR, pH and pCO2. Here we take advantage of our multiple high-resolution time-series to identify timing of productivity-associated events such as change in the sign of oxygen dynamics (shift from net respiration to production) and phytoplankton biomass production relative to solar irradiance and ice thickness. Our time-series identify a shift from net respiration (dissolved oxygen decrease and pCO2 buildup) to oxygen production (and pCO2 drawdown) that takes place in all years several months (late March to early April) before ice melt. Finally we explore potential regulation of interannual variability of both the shift to net autotrophy and the timing of the spring phytoplankton bloom.

QUANTITATIVE SEA ICE RECONSTRUCTION FOR THE CANADIAN ARCTIC ARCHIPELAGO USING THE PIP25 APPROACH

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Sea ice is an important component of Earth's climate system; it plays major roles in albedo, carbon dioxide exchange, ocean circulation, and is an integral component of polar ecosystems. Sea ice in the Arctic, however, is rapidly declining; a trend which is projected to continue throughout the 21st century as annual mean global surface temperature rises. The possibility of a nearly ice-free Arctic Ocean will have negative consequences for the Earth's climate system, such as creating positive feedbacks that will intensify warming. Reconstructing the past observational records since 1979 of Arctic sea ice and sea surface conditions provides essential context for the recently observed multi-year sea ice decline. The primary objective of this project is to analyze sea ice and open-water algae biomarker content in surface sediments of the Canadian Arctic Archipelago. This will then be used as a basis on which to reconstruct sea ice histories over the historical past from longer marine sediment cores. By recovering both IP25 and phytoplankton biomarker concentrations from marine sediment cores, PIP25 sea ice indices for the Northwest Passage can be calculated. This sea ice index can then be used for reconstructing and mapping specific past sea ice conditions, such as first-year vs multi-year ice cover, for a specific subregion. In order to compare current sea-ice conditions with the historical past, current PIP25 values need to be related to observed modern sea ice conditions, therefore providing a regionally appropriate calibration for the study of past conditions in the geological record.

POLAR BEAR DENNING DISTRIBUTION AND HOT-SPOTS IN THE CANADIAN ARCTIC

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Climate change has led to rapid declines in Arctic sea ice, resulting in habitat loss for ice-adapted species, while allowing for increased development at higher latitudes. Development brings important economic growth to Northern communities, but also increases land use and shipping traffic which can pose a threat to ecologically and culturally important species. Although numerous studies have assessed the climate-related consequences of spring and summer sea ice habitat loss to polar bears (Ursus maritimus), less research has been focused on critical winter habitat such as denning areas. Female polar bears and cubs are particularly susceptible to disturbance during denning; a better understanding of the distribution of denning habitat is a critical first step for effective management. We compiled all existing data on polar bear denning (n = 64 sources) in Canada published between 1967 and 2018. These include traditional ecological knowledge (TEK) studies, government and consultant reports, peer-reviewed scientific articles, and unpublished data acquired through data-sharing agreements with local jurisdictions. We synthesized these data to create a comprehensive map of all denning locations and performed Optimized Hot-Spot Analysis on point-location data. We found most coastal regions in northern Canada supported denning, but large areas exist where denning has not been reported. Optimized Hot-Spot Analysis identified significant denning regions (Manitoba and Ontario Coast, Gulf of Boothia, and eastern Victoria Island). Most denning information from remote areas was accessed through TEK surveys; thus, our study highlights the importance of these data to the identification of critical denning habitat and management of the species. Future studies should directly collect TEK to broaden our understanding of areas critical for polar bear reproduction. Gaps still remain in the knowledge of polar bear denning in Canada: filling these gaps is essential to facilitate long-term conservation and co-management of polar bears.

THE CANADIAN HIGH ARCTIC RESEARCH STATION (CHARS): DESIGNING A MEETING PLACE AS A MEETING GROUND

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The subject proposed aims to support the session's topic in an unconventional way, outside of the standard realm of scientific research. It relates to the CHARS ERA but will focus on the new CHARS facility itself. This new "base-camp" was designed to operate as more than just another arctic research station. The overarching vision was to develop a meeting place that was going to function as a meeting ground. One of the design team architects will present a short walkthrough not only of the CHARS 8,000m2 facility, but also and just as significant, the design process that led to its design. In many ways the design process mirrored the knowledge-sharing that is now sought between researchers and community representatives from across the Kitikmeot region. Knowledge-sharing was in fact an essential part of the process that led to the design and construction of the CHARS campus. The main objective was to create a built environment that would be conducive to knowledge-sharing. Inuit Qaujimajatuqanjit (IQ) principles were applied to both the design process and the facility's design. For the sake of clarity, the main features and highlights of the integrated design process and the facility will be analyzed through the lens of the following five guiding principles. • Commission: Canada's Northern Strategy • Community Relevance: Cultural context of the Kitikmeot Region, Nunavut and the Inuit Nunangat Territory • Technical Feasibility: Bioclimatic conditions in the Kitikmeot Region • Users: Multidisciplinary, National and International scientists operating in a built environment facilitating knowledge-sharing with the community • Sustainable principles integrated in the CHARS

BOWHEAD WHALES USE ADAPTIVE FORAGING STRATEGIES TO MAXIMIZE FEEDING OPPORTUNITIES

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As zooplanktivorous predators, bowhead whales (Balaena mysticetus) must routinely locate prey patches of sufficient energetic densities to meet their metabolic needs. However, little is known about Eastern Canada-West Greenland bowhead whale foraging behaviour and the quality or quantity of their prey in Canadian waters. We used a new approach to study bowhead feeding ecology in Cumberland Sound, Nunavut, that included: 1) multi-scale biologging, 2) an unmanned aerial system (i.e., drone), and 3) vertical prey collection at discrete depths using an optical plankton counter (OPC) and net collections for species identification and enumeration. Tag attachments for 17 whales ranged from 0.8 to 15.6 hours for fine-scale time depth recorders (TDRs), and for several days to weeks for long-term SPLASH tags. Analysis of drone-shot video showed that the whales did not feed at the surface during daytime (0-20 m), while the SPLASH tag data indicated that they made two types of probable foraging dives: long, deep square-shaped dives (80% of dives; 260 m ± 35 SD) and short, shallow square-shaped dives (16%; 22 m ± 5 SD). Vertical profiles of particle size and abundance from 72 OPC casts consistently revealed two layers of prey likely comprised of calanoid copepods (dominated by lipid-rich Arctic species—Calanus glacialis and C. hyperboreus) at depths that corresponded to bowhead whale dive depths from both fine-scale TDR and coarser-scale SPLASH tag data. The deep layer consistently contained fewer, but larger, particles (10% greater biomass) than the shallow layer. Higher and more predictable zooplankton biomass at depth may explain why the whales conducted proportionally more deep feeding dives. Bowheads may offset the increased energy costs of prolonged deep foraging dives by opportunistically exploiting shallow prey layers when they occur in high-abundances. Combining drones with tag-derived dive data and prey sampling showed a more complex feeding ecology then previously understood, and provides a means to evaluate the energetic balance of individuals under current environmental conditions.

CLIMATE SENSITIVITY OF HIGH ARCTIC PERMAFROST TERRAIN DEMONSTRATED BY WIDESPREAD ICE-WEDGE THERMOKARST ACROSS THE CANADIAN ARCTIC ARCHIPELAGO

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Ground-ice conditions dictate permafrost landscape response to climate-driven thaw. Ice-wedge networks underlie polygonal terrain and comprise the most widespread form of massive ground ice in continuous permafrost. Ice-wedge thermokarst, increasingly reported at local-scales, is associated with ground subsidence and ponding, development of high-centred polygons, and thermoerosional channels. Our research shows that recent thawing of hilltop ice-wedge networks is transforming many upland areas across the Canadian Arctic Archipelago. Change detection using high-resolution images coupled with Landsat reflectance trends indicates broad-scale increases in ponding from ice-wedge thaw on hilltops, which has especially affected ice-cored moraine on Banks Island and Victoria Island. The abrupt and widespread increase in ice-wedge ponding results from anomalously warm summers and indicates top-down ice-wedge thaw. Millennia of cooling climate have favoured ice-wedge growth, and an absence of ecosystem disturbance combined with surface denudation by solifluction has produced hilltops and sloping terrain underlain by extensive ice-wedge networks truncated at the permafrost table. The veneer of thermally-conductive mineral soils and absence of surface organic cover amplify upland active-layer response to summer warming. For these reasons, the intensity of ice-wedge thermokarst on Arctic uplands contrasts more muted responses to warming in low and subarctic environments. The magnitude and extent of the changes we observe has significant implications for ground thermal regimes, patterns of soil moisture, ecological change, and hydrological and geochemical fluxes. Increasing field evidence of thermokarst in Arctic permafrost highlights the need for integrated approaches to monitor change and investigate the cascade of environmental consequences.

EVALUATION OF NEW REMOTE SENSING PLATFORMS FOR THERMOKARST PONDS MONITORIZATION (CANADIAN SUBARCTIC)

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On the Eastern side of the Hudson Bay, in the Canadian Subarctic, fast changes are affecting the thermal regimes of permafrost and the active layer, with implications on the terrestrial ecosystems, due to a set of complex feedback mechanisms, mostly associated to the Arctic Amplification effect. Changes in snow and see-ice patterns, along with increasing temperature and precipitation, have led to rapid permafrost degradation, creating thermokarst lakes and ponds. These new dynamics are affecting Greenhouse Gas (GHG) emissions to an extent that still needs to be fully integrated in Global Climate Models. Few considerations have been given waterbodies below 10 000 square meters, yet these are known to be biogeochemically more active than larger lakes. Variations in the optical properties of these small thermokarst lakes and ponds provide insights into their capacity for greenhouse gas emissions and can potentially be assessed via different Remote Sensing platforms in combination with statistical approaches and Geographical Information Systems. I undertook field surveys in lakes and ponds in the region of Kuujjuarapik-Whapmagoostui in the summer 2017 using and Unmanned Aerial Vehicle eBee with a Sequoia multispectral camera and developed very high resolution (13 cm) orthomosaics and digital surface models for the BGR and KWAK monitoring sites of the Centre of Northern Studies. The data was used as ground truthing for lake spectral characteristics to evaluate the potential use of Landsat 8 and Sentinel-2 satellite imagery for research of small lakes and ponds characteristics dynamics. The methodology allowed to evaluate the capacity of very high-resolution imagery (Sequoia, WorldView 2 e WorldView 4) for the detection

of thermokarst ponds, and of high-resolution images (Landsat 8 and Sentinel-2) for monitoring variability of their spectral characteristics. The results show that Sentinel-2 imagery, offers the highest correlations with ground truthing data, introducing new possibilities for monitoring the spectral characteristics of thermokarst lakes and ponds with over 350 square meters.

BUILDING CAPACITY IN TRICHINELLA TESTING OF COUNTRY FOODS IN CANADA'S NORTH

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There are 12 recognized species or genotypes of the zoonotic nematode Trichinella, responsible for causing the disease known as trichinellosis in humans. Transmission can occur via consumption of raw or otherwise ineffectively treated meat harbouring infective first stage larvae from a wide variety of carnivorous or omnivorous mammals, as well as some birds and reptiles. Although not associated with clinical manifestations in animals, infection with Trichinella spp. can cause severe, occasionally fatal, disease in humans. Historically, most outbreaks of trichinellosis have been linked to infected pork, and to a lesser extent wild boar and horsemeat. However, in Canada and elsewhere where pigs are commercially raised under controlled management conditions, Trichinella has essentially been eradicated from domestic pork. Thus, current regulatory control measures are aimed primarily at continued demonstration of negligible risk of infection in the national swine herd for domestic food safety assurance and international trade purposes. However, consumption of harvested wildlife continues to constitute a food safety risk for trichinellosis, particularly to Canada's northern indigenous populations which rely on these 'country foods' for sustenance. The main commodity of concern is walrus (Odobenus rosmarus) meat, which is often consumed raw or fermented, and can be infected with the sylvatic species T. nativa. This has prompted food safety initiatives, such as the Nunavik Trichinellosis Prevention Program in northern Quebec, to establish community engagement and diagnostic testing capacity to screen harvested walruses for Trichinella prior to consumption. Our CFIA laboratory, a national and international (OIE) reference laboratory for trichinellosis, has been invited in recent years to provide guidance and on-site training on Trichinella testing of walrus to laboratory staff in both Nunavik and the neighbouring northern territory of Nunavut. This week-long training was adapted from a national certification program previously established to qualify industry laboratories to test pork and horsemeat for export, and incorporating quality assurance principles based on the ISO 17025 standard, including use of a validated method (magnetic stirrer digestion assay) and proficiency testing of samples spiked with known numbers of Trichinella larvae. Demonstration of effective training and ongoing competency of analysts to generate reliable results is key to informing defensible food safety decisions by public health authorities. This, combined with the faster turnaround times afforded by such regional testing, will hopefully further enhance community commitment to these efforts to mitigate zoonotic Trichinella transmission in the North.

CLAMS AS A SOURCE OF TOXOPLASMA GONDII IN IQALUIT, NUNAVUT

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Introduction: The seroprevalence of Toxoplasma gondii in Inuit communities of Nunavik is twice the global average. Ingestion of T. gondii oocysts may cause toxoplasmosis, a disease with worldwide distribution and clinical signs ranging in severity from asymptomatic to severe and life-threatening for immunocompromised individuals and children infected in utero. The robust environmental stage of the parasite (oocysts) can only be shed in feces of felids and could reach coastal waters via overland runoff. Uptake and concentration in bivalve shellfish may subsequently lead to seafood-borne exposure in humans if consumed raw or undercooked. Clams are an important country food in Iqaluit both in terms of cultural continuity as well as an affordable and available form of sustenance. To further investigate if shellfish may be relevant to the transmission of toxoplasmosis in Arctic communities, this study was designed to evaluate whether T. gondii is present in clams collected from Iqaluit, Nunavut. Methodology: Clams (Mya truncata) were donated by local harvesters from nine locations over a one-week period in September 2016 in and near Iqaluit as part of the People Animals Water Sustenance (PAWS) project investigating enteric illness in Iqaluit. Digestive gland and hemolymph were collected from each clam, DNA extracted, and polymerase chain reaction (PCR) targeting the 18S ssRNA gene performed to test for presence of T. gondii DNA. Samples that yielded amplicon products consistent with T. gondii were further processed for sequence analysis. Results: Six of 390 (1.5%) digestive gland and two of 328 (0.6%) hemolymph samples were confirmed positive for T. gondii. In total, eight of 390 clams had confirmed (>99% identity via sequence analysis) T. gondii DNA, with an overall prevalence of 2%. The eight T. gondii-positive clams were collected at two sampling sites (three at Apex, and five at Red Island), both within 5 km of the Iqaluit town center. The limited sample size, short duration of sampling, and relative low number of positive samples precluded statistical analysis for determining spatial or temporal risk factors associated with T. gondii contamination of clams. Conclusions: Molecular confirmation of T. gondii DNA in clams harvested for food in Iqaluit was intended to be useful for public health practice in Iqaluit. The source of T. gondii oocysts contaminating clams in this region is still unknown and deserves future investigation. Relatively few domestic cats are known to be present in Iqaluit, and wild felids are absent from this locale. Advection of oocysts from Southern waters through ocean currents or in migratory fish may be possible. These results on T. gondii in clams can support public health messaging, particularly for high risk people including pregnant women and patients who are immunocompromised.

CAN AN ARCTIC TURBOT FISHERY ADAPT TO CLIMATE CHANGE? AN EMPIRICAL STUDY FROM THE PANGNIRTUNG COASTAL COMMUNITY IN BAFFIN ISLAND, NUNAVUT, CANADA.

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Global climate change is warming the Arctic. Inuit fishery systems are undergoing rapid change. Using the social-ecological systems resilience approach, this paper examines the extent to which an Inuit turbot fishery can adapt to climate change. We studied the Pangnirtung Inuit fisher community located in Baffin Island, Nunavut, Canada. The winter turbot fishery is the only commercial fishery co-existing with Arctic char subsistence fishery. Annually, the turbot fishery brings a large amount of resources (about C$ one million) to the community, mainly through fish selling and seasonal employment opportunities, significantly boosting Inuit livelihoods. The fishery is managed primarily by the community's largest employer, Pang Fisheries, under the supervision of Department of Fisheries and Oceans regulations. Climate change impacts such as warming sea water, changing sea ice conditions, and unpredictable extreme weather affect the Inuit way of life – including the turbot fishery – in different ways. The turbot fisheries system's key adaptive responses are: 1). an increasing trend towards including turbot in the meals of young Inuit, 2). the use of technological advancements such as motorised long-line pullers, GPS, VHF radios, and the internet for weather updates, 3). experimentation on summer turbot fishing using long-line trawling, 4). the sharing of turbot fishing knowledge/skills among neighbouring communities, and 5). the expansion of international niche markets for turbot fish products. However, additional attention is required on: a). researching turbot fishing spots, b). promoting turbot cooking recipes among Inuit youth, c). encouraging participatory decision-making, and d). further diversification of turbot markets. The paper argues that the adaptive responses of the turbot fishery create an entry point for adaptation to climate change but are not as promising, as such adaptations are eventually connected to global systems.

SPATIO-TEMPORAL DISTRIBUTION OF MICROBIAL COMMUNITIES ALONG EASTERN JAMES BAY

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James Bay is a wide and shallow basin affected by freshwater inputs from several rivers along the eastern coast. These 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 seasonal and spatial changes of the microbial community structure at stations located between Roggan River and north of Eastmain River from winter to summer 2018. During winter, abundances of phytoplankton < 20 μm (0.5-12 x 10^6 cells L-1), heterotrophic bacteria (HB) (2.1-21 x 10^8 cells L-1) and heterotrophic nanoflagellates (HNF) (0.1-3 x 10^6 cells L-1) under the ice cover were consistently low along the coast. During spring, cell abundances increased throughout the sampling region, but the highest numbers were observed around the Wemindji area (south of James Bay; up to 140 x 10^6 cells L-1 for phytoplankton <20 μm, 43 x 10^8 cells L-1 for HB and 7 x 10^6 cells L-1 for HNF). During summer, phytoplankton abundance was higher north of Chisasibi (Bay of Many Islands and near Piagochioui River), at 2 stations near Castor River and at 4 stations near Maquata River, with abundances superior to 45 x 10^6 cells L-1. However, HB and HNF abundances were sensibly consistent along the coast, except at the mentioned stations near Castor and Maquata rivers. Furthermore, phycocyanin-containing cyanobacteria (generally associated to freshwater ecosystems) numerically dominated the phytoplankton community at stations near Wemindji during spring and at most stations during summer, while there was a co-dominance with photosynthetic eukaryotes during winter. Changes in microbial communities will be discussed taking account environmental factors, such as salinity, temperature, light and nutrient availability.

A RETROSPECTIVE DENDROCLIMATOLOGY ANALYSIS OF CIRCUMPOLAR LONG–TERM EXPERIMENTAL WARMING USING CASSIOPE TETRAGONA

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Annual stem growth and reproductive effort of the evergreen dwarf-shrub, Cassiope tetragona, exhibit a strong positive relationship to summer temperature and have previously been used in dendroclimatology analyses to reconstruct climate in the High Arctic through the application of transfer functions. Retrospective analysis of the annual growth increments (AGI) have also been used to examine the impact of short term warming in a few tundra sites and across a limited latitudinal gradient. We will present the preliminary results of a full retrospective analysis approach to reconstruct the impact of long-term experimental warming in tundra communities at Alexandra Fiord (Ellesmere Island, Nunavut) sites on growth and reproduction variables using a before-after-control-intervention (BACI) design, from before the installation of open-top-chambers (OTCs) in 1992 to the present day. The secondary purpose of this study is to compare chronologies of experimentally warmed Cassiope tetragona samples from multiple International Tundra Experiment (ITEX) field sites to investigate the extent to which growth and reproductive responses to experimental warming vary across bioclimatic gradients within the Arctic. We will also present details on a novel methodology for AGI measurement and analysis, using CDendro scanning imagery and CooRecorder software. This replaces a previous methodology which made use of a manually operated calliper device, and allows for cross-validation of measurements and the processing of a greater number of stem samples.

THE CRYOLOGGER: A LOW-COST, OPEN-SOURCE DATALOGGER AND TELEMETER FOR CRYOSPHERIC RESEARCH

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The development of low-cost, open-source instrumentation has the potential to revolutionize cryospheric research, by allowing for improved spatial density and coverage of collected data, and producing new ways to observe and monitor the cryosphere. Here, we provide a detailed description of the Cryologger - an inexpensive, modular and user friendly datalogger and telemeter based on the open-source Arduino platform. The Cryologger can be constructed using off-the-shelf components and does not require any specialized tools or training. Easily modified to satisfy specific user requirements, two design configurations are highlighted to demonstrate the flexible nature of this sensor platform. The first configuration is intended for use as a tracking beacon to monitor the drift patterns of icebergs and ice islands in the Canadian Arctic. This design, planned for extended deployments of one year or greater, provides long term measurements of multiple parameters, including temperature, pressure, orientation (6DoF), GPS coordinates, and battery voltage. Data is transmitted regularly via an Iridium satellite modem. Between August 28 and September 3, 2018, six Cryologgers were successfully deployed by helicopter on icebergs and ice islands along the coasts of Ellesmere and Baffin Island. Since their deployment, all beacons have continuously reported hourly data at specified transmission intervals, which can be remotely updated based on the desired sampling frequency. The second application was designed to be coupled with a low-cost L1/L2 GPS unit to measure the daily displacement and annual velocities of Milne Glacier on Northern Ellesmere Island, NU. Deployed July, 2018 and set to be recovered in 2019, this design includes an increased battery capacity, solar panels and ruggedized enclosure. A third configuration is planned for deployment in Nain, NL in 2019, where it will provide data on local weather conditions to community members. Through an assessment of the performance of these diverse applications, it will be possible to determine whether low-cost, open-source hardware can provide a reliable, and cost-effective alternative to commercially available equipment for use in cryospheric research.

NEAR REAL-TIME CLIMATE AND PERMAFROST DATA INTEGRATION IN SUPPORT OF THE DEVELOPMENT OF THE COMMUNITY OF SALLUIT, NUNAVIK.

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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 way, on a terrain that has difficult topographical constraints and ice-rich permafrost. Under the warming climate, those challenges require regularly updated information on permafrost temperatures, rates of summer thawing of the active layer and on georisks to be readily available to support land use planning, construction and security assessments in the face of potential landslides. Therefore, it is especially important to have continuous data to observe the evolution of permafrost and the impacts of climate change. Given the abundance and spatial distribution of monitoring instruments (i.e. thermistor cables, DTS-fiber optic cables, SILA automatic meteo station), integration of data and day-to-day observation of the thermal conditions will allow monitoring of the performance of buildings and help community management. As for now, these installations are working individually and the data must be downloaded from the instrumentation on site on an annual basis. The main goal of this project is to integrate the information of permafrost temperature and climate monitoring within the existing geospatial information and databases already produced by the Centre d'études nordiques (CEN) in Salluit in an online database that will be updated in real time and easily accessible. This will also provide information on climate factors, such as air temperature, precipitations and wind speeds. Furthermore, it will allow us to anticipate and predict the risk of hazards such as landslides. The centralisation of the information using a geographic information system (GIS) represents a valuable asset for the strategic planning of Salluit. This process includes updating the CEN's mapping base to take into account the community's continuing expansion. This analysis will be conducted using an integrated view of the village of Salluit and the various problems the community is facing as part of the development of its territory.
The updated version of the mapping will be available on ArcGIS online for the institutions involved in the planning of the community's development. Therefore, the database will be presented as interactive maps and aerial photographs and will integrate graphs and tables allowing climate and ground thermal regime evolution with the different monitoring instruments in the village. The data will be integrated into the master plan of the community produced by the Kativik Regional Government (KRG). The creation of a pre-warning signal of landslide risks in the active layer of permafrost in late summer is also planned.

STUDY OF HABITAT QUALITY AND MIGRATORY PATTERNS OF PEARY CARIBOU (RANGIFER TARANDUS PEARYI) USING A THERMODYNAMIC MODEL OF SNOW AND TRADITIONAL KNOWLEDGE

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Arctic climate variability and change is now relatively well documented. Dramatic changes in spatial and temporal trends of sea ice, snow, permafrost, and glaciers have been observed due to a variety of strong climate related feedbacks. This warming was estimated at +1.06 °C/decade, while a much lower rate is observed for the rest of the planet. One of the main consequence of this warming is an increased occurrence of winter extreme events such as rain-on-snow, presence of ice layers and snow densification that are known to affect grazing condition for various ungulate species such as the Peary Caribou (Rangifer tarandus pearyi). Building on past work from our lab highlighting the effect of snow conditions on caribou population, the current project will focus on two main areas where the caribou concentration is highest: Southwestern region of the Canadian Arctic Archipelago (Banks Island and Victoria Island) and the Bathurst Island complex. The first methodological approach will use a spatialization platform for the SNOWPACK model, developed in our lab and simulate snow conditions at 1 to 2,5km of resolution. Results show that simulated snow conditions, when coupled with meteorological variable in the population predictive model MaxEnt, increases the statistical performance in presence/absence prediction. Hence, the project will use this approach along migratory corridors, and investigate a thresholding approach of snow state variables in order to quantify foraging conditions. This aspect will characterize food access during migration from 1979 to present, and when coupled with the Canadian Regional Climate Model (CRCM), up to 2100. The second methodological approach will make use of a polynya (openings in ice/open water) climatology currently being developed in our lab. This climatology uses radar satellite imagery from RADARSAT 1 and 2 since 1997. The climatology and ice charts will be compared to migration patterns of the last 20 years in partnership with the local communities, to integrate their traditional knowledge of the caribou's migration in our habitat prediction models (mainly Ulukhaktok and Resolute Bay communities). Thereby, the main goal this project is to develop and expand to a larger area of the Arctic the caribou habitat quality model that is under development at GRIMP. The goal of this is to predict the most favorable habitats with regards to food access and migration patterns by 2100.

UNDERSTANDING THE ROLE OF RESEARCHERS IN COMMUNICATING SCIENCES AND ENGAGING WITH INUIT YOUTH

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Over the past decade, Inuit and non-Inuit researchers, as well as local partners, have strived to conduct research that better reflect local values and traditions while giving a voice to non-Western knowledge systems (Ferazzi et al., 2018; Tondu et al., 2014). Recent studies in Northern Canada indicate that there remains a gap in the approaches and tools used to reach Inuit youth (Provencher et al., 2013). While researchers demonstrate a strong desire to engage Inuit youth in research activities, they often lack the resources and communication skills to do so (Provencher et al., 2013). This study aims to 1) explore the role of researchers in engaging with Inuit youth and 2) assess different models of communicating sciences with Inuit youth. We use a modified Delphi technique to explore perspectives of knowledgeable key informants in this field from across Canada. This method has been widely used in social science fields to understand how social issues are interpreted and understood by a panel of experts (Skulmoski et al., 2007). Our panel of 30 experts participated in a brainstorming session (Part I) and filled out two rounds of an online questionnaire (Part II). Ten experts from our panel were interviewed in person and by phone. Our preliminary findings indicate that researchers have a responsibility to make their research projects relatable and engage Inuit youth in hands-on learning activities. According to several experts, Inuit youth should be involved throughout the research process: from research design to data collection, analysis, and dissemination of results. Other experts explained that researchers sometimes have unrealistic assumptions about the roles Inuit youth can and should play in research projects. It was determined that researchers must recognize the unique capacities and diversity of interests among Inuit youth. Researchers show a keen interest in engaging with Inuit youth but are limited in financial resources and capacities. The lack of funding flexibility limit researchers from hiring and compensating youth who are interested in learning about sciences. Experts stressed the importance of providing community members and Inuit knowledge holders with equal opportunities to access research funds. Additionally, early-career researchers require training to do science outreach in Inuit communities. Education specialists also expressed that they lack relevant education materials needed to teach Inuit youth about sciences in a culturally appropriate way. In light of this, the panel of experts recommended that researchers collaborate with education specialists to hosts workshops and land-based science camps. Furthermore, communication specialists indicated instances where researchers will visit Inuit communities and engage with youth in short timelines. The panel of experts expressed that it is important for researchers to build relationships and trust with Inuit youth. Researchers must practice active listening, conduct multiple visits to get to know youth in their communities and make it known to youth that their contribution to research projects is valued. Overall, the outcome of this study will help us better understand how researchers can communicate sciences in a meaningful way and support the representation of Inuit youth in Arctic research.

CARBON QUALITY AND QUANTITY IN LAKE SEDIMENTS AND THEIR RELATION WITH LAKE-WATER METHANE AMONG LAKES OF THE MACKENZIE RIVER DELTA

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The Mackenzie River Delta is the second largest river floodplain in the Arctic and represents an important model ecosystem to advance our understanding of carbon cycling in large Arctic river floodplains. The Delta is in an area of continuous permafrost that contains over 45,000 shallow freshwater lakes that range widely in their quality and quantity of organic carbon received from a combination of in situ autotrophic production and varying degrees of annual flooding with river-water. It is a key ecosystem of the Canadian Western Arctic because it functions as a biological hotspot, relative to the surrounding tundra landscape. In particular, the lake-richness of the Mackenzie Delta enhances its importance as a CH_4 source to the atmosphere relative to landscapes more sparsely populated by lakes, and thus, such deltas may contribute disproportionately to the Arctic atmospheric CH_4 budget. CH_4 is also a significant source of carbon and energy in this class of Arctic lakes and thus an important fuel for local food webs. Differing carbon quality translates to widely differing energy efficiencies for microbial communities, which ultimately influence the net amount of CH_4 that is released to the atmosphere or cycled through local food webs. Past studies have observed substantial CH_4 accumulation and release from these lakes but information on the biogeochemical processes that drive these CH_4 dynamics are limited for this system. Our research aims to quantify how carbon quality and quantity of lake sediments affects CH_4 concentrations in the pore-waters and lake-waters among lakes of the Mackenzie Delta. To address this, sediment cores (up to 20 cm) were taken bi-weekly from 6 lakes over the period of May to August 2017. Measures of carbon quality included absorbance and fluorescence-based analysis of sediment pore-waters extracted from vertical core sections, and NP-content of the sediments. Measures of carbon quantity included dissolved organic carbon (DOC) in the pore-waters and total carbon content of the sediments. Preliminary results suggest that carbon quality may be more important than carbon quantity at upper depths in the sediment, and at deeper depths carbon quantity may be more important. In addition, carbon quality may be a bigger driver in pore-water CH_4 content earlier in the open-water period than later. Our results should contribute to revealing links among biogeochemical and physical properties of lake sediments and microbial activity, and thereby provide insight on the short- and long-term storage of carbon in this complex system. Having a better understanding of the physical and biogeochemical factors that influence CH_4-related microbial activity will improve understanding of the overall Delta system and the possible impact of changing future conditions in a region that may contribute significantly to the atmospheric CH_4 budget.

BEHAVIOURAL AND PHYSIOLOGICAL RESPONSES OF AN ARCTIC SEABIRD TO NOVEL PREDATION RISK FROM POLAR BEARS

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Due to a changing Arctic climate, a multitude of complex and unforeseen ecosystem effects are occurring. One such impact is novel predator encounters by prey with no adaptively evolved defenses. In particular, the recent terrestrial foraging of polar bears (Ursus maritimus) on alternative diet items such as seabird eggs has occurred as the result of earlier sea-ice breakup causing a shortened seal-hunting season. To examine this phenomenon in detail, we are studying common eiders (Somateria mollissima) at East Bay Island (EBI), Nunavut, historically considered to have the largest common eider breeding colony in the Canadian Arctic. In recent years, the EBI colony has 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 capacity of breeding eider hens to respond to this increased risk - in terms of incubation behaviour, and the energetic and fitness consequences of doing so. The objective of this study is to determine whether eider hens expend costly energy responding to a novel predator, by integrating behavioural responses with underlying physiological measures. Using aerial-drone and ground-trail camera videography of eider-bear encounters, we will link behavioural responses - e.g., flight initiation distances, disturbance - with a proxy of basal metabolic rate (BMR) - e.g., measures of heart rate and known bioenergetics. These studies will contribute to a quantification of the short- and long-term effects of a novel predator on the fitness of colonial nesting arctic seabirds.

A SYSTEMATIC CONSERVATION PLANNING APPROACH TO IDENTIFY CANDIDATE SITES FOR MARINE PROTECTION IN THE CANADIAN ARCTIC

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MPA networks have been advocated as the most effective tool for marine biodiversity conservation. Systematic conservation planning is a popular framework used worldwide to design marine protected areas networks. In the Canadian Arctic, healthy marine ecosystems are vital to Inuit communities. However, only a small fraction of Arctic marine areas are currently protected. WWF-Canada is undertaking a systematic conservation planning approach to identify candidate sites for marine protection in the Canadian Arctic. Using Marxan decision support tool we developed several potential MPA network scenarios that could help ongoing conservation efforts regarding MPA network development in the Arctic. Scenarios were mostly based on ecological considerations with one that incorporated connectivity. We compared all network scenarios and assessed the level of effectiveness based on network feasibility, ecological functionality and socioeconomic impact. Both scientific and traditional ecological data were used for the analyses. Finally, we discuss the importance of comparing the impact of network design on economic opportunity costs as a tool for demonstrating the implications of the alternatives under negotiation.

A VISUAL TOOL IN PARTICIPATORY ACTION RESEARCH FOR CONSULTING INUIT COMMUNITIES ABOUT THEIR ENVIRONMENTAL CONCERNS AND RESEARCH INTERESTS

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This poster presents a visual tool that was developed to describe the methodology used in consultations with Inuit communities about their environmental concerns and research interests, in a Participatory Action Research perspective. The proposed consultation process involves interactive idea sharing activities to brainstorm with participants, have open discussion, generate ideas and find ways to work more closely with communities with special attention on how to include Inuit Qaujimajatuqangit (IQ) and promote direct local implication. This process encompasses several steps: 1) Small group consultations took place with various local organizations where participants from the same organization could individually express their main environmental concerns, and collectively organize and synthesize their ideas into posters to present their results at a joint workshop later on. 2) The main recurrent themes or concerns were extracted from all posters, initially by researchers but later collectively during a joint workshop, to design synthesis posters that were presented to the whole group. 3) Participants selected a theme they were interested in, and worked in breakout groups to develop and organize their ideas in potential collaborative projects. 4) Each team prepared a poster of their project and presented it to the whole group. Depending of the context, the group could rate (high or low) each initiative with respect to benefits for the community and feasibility. 5) Each project could be developed further, by identifying collectively organizations or individuals already involved locally, regionally and nationally, as well as potential funding sources. 6) Finally, this open formula also allowed spontaneous concerns and topics to be brought up to the group and discussed (e.g.

research ethics and ways of doing). With this emergent and grassroots approach, where a large number of people work together to generate new ideas, the researchers embrace the community's global environmental concerns by trying to find common grounds with their research interests and expertise and to develop ways and tools to address them that benefit both the community and researchers. This creative thinking approach is based on trustful relationships as people have a sense of being consulted and listened to in the co-construction of an action plan to tackle, all together, environmental issues that matter to northerners in sustainable ways. The different steps of this methodology are presented schematically and colourfully in several figures to better explain this interactive and participatory approach to Inuit participants, with a simple and visual tool, both in Inuktitut and English. Two community consultation processes that were realized in 2018 in Pond Inlet, Nunavut and Kangiqsualujjuaq, Nunavik inspired this work.

LINKING CHANGING PERMAFROST CONDITIONS TO CHANGING ECOSYSTEMS TO CHANGING LIVELIHOODS IN THE NORTH

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The future impact of climate warming on communities and infrastructure is one of the most pressing issues facing northern Canada. Large areas of permafrost in Canada show signs of degradation and, with the Northwest Territories (NWT) warming ~4 times the rate of the global average, rates of permafrost thaw are expected to accelerate. Despite a substantial increase in research efforts to understand the effects of climate change in the North, few studies have done so at a regional scale that is useful for community resource planners. Current products are created at circumpolar scales and are often advertised as unsuitable for regional analysis. As climate change continues, the extent of infrastructure damages as well as the costs to maintain, replace, and adapt already existing buildings are expected to increase. Furthermore, climate impacts on northern ecosystems are particularly important for northern indigenous peoples with mixed cash-subsistence economies who have a deep reliance on local subsistence resources. Governments and indigenous communities within the NWT have expressed a desire for an assessment of permafrost thaw vulnerability in their traditional territory to analyze how this may affect the community, particularly in terms of planning, adaptation and food security. In this project, I will first assess the current state of knowledge about the effects of permafrost thaw on natural and human environments to highlight key gaps in our understanding and thus our ability to generate regional scale products. I will then perform an independent validation of the most recent product designed to assess thermokarst risk and in doing so generate regional permafrost thaw risks around six communities in the NWT. Finally, I will determine the risk of permafrost thaw (as measured as the product of the probability of thaw and the consequences of thaw), in selected communities by using surveys to perform a maximum different conjoint analysis (MDC) to determine the weighted preferences for several possible outcomes of thaw that are conceptually related but measured in different metrics. Collectively this work will provide northern governments and communities, a sector of the Canadian population that is particularly vulnerable to climate-driven change, with spatial prediction tools for assessing thaw-sensitive areas and improved understanding of the consequences for infrastructure and subsistence resource access.

EMERGING ISSUES IN HUMAN BIOMONITORING FOR POPULATIONS IN THE ARCTIC: A CANADIAN PERSPECTIVE

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Over twenty five years of human biomonitoring in the Arctic have shown the impacts of long range transport of contaminants of concern on Arctic populations. Recent reports show that certain populations are now experiencing a decline in body burdens of certain contaminants such as mercury, lead and persistent organic pollutants (POPs). However, historical contaminants of concern will not be the only ones to impact human health in the Arctic. Human biomonitoring in the Arctic will be influenced by emerging chemicals, new methods to measure chemicals, novel interdisciplinary studies and stronger relationships between researchers and communities. Several studies have attempted to predict which contaminants will be of concern next in the Arctic based on chemical and physical properties as well as known risk factors for existing Arctic contaminants of concern, e.g., persistence, bioaccumulative potential, long range transport characteristics. Combining the results of these studies showed little overlap between the models, but four of the ranked lists agreed on seven chemicals of potential Arctic concern. Cross referencing recent Arctic environmental monitoring results with these predictions produced a list of 32 contaminants which appeared in at least one study species relevant to traditional diets. This approach could provide a basis upon which to prioritize future contaminants for analysis in human biomonitoring in the Arctic. Other aspects of human biomonitoring in the Arctic are also changing, including ethical and cultural considerations such as data ownership and self-determination, as well as the impacts of climate change. This project aims to present emerging contaminants of potential concern for human health, based on environmental monitoring and modelling work. As well, developing methodologies are reviewed which may support the creation of new and informative measures of human health. These results will inform possible future directions for human biomonitoring and health effects studies in the Arctic.

BRIDGING THE DIGITAL DIVIDE TO SUPPORT COMMUNITY-BASED MONITORING IN THE CIRCUMPOLAR NORTH

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While community-based monitoring has been identified as an important method for tracking and adapting to the impacts of climate change, many communities in the Circumpolar North lack the necessary information and communication technology (ICT) infrastructure required to support the collection and dissemination of data relevant to these programs. In particular, limited internet bandwidth – which results in low throughput and high delay - and a complete lack of cellular connectivity limit the ability of Northern communities to collect and share environment and health data that have been identified by communities as necessary for the development of intervention and adaptation strategies. This is evident in the Inuit community of Rigolet, Nunatsiavut, where community members have been piloting the eNuk health and environment community-based monitoring program. Led by the Rigolet community and developed in partnership with researchers from the University of Guelph, the Labrador Institute of Memorial University, and the University of Alberta, as well as the Nunatsiavut Government, eNuk has been designed to allow users to record observations while in the community and off on the land using hand held mobile devices. Data that are collected on hand held devices are made available through on online website only when users are directly connected to the internet or through wireless signal. This limitation, coupled with limited ICT infrastructure is a bottleneck (at best) in the community-based monitoring program. At worst, it represents a potential health risk because information pertaining to safety issues (e.g. poor ice conditions) is not transmitted in real-time. To bridge the digital divide, the community is exploring alternative ICT known as wireless mobile mesh networks. Wireless mobile mesh networks are formed using a collection of mesh-enabled devices that have Wi-Fi, Wi-Fi Direct, and/or Bluetooth capabilities. In particular, these capabilities are used to create connections between devices instead of to a central device like a Wi-Fi router or cell phone tower. The resulting mesh network is capable of passing data from one device another. In this way networks can form where they are needed, as they are needed, without the overhead of installing and maintaining complicated and potentially costly ICT. In this discussion, we will begin with an overview of the community-led eNuk software, and outline design considerations that need to be made to accommodate the resulting lack of ICT infrastructure in the community of Rigolet. Wireless mobile mesh networks will be described; including considerations such as relevant device density required to sustain a dynamic network, maximum distance between devices to sustain a data linkage, transfer speeds, and more. This will also include a broader discussion of their potential to facilitate the collection and dissemination of data within community-based monitoring programs such as the eNuk health and environment software, and the design considerations required to implement them.

HIGHLIGHTING THE POTENTIAL OF PEER-LED WORKSHOPS IN TRAINING EARLY CAREER RESEARCHERS FOR CONDUCTING RESEARCH WITH INDIGENOUS COMMUNITIES

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For decades, Indigenous voices have been calling for changes to research approaches and researchers are also increasingly aware of the importance of community-collaborative research. However, in Canada, most researchers get little-to-no formal training on conducting research with Indigenous communities. This is particularly problematic for early-career researchers (ECRs) whose fieldwork often involves interactions with Indigenous communities. To address this lack of training, two peer-led workshops targeted to Canadian ECRs were organized with the following objectives: (a) to cultivate awareness about Indigenous cultures, histories and languages; (b) to promote sharing of Indigenous and non-Indigenous ways of knowing; and (c) to foster approaches and explore tools for conducting collaborative research with Indigenous communities. Workshop success was evaluated based on five themes: scope and interdisciplinarity, Indigenous representation, context matters, skillful moderation and workshop outcomes. Here we present Indigenous Intercultural Workshops, describe the methodology used to evaluate them and discuss the workshops' success in reaching its objectives. Our findings show that peer-led workshops are an efficient way for ECRs to cultivate awareness of Indigenous realities and to learn about diverse ways of knowing, essential skills that are necessary for the type of collaborative research being requested by Indigenous Peoples.

STUDIES ON THE NUTRITIONAL ECOLOGY AND BEHAVIOUR OF POLAR BEARS UNDER HUMAN CARE

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Many diverse behavioural and physiological adjustments allow Arctic species to cope with changing photoperiods and seasonal shifts in temperature and food availability. Climate warming poses a threat to polar bears (Ursus maritimus) because in some areas, declines in Arctic sea ice are leaving less time for polar bears to adequately prepare themselves for progressively longer periods of onshore fasting. It is likely that changes in energy expenditure and nutritional intake associated with reduced food availability will be reflected in changes in blood biochemistry, body temperature, and behaviour. We used a combination of seasonal feeding, animal training, voluntary blood draws, body temperature analysis, and behavioural observations to quantify relationships between energy intake and the nutritional and physiological status of polar bears under human care. Four polar bears housed at the Toronto Zoo were maintained on a seasonal feeding regime whereby bears were in a positive energy balance in the winter and spring, and in a negative energy balance in the summer and fall. All 4 bears were trained to present their front paw through a blood sleeve for a voluntary blood draw using positive reinforcement training. A blood chemistry analyzer was used to generate a biochemical profile for each bear and successive sampling allowed us to monitor shifts in the biochemical blood values that could be reflective of changes in organ function and metabolic processes in response to seasonal energy intake and changes in body condition. Small temperature loggers were inserted into fish or meatballs and consumed by the bears, allowing us to monitor changes in core body temperature across season. Surveillance cameras allowed us to monitor the activity levels of the polar bears while on exhibit. These data allowed us to create an activity budget for the bears and monitor changes in relative activity levels throughout the year. The behavioural observation data were compared to temperature data and used to elucidate relationships between changes in body temperature and activity levels that were indicative of metabolic savings or

behavioural thermoregulation strategies. The results are relevant to our understanding of how wild polar bears may respond to seasonal changes in food availability, and the long term consequences of a warming Arctic and climate-driven habitat loss.

GENETIC DIVERSITY AND STRUCTURE IN THE SNOWY OWL (BUBO SCANDIACUS)

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Shifts in species movements and ultimately distributions are the most commonly documented responses to warming temperatures, with important consequences for the function and structure of ecosystems. With the fast changing Arctic climate, many migratory birds are also facing new challenges to arrive on their breeding grounds on time to maximize nesting success and survival. Several migratory strategies, from nomadic to site fidelity have various pros and cons with respect to tracking the best spring conditions and adapt to more extreme climate perturbations. How migratory strategies interact with genetic diversity is still unknown yet essential to understand their resilience to environmental changes. Here we link phenotypic and genotypic signatures in a nomadic migrant, the snowy owl. This top predator has a circumpolar distribution and breeds mainly on the arctic tundra. It is a food specialist, preying on rodents with fluctuating population cycles. Our study will help decipher the determinants of genetic diversity in a predator closely linked to fast changing prey and climate dynamics.

MODELING ORGANIC MATTER SETTLING IN A PRODUCTIVE ARCTIC ENVIRONMENT

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The ocean biological pump transports organic carbon produced in surface waters to the seafloor, where it can be consumed by benthic organisms. This last process is part of the commonly called bentho-pelagic coupling (BPC), which in certain environments controls the abundance and composition of benthic communities. Aggregates constitute an important fraction of the organic matter in the ocean. However, only few biogeochemical models include the formation of aggregates (coagulation), their contribution to the downward flux of organic matter and their pathways in the planktonic food web. Even fewer coagulation models are coupled to a physical model to study carbon export. Here, a coupled biogeochemical-physical model in which we incorporated parameterizations for coagulation and fragmentation of marine snow is applied to an idealised one-dimensional representation of an Arctic marine ecosystem, namely the North Water Polynya (NOW), northern Baffin Bay. It is long known as a hotspot of biological productivity that shows fading signs in response to recent climate changes. Recent observations of bivalve growth rate trends at 600 m below the polynya strongly suggest changes in the BPC are occuring. Our results show that marine snow aggregates may reach a diameter size of 75 mm and settle at a speed of 44 m d-1 to provide food for the benthic community in a short timescale. However, the settling velocity is not constant over the water column, as mainly assumed in previous modeling approaches, and varies prognostically as a function of the size of marine snow particles over the time and depth. Stratification, turbulence and concentration as well as size of organic matter in the water column constrain the size evolution of aggregates and therefore the related time and concentration that will reach the seabed. The resulting vertical velocity profile obtained by our prognostic model allow reconciling biological processes happening in the upper and in the deep ocean and may explain particulate organic matter flux in the NOW.

GIVING A VOICE TO EARLY CAREER SCIENTISTS THROUGH PEER-REVIEW

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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 the society. But what is the role of Early Career Scientists (ECS) in these processes that help bridge 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 could be very valuable to ECS and to the scientific community as a whole. On behalf of the Association of Polar Early Careers Scientists (APECS), we report here on the 2018 group review of the first order draft of the Intergovernmental Panel on Climate Change (IPCC) "Special Report on Ocean and Cryosphere in a Changing Climate" (SROCC) spearheaded by 75 ECS from 22 countries. Approaches developed and deployed, as well as lessons learned from this group review, will be discussed in the broader context of peer-review mechanisms and platforms. Data collected through the compilation of review comments and a post-review survey illustrate that ECS referees are as competent as more experienced referees. The diverse disciplines and geographic perspectives, fostered through APECS, will be mobilized once more during a second round of review of the SROCC in late 2018. Information gathered during this second refereeing cycle will add to the findings from the first round of review.

CUMULATIVE EFFECTS OF MINING IN THE CANADIAN ARCTIC ON SHOREBIRD DENSITIES USING THE ARCTIC PRISM DATA

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Biologists and researchers from the United States and Canadian Governments designed the Arctic Program for Regional and International Shorebird Monitoring (PRISM) when declines of shorebird populations during migration surveys were detected (Government of Canada 2017). PRISM was divided into 20 regions, 13 of which are within Canada and the remaining 7 in Alaska (Government of Canada 2017). Of the 21 species of breeding shorebirds in the Canadian Arctic, approximately 13 species are experiencing a population decline (Government of Canada 2017). Of these 13 species, some have been listed by the Status of Endangered Wildlife in Canada (COSEWIC) or Federal Species at Risk Act (SARA) and are therefore of special interest and concern to conservation biologists (Government of Canada 2017). Natural habitat is lost to shorebirds when mines are constructed in the arctic, but the creation of these mines may favour other species of arctic breeding birds. A synathropic relationship is being formed between the mines and the shorebird species that nest in close proximity to the mine (Smith et al. 2005). The differences in nest behaviours impact the nest survival of the shorebird species in the mining regions (Liebezeit et al. 2009). With the increased presence of mines in the arctic, predators to mining sites have expanded their home ranges (Liebezeit et al. 2009), which has the potential to impact shorebirds in those areas. The purpose of this study is to determine how the cumulative effect of arctic mining is impacting shorebird densities. The study expects that mining in the Canadian Arctic will impact shorebirds that nest in the immediate mining grounds (e.g., < 1 km from the mines) but will not affect the overall whole of the breeding shorebirds throughout the arctic.

PRELIMINARY LESSONS LEARNED FROM CONDUCTING TRADITIONAL KNOWLEDGE INTERVIEWS TO INFORM ANIMAL MOVEMENT MODELS

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Quantitatively combining traditional knowledge (TK) with western science has proven challenging due to a mismatch between the type and structure of the information and the difficulty in developing formal quantitative frameworks that can integrates both types of knowledge. TK is a vast source of information and, while often well documented, is typically included in scientific studies as supplementary or corroborative information. Although the depth of knowledge inherent in TK is acknowledged, this approach treats these types of knowledge in parallel frameworks. Quantitative methods to combine TK and western science into one framework are emerging but examples are still few. We are seeking to develop an analytical approach that allows for the formal quantitative integration of TK and western science into animal movement and behaviour models, focusing on ringed, bearded, and spotted seals. To do this, we are initially focusing on methods to interpret and quantify TK and represent it spatially in a way that can be included in further analysis. Our first step was to determine the parameters that would be used in the animal movement models to define behaviour and the relevant, complementary threads of TK that would be included in the analysis. Initial interviews were conducted in Utqiagvik, Alaska. The interviews focused on topics related to ringed, bearded, and spotted seal movement, activity and behaviours associated with specific locations or times of year. Preliminary lessons learned about the types of questions regarding animal movement and behaviour asked during TK interviews and how the TK can be quantified provided insights into furthering our approach and efforts to develop animal movement models that equally consider and integrate two valuable sources of information into one analytical framework.

RESPONSES OF ARCTIC TUNDRA SHRUB SPECIES TO CLIMATE CHANGE: DIFFERENCES BETWEEN BIOTIC AND ABIOTIC FACTORS, AND BETWEEN SHORT- AND LONG-TERM EFFECTS

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Climate change in arctic tundra is projected to affect multiple biotic and abiotic factors, including increases in air temperature, soil fertility, snow depth, and changes in caribou herbivory. These effects may alter plant community composition differently by shifting niche space to favor particular species' life-history strategies. Here we report the results of a series of long-term (12 years) manipulative experiments (control, greenhouse summer warming, low nitrogen addition (LN), high nitrogen addition (HN), high phosphorus addition (HP), high nitrogen plus high phosphorus addition (HNHP), snowfence, and caribou exclosure treatments) in a mesic birch hummock tundra ecosystem. Aboveground biomass change in 5 major shrub plant species was repeatedly measured using a point framing method in three separate years (2005, 2011, and 2017). Significant temporal (over 12 years) changes in shoot biomass were observed under control, warming, HN, and HNHP, but not under other treatments, for three dominant species: Rhododendron subarcticum, Betula glandulosa, and Vaccinium vitis-idaea. Specifically, biomass of B.glandulosa increased under control, warming, HN and HNHP treatments, biomass of V. vitis-idaea increased under control and warming but decreased under the HN and HNHP treatments, and biomass of R. subarcticum increased under the control and warming treatment but decreased under the HNHP treatment. Furthermore, over the 12 years of treatments, biomass of the two evergreen species, R. subarcticum and V. vitis-idaea decreased, whereas biomass of the deciduous species, B. glandulosa increased, with both HN and HNHP treatments. These findings show that vegetation biomass responds most significantly to warming and nutrient addition manipulations, with the dominant species being mostly affected.

HYDROGRAPHIC AND BIOGEOCHEMICAL CONDITIONS IN NORTHEASTERN COASTAL JAMES BAY AND SOUTHEASTERN HUDSON BAY DURING WINTER AND SUMMER OF 2016-2017

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The watershed and coastal environment of eastern James Bay have undergone evident change since the late 1970s. The change may be attributed in part to climate change, which has reduced the season of ice cover by freezing up later and melting earlier than usual in this region. It is also attributed in part to altered seasonality and magnitude of river discharge associated with diversions and dam construction on the La Grande River beginning in the 1970s. These alterations to the natural system provide potential mechanisms for changing the freshwater and nutrient dynamics in northeast coastal James Bay and the downstream area of southeast Hudson Bay. In view of the scarcity of data collected in this area prior to 2016, this study aims to introduce the present-day hydrographic and biogeochemical conditions of the area as context for ongoing and future studies of potential threats to eelgrass (Zostera marina), an essential vegetative species for maintaining the ecosystems located along the coast in this area. Eelgrass is an important part of the Cree culture in this area and has been recently showing indications of decline in spread and health. Fieldwork was conducted in conjunction with the Cree Nation of Chisasibi and the Arctic Eider Society. Oxygen isotope ratio data (δ18O) and nutrient concentrations (phosphate, nitrate, and silicate) were obtained from analyzed water samples taken in eastern James Bay and southeast Hudson Bay to help describe the nutrient distribution in this area based on the seasonal freshwater composition. The data encompasses winter, spring, and summer of 2016 and 2017. CTD profiles were also taken to better understand the structure of the water column. River and seawater end members were established based on δ18O and salinity data, and were used to determine the freshwater composition of all individual samples. In winter, the La Grande was found to be a very low source of phosphate (0 to 0.15μM) but a high local source of nitrate (just above 5μM) relative to the marine waters that circulate along the northeast James Bay coast (above 0.6μM phosphate, 3μM nitrate). Southeast Hudson Bay had higher nutrient concentrations overall, in comparison to eastern James Bay sites. Preliminary interpretation of the results suggests that the northeast James Bay coast is oceanographically isolated from the deep, nutrient-rich waters that lie below the winter mixed-layer in Hudson Bay (at a depth of 100m). Because dissolved inorganic nitrogen is generally the limited macronutrient for phytoplankton growth in the Hudson Bay system, riverine contributions may play a disproportionate role relative to upwelling in controlling phytoplankton and algal growth in northeast coastal James Bay.

ICING PROTECTION SYSTEMS FOR UAVS IN THE ARCTIC

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Unmanned aerial vehicles (UAVs) offer great opportunities in the Arctic. They can deploy a large variety of remote-sensing instruments into inaccessible areas at low cost without putting human life at risk. Many potential applications have been theorized in past and many of them have been realized today. For example, sea ice monitoring, iceberg tracking, oil spill detection, glacial photogrammetry, vegetation & wildlife observations, search & rescue operations, power line inspections and many more. Seizing these opportunities can be highly relevant for the Arctic as it may improve our understanding of the ecosystem, allow for safe shipping operations, improve living conditions and provide a multitude of scientific data. However, there are severe challenges to UAV operations in the Arctic. In particular, atmospheric icing poses an important technical challenge. When ice collects on an aircraft during flight it will decrease the aerodynamic performance by decreasing lift, increasing drag and deteriorating the stall behavior. Experience shows that this often can lead to the loss of a UAV. Currently, there are no mature icing protection systems (IPS) available for UAVs. Effectively, this means that during icing conditions UAVs need to stay grounded or face an substantial risk. This study investigates general requirements and design specifications for an IPS enabling all-weather capability for UAVs. Reliability, energy efficiency, and weight are key variables that have to be selected carefully depending on the platform and mission type. Several potential technical solutions are discussed and two protections strategies explored on a generic UAV example. Anti-icing systems prevent any ice to form on a surface by continuously providing heat to it. De-icing systems allow for a certain amount of ice to form which is then periodically removed. The characteristic advantages and disadvantages of each system are presented. Data is provided by both, computational fluid dynamic (CFD) simulations and experiences from a UAV-IPS developed at NTNU.

HOUSING BEYOND HOUSES: UP-CYCLING URBANISM

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In the face of extreme housing shortages, physical isolation and weather conditions, outdoor public spaces in Canadian First Nation and Inuit communities continue to be overlooked and remain largely undesigned and underused. Good housing should be more than just a bunch of adequate dwellings, a harmonious and lively public realm constitutes a good community and successful housing. At present, in remote Sub Arctic and Arctic villages, the in-between spaces are strewn with stuff: plywood crates, tires, sea-cans, palettes, diesel fuel drums etc. Most housing and civic buildings have emerged from and stand as markers of southern Canadian values. The Royal Architectural Institute of Canada has begun a discourse on design in northern Canadian communities, but conversations continue to dwell on homes-shelters and civic buildings. A strong need exists to open conversations about the design process and the public real in northern villages, which this project addressed, creating a unique experience in which northern and southern groups could apply a “hacking mindset” to reimagine the entire community. They have also shown that the reuse and recycling of defunct parts and existing technologies can radically transform everyday life. Hence, hacking is relevant to designing in northern villages where the DIY up-cycling culture is widely practised and necessary. The culture has grown so much that the Kuujjuaq dump, for example, is now colloquially referred to as “Canadian Tire”. The Hackathon celebrated this innovative culture of up-cycling and showcased its relevance to open shared conversations about the built environment and the need to reduce waste and rethink consumption patterns globally.

MULTI-CENTURY IMPACTS OF ICE SHEET RETREAT ON SEA LEVEL AND TIDES IN HUDSON BAY

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In Hudson Bay, sea level changes associated with ice loss from the Greenland and Antarctic ice sheets will differ in both sign and magnitude due to gravitational effects. Changing water depths give rise to changes in ocean tides, for which tidal energy dissipation and tidal amplitudes are directly linked to ocean bathymetry (Green, 2010). In the present study, we investigate the impact of sea level changes on tides in Hudson Bay, Canada - a region where tidal energy dissipation is strongly sensitive to bathymetry (e.g. Egbert and Ray, 2000), and the bathymetry is in turn highly uncertain in some parts of the bay. Recent work by Wilmes et al. (2017) indicates that regional variability in future sea level changes as a consequence of ice sheet collapse will impact tides globally, in particular in Hudson Bay. As the magnitude of globally averaged sea level change due to Greenland and Antarctic ice loss remains highly uncertain (e.g. Church et al., 2013; DeConto and Pollard, 2016; Golledge et al., 2015), we present simulations of multi-century sea level changes associated with a suite of Greenland and Antarctic ice loss scenarios using a gravitationally self-consistent sea level model (Gomez et al., 2010). To fully quantify the sea level changes in Hudson Bay, we incorporate the contributions of glacial isostatic adjustment associated with the last deglaciation in our projections. We then consider the impact of these sea level changes on tides in Hudson Bay using the OTIS tidal model. Our results aid in constraining the response of Hudson Bay tidal dynamics to projected sea level changes, elucidating the feedbacks between energy dissipation and shoreline migration, and assessing the impact of climate change on coastal regions in the Hudson Bay.

ENGAGING INUIT YOUTH IN RESEARCH: A RINGED SEAL WORKSHOP IN ARVIAT, NUNAVUT

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The ringed seal (Phoca hispida) is of great cultural, economic and nutritional importance for northern communities and a key organism for contaminants monitoring. Scientists work in collaboration with Inuit to better understand the spatial and temporal trends of pollutants in ringed seals. Developing innovative tools and ways of communicating research with Inuit youth, Elders and community members addresses a shared interest among Inuit and scientific researchers. In fall 2018, we conducted one educational workshop in Arviat, Nunavut, in collaboration with the Qitiqliq Middle School, the Levi Angmak Elementary School, and the Arviat Hunters and Trappers Organization. The main goals of this workshop were to: (1) allow scientists working on contaminants in ringed seals to share information about their work with students and community members from Arviat; (2) provide an opportunity for Inuit Elders to share their knowledge with students and researchers in seal ecology and traditional methods for hunting/ preparing seals and identifying abnormalities or diseases; (3) increase the engagement and interest of northern students in contaminants research and traditional seal harvesting; and (4) identify best practices for engaging and communicating with Inuit youth. We used a combination of short interactive presentations, laboratory activities, group discussions, storytelling, games, art activities, and a ringed seal dissection. A student from the Arctic College Environmental Technology Program (ETP) in Iqaluit, and one graduate student from the University of Manitoba co-led the workshop as a way to increase the capacity of northern students and early career scientific researchers to engage with northerners in contaminants research. A student-developed survey was used to document Inuit Knowledge that may be associated with contaminants in ringed seals. Lastly, a workshop assessment involving discussions and a written survey helped us identify best practices for engaging and communicating with Inuit youth. By developing innovative educational tools built on science and Inuit Knowledge, our project will help scientific researchers, educators, and community members interested in Inuit engagement in research.

HYDROLOGICAL AND LANDSCAPE CONTROLS ON POTENTIAL CO2 FLUXES FROM PONDS IN THE CANADIAN HIGH ARCTIC

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Globally, inland waters receive and process significant but poorly-constrained amounts of terrestrial carbon (C). A portion of terrestrially-derived C in inland waters is microbially processed into the greenhouse gas carbon dioxide (CO2) and outgassed into the atmospheric C pool, making inland waters important components of the global C cycle. In the Arctic, ponds represent a substantial portion of inland water surface area. Thus, C processing and subsequent CO2 outgassing from ponds could play a significant role in the Arctic C cycle and potential greenhouse gas emissions. In this study, we examined 19 ponds near the Cape Bounty Arctic Watershed Observatory (CBAWO), Melville Island, Nunavut, Canada. The ponds were selected to be representative of a range of hydrological inputs (precipitation-fed versus soil water-influenced) and permafrost disturbance regimes (thermokarst, active layer detachment, undisturbed) observed in a well-characterized High Arctic watershed. Depending on the physical and hydrological characteristics of each pond and its surrounding landscape, potential terrestrial C sources to these ponds include the surrounding active layer and vegetation, permafrost, and/or ground ice. We sampled each of these ponds weekly for water stable isotopes (dD and d18O), biogeochemical properties (DOC, TDN, FDOM, and major ions), and dissolved gasses (CO2) from 16 July – 12 August 2018. Preliminary water isotope data show a subset of our sampled ponds became enriched in d18O as our sampling period progressed. We suggest this is evidence of a subset of our ponds being influenced by evaporation and/or groundwater influx. We anticipate observing shifts in the ponds' biogeochemical properties that will reflect the temporal d18O enrichment. Specifically, we anticipate increased evaporative and soil water influence in these ponds will correlate with higher concentrations of DOC, TDN, and major anions and cations compared to the ponds which did not experience d18O enrichment during the sampling season. Further, we will use the dissolved CO2 concentrations to determine the spatial and temporal variability in potential CO2 diffusive flux from the ponds during our sampling period. We anticipate we will be able to: (i) categorize each of our ponds according to their diffusive CO_2 flux potentials, and (ii) identify key isotopic and biogeochemical variables which can be used to predict and upscale CO_2 emissions from ponds to a watershed level.

USING A WEIGHTED TERRAIN UNIT METHOD TO IMPROVE ACCURACY IN SWE ESTIMATES IN THE SNARE RIVER WATERSHED, NORTHWEST TERRITORIES, CANADA

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The Snare River watershed supplies hydroelectric power to about 62% of the NWT population, including the capital city of Yellowknife. The Northwest Territories Power Corporation (NTPC) operates four hydroelectric facilities along the lower portion of the river, but low water levels and drought conditions in the territory during the last two decades have intermittently and/or completely reduced the possibility of generating hydroelectric power. The International Governmental Panel on Climate Change (IPCC) predicts future amplified warming in the NWT, but is less certain on the future hydrological cycle, particularly how total snowpack water equivalent (SWE) may be influenced. Accurately assessing SWE before the spring freshet in watersheds providing hydroelectricity to northern communities is imperative as annual snowfall represents about 40% of annual precipitation and more than 80% of annual runoff (Environment and Natural Resources Canada). The importance is amplified by the fact that storage in these northern boreal shield systems is limited due to shallow overburden and presence of widespread discontinuous permafrost. As such the dependency on annual snowpack recharge is significant. The objective of this research was to devise and conduct a physically based snow survey which provides a more accurate quantitative assessment of SWE in the Snare River watershed than previous snow surveys conducted in the area. As such, our sampling design accounted for topographical changes that play a role in snow depositional patterns and include considerations of slope and aspect. Our snow survey focused on a single 25 x 25 km EASE-GRID pixel about 20 km south of Wekweeti, NWT in the Snare River watershed. Within this area we selected four 75 km2 sites, within which we conducted the snow surveys in late March 2018. Using a DEM of the area, terrain units were determined and the landscape was divided into lakes, units with gradients of greater than or less than 7° and aspect based on the four cardinal directions, creating 9 terrain units. The percent aerial coverage of each terrain unit was quantified, and the sampling sites were weighted to represent the landscape coverage of each unit. This was an attempt to reduce sampling bias. Preliminary results indicate that 1) lakes have the greatest densities (0.237 g/cm3), 2) shallow sites (slopes less than 7°) have slightly greater densities (0.182 g/cm3) than steep sites (0.178 g/cm3), 3) SWE in the shallow sites (9.51 cm) is on average 0.6 cm greater than steep slopes (8.9 cm), 4) the exposed lake surfaces have a notable lower SWE value of 6.04 cm, and 5) SWE values ranged by 1.92 cm in the sites with lower slopes, and by 0.67 cm in the sites with steeper slopes. These differences might be related to prevailing wind direction and differences in vegetation growth. Statistical analysis of this data will enable us to determine if there are significant differences in SWE among the terrain units we have selected, as well as determine an error margin and correction factor for previous snow surveys conducted in the area that did not use the weighted terrain unit methodology.

BANKS ISLAND MIGRATORY BIRD SANCTUARY HABITAT ASSESSMENT

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Evidence suggests that northern regions across the globe may experience significant cliome (climate and associated vegetation) shifts over the next century. This has raised concerns that present-day protected areas may not adequately protect their targeted biological assets in the future. As such, it is important that present-day protected area managers are able to monitor changes within their areas in order to assess the need to adapt management plans to accommodate future ecosystem states and environmental conditions. There is limited baseline habitat data for the Canadian Wildlife Service's protected area, Banks Island Migratory Bird Sanctuary (MBS) No.1, located in the Inuvialuit Settlement Region of the Northwest Territories. This project aims to: 1) obtain detailed habitat data for Banks Island MBS No.1

to ensure a basis for future monitoring of changes in plant community productivity, structure, and health and 2) explore long-term trends in vegetative indices obtained through remote sensing, in order to provide insight into the driving factors behind observed changes. This data will be important as the Canadian Wildlife Service moves forward to assess impacts of biotic and abiotic factors on migratory birds, species at risk, and biodiversity in the area. Data collected will also aid in the development of a long-term management plan for the area. One hundred (100) sample sites were randomly selected within Banks Island MBS No.1, stratified by collapsed land cover classes: wet, dry, and hummocky tundra. We performed rapid habitat assessments at 40 sites in July and August 2018 and plan to visit the remaining sites in July and August 2019. Preliminary results from 2018 data will be presented.

ALLOCATION AND SUB-ALLOCATION OF NUNAVUT ADJACENT COMMERCIAL FISHERIES RESOURCES

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Large scale commercial fisheries in the Canadian Arctic consist primarily of Greenland halibut (aka turbot: Reinhardtius hippoglossoides) and Northern shrimp (Pandalus borealis). Within Nunavut and Nunavut adjacent waters, the Nunavut Wildlife Management Board (NWMB) and the Department of Fisheries and Oceans Canada (DFO) are responsible for co-management of these resources. However, depending on the location of the stock at different scales; inside vs. outside the Nunavut Settlement Area, Northwest Atlantic Fisheries Organization fishing areas, different process for allocation and/or sub-allocation occur. Here we highlight the different processes that occur across Nunavut and Nunavut-adjacent waters for both species, and how the co-management structure differs in these circumstances. Last, we outline the Nunavut sub-allocation process as identified in the NWMB's commercial fisheries allocation policy in determining access to the resource. In doing so, we highlight how the co-management process works to address ongoing tensions between meeting the needs of fishing enterprises, such as security of allocation, with desires for Land Claims beneficiaries to maximize the value they obtain from their adjacent resources.

COMPARISON OF TRENDS OF PERFLUOROALKYL SUBSTANCES (PFASS) IN RINGED SEALS AND IN SEAWATER ACROSS THE CANADIAN ARCTIC

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The ringed seal (Phoca hispida) is the most abundant Arctic pinniped with a circumpolar distribution and a key biomonitoring species for the evaluation of contaminants. Early temporal trend studies on perfluoroalkyl substances (PFASs) in liver of ringed seals at two locations in the Canadian Arctic, showed C9–C15 perfluorocarboxylates (PFCAs) had increasing levels during the period 1998-2005 while perfluorooctane sulfonate (PFOS) achieved maximum concentrations in 1998-2000 and declined from 2000 to 2005. Ocean transport of PFASs was proposed as the main route of deliver of PFASs to the arctic marine environment, however, the rapid response to phase out of PFOS suggested the importance of an atmospheric pathway as well. The objective of this study was to compare temporal trend data for PFASs in ringed seals in several widely separate locations in the Canadian Arctic over a 15 to 20 yr period, as well as newly available time trends in ocean waters from the central Canadian archipelago, and with trends in atmospheric concentrations. Ringed seal samples were obtained from subsistence harvesting in four regions of Inuit Nunangat: Sachs Harbour (NWT), Resolute and Arviat (Nunavut) as well as in Nain (Labrador). Seawater (1L) was collected in Lancaster Sound, near Resolute Bay, between 2005 and 2017 at depths of 10-100m. Seal liver and seawater were analyzed for PFASs by LC-MS/MS. Highest total PFASs (PFOS + C8–C15 PFCAs) in ringed seals over the period 2011-2016 were observed in the more southern locations, Arviat (52 ng/g ww) and Nain (41 ng/g ww), compared to more northern (Sachs Harbour; 30 ng/g; Resolute 24 ng/g). Lowest concentrations of PFOS were generally observed during the period 2005-2010, following a decline from higher levels in the period 1998-2005. Since 2011 PFOS concentrations in liver have increased at Resolute and Arviat by about 2-fold. The trends for PFCAs generally show a similar temporal pattern as PFOS with indications of recent increases particularly at Arviat. In seawater collected near Resolute since 2005, PFOS has declined significantly with an overall disappearance half-life of 4.4 yr. PFOA showed no trend between 2005 and 2017 in seawater. The increase in PFOS in seals is also observed in atmospheric measurements in the Canadian Arctic where PFOS had a doubling time of 2.9 years between 2006 and 2014. Thus trends of PFOS concentrations in ringed seals appear to reflect atmospheric rather than oceanic trends in the Canadian arctic.

NUTRIENT AMENDED BIODEGRADATION OF PETROLEUM HYDROCARBONS BY MARINE MICROBIAL COMMUNITIES IN THE LABRADOR SEA AND HUDSON BAY

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Labrador's offshore region in the northwest Atlantic Ocean is the focus of ongoing oil exploration via high-resolution seismic surveys. The region is also part of the shipping lane into Hudson Bay, with transits through to the deep water port at Churchill, Manitoba, and to coastal communities throughout the bay. In the Labrador, Hudson Straight and Hudson Bay region, future oil production combined with increased shipping traffic raise the risk of a marine oil spill or fuel spill. Sediment microcosms were amended with diesel fuel or crude oil and limiting nutrients to demonstrate the microbial response to oil spills within this corridor. Sediment was sampled in triplicate using a box corer deployed from the CCGS Amundsen icebreaker, such that triplicate microcosms were established using replicate seabed samples (i.e. triplicate box core casts). $O2$ and $CO2$ were monitored in the headspace of treatment bottles (relative to unamended controls) as proxies for biodegradation. Microbial communities associated with biodegradation were assessed using 16S rRNA gene amplicon libraries. Labrador Shelf sediments amended with diesel (0.1% v/v) and incubated at 4°C experienced greater O2 consumption and CO2 production relative to unamended controls. Similar observations were made with microcosms using sediment sampled near Kuujjuarapik, QC, in Hudson Bay. Treatments with higher concentrations of nitrogen and phosphorous (4.7mM N, 1.5mM P) experienced greater O2 depletion and CO2 production relative to tests with ambient nutrient levels (i.e., seawater concentrations of 15 µM N and 2 µM P). Microcosms amended with 10-fold more diesel (1% v/v) and the high nutrient concentration experienced the most rapid response, with complete removal of the 21% O2 initially present in the headspace. Oleispira and Thalassolituus dominated the microbial community profiles after 28 days in microcosms treated with high nutrient and diesel concentrations; such community shifts in response to both exposure time and nutrient amendments were reproducible across triplicate microcosms. These microbial key players are thus important constituents of pre-spill baseline conditions in the marine environment, yet they may be relatively rare in situ, in the absence of hydrocarbon input, such that baseline diversity surveys that apply moderate DNA sequencing effort may not detect them. These results indicate the potential for natural attenuation catalyzed by indigenous microbial communities in the event of a spill, and show that strategies for increasing nutrient bioavailability are likely to be effective for oil spill response by mobilising a subset of the marine microbiome that is capable of hydrocarbon degradation at low temperature.

MULTISPECTRAL SERIAL LASER IMAGING TECHNIQUES FOR UNDERWATER SPECTRAL DISCRIMINATION OF MACROALGAE AND CORAL

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Noticeable climate-mediated changes are occurring in the Arctic and affecting various ecosystem components in the process. These changes in environmental conditions can be important for coastal water components such as macroalgae, which provide essential ecosystem services ranging worldwide. A better understanding of spatial distribution patterns in primary producers such as macroalgae can guide us in anticipating effects of future changes. The development of innovative underwater detection and imaging methods, such as multispectral laser serial imaging techniques, may provide solutions for studying Arctic substrates as macroalgae in coastal environments when coupled with proven and available deployment platforms, such as AUVs (Autonomous Underwater Vehicles). In this context, the objective of the current work is to develop an automated classifier designed for detection and identification of macroalgae and other underwater substrates such as coral. By using multiple laser wavelength sources as a means to illuminate recreated benthic environments composed of these living substrates, it will be possible to characterize elastic and inelastic spectral responses at different wavelengths. The information gained through this process will enable us to begin development of an automated benthic substrate classifier.

ICE ECOLOGY IN ARCTIC LAKES

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All Arctic lakes freeze in winter and most of them for more than 8 months but for a shorter duration each year. Reductions in lake ice thickness, coverage and duration may have important consequences on safety of animals and people across moving ice and for the traditional use of the lake ice by Inuit households, but also on aquatic ecosystems. However, very little information is available on the winter ecology of lakes and only 2% of peer-reviewed freshwater literature includes under-ice lake processes. Considering that the ice cover period on lakes and rivers around the world is decreasing every year, it is clear that there is an urgent need for research on ice ecosystems in order to be able to make accurate predictions about the impacts of ice cover loss on the ecology and functioning of lakes. In this study, we sampled 6 Arctic lakes in Kitimeok Region near Iqaluktuuttiaq (Cambridge Bay, Nunavut, Canada) in early (October-November 2017) and late winter (April-June 2018) to characterize the composition of lake ice in terms of nutrients, carbon and algae. We found that ice contained substantial concentrations of inorganic nutrients and carbon. Compared to the high biomass of ice algae present in sea ice, the lake ice algae were less abundant but taxonomically diverse. Our results also suggest that because of the large proportion of lake volume that ice occupies in late winter, the storage of nutrients and carbon, and the inoculum of algae it contains have an underestimated role in stimulating spring and summer production in Arctic lakes ecosystems. This study demonstrates that we currently underestimate the role of freshwater ice in aquatic ecosystems and that studying Arctic lake ice is necessary to predict the effects of global warming on these fragile ecosystems.

DETERMINING THE ENERGETIC CONSEQUENCES OF TERRESTRIAL FORAGING ON SEADUCK EGGS IN AN APEX MARINE PREDATOR, THE POLAR BEAR

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The decreasing spatial and temporal extent of Arctic sea-ice is the greatest threat to polar bears' continued persistence in the wild. Sea-ice is critical for polar bears to hunt their main prey (seals), and the lengthening 'ice-free periods' are forcing polar bears to spend more time in coastal terrestrial environments. The onshore migration of polar bears has now aligned with many bird species' breeding schedules and polar bears are increasingly foraging on eggs in lieu of ice-based hunting. Using unmanned aircraft vehicles (UAVs), we recorded 22 hours of polar bears foraging on common eider eggs and deployed 33 trail video cameras on East Bay Island (Northern Hudson Bay) during the summers of 2016-2018. Using these data, we examined variation in individual polar bear foraging behaviours and estimated associated energy budgets, to gain a better understanding of the energetic consequences of this novel foraging behaviour. By coupling energy budgets with variable behavioural modes, this study provides an energetic quantification of polar bear terrestrial foraging ecology as the resultant effect of sea-ice loss.

DO BIOTIC INTERACTIONS INFORM THE SPATIAL DISTRIBUTION OF COEXISTING UNGULATES IN THE CANADIAN ARCTIC ARCHIPELAGO?

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The longstanding quest to understand species' geographic and ecological distributions has become urgent with global declines in wildlife and their habitat. In response, modelling the distribution of species has emerged as a fundamental conservation tool. Yet predictions from these models, under current or future conditions, are often based on environmental variables alone (e.g. temperature, precipitation); they overlook fundamental biotic interactions (e.g. competition, predation) that can shape a species range. Using caribou and muskoxen as study species, we are applying a multi-species, multi-scale approach to build species distribution models, to determine niche dimensions, and to test for competitive interactions between these two large herbivores. Specifically, we are using maximum entropy models (Maxent) to couple extensive observations of animals and their sign from systematic and opportunistic winter surveys (across a vast High Arctic area of almost 800,000 km2; 2000-2008) with a suite of land cover, topographic, and climate variables putatively related to the distribution of each species. To evaluate caribou-muskoxen interactions, we are comparing the large-scale fundamental niche of each species to their realized niches on individual islands, where they occur singularly or in sympatry. Our results demonstrate how both biotic and abiotic features can shape a species range and ultimately influence conservation planning.

HARVEST STUDY: HARVEST TRIP PATTERNS IN GJOA HAVEN, NUNAVUT

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The purpose of this study is to explore harvest practices in Gjoa Haven and the Gjoa Haven hunting and fishing grounds in relation to fish and other harvest species, sustainable co-management and food security. The objectives of the harvest study are: • To get a better idea about harvest locations and to identify potential overlaps with commercial fisheries; • to investigate the costs and benefits of fishing efforts; • to strengthen food security with potential inputs in a revised Nutrition North programme • to explore how animals and fish species are co-harvested; • to assess how different harvested species are shared within the community; • to assist in the potential design and implementation of a co-management strategy, specifically to identify the potential tradeoffs between food security and commercial harvest in the region and; • to investigate the relationship between employment and harvest practices. The harvest trip survey is conducted with the help of tracking devices employed by hunters as they harvest throughout the different seasons allowing for GPS tracking data. Hunters carry inReach devices set to tracking mode to record hunting paths. The devices are also be set up to enable quick messages that hunters can use to record sightings and kills of harvested species. Importantly, these tracks will be used in combination with the detailed trip surveys to allow for the incorporation of both the tracking data and traditional knowledge reported for each trip upon its completion. Additionally, this will also allow us to test how accurate different tracking systems are at recording harvest patterns, and how much value they add for safety and communication purposes. Funded by Polar Knowledge Canada, the harvest trip survey launched in April 2017, and is now in its second year. In addition to the tracking device results, each community hunter who has signed out a device has also submitted a registration survey. This survey provides additional details independent of specific trip data, such as: number of hunting trips per season, number of hunting trips per mode of transportation, costs associated with hunting trips, food sharing habits, etc. This poster will present results and interpretations from both the harvest trip survey and registration survey, as well as a brief overview of the process.

THE NEED FOR COMMUNITY-LED, INTEGRATED, AND INNOVATIVE MONITORING PROGRAMS WHEN RESPONDING TO THE HEALTH IMPACTS OF CLIMATE CHANGE

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In Northern Canada, the environment is undergoing a multitude of changes as a result of climate change, with many acute and interrelated health and environmental impacts experienced among Inuit populations. Community-based monitoring, in which community members participate in monitoring initiatives using various forms of technology, is a key strategy increasingly used to detect, monitor, and respond to climate change impacts. To better understand the landscape of existing environmental and health monitoring programs mobilizing different technologies and operating in the North, we conducted a review that used environmental scan methodologies to explore and contextualize these programs. We consulted with academic researchers with experience in community-led monitoring in the North, conducted systematic searches of grey and peer-reviewed literature, and conducted a secondary search for environment and health mobile-phone applications. Following specific criteria, we identified 18 monitoring programs using information and communication technologies in the North, and three global monitoring mobile-phone applications, which cumulatively monitored 74 environment and health indicators, which were synthesized to fit within nine overarching categories: atmosphere, aquatic environments, cryosphere, marine ecology, wildlife ecology, plant ecology, contaminants, and human and built environment. Several critical themes emerged across programs, including the need for: 1) community leadership, 2) indicators of both environment and/or human health, and 3) innovative technology. By identifying and discussing the implications of these gaps, this synthesis supports the development of community-led, environment-health monitoring programs that use innovative technology to monitor and share information related to the health implications of climate change in and around Indigenous communities throughout the Circumpolar North.

NUNATUKAVUT'S COMMUNITY-BASED CLIMATE MONITORING PROGRAM

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Oriented around the seven key climate indictors mentioned below, NunatuKavut Community Council (NCC), the governing body for the people in NunatuKavut, the territory of the southern Inuit people of Labrador (approximate population, 6,000), has designed a community-based climate monitoring project that will be community-led, community-driven, and will engage community youth, elders as well as adults who currently spend significant time out on the land for activities such as hunting, fishing and berry- and plant-gathering. At the same time, the Project's multi-track design will facilitate intergenerational transfer of knowledge and help build youth skills. Specifically, the Project aims to gather and increase both Indigenous Knowledge and "mainstream" scientific data on our chosen climate indicators, primarily in five NunatuKavut communities in southern Labrador. The key climate indicators to be monitored through NunatuKavut's community-based climate monitoring program will include, at a minimum, the following: 1) sea ice; 2) freshwater ice; 3) water temperature (freshwater); 4) sea level; 5) freshwater level; 6) invasive species (primarily aquatic); and 7) health and seasonal timing of plants. Knowledge and data will be collected via three tracks: the Youth Direct Ice and Water Monitoring Track, the Elder Climate Knowledge Track, and the "Out on the Land" Track, for collecting observations from active Community adults. While the first track is specifically designed to provide youth with skills and climate knowledge, youth will also be involved in the other two tracks as observers and assistants to NCC staff, in ways that will increase opportunities for intergenerational transfer of knowledge as well as build skills.

STUCKBERRY VALLEY LAKES: SENTINELS OF ENVIRONMENTAL CHANGE AT CANADA'S EXTREME NORTHERN LIMIT

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Despite being at the northernmost fringe of land on Earth, the northwest coast of Ellesmere Island is a highly dynamic region at the interface of the Canadian Arctic Archipelago and the Arctic Ocean ice pack. The region contains a variety of aquatic ecosystem types, including fiords, meromictic lakes, epishelf lakes, and supraglacial meltwater ponds. Many such ecosystem types exist at the climatic limits of their viability and when environmental thresholds are crossed they are often manifest as ecosystem regime changes. The region has seen important Holocene climate variability, however little is known about the history of ice shelves or sea ice prior to the late 19th Century. This information is critical for assessing the recent degradation of coastal ice in the context of long-term natural variability. Eight km to the west of Clements Markham Inlet, Stuckberry Valley (82° 54' N, 66° 56' W) ascends from the ocean to encompass a series of four unnamed lakes, the last of which is situated 56 m asl. The marine limit in this region was 124 m asl and these lakes were thus submerged sea floor depressions when glaciomarine environments appeared following glacial retreat ~11.4 cal ka BP. Isostatic uplift later sequentially separated the lakes from the ocean. To our knowledge, it is the only chain of coastal lakes spanning such an altitudinal gradient on the northern coast of Ellesmere Island. With their different time spans in isolation, these lakes present a unique opportunity to reconstruct past sea ice cover and to evaluate natural climate variability. In summer 2017, we sampled sediments of four lakes which were previously completely unexplored. Here we present preliminary results from our project, a multidisciplinary study that seeks to understand the ecology and history of these lakes through studies of photosynthetic pigments, hyperspectral imaging spectroscopy, Micro XRF and paleomagnetic analyses.

GOING AGAINST THE FLOW: ICE DRIFT AND POLAR BEAR MOVEMENT IN HUDSON BAY

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Animals that live in dynamic habitats face unique energetic challenges, as movement with or against the environment may be necessary and therefore the velocity of the medium may affect the energy expenditure of the individual. Sea ice is dynamic as it is drifts due to wind and water currents. Drift speeds in much of the Arctic have been increasing due to climate-induced changes, which may present challenges for sea ice specialists. Polar bears (Ursus maritimus) move against ice drift in high Arctic seas, and in recent years, the increasing drift rates have been linked to increased energetic demands. However, this has not been evaluated in a low-latitude ecosystem; our study is the first to do and examine the western Hudson Bay population, which has declined by approximately 30%. Decreases in body condition and survival have been linked to an increased ice-free season and decreased foraging opportunities. The possible effects of changing ice drift on energy expenditure has never been assessed in this population. We examined spatial ice drift patterns, as well as trends in ice drift speeds across months (November – July) and across years (1987-2016). Variable environments can pose additional challenges for species that must predict the outcomes of space-use decisions based on environmental factors and therefore, to assess the impact of environmental variability, we calculated coefficients of variation for each gridded ice drift location, each month, and each year, as well as assessing a trend in this variation from 1987 – 2016. We linked ice drift vectors to polar bear movement vectors from GPS-collared adult females to assess for any counter-ice drift movement. Our results indicate a spatial trend in ice drift, with slower ice drift near the coast, and the strength of this relationship varied monthly. We also found a within-year trend of decreasing drift from November – July, a decrease in ice drift from 1987 – 2016, and an increase in ice drift variability over time. Generally, bears moved perpendicular to ice drift in November and December, opposite drift in January – March, but patterns became negligible as bear movement became highly dispersed in April – July. Although there is some counter-ice movement in certain months, lack of a long-term increase in ice drift suggests this may not have contributed to the body decline of the population as a whole.

WHERE ARE YOU? PRECISE POSITIONING SERVICES FOR THE ARCTIC

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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 Artic. 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 Artic.

ASSESSING THE LOCAL NATURE OF ARCTIC NEARSHORE ENVIRONMENTS USING BIO-OPTICAL PARAMETERS. A CASE STUDY FROM HERSCHEL ISLAND, WESTERN CANADIAN ARCTIC

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The Arctic is subject to substantial changes due to the greenhouse gas induced climate change. While impacts on lateral transport pathways such as rivers have been extensively studied yet, there is little knowledge about ecological and geological reactions of nearshore environments, even though those are of high importance for native communities. Here we present an extensive dataset of bio-optical parameters collected in the nearshore zone of Herschel Island, western Canadian Arctic in summer 2018, containing suspended particulate matter concentration (SPM), turbidity, sea surface temperature (SST) and the water leaving reflectance (RRS). Our results clearly indicate that recently published bio-optical models using validation data from the Canadian Beaufort Shelf are not able to reflect the local nature of Herschel Islands nearshore environment and strongly underestimate reality. Accurate bio-optical models of Arctic nearshore environments are necessary to enhance the knowledge of Arctic marine dynamics and recently published bio-optical models need an adjustment.

PREVALENCE, DISTRIBUTION, DIVERSITY, AND IMPROVED DIAGNOSTICS FOR ZOONOTIC ECHINOCOCCUS SPP. IN THE CANADIAN NORTH

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Wild canids (foxes, wolves, coyotes) are essential parts of a balanced ecosystem especially in Northern Canada. These animals serve as reservoirs or definitive hosts to zoonotic helminth parasites like Echinococcus multilocularis and E. canadensis. Increasingly, climate change affects the life cycle and distribution of both hosts and parasites in the North, creating a need for baseline knowledge of the prevalence of parasites and for improved diagnostic tools. In this study, wild canids (184 foxes, 23 wolves, and 77 coyotes) from Quebec, the Yukon (39 red foxes, 9 Coyotes, 38 Wolves,) and the Northwest Territories (39 Arctic foxes) were examined for the presence of Echinococcus spp. using the sedimentation, filtration and counting technique (SFCT), considered the gold standard for wildlife surveillance. A multiplex polymerase chain reaction (PCR) was used to determine the species of 3-10 individual Echinococcus worms in each positive animal. We also tested fecal material from canids to evaluate the performance of centrifugal flotation for helminth eggs, which is the most common technique in veterinary diagnostics, and a newly developed point of care coproPCR test kit. Overall prevalence of Echinococcus spp was 13% (54/409) wild canids of Canadian North. Echinococcus multilocularis was detected in Arctic foxes from Banks Island and Victoria Island of the Northwest Territories (NT), at a prevalence of 26%. E. canadensis was found in 71% of Yukon wolves, 35% of Quebec wolves, and 12% of Quebec coyotes. The outcome of this work, so far, has revealed that Victoria Island NT is a new geographic record for E. multilocularis, and higher prevalence for E. multilocularis in Arctic fox in the NT and E. canadensis in wolves in the Yukon compared to QC and to previous studies. Parasite genotyping results will be presented, as there may be differences in pathogenicity for people between G8 and G10 strains of E. canadensis, and European and North American strains of E. multilocularis. We also demonstrate that a new fecal PCR for tapeworm has substantially higher sensitivity than fecal flotation, which has promising implication for use in wildlife surveillance and veterinary clinics and diagnostic laboratories, along with ease of use by inexperienced evaluators.

ABORIGINAL LIAISON PROGRAM AT STATISTICS CANADA

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The Aboriginal Liaison Program serves as a bridge between Statistics Canada and Inuit communities and Inuit organizations. Some our program objectives include working in partnership with First Nations, Métis, and Inuit communities and organizations to build strong relationships, increase understanding and access to our data sources for decision-making and community planning activities; build statistical capacity of Aboriginal peoples and organizations; liaise with communities and organizations on Statistics Canada surveys and other important initiatives. In particular, this presentation will give an overview of the program and showcase how to find data on the Statistics Canada website. This presentation will give an overview on Inuit data at the territorial and community level; data distribution to Inuit governments, organizations and communities; data and information request support through personal consultations; networking that leads to establishing durable and meaningful relationships. We aim to improve outreach to client groups such as Inuit communities through statistical capacity building.

DEVELOPING A LOW-COST DIY UNMANNED-AERIAL-VEHICLE (UAV) FOR ARCTIC SNOW AND ICE MONITORING

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Snow is highly variable both spatially and temporally, and established procedures for retrieving snow depth usually lack high resolution or do not cover an extended area. UAV-technology is developing rapidly and, for snow science, it has the great advantage of covering a large area in a short period of time, which allows for multiple deployments on a single day. High spatial resolution snow information in regions where data is scarce will help improve our empirical understanding of the various processes governing snow spatial and temporal variability. Although the use of UAV technology has shown promising results, arctic UAV monitoring has remained virtually non-existent due to complications of automated flying in proximity to the magnetic north pole, harsh climatic conditions and prohibitive costs of running a UAV program. Our U Sherbrooke group is developing a Do-It-Yourself (DIY) approach that allows for an aircraft specifically designed for the desired task that can be easily repaired and/or modified during field campaigns. The cost is less than $1,000 USD, which is comparable to low-end, off-the-shelf UAVs. We have designed and tested various fully-GPS flying platforms (fixed-wings, quad-copters) that will enable automated flight plans. Flights were conducted near Cambridge Bay, Nunavut, Canada, at 69° 7' N and 105° 3' W in the winter and summer of 2018. The main deployments have been near the northwestern shore of Greiner Lake in the Intensive Monitoring Area (IMA) of the Canadian High Arctic Research Station (CHARS), with other deployments over nearby sea ice. First flights have shown that a small UAV can work in arctic conditions. Battery-life has not been an issue, even in temperatures below -30°C. The UAV was flown with a heavy payload using GPS navigation in winds up to 10 m/s. The UAVs we have developed can fly in even higher wind speeds, although the autopilot is then necessary to keep a specific flight pattern. To support our own snow-related work, and for use by our partners for other research and monitoring applications, we are continuing to develop affordable UAVs that meet the key challenges presented in the Arctic – compass-based navigation, short battery life at low temperatures, and consistently high winds.

THE HUDSON BAY INTEGRATED REGIONAL IMPACT STUDY (IRIS) AND FUTURE RESEARCH PERSPECTIVES

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The Greater Hudson Bay Marine Region, comprising Hudson Bay, James Bay, Foxe Basin, Hudson Strait and Ungava Bay, is the largest inland sea in the world to experience a seasonal sea-ice cover. A massive amount of freshwater enters the Marine Region from its large watershed, which covers a third of the Canadian landmass. Its ecosystems are broad and varied, with both year-round presence and seasonal abundances of fish, birds, and marine mammals. There are forty coastal communities, mostly Inuit and Cree, who have depended on the waters and icescapes for their food, culture, mobility, and livelihoods for millennia. The significance of environmental change in the Marine Region is thus most profound for these people; yet the results of scientific studies have not been widely disseminated outside academia nor influential with regard to policy. Inuit and Cree priorities such as changes in coastal sea ice affecting safety of travel have escaped scientific agendas. We have recently completed the ArcticNet Integrated Regional Impact Study (IRIS) for the Greater Hudson Bay Marine Region. The IRIS report incorporates results from scientific studies, published compilations of traditional knowledge, insights of Inuit and Cree represented through the IRIS steering committee, input from community meetings at which components of the IRIS were presented, and comments from a variety of stakeholders who contributed to the editorial team. The goal of this document was to provide relevant and practical information for regional decision-makers in an accessible format. In this presentation, we will summarize the process, which was an example of cooperation among the regional, national and local partners and academics. We will give a short overview of the topics addressed in the report and the key recommendations that have emerged, including perspectives on future research priorities.

A SIGNIFICANT DIETARY SOURCE OF LEAD TO NUNAVIK INUIT: PTARMIGAN HUNTING.

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Despite the ban of lead pellets in shotgun cartridges used in Nunavik, blood lead concentrations in Nunavik Inuit remain higher than that in southern populations. Lead exposure sources have not been fully identified in the region. Many thousands of ptarmigans are being harvested for food in each Nunavik community for as long as eight to ten months yearly. Ptarmigan are one of the most widely consumed traditional foods in the fall through spring period in the region. Ptarmigans are harvested almost exclusively by using small calibre (0.22 cal.) rifle bullets with lead projectiles. Lead concentration in ptarmigans is extremely low. However, lead fragments from lead projectiles used in small calibre rifles for harvesting ptarmigans in Nunavik can significantly increase the lead concentration in the edible parts of the bird. The geometric mean lead concentration in 180 samples of edible parts from 36 ptarmigans is 1.90 μg /g w.w. which is 19 times above the European Union Maximum Level (0.1 μg /g w.w.) for commercial meat destined for human consumption; or 3.8 times the Canadian lead residue guideline for fish protein (0.5 μg /g w.w.) Consumption of more than three ptarmigans per week by an adult might exceed the Provisional Tolerable Weekly Intake (PTWI) for lead (25 μg /kg body weight/ week for both adults and children) set by the World Health Organization. It might take no more than two birds per week for children to exceed the PTWI because of their smaller sizes. In view of the large quantities of ptarmigans consumed in all Nunavik communities, ptarmigan hunting is a very significant dietary source of lead to Nunavik Inuit.

SPATIAL AND TEMPORAL VARIABILITY IN DISSOLVED ORGANIC MATTER COMPOSITION IN THE LABRADOR SEA

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Dissolved organic matter (DOM) is a complex mixture of different substrates that fuels microbial secondary production. However, the factors that influence its chemical composition and therefore its bioavailability are multifold, and typically poorly understood. Here we looked at the seasonal and spatial variability of dissolved organic matter (DOM) quantity and chemical composition in the Labrador Sea. Dissolved organic carbon (DOC), fluorescent DOM (FDOM), and dissolved amino acids were measured across three different water masses during the same week in three different years during the spring. There was a marked difference in the average DOC concentrations among years. Concentration ranged from an average of 73 .1μM in 2016 to 108.9 μM in 2015. Patterns were linked to the onset of stratification and the timing of the spring bloom. There was a particularly large phaeocystis poutcheti bloom that covered almost the entire central basin as well as the Greenland side in 2015, whereas in 2016 conditions were more typical. FDOM, measured using parallel factor (PARAFAC) analysis, varied considerably across sites, particularly within the humic acids peaks (peak “M”, “AC” and “M2”) which had higher relative concentrations on the Greenland side. There was no clear pattern with the other three peaks typically associated with fresh production (peak “T”, “B” and “phyto”), and no relationship between chlorophyll a concentrations nor primary production with these fluorescent components. Although DOC concentrations changed among years, fluorescent components were rather stable. DOC concentrations were well correlated with the development of the bloom, suggesting a buildup of organic carbon reflected in the “AC” humic acid component only. Amino acids varied considerably, but patterns were unclear. The high variability in the DOC concentration is apparently linked to bloom conditions, however the FDOM composition in both space and time appear to be linked better with freshwaters coming from the Greenland melt since we observe low relative concentrations freshly produced DOC (peak “T”, “B” and “phyto”). This DOM source is likely rapidly consumed by bacteria and as a consequence likely does not accumulate in the water.

A SIMPLE METHOD TO RETRIEVE VISIBLE ALBEDO WITH MODIS OVER SEA ICE

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Arctic marine ecosystems are fueled by the production of algal biomass. While the growth of phytoplankton (single-celled algae suspended in seawater) was believed to be largely limited to the period when Arctic Ocean seasonal ice cover was decreasing (Jul-Oct), massive blooms of phytoplankton occurring under sea ice in the spring were recently documented. It is currently impossible to determine the extent of this phenomenon and its contribution, perhaps major, to annual marine primary production, as the mechanisms controlling the dynamics of phytoplankton blooms under sea ice are not well understood. Recent observations suggest that phytoplankton growth under sea ice is largely conditioned by access to underwater light, which is predominantly determined by the surface albedo at the local scale. Therefore, it is critical to have an estimate of the surface albedo, the ratio of how much light the surface reflects in comparison to how much impinges on it. Combining MODIS-Aqua and -Terra sweeps across the viewing hemisphere regularly provides up to 13 daily observations of a coastal Baffin Bay location where many environmental components were measured during the Green Edge 2015 and 2016 field campaigns. To retrieve the area-averaged seasonal evolution of visible albedo from winter conditions (beginning of May ~ - 8°C) to ice break up (mid-July ~ +10°C) for the years 2015 and 2016, we use the daily surface reflectance products at 500m spatial resolution. Directional satellite surface reflectance is linked to albedo by surface anisotropy. A collection of multi-angle observations may be sufficient to capture the anisotropy of the cryosphere.

RED FOXES AS ECOSYSTEM ENGINEERS: IMPACTS OF DENNING ON SUBARCTIC FLORA

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Terrestrial predators are well known for their roles in controlling herbivore populations, thereby preventing the overconsumption of vegetation. Yet predators are also important vectors for nutrients by depositing feces, urine and prey remains. Redistributing nutrients may alter plant growth, thereby creating or modifying existing habitats. Added nutrients (specifically nitrogen and phosphorus) may be especially important in areas with already low nutrient concentrations and primary productivity, such as in the Subarctic. Red foxes (Vulpes vulpes), a top predator in the Subarctic, occupy dens to rear pups during the breeding season. Red fox dens can persist in the landscape for decades, being reused over several years by solitary or breeding individuals. As a result, these dens could serve as potential hotspots of nutrients due to the accumulation of prey remains and excretions. Despite occupying the largest distribution of all carnivores, little is known about how red foxes affect ecosystems, including how denning influences plant communities. The objective of this study was to examine red fox dens at the taiga-tundra transition zone in the Subarctic near Churchill, Manitoba. We examined concentrations of inorganic nitrogen (ammonium and nitrate) and extractable phosphates in soil samples from red fox dens and paired control sites. We also compared vegetation by quantifying all plant species in five 1-m2 quadrats on dens and paired control sites. Dens were mainly dominated by erect shrubs, specifically tall willows (Salix sp.; percent cover = 25.16 ± 4.73%), which is uncommon on control sites (percent cover = 2.93 ± 1.93%). In contrast, control sites were dominated by black crowberry (Empetrum nigrum; percent cover = 27.30 ± 4.99 %), a prostrate shrub that is also found on dens but at a lower percent cover (11.44 ± 3.58 %). Furthermore, stem density from erect shrubs and trees (e.g. Salix sp. Betula glandulosa, Picea glauca, Larix laricina, and Juniperus communis) was higher on dens (7.81 ± 2.53) compared to control sites (1.48 ± 2.16). Red fox dens, therefore, have plant communities that are distinct from surrounding vegetation. Warmer climates are already resulting in notable changes to vegetation at the Arctic's edge, such as increased primary productivity and advancing tree line onto the tundra. Additional nutrients by red foxes may exacerbate existing changes to northern ecosystems by also influencing plant diversity and growth. Although the effects of denning on vegetation may appear within a few years, the effects can persist for decades, creating long-term changes in northern plant communities.

OPERATIONAL CONSIDERATIONS OF UNMANNED AERIAL VEHICLE (UAV)-BASED APPROACHES FOR MAPPING SNOW AND SEA ICE HABITAT PROPERTIES

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The logistical difficulties of polar research in ice-covered regions have resulted in spatial and temporal knowledge gaps of key physical and biological processes. Airborne and satellite-based approaches to remotely map the marine environment provide synoptic observations at regional to basin-wide scales, which have been crucial for our current understanding of climate change impacts. This large spatial coverage typically comes at the expense of better spatial resolution. Bridging the gap between ground-based local measurements and larger-scale airborne or satellite-based surveys is required to resolve the appropriate scales of variability on the order of 100s to 1000s of meters. However, ground-based operations in polar regions can be unsafe, logistically demanding and unfeasible. With the rapid advances in Unmanned Aerial Vehicle (UAV) technologies and the increased affordability that comes with widespread usage and application, UAVs have become an obvious choice for research applications to improve the spatial coverage observations in polar environments. UAV operations, however, are not without limitations and uncertainties. Identifying and addressing these limitations and uncertainties are the first steps to developing best practices and standard methodologies to ensure consistency and inter-comparability of scientific results. Here, we present a case study of UAV surveys conducted on landfast first-year sea ice and multi-year sea ice in the Lincoln Sea, as part of the Multidisciplinary Arctic Program (MAP) – Last Ice. We deployed an Indro Robotics M210C RTK model quad-copter style UAV. The UAV was flown in systematic overlapping grids (~400 x 400 m), with visible (DJI Zenmuse X5S), thermal infrared (DJI Zenmuse XT Flir) and multi-spectral cameras (MicaSense RedEdge). Our operations were limited by weather to only 3 survey days. Preliminary analyses of visible and multispectral imagery indicate that lighting conditions (e.g., clear sky vs overcast) had large impact on data quality, specifically for the development of digital surface models and stitching of imagery. Based on our results, we provide some insights into what is required for operations from a logistical stand-point, in addition to suggestions on deployment protocols specifically for mapping of sea ice habitats with these type of sensors. We conclude by providing some potential future applications of the UAV system for sea ice and marine habitat mapping.

IMPACTS OF THE INUVIK TO TUKTOYAKTUK HIGHWAY ON SURFACE WATER IN HIGH-CENTRED POLYGONAL TERRAIN.

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High-centred polygonal terrain is a form of patterned ground characterized by raised polygon-centres surrounded by a network of low-lying troughs. Wedge ice underlying polygon troughs makes this terrain type highly sensitive to disturbance (seismic lines, tundra fires, roads, etc.). In the Tuktoyaktuk Coastlands high-centered polygonal terrain is associated with organic deposits commonly found in poorly drained low-lying areas and covers approximately 13% of the landscape. In this study we investigated the impact of the Inuvik to Tuktoyaktuk highway on surface water in high-centred polygonal terrain adjacent to the gravel embankment. To compare changes in the area of surface water in areas of polygonal terrain: 1) adjacent to and 2) more than 500 m from the right of way, we used air photos (2012) and Worldview-3 imagery (2017) to manually delineate the cover of surface water. Changes in surface water along the entire highway corridor were also mapped within a 100m buffer using image segmentation, interactive thresholding, and differencing of satellite images from 2005 (Quickbird) and 2017 (WorldView3). In the summer of 2018, we also visited 24 roadside sites to measure soil moisture and topography. At eight of these locations we conducted unmanned aerial vehicle (UAV) surveys to characterize topography at a broader scale. Mapping showed that increases in pond area were more common at roadside sites, where the rate of increase was double the rate at sites more than 500 m from the road. Field surveys showed large increases in soil moisture in polygon centers at roadside sites impacted by pond expansion and preliminary analysis of our topographic data suggests that increased ponding has been caused by: 1) impoundment, and 2) increased surface water flow from culverts. The effects of increased moisture on near-surface permafrost conditions, and potential for terrain subsidence, highlight the importance of long-term monitoring adjacent to this important transportation corridor.

SCIENCE SOVEREIGNTY THROUGH KNOWLEDGE-SHARING SUMMER CAMPS: LEARNING FROM THE LABRADOR LANDS AND WATERS SCIENCE CAMP

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Through on-going work and partnerships with Innu and Inuit leaders, governments, and organizations, in addition to work with community and educational organizations, it has been identified that Indigenous and Northern youth in Labrador do not have enough access to diverse science learning. As a result, many students in Labrador are not pursuing science-based pathways in education or careers. Driven by the goal of supporting Indigenous, Northern, and Labrador youth to purse science-based educational pathways, and to support the next generation of Indigenous scientists, the Labrador Institute of Memorial University partnered with the Nunatsiavut Government, the NunatuKavut Community Council, the Innu Nation, and the Torngat Wildlife, Plants and Fisheries Secretariat to design a week-long summer science camp for youth entering into grades 9 to 11. The Labrador Lands and Waters camp offered a hands-on integrated science training experience, mobilizing multiple scientific learning lenses. Modules were co-developed by Indigenous knowledge keepers, Indigenous scientists, and researchers, and were designed to provide hands-on learning in plant ecology, geology and minerals, water and land interactions, geospatial science and technology, archaeology and cultural resource management, fish and fisheries, wildlife and traditional ecological knowledge. The Labrador Lands and Waters Science Camp's overall programmatic objectives were to: (1) develop a camp that inspires and enables local and Indigenous youth to explore future science pathways; (2) offer an applied learning experience by using interdisciplinary programming focused on Labrador-based research and associated hands-on activities and training; (3) provide a dynamic knowledge-sharing environment by integrating learning strategies that include elements such as Indigenous history, culture and pedagogies; and (4) include the expertise of partnering organizations and local and regional experts to ensure a meaningful development and delivery of the program. By the end of the inaugural camp, 16 youth from throughout Labrador had the opportunity to gain experience in basic laboratory skills, field investigative techniques, transferable technological skills that can be applied to various STEM fields, and integrating multiple scientific learning lenses by incorporating Two-Eyed Seeing and Western Science pedagogies to their learning. This presentation will share the development, design and delivery of the Labrador Lands and Waters Science Camp. The discussion will highlight the importance of ensuring youth in remote and Northern locations have access to meaningful STEM programming that reflects and builds from their natural environment, incorporates and values their cultural knowledge and experiences, connects them with positive science role models to support their educational goals, and develops capacities among Northern and Indigenous populations for science leadership.

FORAGING BEHAVIOR PLASTICITY DURING THE BREEDING SEASON IN AN ARCTIC SEABIRD: THE THICK-BILLED MURRE

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Breeding seasons are typically energetically demanding for parents. For some species which are breeding in colonies (central place foragers), reproduction has an additional cost: commuting. Because of the increased competition and the local depletion of resources around the colony, foraging gets harder and forces individuals to forage further as time goes on (Ashmole's halo theory). Seabirds, tend to adapt to long commuting by fasting: one parent forages for up to a couple of days while the other one takes care of the offspring at the colony and fasts. Effort reaches its maximum during chick-rearing, when parents also have to feed their chicks and therefore carry food when commuting. In that regard, thick-billed murres (Uria lomvia) seem doubly handicapped: 1) they are constrained to only carry one prey item to their chick per foraging trip and 2) they have the highest recorded flight cost in vertebrates, which makes the commuting flights very expensive. Yet, despite impressive constraints, thick-billed murres are performing extended foraging trips (up to 300 km away from their colonies, for up to three days), with a lot of inter-individual variability. These birds being adapted to the Arctic climate, we could assume that warmer conditions would negatively impact the birds' ability to forage, mostly by affecting prey availability. In this study, we propose to investigate how murres adapt to varying environmental conditions during via foraging behavior, energy expenditure and physiological state (which groups proxies for stress, fasting and energetic condition). 251 GPS units were deployed on sexed, weighted and measured birds on the colony of Digges islands between 2014 and 2016, with 2015 being a significantly colder year. 106 of these birds were also bled before and after the GPS deployment to get corticosterone, beta-hydroxybutyrate, and triglycerides. After analysis of GPS data, we correlate six key foraging parameters with physiological state, mass and energy expenditure estimated using previous doubly-labeled water measurements. Impact of breeding stage is also considered. The goal is to develop a general model which can predict the impact of climate on foraging effort via foraging behavior plasticity.

DARING CROSSING OR CAUTIOUS DETOUR? CONTRASTING TRANSATLANTIC MIGRATION STRATEGIES IN A SMALL MIGRATORY BIRD BREEDING IN THE CANADIAN ARCTIC AND WINTERING IN AFRICA

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Ecological barriers such as oceans, mountain ranges or glaciers can have a substantial influence on the evolution of animal migration. Along the migration flyway connecting breeding sites in the North American Arctic and wintering grounds in Europe or Africa, Nearctic bird species are confronted with significant barriers such as the Atlantic Ocean and the Greenland icecap. Using geolocation devices, we identified wintering areas used by Ringed Plovers (Charadrius hiaticula) nesting in the Canadian High-Arctic and investigated migration strategies used by these small Nearctic migrants (60g) along the transatlantic migration route. The main wintering area of the Ringed Plovers was located in Western Africa. We found contrasting seasonal migration strategies, with Ringed Plovers minimizing continuous flight distances over the ocean in spring by making a detour to stop in Iceland. In autumn, however, most individuals crossed the ocean in one direct flight from Southern Greenland to Western Europe, as far as Southern Spain. Moreover, the plovers we tracked largely circumvented the Greenland icecap in autumn, but in spring, some plovers apparently crossed the icecap where it reaches over 2 500 km in height. We explored factors behind such contrasting seasonal strategies along this peculiar migration route. Our study highlighted the importance of Iceland as a stepping-stone during the spring migration and showed that small Nearctic migrants can perform non-stop flights over the ocean from Greenland to Southern Europe, a distance of > 3 500 km.

PELAGIC ECOSYSTEM PRODUCTIVITY AND THE RECRUITMENT OF JUVENILE POLAR COD BOREOGADUS SAIDA IN CANADIAN ARCTIC SEAS

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Arctic cod (Boreogadus saida) is the most abundant pelagic fish in Arctic seas and a staple food for arctic predators. Strongly linked to environmental conditions, Arctic cod recruitment is expected to be greatly influenced by climate warming. The North Water (NOW) polynya is an area of open waters historically considered as one of the most productive regions of the Arctic Ocean where fish, marine mammals and seabirds thrive. In this study, we first investigated the role of ecosystem productivity in Arctic cod recruitment. We tested the hypothesis that an earlier ice breakup hastens the timing of the phytoplankton bloom and enhances primary and secondary (mesozooplankton) production over the summer in different regions of the Canadian Arctic. We also investigated the importance of the NOW polynya in Arctic cod recruitment by comparing its ecosystem productivity to other regions of the Canadian Arctic. Earlier ice breakup resulted in earlier phytoplankton bloom and higher ecosystem productivity (remotely sensed primary production, mesozooplankton density and age-0 Arctic cod biomass estimated with hydroacoustics) in summer measured over 11 years in 10 regions of the Canadian Arctic. Mesozooplankton density was the main determinant of Arctic cod recruitment, which indicates that both warm temperatures and, mostly, abundant food resource allow age-0 individuals to benefit from an earlier ice breakup and lead to enhanced survival. During the period of the study, the ecosystem productivity in the Beaufort Sea was generally higher than in the North Water polynya, which in turn was higher than in Baffin Bay and the Kitikmeot. We therefore suspect that the NOW polynya is still a biologically productive area for Arctic cod recruitment, but rather more a "warm spot" in the Canadian Arctic than a true hotspot as previously thought.

ESTIMATED PREY REQUIREMENTS OF EASTERN CANADIAN ARCTIC KILLER WHALES (ORCINUS ORCA) IN THE LANCASTER SOUND ECOREGION

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Killer whales (Orcinus orca) have historically been observed in the Canadian Arctic during the ice-free season, and increases in sightings have been documented with decreases in the extent and duration of seasonal sea ice. Climate change and continued warming may result in killer whales undergoing a northern range expansion, occupying higher latitudes for longer periods of time. This may result in increased killer whale predation on local marine mammal prey species (e.g., bowhead whales, beluga whales, narwhals, and several species of seal). Accounting for the effects of killer whale predation on prey populations of cultural and economic importance to Inuit is necessary for effective stock management. However, our limited understanding of Canadian Arctic killer whale abundance and feeding ecology make it difficult to quantify their effects on the ecosystem. The objectives of this study were to estimate the abundance of killer whales and seasonal narwhal consumption by killer whales in the Lancaster Sound ecoregion of the Canadian Arctic. Photographs collected by researchers and non-scientific personnel (i.e., tour companies, professional photographers, and local harvesters) were analyzed in a capture-mark-recapture framework to estimate abundance. This estimate was used in combination with information on killer whale energetics and Inuit traditional knowledge to estimate seasonal narwhal consumption in the Lancaster Sound ecoregion. Killer whale abundance was estimated to be approximately 100 individuals, which, based on our knowledge of killer whale feeding ecology in this region, would need to consume over 700 narwhal seasonally. This estimate of narwhal consumption exceeds the recommended total allowable landed catch for the narwhal stocks within the Lancaster Sound ecoregion, indicating that it is not unreasonable to assume that killer whale predation on narwhal in this area may have substantial impacts. Narwhal are listed as a species of special concern, and narwhal stocks must therefore be carefully managed. These findings are illustrative of the magnitude of ecosystem changes that can occur with range expansions and/or changes in species distribution as a result of a changing climate.

INDIRECT CONSEQUENCES OF SHRUBIFICATION ON SUMMER FORAGE OF CARIBOU

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A striking consequence of climate change is the densification of the shrub layer in subarctic regions. These shrubs could be seen as an increased amount of available forage for arctic ungulates such as caribou, but we don't know how the quality of the resource will change. By acting as a snow barrier, erected shrubs can increase snow cover during winter, which insulates the soil upper layer and increases nutrients availability by promoting microbial activity. However, in the snow-free period, shrubs could limit the amount of light reaching the ground, resulting in reduced soil temperature and increased soil moisture, thus affecting both shrubs and surrounding plants. Our objective is to determine the effects of increased snow cover and light attenuation by shrubs on the availability of digestible protein for caribou across summer. In 2015, we implemented an experiment simulating conditions induced by increased shrub cover using snow barriers and shading tarps at Deception Bay, Nunavik, within the summer range of the Rivière-aux-Feuilles caribou herd. We estimated plant biomass using point intercepts and localized Normalized Difference Vegetation Index (NDVI) sensors. We harvested plants foliar tissues from July to mid-August and conducted analyses of their chemical composition (nitrogen, carbon, fibres, phenols) and digestibility. Our results will help understanding indirect effects of climate change on caribou habitat and improve management and conservation actions.

WHAT CAN WE LEARN BY COMPARING TEMPORAL TRENDS OF MERCURY ACCUMULATION RECORDED IN ICE CORES AND SEDIMENT CORES FROM THE LAKE HAZEN WATERSHED (NUNAVUT)?

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Mercury (Hg) is a globally-dispersed pollutant that can bioaccumulate and biomagnify in foodwebs with important implications for human health. For example, human exposure to Hg carries an associated socio-economic cost of €8-9 billion annually in EU nations. Although Hg is primarily emitted at lower latitudes, its ability to undergo long-range atmospheric transport can result in contamination of foodwebs in remote and "pristine" regions such as the Arctic, which may pose health risks for Arctic indigenous people that regularly consume traditional country foods. To better predict future exposure risk to mercury in Arctic ecosytems, it is important to understand how atmospheric deposition of Hg to Arctic terrestrial ecosystems is changing in response to changes in anthropogenic Hg emission quantities and source region. Additionally, climate change is likely to impact the delivery of deposited Hg from terrestrial ecosystems to downstream lakes and foodwebs. We will present preliminary data obtained from both ice cores, thought to capture only atmospheric deposition, and sediment cores, which integrate watershed processes, collected from the Lake Hazen watershed (Northern Ellesmere Island, NU) to examine temporal trends in Hg deposition and changes in watershed Hg cycling. By comparing ice core and sediment core data, we will be able to determine how efficiently Hg is transported or retained in the catchment prior to entering downstream lakes, where it can bioaccumulate in fish such as Arctic char, which are an important traditional country food. This data will also shed light on how ongoing climate change, through changes in hydrology (e.g., rates of glacier melt) and sediment transport, can impact contaminant transport and remobilize older legacy mercury previously stored frozen in permafrost and glaciers. Overall, this research will contribute valuable field data to improve computational models of global Hg cycling and better manage contaminant exposure for people and wildlife in the Arctic.

MODELING SNOWMELT RUNOFF AND ANALYSIS OF ITS IMPACT ON GEOCHEMICAL ELEMENTS TRANSPORT IN THE ARCTIC

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In Canada, watershed hydrology and stream hydraulics are strongly influenced by spring snow melt. Snow water equivalent must be estimated with the most precision possible, in particular to improve water resources management and mitigation of associated natural hazards. For Arctic regions, where hydrology is mostly driven by snowmelt, predictions of runoff may lead to a better understanding several phenomena such as isotope transportation within snow cover. This project is under the umbrella of the multi-scale cryosphere monitoring network for the Kitikmeot region and Northwest Territories developed by the GRIMP at the Université de Sherbrooke. The network uses in-situ measurements, modeling and remote sensing. The aim is to understand the distribution of isotopic chemical elements in the snow cover to monitor their transport and the temporal trends during melting snow runoff. Using the SNOWPACK modeling platform, the main objective is to quantify snow depth, water equivalent and the associated runoff. With this information, isotope measurements will be conducted to quantify their influx into the marine environment. Three main study sites will be used for measurement and sampling campaigns. They are located in the Greiner basin near Cambridge Bay (Nunavut), Kugluktuk (Nunavut) and Wekweeti community (NWT). Preliminary results from 3 field campaigns in 2018 suggest a significant correlation between geochemical load and snow depth. Repetitive measurements indicated that snow stratigraphy, more specifically density, are well correlated to geochemical load where dense layers seemed to retain strong negative values. Future work will investigate the effect of sublimation and temperature variability so that the influx of isotopes into the marine system during freshet can be better understood and predicted.

DEVELOPING A NEW OCEAN COLOR ALGORITHM OF THE PAN-ARCTIC OCEAN: A SYNTHETIC APPROACH

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As evidenced by a recent dramatic decrease of sea ice in both area and thickness of the Arctic Ocean (AO), primary production (PP) of the AO is likely increasing, as many remote sensing studies have suggested. It is well acknowledged that chlorophyll a concentration (chl a) is an essential variable for an estimate of PP. However, the performance of chl algorithms for the Arctic Ocean have not been thouroughly evaluated, especially in and around the several large river plumes dominated by CDOM that may significantly bias pan-Arctic primary production estimates. To overcome this issue, we first built a large in situ optical database of high-quality remote sensing reflectance at the Pan-Arctic scale. These data were subsequently used for tuning the original Garver-Seigel-Maritorena model (GSM01) for application to Arctic waters. Within the optical variability observed in natural waters, a bootstrap method was used to examine the performance of an algorithm that requires estimates for parameters including chl a specific absorption coefficients (aph-star), spectral decay constant for colored detrital matter absorption (s_cdm), and the power-law exponent for particle backscattering coefficient (s_bbp). A scoring system proposed by Brewin et al. (2015) was used to objectively determine the best combination of the parameters. Results show that the apparent percent difference of chl a estimates using the Arctic-tuned algorithm improved by 15% relative to the original one. The influence of the new chl a estimates on PP estimate relative to the original ones will be discussed.

OBSERVATIONS OF WAVE DISPERSION UNDER SEA ICE USING SAR IMAGERY AND WAVE BUOYS

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When ocean surface waves encounter sea ice, interactions between the waves and ice occur. Two way interactions may occur: ice may cause waves to refract, shoal or attenuate, while waves may cause the ice to break-up or compress. Understanding the interactions between waves and sea ice is necessary to create accurate wave prediction models, which aid the safety of marine operations. Additionally, feedback mechanisms between waves and ice may have an important influence on the future extent of sea ice. We investigate the effects of sea ice on propagating ocean waves using synthetic aperture radar (SAR) imagery from the TerraSAR-X satellite taken in the Ross Sea in Antarctica, in addition to in-situ buoy data from the same time and location. These observations provide information about changes in the dominant wavelength and direction of waves using spectral analysis as they propagate through ice-covered regions of the ocean. We compare our observations to wave dispersion models which include wave-ice interactions to determine the applicability of different wave-ice models to certain ice conditions.

DAILY OR INTRA-DAILY SEAMLESS SAR MOSAIC PRODUCT OF SEA ICE FOR OPERATIONAL MONITORING

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Space-borne synthetic aperture radar (SAR) satellites, such as RADARSAT-2 and Sentinel-1, are currently the primary data source for operational monitoring and mapping of sea and lake ice at the Canadian Ice Service (CIS). However, the upcoming three-satellite RADARSAT Constellation Mission (RCM) will provide improved capability with enhanced revisit frequency and extended spatial coverage. By the time RCM is operational, the CIS will be receiving hundreds of SAR images daily from various satellites, resulting in a near-complete coverage of the CIS seasonal areas of interest. In order to efficiently use and analyze such a large amount and a wide areal extent of SAR data, daily (or intra-daily) high-quality mosaic products are needed to meet operational requirements. A system to produce these mosaics is being developed and sample mosaic products are being generated using RADARSAT-2 and Sentinel-1 A/B data to simulate the expected data volume and coverage from RCM. Mosaicking SAR image frames or swaths acquired at different times, look directions, observation angles, in different resolutions and beam modes with varying noise floor is a challenge, further complicated by the inclusion of artifacts along the ScanSAR constituent beam edges (i.e. border noises) and scene-to-scene signal and tonal variations. For visual display, analysis, and interpretation, a tone-balanced smooth mosaic is of interest and value to ice analysts and forecasters in displaying the overall ice distribution regionally and in comparing ice conditions across-the-region. To address this, a boundary noise removal algorithm and a scene boundary histogram balancing method have been developed to generate a seamless tone-balanced mosaic product. These mosaic products can also be used as baseline data for CIS weekly regional analysis or for further processing where raw data with absolute values are not critical, such as animation of a time series and quantification of macroscopic ice drift. The RCM satellites launch is planned for November 2018, it is expected that RCM (or RCM + other sensors) mosaics are available and used operationally in 2020.

BUILDING A COMMUNITY-BASED AND COLLABORATIVE RESEARCH PARTNERSHIP TO DESCRIBE INUIT HEALTH IN SOUTHERN QUEBEC: THE QANUIKKAT SIQINIRMIUT PROJECT.

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This paper describes two years of work to develop a community-based research partnership to study the health and wellbeing of Inuit in southern Quebec. The partnership development phase is a critical yet rarely discussed phase of research with Indigenous communities. The process we describe here was influenced by a range of people and organizations including local community members who came together to create the non-profit Inuit community organization Southern Quebec Inuit Association (SQIA), and Tungasuvvingat Inuit, a national organization that helped mobilize and support the SQIA development. Study context The number of Inuit living in cities is increasing rapidly. Nationally, over a quarter of Inuit live outside the traditional territories of Inuit Nunangat. For Nunavimmiut we estimate the percentage at between 15 and 20%. Despite the growing importance of these demographic and sociological shifts, the health status of Inuit in the south has never been systematically examined. It is clear that Inuit living in southern Quebec (Siqinirmiut hereafter), like those in the North, suffer from major health disparities compared to the majority population. Unlike in the North however, culturally relevant services, treatments and health programs have not been developed to meet the needs of the population. The absence of information allowing a systematic understanding of the social and contextual dimensions of the Siqinirmiut community make the development of a public health approach difficult. Our project is a first step in building the knowledge base that will permit the development of the needed services. Constructing the project The creation of the SQIA in 2016 is a clear indication of the dynamic nature of the Siqinirmiut community. The quality of the partnership between the core research team and SQIA was a critical factor in our successful application to the Canadian Institutes of Health Research to undertake a four year mixed-methods study of the health of southern Quebec Inuit community. Based on a culturally-derived, social determinants of Inuit health framework, our community-based and participatory project thus grew out of, and is dependant on, a strong working partnership of equals. In getting to the stage of funding we invested time and energy in a series of activities that are the building blocks of our partnership. These include the constitution of an Inuit Community Advisory Committee; the identification and assessment of models of research agreements that include guidelines for OCAP, publication and data management; the identification of partners' needs and short term goals in health and wellbeing; a commitment to an integrated knowledge translation process; the development of a statement of project principles and values; and the identification of community capacity building and training opportunities and needs. These efforts are meant to ensure a successful relationship to build knowledge based on southern Inuit experience. In contributing to the growing capacity of the urban Inuit community our project has the potential to effect positive change in the long run.

COMPOSITION AND BIODEGRADABILITY OF DOM DERIVED FROM THAW SLUMP HEADWALLS ON THE PEEL PLATEAU

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Increasing temperatures from climate change are enhancing permafrost thaw, which allows previously stored carbon to become available for release. Once exposed, this organic carbon is decomposed by microbes through biodegradation, a key mechanism that determines the transport and fate of dissolved organic matter (DOM). The rate of biodegradation is codependent on the composition of the carbon substrate and the microbial community's preferences to decompose certain substrate types, but these factors are not well characterized among different permafrost deposits in northwestern Canada. Retrogressive thaw slumps are highly abundant in this region, particularly on the Peel Plateau, and expose distinct stratigraphic permafrost deposits in the headwall. The headwall of these thaw slumps can range in height up to several meters and exposes the underlying Pleistocene permafrost, the Holocene paleo-active layer that thawed and re-froze, and the contemporary active layer. In the summer of 2018, I collected permafrost samples from Pleistocene (ca. 3-7 m), Holocene (ca. 2 m) and active layer (ca. 0.3 m) at three active thaw slumps. Adjacent to each slump, stream inoculator samples were collected from the upstream, un-impacted site and from rill water draining the slump. Permafrost and soil samples were leached (1:1 with deionized water), centrifuged, filtered (0.7μm GF/F filter) and homogenized, and subsampled into treatments of either: no inoculate, upstream inoculate, rillwater inoculate, or a killed (1% hydrochloric acid) control. Initial samples were collected for dissolved organic carbon (DOC) concentration, nutrients, and optical analyses (i.e. absorbance and fluorescence). Experiment bottles were left at room temperature in a dark incubator for 28 days. SPOT sensors were used to track oxygen concentrations every 1 to 3 days. Bacterial abundance samples were collected after 2, 7, 14 and 28 days. Experiment bottle water was re-filtered (0.7μm GF/F filter) and final samples were collected for DOC, nutrients and optical analyses. Preliminary results show that Holocene samples had increased oxygen consumption (indicative of DOC biodegradation) relative to active layer and Pleistocene samples. The treatments of different inoculations affected the degree of oxygen consumed, but these trends varied across layers and by slump. Due to the varying biodegradability between stratigraphic layers, it is critical for studies to include a range of permafrost deposits, especially when comparing between regions across the circumpolar Arctic. These results will allow for more accurate predictions of how much DOC may be released from thaw slump headwalls and how quickly it will biodegrade, which has important implications for carbon cycling in a warming climate.

INFLUENCE OF NUTRIENT STOICHIOMETRY ON MERCURY BIOACCUMULATION IN ARCTIC FRESHWATER ZOOPLANKTON

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This study examined the role of aquatic productivity and nutrient stoichiometry on methylmercury bioaccumulation in Arctic aquatic ecosystems. Methylmercury (MeHg) is a highly toxic and mobile pollutant that is of concern in the Canadian Arctic. In the context of rapid climate change, an understanding of productivity influences on mercury bioaccumulation at the base of the food web is crucial to predict long-term shifts in mercury dynamics in the Arctic. Consistent with previous findings at temperate latitudes, we hypothesized that higher algal biomass in Arctic lakes and/or more rapid zooplankton growth from the consumption of high-quality food, will reduce MeHg concentrations in zooplankton through biodilution. To test these hypotheses, we sampled a gradient in ecosystem productivity in the eastern Canadian Arctic and measured MeHg bioaccumulation and the carbon:nutrient ratios (C:N, C:P) in seston and zooplankton from each water body. Observations spanning 20° of latitude from Kuujjuarapik-Whapmagoostui (QC), Iqaluit (NU) and Resolute Bay (NU) were used to compare MeHg bioaccumulation with physicochemical variables, water chemistry, food resource quality, growth rates, and food web structure. Little is known about the nutrient stoichiometry and methylmercury concentrations of arctic seston and this study contributes significantly to our understanding of relationships between these variables. Contrary to biodilution theory, seston biomass, chlorophyll concentrations and seston nutritional quality (seston %P, and C:N, C:P ratios) were not good predictors of either seston or zooplankton MeHg concentrations. Rather, bulk zooplankton and Daphnia MeHg concentrations were positively correlated with water MeHg concentrations and negatively correlated to water nutrient concentrations (TN, TP). Our results therefore suggest aqueous MeHg exposure is the dominant factor controlling MeHg uptake at the base of the food web and biodilution and nutritional quality are not important drivers of MeHg concentrations of seston or zooplankton within Subarctic and Arctic waterbodies.

EVOLUTION OF CUMULATIVE MASS BALANCE OF A SURGE-TYPE GLACIER

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Glaciers outside of the Antarctic and Greenland Ice Sheets are currently the largest contributors to global sea level rise, poised to contribute 79-157 mm by 2100 (Huss and Hock, 2015). However, the role of glacier dynamics presents a major source of uncertainty in assessing their future contributions under a warming climate. While some theories suggest increased surface melt and enhanced basal lubrication will lead to glacier acceleration, others contend that an increase in melt will subsequently enhance the efficiency of the subglacial drainage system, resulting in a net slowdown. This issue is especially complicated for surge-type glaciers, as the principal influences on motion are inadequately understood, and requires an improved understanding of the evolution in mass balance during a surge. While the exact mechanisms behind surging phenomena are not yet fully understood, it appears that cumulative mass balance may have a role in initiating surge events. To infer cumulative mass balance during a surge cycle for an Arctic glacier, we have derived repeat digital elevation models (DEMs) of the glacier surface from stereo satellite imagery, Structure from Motion processing of air photos, and ground surveys. Differencing of these Digital Elevation Models (DEMs) illustrates how the geodetic mass balance of a glacier evolves during the quiescent phase, and provides insight into the conditions necessary to cause a surge. The geodetic mass balance patterns are combined with velocities determined from Synthetic Aperture Radar (SAR) offset tracking and feature tracking of optical imagery to analyze how the interplay between fluctuations in glacier surface elevation and ice dynamics evolves between quiescent and active surge phases. Early results suggest that while surging is a principally internal, cyclical process, climatic and environmental factors may help explain their frequency and magnitude.

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 at 0.5 m/yr, 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 region 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 coastal 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 collected using unmanned aerial vehicles (UAVs) during field surveys between 2016 and 2018. 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 16.5 m/yr since 2000, which is almost double the 1950-2000 average of 8.2 m/yr. Since 2014, up to 100 m of coastal retreat occurred, resulting in release of large amounts of sediment into the nearshore environment. The volume of ground and massive ice within the cliffs is being estimated from in-situ field samples and measurements along with mapping of ice-wedges in a geographic information system (GIS). In recent field experiments, time-lapse cameras onshore have contributed to understanding the temporal variability of mass movements. Satellite imagery is being used to digitize the shoreline and estimate spatial and temporal change for all of Pelly Island. The estimate of sediment delivered to the nearshore from coastal erosion on Pelly Island will be integrated with other models being developed in the Beaufort region. The integration of satellite and UAV imagery is expected to provide 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.

SOIL NITROGEN DYNAMIC ACROSS SUBARCTIC ALPINE MOUNTAIN TUNDRA ECOSYSTEMS

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The availability of nitrogen sources is one of the main factors regulating plant productivity and determines the ability of ecosystems to store carbon from the atmosphere. It is believed that the soils of the mountain tundra 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. The study was conducted on the north-east facing slope of Woodyavrchorr (67°64' N 33°64' E), Khibiny, Russia. We studied the characteristics of nitrogen cycle in the soils of the 4 most common types of alpine tundra ecosystems: lichen heaths, dwarf-shrub heaths, grass-forb and sedge meadows. Soils contain significant reserves of total nitrogen (1.1–1.7% in top horizons). The greatest differences between the soils associated with the content of mineral nitrogen forms which were significantly higher in the meadows than in the heaths. For example, soils of heaths content 2 mg N-NH4+ /kg dry soil and 0.2 mg N-NO3− /kg dry soil while as meadows soils content 80-100 mg N-NH4+ /kg dry soil and 2-4 mg N-NO3−/kg dry soil. The soils of the heaths are also characterized by the low net-mineralization rate (0.4-0.8 mg N/kg dry soil per day), frequently no nitrification. In the meadows, net-mineralization is higher by 10-15 times; nitrate nitrogen is also detected among the mineralization products. Low mineral N concentrations and net-mineralization throughout the heath sites may be explain by alpine heath vegetation have an overall close N cycle. It may be a consequence of the overall poor quality of plant litter, which consists from derivatives of lignin, phenols and other resistance substances. In contrast, meadows always have high soil mineral N concentrations, indicating that the meadow vegetation has a less closed nitrogen cycle than heath and the mineralization rates are higher than the plant and microbial uptake rates. The high mineralization rates at the meadows (in contrast of heaths sites) are likely related to a lower microbial demand for N rather. The mineralization or microbial immobilization of nitrogen compounds depends on the C : N ratio in microbial biomass and soil labile organic matter. If the C : N ratio in the microbial biomass is lower or similar to that in the substrate (as in the heaths), microorganisms are limited by the availability of carbon, and the further growth during incubation is impossible without the partial death of community and the assimilation of the released carbon. In the soils of meadows, the extractable organic matter is more enriched with nitrogen than the microbial biomass; therefore, the consumption of substrate nitrogen by microorganisms occurs during the incubation of samples. Thus, our results show that the direct effect of temperature is not the main factor regulating N cycling in subarctic soils and there can be great variation for contrasting alpine tundra vegetation types. The microbial biomass nitrogen can be a important factor influencing the nitrogen cycle in soils and the availability of inorganic forms of the element to plants. This work was supported by RFBR (grant № 18-34-20053).

INTERANNUAL CONSISTENCY IN MIGRATORY BEHAVIOUR AND WINTERING LOCATIONS OF EASTERN NORTH AMERICAN GOLDEN EAGLES

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Animal movement varies according to individual and environmental factors, creating variation among seasons and years. Changes in the environment represent a global test of how individuals can alter their movement patterns. In partial migrants, some populations are considered resident (i.e., overwintering on their breeding ground) or migratory (i.e., moving seasonally from one site to another) and these populations can potentially switch strategy. Whether such dynamic change is a response to both individual and environmental factors is yet unclear. Here we focus on the Golden Eagles (Aquila chrysaetos), a partial migrant distributed across the northern hemisphere. The North American eastern population, which is in decline, is considered migratory with the majority of individuals nesting in the tundra and boreal forests of Québec, Canada and overwintering in the Appalachian Mountains. Using GPS tracking devices, we examined annual differences in migratory behaviour (date of departure and duration) and wintering home-range size and locations at the individual- and population-level of 13 adult Golden Eagles in eastern North America. Duration (mean ± SE; spring: 10 ± 2 days; fall: 24 ± 3 days) and dates of departure of both spring (March 10 ± 3 days) and fall (October 27 ± 5 days) migrations were not different among years, but were different among individuals. We used kernel density estimators (95%) to estimate home-range size differences between years. Individual-specific winter locations did not vary annually, except for two males, which spent winters on breeding grounds or at different latitudes each winter. While winter home-range size varied 6-fold (from 396 to 63 km2) overall, we detected a large variance in the year-to-year inter-individual differences. Our results suggest that the population-level migratory behaviour and wintering locations are consistent over time. Yet 38% of the individuals demonstrated potential for switching movement patterns. Local environmental conditions (mean temperature, prey availability, etc.) might allow individuals to skip migration in years with adequate conditions.

NOT WITHOUT THE NORTH: CONTEMPORARY MARINE PROTECTED AREA CREATION AND LOCAL MANAGEMENT IN NORTHERN CANADA ON THE ROAD TO REACHING THE AICHI 2020 TARGETS

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Land protection and wildlife conservation area creation is a political act in Canada; based on political pressures more so than on scientific evidence or cultural sensitivities. International pressure, from environmental groups, Indigenous organizations and from sustainability-minded States, have led Canada to commit to the Aichi 2020 Targets, as part of the International Convention on Biological Diversity. One of the substantial target challenges that Canada has committed to fulfilling is Target 11: "By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape" Well-governed and effectively managed protected areas (PA) are a proven method for safeguarding both habitats and populations of species and for delivering important ecosystem services. Particular emphasis is needed to protect critical ecosystems such as tropical coral reefs, sea-grass beds, deepwater cold coral reefs, seamounts, tropical forests, peat lands, freshwater ecosystems and coastal wetlands. Additionally, there is a need for increased attention to the representativity, connectivity and management effectiveness of protected areas. International pressure towards Canada is understandable. Approximately 30% of the world's boreal forest, 20% of the world's freshwater resources, the world's longest coastline and one of the world's largest marine territories are found within national boundaries. Canada's natural areas include critical habitat for species at risk on land and at sea, thousands of lakes and rivers that provide drinking water and energy, and forests and wetlands that store greenhouse gases, produce oxygen and regulate flooding. Canada's natural spaces are a vital component of culture, heritage, economy, and they are of global importance. Target 1 of 2020 Biodiversity Goals and Targets for Canada states that: "By 2020, at least 17% of terrestrial areas and inland water, and 10% of coastal and marine areas, are conserved through networks of protected areas and other effective area-based conservation measures." Considering that Canada started with less then 1% of its marine area under any protection, and less then 5% of it landmass set aside for parks and reserves at the time of committing to the Aichi Targets, this is an impressive accomplishment in little time. Can Canada reach its Targets by 2020, and more so if the commitment of "careful management" and "effective area-based conservation measures" is actually a reality, especially in Northern Canada. As the longest coastline and most fragile marine ecosystems are found in the North, these objectives will be impossible to reach without the creation of northern protected areas, and with local decision-making and management. There is a need to improve effectiveness of protected areas (PAs) and rapid strengthening of stakeholder involvement, including Indigenous peoples. First Nations and Inuit have already contributed tens of thousands of square kilometers of PAs across the country, through modern land claims, treaties, or collaborative land-use plans.

DEVELOPMENT AND VALIDATION OF AN AUTONOMOUS MEASUREMENT SYSTEM FOR CO2 AND CH4 FROM DISCONTINUOUS PERMAFROST

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Quantifying the rate at which CH_4 and CO_2 are released from permafrost degradation is important for understanding carbon dynamics in the Arctic. Autonomous measurement of soil CH_4 and CO_2 provides necessary data on these processes, although autonomous systems are challenging to operate in Arctic environments because of their significant energy consumption. Power is unavailable at remote sites, nor can solar arrays produce enough power during months when the sun is low or absent. In this study, we developed novel approaches to decrease power consumption of an autonomous measurement system built for a site in northern Norway. The system uses a custom 12-port automated sampler for CO_2 and CH_4 measurement with an open-path methane analyzer. This configuration allows us to measure from several locations with power demands of a single methane analyzer. To reduce power, we developed a dilution analysis procedure to cut total sampling time, which was developed experimentally by determining the lower limit on sample volume injected into the encased open-path analyzer. By understanding mixing dynamics within the analyzer, we determined four sample aliquots could be sequentially injected into the analyzer ("stacked") before sample analysis exceeded our 5% uncertainty target. Atmospheric air was used as a carrier gas following each aliquot to flush the system and carry samples though the consecutive instruments. A power management algorithm was added to decrease sampling frequency at times when solar panels were generating minimum output. Overall, this work resulted in a significant increase in energy efficiency, allowing the system to run longer outside of sunny months. The measurement system was installed on a thaw transect in an area of discontinuous permafrost in Finnmark, Norway. Drawing aliquots from soil chambers at depth along a hydrological gradient, the station has sampled daily throughout the 2018 field season. Our approach represents an evolutionary step forward for autonomous gas monitoring in high-latitude environments.

ASSESSING SEASONAL FINE-SCALE THAW SUBSIDENCE AND SUBSURFACE HYDRAULIC CHANGES IN PERMAFROST LANDSCAPES

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Recent climate warming has caused the permafrost landscape in the Canadian High Arctic to undergo substantial change and degradation. Many of the landscape changes are the result of variations in active layer development and permafrost degradation, associated with thaw consolidation and changes in subsurface water flow pathways and drainage. Knowledge regarding these processes is limited, and integrated research aimed at building linkages between climate, permafrost and hydrologic and geomorphic processes has been previously undertaken only on a limited basis. Approaching this research using mixed methods to target different spatial scales will allow for better predictions about the pattern of future land subsidence to enable an increased understanding of landscape changes, changes in water quality, and the potential hazards associated with permafrost change in the High Arctic. We present results for a study undertaken at the Cape Bounty Arctic Watershed Observatory (CBAWO), Melville Island, Nunavut, Canada (74°54'N, 109°35'W) that focused on two contrasting landscape settings. Initial measurements of land subsidence based on satellite approaches (Differential Interferometric Synthetic Aperture Radar) indicated localized areas of cm-scale seasonal subsidence in recent years, hypothesized to be associated with localized ice content in the active layer and subsurface drainage conditions. Differential global positioning system (DGPS) and surveying techniques were employed to determine precise locational information of permanent monuments and seasonal survey stakes to quantify change over the thaw season. On a larger scale, low-level drone photogrammetry imaging flights were undertaken on a weekly basis to measure fine-scale subsidence throughout the season and capture spatial variability. Additionally, for millimeter-scale subsidence records, custom-designed inclinometer sensors were installed to measure vertical surface level change. Wells were installed to record water level throughout the thaw season to track potential ground ice inputs. Results indicate that the aerial imagery captured the spatial variability in subsidence across the season but was unable to capture the very fine-scale

details such as those acquired with the inclinometers and surveys. There was a high degree of variability in localized subsidence across both study areas; however, the two sites both showed similar trends in subsidence and water level response during the season. Although the study was focused upon localized processes, the intra-site similarities suggest there is the potential for the results to be upscaled to larger zones of interest within the High Arctic. Results from this research will provide important new insights into the relationship between permafrost degradation, hydrology and slope hazards in the High Arctic, and will contribute to our efforts to improve the predictive capacity of hazards and quantify the impacts of permafrost degradation.

A PROPOSAL FOR A STANDARDIZED CLASSIFICATION AND NOMENCLATURE FOR CANADIAN SUBARCTIC AND ARCTIC TERRESTRIAL ECOSYSTEMS

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A Canadian Arctic-Subarctic Biogeoclimatic Ecosystem Classification (CASBEC) is proposed as a standardized classification approach for Subarctic and Arctic terrestrial ecosystems across Canada. The CASBEC is grounded in long-standing terrestrial ecosystem classification theory, and builds on concepts developed for ecosystems in British Columbia, Quebec, and the Yukon. The fundamental classification unit of the CASBEC, the plant association, is compatible with the lower level classifications of the Arctic Vegetation Classification (AVC), the Canadian National Vegetation Classification (CNVC) and the United States National Vegetation Classification (USNVC), and is used to generate a classification and nomenclature for Arctic and Subarctic terrestrial ecological communities. The use of a multi-scalar ecosystem framework, such as that developed by the British Columbia Biogeoclimatic Ecosystem Classification (BCBEC) provides an ecological context to use classified plant associations to delineate and define climatically-equivalent regional scale climate units (biogeoclimatic subzones), and ecologically-equivalent local-scale site units within biogeoclimatic subzones. This presentation proposes that a standardized framework and taxonomy of ecosystem classification for Subarctic and Arctic terrestrial ecological communities will facilitate the planning, coordination, and applicability of terrestrial ecological monitoring and research. Example applications being used to design long-term ecosystem monitoring experiments at the Canadian High Arctic Research Station (CHARS) in Cambridge Bay, Nunavut are presented. Widespread adoption of the CASBEC could provide a spatial and functionally scalable framework and a common language for interpreting, integrating, coordinating, and communicating Arctic and Subarctic monitoring, research and land management activities across the Canadian North.

LOSS OF A SMALL ICE CAP NEAR TANQUARY CAMP, ELLESMERE ISLAND

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Glacier mass balance in the northern Canadian Arctic Archipelago (Ellesmere, Axel Heiberg, and Devon islands) has been mostly negative since the 1960s, and mass loss more than doubled in the last two decades as a result of rising summer air temperatures, higher surface melt rates, and longer melt seasons. While most land-terminating glaciers in the region have been shrinking, small glaciers at lower elevations suffered the greatest losses, with many of them disappearing entirely. In this study, we reconstruct the long term changes in the extent and thickness of Bowman Glacier, a small ice cap ~8 km southeast of the Parks Canada base camp at Tanquary Fjord, Quttinirpaaq National Park, Ellesmere Island. In the early 1960s, the ~3 km2 ice cap reached an elevation of ~1200 m a.s.l. and drained into three main valleys.. Field observations combined with historical aerial photographs and recent satellite images show that the glacier has shrunk in area by ~73% since the 1960s and has now retreated from the westernmost drainage basin. The current volume of the glacier is estimated from ice thickness measurements made with a 10 MHz ground-penetrating radar system and a high resolution digital elevation model derived from >1300 air photos acquired during a helicopter survey in August 2018. These measurements show that under current climatic conditions the Bowman Glacier is undergoing irreversible mass loss, similar to other ice caps in the region.

HIGH RESOLUTION MAPPING OF SNOW DEPTH USING UAV AND KINEMATIC DGPS IN THE CANADIAN ARCTIC

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Climate change affect the entire globe but as many scientist have shown, it is more pronounce in Polar Regions. The constant ongoing lost of sea ice and snow cover increase Arctic warming due to their strong albedo and low thermal conductivity. This leads to strong positive climate feedbacks for which snow cover plays a key role. As such, snow is a key variable in polar climate phenomenon, yet it remains poorly monitored spatially and temporally, which leads systematic bias in climate predictions. In order to improve snow monitoring at the global scale using satellites, there is an urging need to improve monitoring on a spatial scale smaller than satellite images to better understand the governing process controlling its spatial and temporal distribution. The main objective of this project is thus to map snow depth using Unmanned Aerial Vehicle (UAV) adapted to Arctic conditions. To do so, we produced Digital Elevation Model (DEM) from 2D images using Structure-From-Motion Algorithm software. Two DEMs are needed, one without snow and one with snow. From that, difference can be computed in a GIS and produce a snow depth map. Secondly, high resolution mapping with UAV implies dGPS system for acquisition of ground control points. We decided to try a technique that uses kinematic dGPS from an antenna mounted on a snowmobile and interpolated all the point into a DEM that will also be use to produce snow depth map. We present modification of our UAV for polar conditions and preliminary results from summer and winter field campaigns in 2018. From the two campaigns, a snow depth map was produced using images taken both in manual flight since problems with the autopilot occurred in both cases. The snow depth map will be compared to manual probing of snow depths point evenly distributed in the flight zone. On top of that, kinematic transects of dGPS points will be used to create a DEM strictly from dGPS surface point. This elevation model used with the summer DEM produced from UAV survey will result in another snow depth map. The same comparison with manually probed points will be conducted. So far, pixel resolution of our DEM is 4cm for summer flight and is expected to be a little larger for winter due to our different set of images.

THE LAST ICE AREA: A GLIMPSE INTO THE CHANGING ARCTIC SEA ICE ECOSYSTEM

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The Last Ice Area (LIA), north of Ellesmere Island, is the only region of the Arctic Ocean where multiyear ice is predicted to persist over the next decades. This region is poorly characterized, largely due to constraints of accessibility and sampling in a multiyear ice environment. Fisheries and Oceans Canada established the Multidisciplinary Arctic Program (MAP) – Last Ice Science Program to study the unique ecosystem of this region, in support of conservation initiatives in the Arctic. The first LIA field campaign took place from 25 April to 7 June 2018 in the Lincoln Sea, off Ellesmere Island. Sea ice, water column and zooplankton sampling, as well as continuous atmospheric, cryospheric and oceanographic measurements were carried out at an ice camp 9 km offshore of CFS (Canadian Forces Station) Alert until May 26th, when the ice cover broke up. Sea ice and water samples were regularly collected and processed for biochemical analyses including nutrients, protist abundance and composition, pigmented biomass and primary production (sea ice only). Sea ice biomass, zooplankton and fish larvae collected under the ice were also analyzed for fatty acid biomarkers. A remotely operated underwater vehicle (ROV) provided in situ bio-physical measurements at the under-ice interface along repeated transects. Ice thickness surveys were carried out by airborne electromagnetic induction aboard a DC3 plane. Aerial marine mammal surveys, carried out with a Twin Otter, produced 51 transect lines which were completed on June 2-5. A total of 258 ice cores were collected, or which 131 were multiyear ice. Ice thickness ranged between 1.37 and 4.58 m. Preliminary results show higher biomass in first-year than multiyear ice, likely related to habitat space availability. The remarkable mesoscale variability in sea ice conditions, with contiguous ridges, thick hummocks and thinner first-year ice creates a unique ecosystem with a variety of sea ice and under-ice habitats. We propose that these unique conditions support heightened diversity associated with distinctive niches benefiting highly-specialized species. The loss of thick multiyear ice is expected to directly impact these species and, as a corollary, the structure and function of this unique ecosystem.

ACCESSING AND ASSESSING ENVIRONMENTAL INFORMATION: COMMUNITY-IDENTIFIED METRICS AND MODIFIERS THAT MATTER IN A CHANGING CLIMATE

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Introduction: As the Arctic undergoes dramatic changes in its physical environment due to climate change, Inuit throughout the Circumpolar North are experiencing disruptions to their livelihoods, cultural practices and knowledge-sharing, food security, human safety, and overall health and wellbeing. Amidst these changes, monitoring and surveillance are consistently identified as key health-related adaptation strategies. There is also a need for monitoring that prioritizes Indigenous knowledges and sciences, and that integrates locally relevant socio-environmental factors to provide decision-makers and communities with effective evidence-based knowledge. Understanding the need for Inuit-owned and Inuit-run monitoring and surveillance programs, Rigolet, Nunatsiavut, Labrador is designing and developing a community-based mobile monitoring program (eNuk), with the goal of allowing community members to actively track changes and share information about their environment and health in a timely and efficient manner. Purpose: The aim of this study was to support and inform the ongoing development of the eNuk program by exploring how Rigolet Inuit perceive, prioritize, and interact with meteorological variables on the land and in the community. The objectives were to: (1) identify meteorological conditions, including measures and thresholds important to community members' decision-making processes both on and off the land; and (2) explore other contextual factors that modify how meteorological conditions are interpreted, and decisions are made. Methods: Qualitative data were drawn from in-depth, semi-structured interviews with community members in Rigolet conducted by community research leads (co-authors IS and CF) from January to Fall 2018. Participants were asked what types of meteorological information they used; how they received, interpreted, and shared information; and how it all informed their practices, and wellbeing. Following each interview, data were transcribed verbatim, and team debriefs took place to ensure ongoing co-analyses were grounded in community understandings of environment and health. Thematic analysis was employed along with the constant comparative method, to explore patterns within and between participants. Preliminary Results: Wind, snow, rain, and ice, were among the metrics most commonly reported to determine land access and mobility within the community. However, participants identified that the intersection of conditions, and holistic interpretation of multiple metrics was integral to their decision-making process. Importantly, participants discussed individual- (e.g. age, and gender), household- (e.g. size), community- (e.g. available social networks), and regional-level (e.g. development) factors that modified their decision-making process. These socio-cultural factors were linked to transient thresholds for travel decisions, and changing measures of meteorological conditions. Significance: These findings will provide information on environmental-health indicators that are most critical to Rigolet community members, including how residents use that information in making decisions about their daily practices and wellbeing. These data will inform the ongoing development of the eNuk program, contributing directly to wellbeing and capacity-building in Rigolet, while serving as a learning opportunity for similar collaborative monitoring efforts across the Arctic. Importantly, critical metrics, thresholds, and modifiers identified here will enhance future research efforts, including improved empirical investigations as causal models are grounded in local knowledge. As such, this research will better inform adaptive policies and planning decisions in a time of rapid environmental changes.

INVESTIGATION OF SEASONAL INTERACTIONS BETWEEN MICROTOPOGRAPHY, SNOW COVER AND GROUND SURFACE TEMPERATURE IN A HIGH-ARCTIC AREA

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The strong interactions between the near-surface atmosphere and the underlying ground via heat exchange processes make the presence of snow a key component of the Earth system. The timing and duration of snow cover in mountain permafrost areas affect the ground thermal regime, mainly by reflecting incoming solar radiation and thermally insulating the ground from the atmosphere. In this study, the spatial variability of the ground surface thermal regime is explored in a small catchment on Bylot Island in the Canadian High Arctic. 95 micro-temperature loggers were deployed for two years in different parts of the landscape. The influence of microtopography resulting from cryoturbation processes was investigated by placing loggers at the top and bottom of earth hummocks and on the rim and center of polygons. Snow accumulation was measured at the end of winter at each site. The recorded ground surface temperature (GST) was used to compute snow thermal insulation and melt indices at each site. Analysis of these indices revealed large spatial variability in both the onset and duration of snow cover and in the computed snowmelt rate at the microtopographic scale (hummocks and polygons), and larger (slope) scale.

NUTRITIOUS AND DELICIOUS: HEALTHY ARCTIC CHAR AS A BASIS FOR A COMMERCIAL FISHERY 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, or Arctic char, not only represent part of a cultural integrity but offer the prospect of enhancing employment and food security. To this end community leaders, elders and youth are investigating the possibility of a commercial fishery for Gjoa Haven in collaboration with a large-scale Genome Canada-supported project, "Towards a Sustainable Fishery for Nunavummiut" (TSFN). Key to future marketing of this resource, either locally or across the territorial boundaries is the assurance that the fish are healthy as well as safe to eat. We have assayed Arctic char muscle samples for contaminants including mercury and other metals, polychlorinated biphenyls (PCBs), and parasites, and in addition, have subjected pooled samples from different fishing sites for nutritional analysis. We are pleased to report that to date, Arctic char from all examined traditional subsistence fishing sites as well as sites with Department of Fisheries and Ocean's commercial quota have tested low for mercury (< 0.5 ppm) and PCB contamination (< 15 ppb) in every age class (8-33 years old); these values are within Canadian and the International Joint Committee guidelines, respectively. As well, levels of parasites are not of concern. Overall, "Gjoa Haven char" are an excellent source 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. The distribution of this country food 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: We thank Gjoa Haven community residents, the Hunters and Trappers Association (HTA), the Government of Nunavut, The Northern Contaminants Program, and a Genome-Canada Project, Towards a Sustainable Fishery for Nunavummiut and associated supporters

THE CANADIAN CONSORTIUM FOR ARCTIC DATA INTEROPERABILITY: CONNECTING CANADIAN ARCTIC DATA INFRASTRUCTURES

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The Canadian Consortium for Arctic Data Interoperability (CCADI) is a recent initiative to advance collaboration, both nationally and internationally, through the development of an integrated data management system that will facilitate information discovery, establish metadata and data sharing standards, enable interoperability among several existing Canadian Arctic data infrastructures, and provide accessible data to a broad audience of users (e.g. researchers, students, government, industry, northern community members, and the general public). The consortium is currently composed of six Canadian universities, two Canadian federal agencies, two Inuit organizations, and three non-profit partners. The CCADI aims to connect a broad variety of information types, ranging from bibliographic records to metadata to raw data sets. Connecting these variable data types will grant users the ability to build a holistic view of research, from inception and throughout the data life cycle. It will provide greater opportunity to re-create scientific studies and review them from different angles and to compare and link data, both quantitative and qualitative, across disciplines. The CCADI works with Inuit Tapiriit Kanatami and with regional Inuit organizations to ensure that Indigenous information is included ethically, with full Inuit involvement in the design of systems, and in the management and use of their data. This presentation will focus primarily on establishing interoperability between CCADI members' existing data structures.

BRIDGING ARCTIC MARINE SHIPPING CONCERNS AND RECOMMENDATIONS WITH MANAGEMENT AND POLICY

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As a result of climate change, summer sea ice is on the decline and there are greater opportunities for industrial development, leading to an increase in shipping traffic in the Canadian Arctic. Through workshops with elders, active harvesters and youth, all six communities in the Inuvialuit Settlement Area have identified potential impacts of shipping traffic on cultural use areas and potential management strategies for the Low Impact Corridors. To operationalize and implement these recommendations, WWF-Canada is developing a Western Arctic Mariner's Guide - a visual aid intended for a ship's bridge that will help mariners identify marine mammals and reduce impacts on sensitive cultural and ecological areas identified by project participants. This guide will be used in combination with additional management measures based on community recommendations to engage with stakeholders and address other national tools, such as voluntary measures and policy changes. At an international level, the Western Arctic Mariner's Guide is an example of a tool which can be used to strengthen the implementation of Chapter 11 of the International Maritime Organization's Code for Ships Operating in Polar Waters (Polar Code).

IMPACT OF EARLY SNOW MELT AND SEA ICE RETREAT ON PHYTOPLANKTON EXPORT IN THE BEAUFORT SEA

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Recent satellite-derived observations suggest that the current reduction in sea ice cover extent and the longer phytoplankton growing season resulted in increased primary production during spring and/or fall on several Arctic continental shelves. However, satellites are unable to detect primary production under ice, clouds, or deeper than 10 m in the water column. Ship-based observations in the Arctic Ocean are also incomplete, as they are usually limited to the period of minimum ice extent, excluding the beginning of the bloom. As part of ArcticNet's Long-Term Oceanic Observatories (LTOO) project, moored sediment traps were deployed over several years in the

Beaufort Sea. Sediment traps provide continuous and sequential biological samples at a high temporal resolution over an annual cycle, tracking spatial, seasonal and interannual variations in the pelagic ecosystem. In this study, phytoplankton cells collected in sediment traps over a 5-year period at 3 locations over the shelf break of the Beaufort Sea were quantified and identified to investigate changes in abundance and composition associated with variations in the snow and sea ice regime. Highest diatom fluxes were observed at the 3 sediment trap positions following ice melt in 2016. Seasonal variations of key diatom species and other significant groups (flagellates, silicoflagellates and coccolithophores) showed species succession driven by snow and ice melt. Peak fluxes of the ice alga Nitzschia frigida were associated with snow melt events in the region, followed by peak fluxes of the pennate diatoms Fragilariopsis spp., Fossula arctica, and Nitzschia/Pseudo-Nitzschia spp. and of the centric diatom Chaetoceros spp. during and following ice melt. This monitoring of algal cell fluxes provides insights into the seasonal development of the algal community and timing of the primary production in the Beaufort Sea.

OPERATIONALIZING PARTICIPATORY GIS (PGIS) WITH INDIGENOUS GROUPS: REFLECTIONS FROM THE CANADIAN ARCTIC

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Adopting technocentric approaches to social sciences research can present significant ethical and logistical challenges, particularly when applied through the lens of community-based participatory research (CBPR). In the context of Indigenous groups, these challenges can be compounded by historically lower rates of exposure to technology, the reflexivity of researchers throughout the investigative process, and the agency provided to individuals involved in data collection or as local project coordinators. This presentation evaluates a real-time participatory GIS (PGIS) approach, used to evaluate the microeconomics of subsistence in the Canadian Arctic for the year 2018-19, to broaden the participatory GIS research methods scholarship for the Arctic, and assess the potential of wider CBPR involving PGIS among indigenous peoples as a whole. Focusing on what works, and what does not work, the need for research approaches to adapt to the predominantly verbal culture of many indigenous groups is recognised, especially in the context of ethics and methodological instruction, in addition to the difficulties that may be encountered in sustaining stakeholder engagement in longer-term projects of this nature. The role that technological advance has had in the potential for the 'democratization of PGIS' is also discussed, particularly in the context of open-source GIS systems and smartphone-compatible GIS software as tools for improving participant agency.

CHARACTERIZATION OF A FRONTIER DEEP-SEA ECOSYSTEM TO SUPPORT MARINE PROTECTED AREA (MPA) ESTABLISHMENT IN THE ARCTIC GATEWAY

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The Government of Canada has committed to protecting 10% of Canada's marine and coastal areas by 2020. In order to accomplish its domestic and international biodiversity targets and goals, one of its objectives is to consider the designation of certain large ocean offshore regions as Marine Protected Areas (MPAs). A 150,000 km^2 area of the Labrador Sea continental shelf and slope area (the Atlantic Ocean's Gateway to the Arctic) was being considered for MPA status. Unfortunately, establishing an MPA in this area is hindered by a lack of biological knowledge as the large majority of the area extends beyond the depths that are typically covered by Fisheries and Oceans Canada (DFO) and NAFO offshore stock assessment surveys. With increased interest in offshore resource development, the opening of new shipping routes, and changing ice patterns in this region it has become increasingly important to characterize these ecosystems, establish ecological baselines, and understand the biophysical processes that affect these ecological communities. An ongoing research program (2017-2019) is targeting identified data gaps related to mesopelagic fish, demersal fish, and the benthic community (including corals and sponges) and is addressing how depth gradients and globally important deep-water convection processes are affecting Labrador Sea faunal communities. Preliminary data collected from studies conducted in the Labrador Sea from 2017 and 2018 will be presented.

KEY-FACTORS INFLUENCING SENIORS' FOOD SECURITY STATUS IN INDIGENOUS COMMUNITIES: A SYSTEMATIC LITERATURE REVIEW

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High food insecurity levels documented among Indigenous peoples in Canada relative to national levels are the cause of significant public health concern. This is particularly important for Canada's Northern Indigenous communities 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 the associated health outcomes. These outcomes include nutritional deficiencies, obesity, higher prevalence of chronic diseases, neurological disorders, and stress. However, little is known about Indigenous-specific factors influencing food insecurity and even less about which sub-groups within Indigenous populations or communities are more vulnerable to food insecurity than others. It is important to understand population-specific factors and sub-group vulnerability for developing evidence-based food insecurity mitigation strategies and understand health inequities within one of the most vulnerable populations and sub-groups in this country, Indigenous peoples in Northern Canada. In partnership with the Nunatsiavut Government, this study examines key-factors influencing the food security status of Seniors, a group identified by the Nunatsiavut Government to be vulnerable to food insecurity in that region. The study follows an exploratory and explanatory sequential mixed-methods design with three phases. The study started with a systematic literature review aimed at identifying all published peer-reviewed literature on Seniors' food security in Indigenous communities globally. Following PRISMA methods for reviewing and reporting results, we searched online articles in several databases including Web of Science, Medline, CINAHL and the Bibliography of Native North Americans. We accounted for potentially missed studies by scanning reference lists of included studies, performing backward citation searches and hand-searching publications of key authors and relevant journals in the field. After removing duplicates, all titles and abstracts were reviewed and screened using inclusion criteria aimed at keeping studies that identified Seniors' food security status as the dependent variable of the study. Resulting articles were analyzed thematically to identify a list of factors reported to influence the food security status of Indigenous Seniors. Key-factors from this list will be considered in phase 2 of the study which involves multivariate analysis of an existing dataset on the food security status of Seniors in Nunatsiavut. This database is the only complete community-representative food security dataset in Canada to-date of a specific sub-group within an Indigenous population. Results from the statistical analysis will be further examined in phase 3 through key-informant interviews with local health and community representatives. Results from this project will enhance understanding of the vulnerabilities to food insecurity experienced within the Inuit population. Results will inform the development of a regional food security strategy currently led by the Nunatsiavut Government and make a specific contribution to interventions for Seniors' food insecurity. Results will also contribute to a larger national and international discourse on the determinants of food security and health of Indigenous peoples and of Seniors specifically.

THE MAIDEN VOYAGE: EXPLORING THE FIRST MIGRATIONS OF AN ARCTIC-NESTING SHOREBIRD

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Amidst the rapid environmental changes currently occurring in global Arctic ecosystems, approximately 45% of the populations of Arctic-nesting shorebird species are declining. Some common species that breed in the Canadian Arctic, such as the Dunlin (Calidris alpina) and Short-Billed Dowitcher (Limnodromus griseus) have decreased in population size by nearly 60% since 1974, while the populations of other species like the Red Knot (Calidris canutus) have shrunk by over 90%. Despite the role of juvenile birds as an important limiting factor in declining populations, much of the contemporary research on shorebird migration focuses on adult birds, with much less emphasis on juveniles. Exploring the details of juvenile shorebird migration, such as geographic bottlenecks, crucial on-route feeding sites, migration phenology as well as the factors influencing these parameters, is essential for identifying causes of declining shorebird populations and developing appropriate conservation strategies. Here we document, for the first time ever, the first fall migration of juvenile Dunlin (Calidris alpina hudsonia), from their breeding grounds in Churchill, Manitoba to wintering grounds along the East Coast of the United States. We took advantage of the Motus automated radio telemetry system – a collaborative network of international researchers using automated radio telemetry arrays to track large and small-scale movements of a variety of small aerial species. We deployed a total of 44 Motus telemetry tags on juvenile Dunlin over a period of three summers (2016-2018). During the fall of 2016 and 2017, we documented migration pathways of fifteen individuals, all of which were detected at a minimum of one Motus receiver tower outside of their breeding grounds. Individuals were detected an average of 6.4 ±6.3 times on their migratory routes, between the months of July and October. The longest timespan over which a tag was detected was 85 days (from July 12, 2016 to October 4, 2016). All recorded migratory routes passed through a section of Southern and Southeastern Ontario, spanning from South-West Oxford to Wolfe Island. King, Ontario seemed to be a well-frequented migratory passage point, as 80% of tracked individuals flew through this area. The most common regions at which birds stopped over appeared to be Long Point Provincial Park, located on a peninsula off the North coast of Lake Erie, and Wolfe Island, on the Northern-most tip of Lake Ontario. Individuals remained at these sites for an average of 7.2±9.9 days and 4.3±11.9 days, respectively. This research is of high future conservation value, as it may help identify essential stopover sites of juvenile Dunlin, which may differ from those of adults.

A TALE OF TWO HAMLETS – THE ROLE OF A TOURISM CHAMPION IN THE RELATIVE SUCCESS OF THE 2016 VISIT OF THE CRYSTAL SERENITY TO NUNAVUT, CANADA

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The summer of 2016 saw history made when the Crystal Serenity became the largest passenger vessel to transit the Northwest Passage. Carrying approximately 1,000 passengers and 600 crew, this maiden voyage made history in many other respects as well - setting a particularly high number of tourism records in the Canadian Arctic territory of Nunavut. Chief among these new records in Nunavut was the total impact that the ship had on the two community visits in the territory, in the hamlets of Cambridge Bay and Pond Inlet. Never before had either of these communities experienced the sheer number of visitors in one day as they did when the Crystal Serenity arrived, with the vessel temporarily doubling their population sizes. In the lead-up to the visit, numerous questions lingered as to whether these small remote communities where adequately prepared for an event of that magnitude. This research analyzes the relative successes and failures of Cambridge Bay and Pond Inlet with regards to the Crystal Serenity's visit. Results show that there were striking differences between the two communities in both preparations for and reception of the vessel, and that these differences can largely be attributable to the presence of a 'tourism champion' - or lack thereof. This analysis is situated within the overarching concepts of sustainable development, and more specifically community-based sustainable tourism (CBST). In other words, this research supports the idea that successful operationalization of CBST (particularly in small, remote communities) is strongly influenced by the presence of 'tourism champions'.

COASTAL RESTORATION NUNAVUT: SUPPORTING SUSTAINABLE FISHERIES AND HEATLHY AQUATIC ECOSYSTEMS

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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 addressing data gaps in coastal habitat health, habitat fragmentation and fish health within the context of a changing climate. The project team is consulting communities to identify and document any coastal changes that harm fish, fishing, fish habitat or marine life. Whereas other government research has documented the existence and location of marine resources, CRN is documenting the health and condition of those resources. 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, 11 communities have been visited by the research team: Clyde River, Sanikiluaq, Arviat, Whale Cove, Chesterfield Inlet, Coral Harbour, Pangnirtung, Igloolik, Hall Beach, Resolute Bay and Grise Fiord. In 2019, seven communities will be visited, and the remaining seven communities will be visited in 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 habitats. A pilot restoration project is currently underway in the community of Clyde River. This project includes the development of a coastal restoration and monitoring plan for the community and implementation of the priority project as identified by local stakeholders. Specifically, the Nangmautaq Hunters and Trappers Organization has requested assistance to help the community restore and enhance the Nilaqtarvik River. An old and no longer used quarry road was built by stacking rocks in the river, allowing trucks to drive through a key migratory corridor for char. This road adversely affects the 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. Restoration of the river system was completed in September. Lessons learned from the pilot restoration will inform subsequent designs and restorations via knowledge sharing and the development of promising practices in coastal restoration in Nunavut. Funding provided by DFO's Coastal Restoration Fund.

HIGH-ARCTIC PHENOLOGY SHIFTS UNDER A CHANGING CLIMATE: CONSEQUENCES FOR REPRODUCTIVE SUCCESS AND PLANT COMMUNITY COMPOSITION

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The warming Arctic climate is resulting in earlier snow melt and higher temperatures, which, in turn, is causing earlier flowering and green-up of most Arctic tundra plant species. The very few studies of reproductive effort and success in tundra species have shown that warming also increases the production of viable seed from the currently very low viability levels. However, flowering time, green up time and seed viability responses to climate change differ markedly among Arctic plant species. We may, therefore, expect a shift in species composition towards a greater proportion of species that benefit most from climate change. For example, some deciduous shrub species are flowering earlier, and this may help to explain the well-documented increase in shrub cover across the Arctic. There are no studies explicitly linking flowering or green-up time (phenology) to viable seed production in Arctic species. Thus, the objectives of our research are to determine 1) the relationship between changes in phenology and reproductive success of tundra plant species, and 2) how phenology-reproductive success relationships relate to changes in species composition and abundance. We are assessing these relationships utilising the International Tundra Experiment (ITEX) long-term experimental warming plots at Alexandra Fiord, Ellesmere Island, Nunavut. We are recording the flowering and green-up times of plant species with a range of flowering times, different reproductive strategies (e.g. self-pollination compatible versus incompatible) and pollination syndromes (e.g. wind- verses insect-pollinated). We are monitoring tagged plants of these species at experimentally warmed and control plots. The plots were established in 1992 in seven different tundra plant communities along a moisture gradient. The open-top chambers (OTCs) passively warm experimental plots 1.0-3.5ºC above ambient. Hence, there is a gradient of climatic environments resulting in a range of flowering and green-up times for each species. To measure reproductive success, we are (i) counting and weighing seeds produced by each tagged plant; (ii) germinating collected seeds in UBC's specially adapted Arctic growth chamber to determine seed viability ratios and optimum germination conditions for each species-plot combination; (iii) collecting plot soil samples to compare the soil seed bank between warmed and control plots. We will assess how the timing of green up and flowering influences sexual reproductive success. We will also determine the role reproductive strategy and pollination syndrome plays in sexual reproductive success. Species composition and abundance in the plots will be measured using the standardised point-frame method. Plot-scale temperature, moisture, snow melt, phenology, growth and species composition have been recorded in the plots since 1992. Hence, we can combine our field data with the long-term data to determine the relationship between phenology, reproductive success, and changes in plant community composition and species abundance. This study is in the early stages and we hope to present some preliminary results from our first field season (2018). We would like to discuss the project with ArcticNet participants and receive input and feedback on the project.

POTENTIAL IMPACTS OF SEA ICE AND SHIP TRAFFIC CHANGES ON CARIBOU MIGRATORY ROUTES SURROUNDING KING WILLIAM ISLAND, NUNAVUT

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Caribou (Rangifer tarandus, tuktuit in Inuktitut) use sea ice for seasonal migrations among islands of the Canadian Arctic Archipelago, and between the islands and the mainland. Sea ice is a critical part of caribou habitat and supports their ecological persistence. Research on caribou movement across sea ice is limited, especially in the Northwest Passage surrounding King William Island (KWI), Nunavut. Climate change models predict the lengthening of summer open water season, which is expected to increase the length of Arctic shipping season along with the frequency and diversity of ship traffic. Such changes could have negative impacts on caribou health and movement, as well as curtail hunting success and travel safety for nearby communities. Caribou continue to be very important for Inuit communities, with subsistence hunting contributing to economic, cultural, physical and emotional well-being. This research is a part of an ongoing collaboration with the Inuit community of Gjoa Haven, on KWI. We explore community concerns surrounding changes in sea ice conditions and ship traffic, in relation to caribou crossings to/from KWI previously mapped by Elders and hunters in Gjoa Haven. Using Canadian Ice Service regional ice charts we characterize changes in break-up/freeze-up timing, and length of summer open water season between 1983-2017 for key caribou crossings. Using NORDREG datasets that record ship traffic timing and movement routes, as well as ship type, we also characterize changes in the magnitude and timing of ship traffic around KWI between 1990-2017. Preliminary results will be discussed in workshops in Gjoa Haven in the fall of 2018, and community feedback will help to refine sea ice and ship traffic analysis in relation to impacts on caribou and local travel safety. Our work emphasizes the importance of multidisciplinary and collaborative research guided by Inuit knowledge. Working together is integral to improving caribou research and our understanding of the socio-ecological impacts of climate change in the Arctic. Preliminary analysis and results of workshops will be presented.

ICE-RICH ENVIRONMENTS OF HIGH ECOLOGICAL AND HYDROLOGICAL SIGNIFICANCE IN POLAR DESERT LANDSCAPES

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Ground ice is a fundamental component of permafrost landscapes. It is a defining parameter for soil thermal behavior and strongly influences the geomorphological response to warm events and to soil thawing. In addition, the thawing of ice-rich soils can have large impacts on hydrology and surface water geochemistry. In the High Arctic polar desert, ground ice is often estimated to be negligible because of the lack of precipitation, but short summers, shallow active-layers and lingering snow can keep a significant portion of the landscape under near-saturation throughout the melt season. This abundance of water leads to the formation of wetland environments and the development of ice-accumulation features. The prevalence of shallow ground ice in this evironment raises fundamental questions on the ground ice content and dynamics in these areas, with wide-ranging implications for hydrology, geomorphology, and ecology. We present results from a permafrost coring campaign investigating near-surface permafrost near Resolute Bay, Nunavut. Results indicate that ground ice is present in abundance in some polar desert soils, often occurring as enduring cryosuspended and banded cryostructures. These ice-rich cryostructures occur in all types of sediments, from coarse, gravelly diamicton to clayey or organic-rich soil. Ice is most extensive in topographic depressions, near lakes and rivers and downslope from perennial snowdrifts. In some cases, permafrost exhibits syngenetic cryofacies, demonstrating aggradation behavior following the frequent deposition of alluvial sediment from surface runoff or from flooding. By comparison, interfluves and well-drained slopes are typically ice-poor at depth, with ice-rich conditions found only over ~ 40 cm in the transition zone of the upper permafrost. These results indicate that hydrological condition (water availability) and geomorphological processes are the primary controlling factors for ground ice conditions, and the nature of deposit only plays a secondary role in defining the ice-content. Ice-rich areas are the most hydrologically active areas in the landscape and are often connected directly with the drainage system or with surface waters such as lakes or ponds. This suggests that the thawing of ground ice following permafrost degradation should strongly affect hydrology, providing some resilience against drought in the form of late-season water supply, but also carrying the potential to modify surface water geochemistry and nutrient supply. Since water availability is the prime limiting factor for plant growth in this landscape, these ice-rich areas occupying the relatively highly vegetated and productive wetlands are a defining link to address in predicting polar desert ecosystems and hydrological responses to climate change.

IMPLEMENTATION OF THE ARCTIC REGIONAL CLIMATE CENTRE

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Climate change in the Arctic is affecting the entire Earth system. Indigenous Peoples and communities, Northerners, industry and wildlife are experiencing significant and direct impacts. Currently, climate products at a circumpolar/pan-arctic scale (i.e. International Panel on Climate Change and Arctic Council working group assessments) are not available in near-real time for Arctic decision-makers. To meet growing Arctic adaptation and decision-making needs, an Arctic Regional Climate Centre Network (ArcRCC-Network) has been established. The purpose of the ArcRCC is to provide biannual seasonal assessments and forecasts of temperature, precipitation and sea-ice conditions each October (for the upcoming winter season) and May (for the upcoming summer season). The ArcRCC-Network is based on the World Meteorological Organization (WMO) Regional Climate Centre (RCC) concept. Active contributions are from the meteorological and ice services of all Arctic Council member countries and are based on a mutually agreed upon structure of three sub-regional geographical nodes, namely, (i) North America Node, (ii) Northern Europe and Greenland Node and (iii) Eurasia Node. As part of the ArcRCC-Network implementation and ongoing engagement strategy, an inaugural user's forum was held in Ottawa, Canada, from 15 to 16 May, 2018, hosted by the Environment and Climate Change Canada (ECCC) and co-sponsored by the WMO. This first annual forum focused on meeting with Arctic Commercial Shipping users and Circumpolar Indigenous organizations to discuss initial ArcRCC climate products and user needs. This presentation will further expand on: the structure and objectives of the ArcRCC; initial climate products; feedback received from circumpolar climate users during its first face-to-face forum; and its follow-up on-line forum held in October 2018.

RESILIENCY TO CLIMATE CHANGE IN AN ARCTIC SEABIRD: A MULTI-SCALE ANALYSIS OF FORAGING VARIABILITY

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It is well established that climate change is having a profound influence on marine polar systems, impacting oceanic patterns and trophic dynamics, posing environmental challenges for many marine species. Polar-breeding seabirds are a diverse group whose life-histories (e.g., long lived, delayed reproductive maturity, low fecundity) have evolved to anticipate inter-annual inconsistencies in resources. Nonetheless, many polar-breeding seabird populations are declining with climate change being implicated as the primary driver of population declines via changes in resource quality and quantity. Unfortunately, we currently know little about the expected resiliency of many of these species to rapid environmental change, especially since we lack important baseline information on key variables known to contribute to individual fitness and hence population persistence. We are using a trophic analysis to assess the potential resiliency of Arctic-breeding Common eiders (Somateria mollissima) at multiple scales (inter-population, intra-population and within individuals) as a means of predicting the persistence of the species in response to environmental change due to climate change. We aim to use stable isotopes to assess foraging (diet) niche and flexibility at these multiple scales. We will first examine inter-population variation in diet niche polygons across multiple circumpolar populations. Using multi-year datasets at select locations, we will then examine the degree of inter-individual variability across years to assess the degree of individual foraging specialization within each population. Finally, using a select Canadian breeding colony (East bay, Nunavut) with long-term data on reproductive decisions and fitness, we will examine whether variation in foraging flexibility affects key reproductive parameters (i.e., timing of breeding, investment) that impact fitness (i.e., reproductive success) in this species. Determining the degree to which eiders as a species are able to mechanistically cope with shifts in critical prey items, and their ability to be flexible in their foraging behaviour will give insight to how other species that depend on similar prey (e.g., other seabirds, pinnipeds, cetaceans) will be impacted, and how constraints may shift in these species as climate change continues to change ecosystems. Overall, this research will have important consequences for understanding the mechanisms that will enable individuals and populations to persist under projected climate change scenarios.

CONTINUOUS OBSERVATION OF RELATED PLANT SPECIES ON THE TWO POLES FOR UNDERSTANDING OF PLANT ADAPTATIONS TO CLIMATE CHANGE EFFECTS

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Polar regions are the unique polygons for research of organisms' adaptations to the most extreme conditions on our planet. The study addresses the causes of the exclusive adaptation of only two aboriginal Antarctic species of vascular plants: Deschampsia antarctica and Colobanthus quitensis and the climate change effect on their population dynamics. Continuous monitoring of climate change impact on number and size of both species populations, their biometry and age structure has been launched at Vernadsky Ukrainian Antarctic Station. We have detected the general reaction of Galindez Island Deschampsia population on the climate change moderation in the region, which resulted in absence of following increase (Parnikoza et al., 2009). Previously we proposed that this plants exclusivity may lie in gradual adaptation of these taxa to the extreme conditions during the development of glacial events, as well as to substantial seed bank, which could ensure mosaic survival in some ice-free areas (Parnikoza et al. 2011). However, the association with the other organisms (e.g. microbes) may be an additional key mechanism of exclusivity. During 2018 the soil samples were collected under plants on the Vernadsky Station and on US Palmer Station for metagenomic analysis. Rhizosphere microorganisms are recognized as the 'second genome' of the plants and are involved in maintenance of the vascular plants' health. The analysis of taxonomic composition and functional capacity of the rhizosphere microbiome is being performed in order to uncover its role in adaptation of Antarctic vascular plants. The study of the Antarctic vascular plants' rhizosphere microbiome is planned to become a part of monitoring program on the Vernadsky Station. Adaptation of terrestrial organisms in the context of global environmental challenges, such as climate change and increased anthropogenic pressure is an acute topic today. Such global challenges call for the joint efforts towards monitoring of indicator organisms simultaneously and utilizing common protocols in both Polar Regions. We suggest that this could be achieved by the joint research actions of Canadian, US and Ukrainian polar scientists. Unique adaptability of these taxa sets significant perspectives on simultaneous monitoring of the related taxa in the Arctic. In particular such species as Deschampsia caespitosa, D. alpina and D. sukatschewii, which are relative to Deschampsia antarctica, and Silene acaulis, Sagina sp., - relative to Colobanthus quitensis, are spread in the Arctic. These genus representatives can be also found in Ukraine and in temperate regions of North America, which sets additional perspectives of comparative research establishment in these regions. It is highly important to establish the network of study plots for research and monitoring of the mentioned plants in the Arctic, similar to the one existing in Antarctic. Likewise, it is promising to study population ecology and genetics of some species, which are rare in Holarctic, eg. those belonging to Ophioglossaceae family: Botrychium simplex, B. boreale and B. lunaria in the Arctic. Such research will contribute to the understanding of the reasons for these species vulnerability in temperate regions.

ART AS KNOWLEDGE MOBILIZATION

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Research pertaining to Inuit can involve language, knowledge databases, and even spaces that can be inaccessible to community members who are not otherwise engaged within institutions such as universities. This results in researchers and academics conducting work on Inuit peoples as opposed to with them, which can result in violence and further trauma. Utilizing an arts based approach can ensure that community and participants take the lead on projects, ensuring their empowerment while also capturing a full qualitative analysis. By highlighting the works of Inuit artists who document day-to-day life (including cultural preservation, climate change, health, and experiences of poverty and trauma) and artists who have used their platform to mobilize groups of people, I will argue the importance of art for bridging the gaps in knowledge systems between Inuit and non-Inuit peoples. Art creates a narrative that cannot be captured through quantitative data, it allows the viewer immersion into the experience. Analysis of artworks such as those created by Annie Pootoogook and Elisapee Ishulutaq provide a window into the experiential knowledge and lived experience of Inuit women. Both artists provide a lens which delivers anthropological analysis including an insight on housing, domestic abuse, mental illness, addiction, climate change, and the transfer of knowledge to ensure the health and wellbeing of Inuit in future generations. Other initiatives, such as the Inuit Tattoo Revitalization Project use artistic processes such as tattooing to mobilize young women to connect with their cultural identities and take charge in their pathways to healing. Art used as a form of qualitative research may access additional data or information, allowing the researcher to view the multifaceted experiences of an individual through their artistic expression. The resulting piece of art can inform us of the artists message long after they are gone - we can gain knowledge and empowerment from what came before us. Accepting art as a valid form of research can allow Inuit to mobilize their knowledge in a way that is true to their own experience and supports self-determination to those who choose to share their perspectives. Arts based approaches also align with the Inuit Tapiriit Kanatami's National Inuit Strategy on Research, and the link between research and the broader goal of creating social and economic equity.

USING FORAGING BEHAVIOUR AND ENERGETICS TO IDENTIFY MARINE HABITAT FOR AN ARCTIC SEABIRD

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Identification of important habitat for seabird species that spend most of their life cycle within Arctic regions is a priority for the Arctic Migratory Bird Initiative. Safeguarding habitat for colonial breeding seabirds is especially important, because breeding is a time of year when many birds are concentrated in a small geographic area and require adequate resources for successful reproduction. Intraspecific competition at large seabird colonies forces birds to travel farther to find food, which is thought to limit colony size through density-dependent effects on reproductive success for many species. Modelling the relationship between colony size, foraging range, and reproductive success can help to explain population dynamics of colonial species and inform marine planning at colonies throughout a species' range. We used multi-colony GPS tracking data and a bioenergetics model to estimate foraging range, chick growth rate, and fledging success as a function of colony size in thick-billed murres (Uria lomvia). We measured detailed foraging behaviour of 550 thick-billed murres from four Canadian colonies, ranging in size from 16,000 to 400,000 pairs. We compiled data on foraging range from 17 different murre colonies in Canada, Greenland, and Europe to model the relationship between colony size and foraging range. Foraging range scaled by 0.44 power of colony size, this relationship explained 88% of the variation in foraging range. Trip duration increased with foraging range to the exponent 0.90. We used these relationships to model foraging range and chick provisioning rates. Murres provisioning chicks with low quality prey, 30 kJ, would experience density dependent limitation on fledging success for colonies larger than 70,000 pairs. With high quality prey, 60 kJ, density dependence would not affect fledging success until colony size exceeded 700,000 pairs; however, chicks from colonies larger than 200,000 pairs will have low fledging weight (<150 g) and longer nestling periods regardless of prey quality. Our model quantifies how density dependence can limit reproductive success for colonial species through changes in foraging behaviour of adults and it provides

a framework for identifying ecologically important areas around seabird colonies that integrates behaviour and population dynamics. This model can be used to estimate the foraging area required for murre colonies based on colony size and to predict how changes in prey availability could affect future reproductive output. These results can inform marine planning and conservation for Arctic seabirds by delineating critical habitat requirements, contributing to development of guidelines for fisheries management and shipping around breeding colonies, and identifying colony-specific criteria for monitoring population level responses to changing environmental conditions.

DETERMINANTS OF NUNAVIMMIUT POSTSECONDARY SUCCESS

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Background: Education is a key determinant of health. Historically, postsecondary institutions in Canada were not designed to support the unique needs of Indigenous youth, leading to the highest postsecondary dropout rates of any other cultural or ethnic group despite evidence of academic ability. In the current wave of effort to implement support services for Indigenous students it is important to study “what works” as presence of these services alone will not guarantee student success. Objective: To explore the determinants of Inuit postsecondary success in the context of first year students moving from Nunavik to Montreal for postsecondary studies. Methods: This study applies a qualitative research method, and a realist inductive thematic analysis of public facebook posts and one-on-one semi-structured interviews with students (n=14) having completed one or more years of postsecondary studies, as well as with relevant academic support staff (n=6) at John Abbott College in Montreal. This project was approved by the Research Ethics Committee of Nunavik’s school board, Kativik Ilisarniliriniq, McGill University, and John Abbott College. Results: Thematic analysis showed that values, skills and attitudes were key drivers of a successful first year student experience. Values referred to the characteristics of student services that students responded to and felt facilitated their success including an emphasis on student well-being in service delivery, the prioritization of trust and relationship building between students and support staff, and the personalization of support offered to students based on their unique circumstances. Skills which students found critical to their transition included leadership opportunities, setting and tracking goals- both personal and academic, resource mapping or knowing who to turn to for different types of problems, and the development of confidence in homework and study skills. Attitudes which were useful to students included gaining a balanced perspective on challenge- understanding that they were not isolated in struggling with adjusting to postsecondary, the development of a sense of belonging on campus, and a positive sense of identity. Conclusions: Values, skills and attitudes shape first year student success. This study showed that values facilitate positive interactions with student services, and the specific skills and attitudes past students have relied on to overcome challenges with the transition to postsecondary. Building on stories of past success, this study sheds light on how student services may strategize to better support Indigenous students and increase retention rates in the first year of postsecondary education through increased attention to the values being promoted in the delivery of student services and through supporting the development of specific skills and attitudes in first year students.

NUNAMIN ILLIHAKVIA: LEARNING FROM THE LAND

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NT, CanadaThe Nunamin Illihavia project in Ulukhaktok, NT represents a new way of conducting research in the Arctic. The project was designed by Inuit and is governed and administered by Inuit, including project finances. The overarching goal of the Nunamin Illihakvia project is to improve the ability of Inuit to adapt to the health impacts caused by climate change through the generation and sharing of traditional knowledge important for subsistence livelihoods. The project has three themes within the focus of knowledge generation and sharing: (1) subsistence hunting: hunter-mentorship program, equipment making, land camps; (2) fur preparation and sewing: traditional sewing projects; and (3) Inuinnaqtun language: local radio, learn Inuinnaqtun videos, language mentors. Research questions that will be asked during the course of the project include: how is sewing important to Inuit women and what contributions do women make to household and community through sewing? What are the implications of formal learning programs for traditional modes of knowledge sharing? What is the feasibility of a cultural school in Ulukhaktok? How do place names influence people's perceptions and use of the land? The project is funded by Health Canada's Climate Change and Health Adaptation Program (CCHAP).

TOONIKTOYOK: REAL-TIME MONITORING OF RISK AND ADAPTATION TO CLIMATE CHANGE IN THE ARCTIC

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TOONIKTOYOK is an Inuinnaqtun word used to describe extreme determination. Inuit hunters express tooniktoyok when they travel and hunt for food and it is this determination to succeed that frames this project. The overarching goal of the TOONIKTOYAK project is to develop a dynamic understanding of how changing climatic conditions are affecting subsistence hunting and adaptation options among Inuit in Ulukhaktok, NT. In doing so, the project will implement a key finding and recommendations of the Arctic Monitoring and Adaptation Program's (AMAP) report "Actions for a Changing Arctic – Bering, Chukchi and Beaufort Sea Region" and share the project outcomes with the broader AMAP community. Specific objectives are: (1) to assist hunters collect and record information about unusual conditions encountered, hazards faced, coping mechanisms used, challenges experienced, and changes in the weather, wildlife and travel routes; (2) document the economic costs of hunting; and (3) provide a venue for hunters, researchers and decision-makers to identify and share their observations, concerns, and information needs. Ten active hunters have been equipped with GPS units which they take on every trip throughout the year to record land use data, downloading trip data and answering a series of fixed questions (based on the project objectives) on their activities bi-weekly with an Inuit project coordinator. The expected outcomes of this project will contribute to a dynamic understanding of how Inuit are affected by and respond to climate change, and identify opportunities to support Inuit adaptation. The Tooniktoyok project is funded by Indigenous and Northern Affairs Canada (INAC)'s Climate Change Preparedness in the North Program (CCP).

HYDROGRAPHICAL VARIATIONS AT JAMES BAY EELGRASS BEDS IN RELATION TO AN UNDER-ICE RIVER PLUME

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Eelgrass beds are globally recognized as important habitats for juvenile fish and birds and provide important ecosystem services including nutrient recycling, sediment trapping, and carbon sequestration. During the 1990s, eelgrass beds in eastern James Bay underwent a massive decline, this study focuses on the coastline north of the La Grande River. A possible contributor to the decline is the freshwater plume of the La Grande River. Hydroelectric developments of the La Grande River have reportedly more than doubled the average annual discharge and shifted peak discharge from spring to winter. In association with the Cree Nation of Chisasibi and the Arctic Eider Society, a series of moorings were deployed during winters of 2016 and 2017 equipped with sensors measuring conductivity-temperature-depth, current velocity, and turbidity. CTD profiles of the water column were collected at various inshore and offshore locations from the mouth of the La Grande River extending along the North East coast, with focus on two Bays that historically contained eelgrass beds. The more northerly site (Bay of Many Islands) still contains relatively healthy eelgrass beds and the other site (Paul Bay) currently contains very little eelgrass. Data was collected in both the winter and summer of 2016 and

2017 to compare the seasonal variation in the properties of the plume. Towards the river mouth (Paul Bay) the winter water column is generally strongly stratified; a relatively thick (5m), low salinity (0psu) surface layer overlies salty water (25psu). In summer, the water column is less stratified and surface salinities are higher (12psu). Both greater river discharge in winter and reduced wind mixing under the landfast ice likely contribute to these differences. 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. The surface currents flow in a north-westerly direction with the direction turning westward with depth and flowing east at bottom. At the nearshore eelgrass bed sites, surface salinity is consistently lower, and temperatures are higher in Paul Bay compared to Bay of Many Islands. For example, in January 2016 and 2017 temperatures in the Bay of Many Islands were below 0°C and salinities were between 8 and 12.5psu. By contrast, in Paul Bay, the winter water temperatures were between 0°C and 3°C and salinities ranged from 0 to 2psu. The currents are also weaker in Bay of Many Islands, and flow predominantly westwards except at depth where they flow south eastwards. Salinity and temperature variations at each site reflect the spring-neap tidal cycle and temporal variability in the vertical properties of the plume. Preliminary interpretation suggests that whereas very fresh surface waters from the offshore river plume circulate freely into Paul Bay, brackish waters produced by vertical mixing of fresh surface waters and saline deep waters circulate into Bay of Many Islands. The topography and weaker currents in the sheltered Bay of Many Islands setting likely lead to higher salinities, providing more favourable conditions for eelgrass growth.

BUILDING KNOWLEDGE AND CAPACITY IN THE NORTH: IS RESEARCH ADDRESSING NORTHERN PRIORITIES?

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Recent studies demonstrate poor alignment of science priorities, funding patterns, and recognized societal needs in the Arctic, suggesting that Arctic research is not meeting regional priorities. In Canada, northern governments, Indigenous organizations, and non-governmental organizations are articulating their research priorities and needs as they outline a path forward for a northern knowledge economy. With the release of the National Inuit Strategy on Research (ITK, 2018) and the Pan-Northern Approach to Science (GY, GNWT, GN, 2016) the discussion has grown beyond local and regional conversations into a national discourse about the Canadian North. A parallel pan-Arctic discussion is also happening through venues like the Arctic Council, the Arctic Observing Summit and the Arctic Science Ministerial meetings. Discussion of a new northern research paradigm, or a focus on collaborative, engaged research in the North, has been happening extensively over the past twenty years. This shift in how research is done has been influenced by both global and local shifts in Indigenous governance and leadership, rapid environmental change, and calls for research that is policy-relevant. However, in the quest for research that informs policy, we also need to address the policies that support research and science. Although currently in the early stages, our study aims to answer the question "is research meeting the community and organizational needs of northern regions?" In this presentation we will explore the policies that support scientific activity across northern Canada, along with northern discourses of research priorities and practices. We will discuss preliminary results of a case study of geographic and thematic research trends which will provide insight into the types of research that are supported in the North. GY, GNWT, GN, 2016. A pan-northern approach to science. 41p. http://www.anorthernvision.ca/documents/A16_Brochure_PanNorthernApproachtoScience_71402_English_WEB-Final.pdf ITK, 2018. National Inuit strategy on research. Ottawa, ON, 44p. https://itk.ca/national-strategy-on-research/

A REFLECTNCE PROBE TO MEASURE SEA ICE INHERENT OPTICAL PROPERTIES

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Expanded, more detailed and in situ spatiotemporal characterization of sea ice inherent optical properties (IOPs) is necessary to better predict sea ice energy and mass budgets and under ice primary production. This project aims at developing an active probe measuring non-invasively IOPs of a small volume of ice (mm3 - cm3) with fast processing. The precision, efficiency and ruggedness of the concept would allow scientists to obtain ice IOPs values directly in the field within minutes. The probe is based on the diffuse reflectance technique used to measure IOPs of human tissues. Conceptually, the instrument emits light guided through ice by an optical fiber. Backscattered light is measured at different distances from the source and compared to Monte Carlo modeled reflectances. An inverse algorithm allows inferring the absorption coefficient, the scattering coefficient and the phase function of the scanned sea ice. This presentation summarizes the probe functioning and the first performance tests of the probe on sea ice in the laboratory and on the field.

BELUGA BITS: PHOTO ID AND WOUND TYPES PROVIDE INSIGHT INTO THE HEALTH OF BELUGA WHALES IN THE CHURCHILL RIVER

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The use of natural marks to re-identify individual animals and to learn about the biology and threats to a species has a long history. The most advanced application of this has been in cetaceans such as killer whales (Orcinus orca) and humpback whales (Megaptera novaeangliae), where fin shape, injuries, natural patterns of pigments are used to reliably identify individuals over time. Beluga whales (Delphinapterus leucas) have been less amenable to these techniques as they tend not to show their flukes, lack a dorsal fin, and surface low in the water. Under water photographs provide a way to increase the observation of beluga whales such that photo ID is possible. The Churchill River Estuary is home to approximately 5000 beluga every summer, and viewers around the world can watch live stream under water video of these animals captured on the 'Beluga Boat'. We have collected photos and classified images from thousands of hours of these underwater videos using the power of citizen scientists around the world. During July and August of 2016, 2017, and 2018, 22,505 snapshots were collected from the explore.org live beluga cam. To date, over 2500 citizen scientists have completed 90,000 classifications of these photos in the Beluga Bits project hosted on Zooniverse.org. Processing of the 2016-2017 data set is ongoing, but has already revealed itself to be a rich source of information on beluga biology. The classifications provide estimates of the number and age classes of beluga in each image with repeated classification allowing for estimates of error rates. The classifications are used to produce a catalogue of individuals with marks or wounds that may provide an opportunity for re-identification. This vastly reduced catalogue of images can also be used to investigate the sources of wounds on beluga and other aspects of population health. Skin conditions seem common in beluga in the Churchill River including those suggestive of herpes and pox virus infections. A number of major wounds have also been identified although the source of these wounds are not always obvious. Small craft strikes, polar bear attack, and ice scaring have been suggested based on wound morphology. Ongoing collection of underwater photos will allow for the non-invasive assessment of beluga health in the Churchill River and Hudson Bay.

WINTERTIME DIEL VERTICAL MIGRATION UNDER SEA ICE IN HUDSON BAY

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A mooring equipped with two acoustic Doppler current profilers (ADCP) and a sediment trap was deployed in September 2016 in Hudson Bay at 59° 58.156' N 91° 57.144' W (~190 km north-east from the port of Churchill). The backscatter intensity and vertical velocity time series from the mooring ADCPs showed a pattern typical for the zooplankton diel vertical migration (DVM) under sea ice during winter. To correct for beam geometry, we derived volume backscatter strength from echo intensity. Actograms were built for the volume backscatter strength, vertical velocity and modelled lunar light. An upward looking ADCP was capable to record the ice thickness and periods of open water above the mooring. The sediment trap captured different types of zooplankton that allow identifying the scatters involved in DVM. From the acquired data we observed the interaction of vertical migration with lunar light, tides, water and sea ice dynamics. The presented data constitutes a first-ever observed presence of DVM in Hudson Bay during winter.

MOBILE LABORATORIES: BRINGING DIAGNOSTIC CAPACITY TO REMOTE NORTHERN COMMUNITIES TO IMPROVE TUBERCULOSIS DETECTION AND CONTROL

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Background Tuberculosis (TB) continues to be a significant health burden in northern and remote parts of Canada, exacting a disproportionate burden on First Nations, Métis and Inuit communities. In 2016, the general, non-foreign born Canadian population experienced an incidence rate of 0.6 cases per 100,000 per year. By comparison, the Métis population experienced 2.1 per 100,000 and First Nations rates were 14.5 per 100,000 (off-reserve) and 34.1 per 100,000 (on-reserve). Inuit populations experienced the highest rate at 170.1 per 100,000, similar that of high burden countries. A key challenges to TB elimination in the north remains limited access to diagnostics. Due to multiple issues, time from sample collection to detection can exceed one month, during which time an infected individual could transmit to others. As part of a community-wide screening effort in northern Canada, the National Microbiology Laboratory (NML) was able to bring diagnostics into the community to help reduce time-to-treatment. Methods The NML mobilised equipment along with several teams of two laboratorians into the community at the request of the community and the Government of Nunavut. The equipment, including a biocontainment tent, was set up within a closed off area in the mobile screening clinic. This was essential to safely process potentially infectious sputum samples. Sputa were directly tested using the Cepheid GeneXpert platform using MTB/RIF cartridges. All samples continued to be referred to the territorial laboratory system in agreement with Canadian TB recommendations (gold standard of 3 sputum for smear and culture). A project to perform Interferon Gamma Release Assay (IGRA) testing in-community was also piloted. Results Approximately 416 sputa were submitted for Xpert testing from 380 patients. Of these patients, six were laboratory confirmed cases: two being smear and culture positive, and four being smear negative but culture positive. Both smear positive cases were found positive by Xpert. Time to detection by smear vs Xpert depends on which sputum was received within the mobile laboratory; In one case, 1 of the 3 sputum collected was found positive by smear and culture, however, this particular sample was not received at the mobile lab. Of the smear negative cases, the majority of samples were also negative by culture, suggesting early-stage paucibacillary infections in an early stage. In addition, the IGRA testing platform was found to be operational in-community, however specimen numbers were too low to perform a meaningful assessment during this deployment. Conclusion Mobile laboratory platforms offering molecular testing provide an opportunity to enhance a mobile mass screening TB clinic by enabling rapid time to detection. The biosafety considerations of sputum handling were resolved using appropriate expertise and equipment. Culture is still needed in order to detect all infections within the population, but all smear-positive individuals were detected using this approach. These individuals are thought to be most infectious and rapid institution of treatment can reduce further transmission events. IGRA testing in community is a promising manner of reducing the number of visits needed for a mass screening clinic for LTBI detection but this will require further development.

IMPACT OF FOREST FIRE ON AQUATIC INVERTEBRATES IN SUBARCTIC LAKES

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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 Canada's Northwest Territories (NWT), burning a landscape rich in lakes and ponds. Lakes found in burned areas often experience large increases in nutrients and metals which can have negative impacts on aquatic communities, including sport and subsistence fish. We compared lakes that were directly impacted by a 2014 megafire in the Sahtú Settlement Area (SSA) of the NWT to non-impacted reference lakes to assess how water quality and invertebrate communities responded to fire in this subarctic region. In the summer of 2018, we sampled nine burned lakes, two partially affected by burn, and five reference lakes. We will compare abundance, richness, and diversity of zooplankton and benthic/macro invertebrates, as well as the interrelationships between the physiochemical environment and invertebrate communities. We will also evaluate other variables that have been reported to change post-fire, including mercury level in water/biota and changes in feeding habits of invertebrates (using isotopic analysis of carbon 13/nitrogen 15). With severe fires becoming more prevalent as a result of climate driven impacts, understanding the response of aquatic habitats to a burned landscape will become increasingly important for local communities and environmental managers.

ARCTIC INDIGENOUS WELLNESS FOUNDATION; URBAN ON THE LAND HEALING CAMP

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The Arctic Indigenous Wellness Foundation (a registered charity) Project is an urban land-based healing program targeting indigenous men and youth at risk of suicide and/or incarceration on the streets. Combining indigenous cultural education with traditional therapeutic interventions in a wilderness urban setting, our program will continue to improve the mental health of indigenous males who are most often left out of conventional support services by targeting factors that promote mental health and protect against suicide risk, including cultural identity, self-esteem, agency, ability to cope with stress, social support, positive role models, and a sense of community belonging. The Arctic Indigenous Wellness Foundation (AIWF) strives to ensure full access to our urban on-the-land cultural site for teaching, mentorship, and support with traditional ceremonies, traditional food preparation, language revitalization, traditional tool making, on-the-land teachings, medicine teachings, sweat lodges, traditional counselling, and cultural gatherings. Our primary objectives are to improve the mental health of at-risk Inuit, First Nation, and Métis peoples with collaborative, culture-specific, community-supported programs and to share program knowledge across the North. The AIWF's land-based urban healing site includes a traditional teepee and canvas tents with stoves in close proximity to the downtown homeless population and the local jail and hospital. The urban land site hosts traditional counsellors, healers, and cultural experts who provide one-on-one and group support services for at-risk men and boys. One-on-one support includes utilizing traditional indigenous male counsellors and indigenous traditional healers as per client request using culture as the lens for supportive care. Group support services also focuses on cultural identity and skill building for indigenous men and boys. Although the project site is located within the capital city of Yellowknife, the beneficiaries of the project are men and boys from across the NWT who end up on the streets. Specific programming on the urban land-based site also includes traditional-skills teachings, such as traditional harvesting and craft and tool making, ensuring an added economic benefit to at-risk men and boys who have a high rate of unemployment. This allows the men and boys to take advantage of learning new skills to enhance their ability to engage with, for example, local tourist markets in addition to building a sense of comradery among the men and boys while providing opportunities for engagement with culturally specific mental-wellness supports. The project has its focus on at risk men; however, we support any person who experience homelessness, addicttions, trauma and would like support on their healing journey. I will be presenting PowerPoint slides and talking of our programs.

FURTHER TESTING OF THE 230TH-EXCESS DISTRIBUTION IN CENTRAL ARCTIC OCEAN SEDIMENTS FOR THE SETTING OF A LATE QUATERNARY CHRONOSTRATIGRAPHY

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Conflictual chronologies have been proposed for the Central Arctic Ocean. Early works in the 80s and 90s pointed to low sedimentation rates of the order of mm/ka (ex : Clark et al, 1986). Later studies gave much higher sedimentation rates of the order of cm/ka (ex : Backman et al., 2004; Jakobsson et al., 2001). Recently, based on the distiribution and inventories of 230Th-excesses (230Thxs) in very low sedimentation rate sites of the central Arctic Ocean, Not et al. (2010), then Hillaire-Marcel et al., (2017), demonstrated that the earlier stratigraphy was more likely. In the present study we further document the potential use of the 230Thxs approach as a stratigraphic tool at sites characterized by significantly higher sedimentation rates. The study core PS2757 was raised from the southern Lomnosov Ridge during a 1995 cruise of the German vesel Polarstern (Rachor et al., 1997). It has been analysed to document the chronostratigraphy based on 230Thxs age constraints. As also observed in other central Arctic sites (Hillaire-Marcel et al., 2017), the present study site records 230Thxs above the vertical production in the overlying water column from the decay of dissolved 234U, leading to infer advection of 230Th as a prominent feature. Another interesting feature is the relatively large amplitude variability of 230Thxs downcore vs a theoretical exponential decay curve, in relation to glacial-stadial vs interglacial-interstadial sedimentary regimes. The estimated extinction age of the 230Thxs downcore (~ 300 ka; Hillaire-Marcel et al., 2017) seems to fit reasonably well with 10Be age estimates from Strobl (1998) for the same sedimentary sequence. Both methods point to a mean sedimentation rate of about 3 cm/ka at the site, i.e., about one order of magnitude above those at sites where the 230Thxs method has first been tested. This leads to the conclusion that this method can reasonably be used for sedimentary sequences experiencing a relatively large spectrum of sediment accumulation rates. A final feature worth of mention is that the 230Thxs inventory at the study site, is nearly similar to those observed at distinct depths and lower sedimentation rate sites from the central Arctic ridges investigated in the earlier studies cited above. This leads to conclude that fluxes of 230Thxs in the central Arctic Ocean are independent of particulate fluxes and governed by a common process, possibly linked to brine production and fate along Arctic margins, as suggested by Hillaire-Marcel et al. (2017). References: Backman et al. (2004). Quat. Sci. Rev. 23 (11e13), 1435e-454 Clark et al. (1986). Geophysical Research Letters, 13(4), 319-321. Hillaire-Marcel et al. (2017). Geochemistry, Geophysics, Geosystems, 18, 4573–4585. Jakobsson et al. (2001). Global and Planetary change, 31(1-4), 1-22. Not et al. (2010). Quaternary Science Reviews, 29(25), 3665-3675. Rachor, E. (1997). Berichte zur Polarforschung Reports on Polar Research 226, 330 pp. Strobl, C. (1998). Doctoral dissertation, Ruprecht Karls University, Heidelberg, 231 pp.

EXPLORING THE ADVANCEMENT OF SCIENCE DIPLOMACY THROUGH ENGAGEMENT - AN ARCTIC COUNCIL SIMULATION

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Prior to Canada's G7 presidency, numerous discussions in Québec and Canada highlighted the intersection of science and diplomacy, with an emphasis on Arctic relations. As a non-profit organization run by graduate students and early career researchers whose mission is to foster these voices in science policy, Science & Policy Exchange was compelled to explore the advancement of science diplomacy through the engagement of students and early career scientists. To do so, we provided training in science diplomacy to a cohort of young researchers by means of a negotiation simulation modeled on the Arctic Council in collaboration with Melody Brown Burkins (U Dartmouth). These trainees were then invited to participate as key stakeholders to two panel discussions held in Montreal, Québec, Canada on May 18th, 2018: (1) The role of the student diaspora and internationalization of research in science diplomacy and (2) How to train scientists to communicate with policymakers and promote/value their policy/diplomacy engagement. The simulation was intended to represent a Sustainable Developmental Working Group Meeting and the goal was to create a final document of recommendations for the project "Connecting UN Sustainable Development Goals to Arctic International Science Cooperation Activities". The students were assigned roles representing the Permanent Participants, the six Arctic Indigenous groups, and the observer states and organization of the Arctic Council. After hours of negotiations, students gained a deeper understanding of sustainability, cooperation and consensus. They learned the importance of creating bridges between nations and cultures and the challenges of such negotiations. This simulation clearly revealed that investing in the next generation of science diplomats will help with working on global challenges, such as achieving the UN 2030 agenda for Sustainability goals, and will promote inclusiveness at an international level.

MEASUREMENTS OF THE POLARIZED BRDF OF ARCTIC MACROALGAE WITH APPLICATIONS TO MODELLING UNDERWATER LIDAR

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The Arctic has been warming steadily for the past few decades causing a reduction in ocean ice-coverage. Consequently, the increased exposure to light has already begun to affect coastal Arctic marine primary productivity, and a regime shift has been observed in some Arctic macroalgal communities where species normally found in cold-temperate waters are seen to occur and survive in Arctic marine ecosystems. There is an urgent need to establish baselines and monitor change in the abundance and diversity of the Arctic marine phytobenthos. Using the absorption, inelastic scattering (fluorescence), and elastic scattering properties of macroalgae excited by lasers, we are developing a LiDAR to carry out surveys of coastal Arctic benthic environments from an autonomous underwater vehicle (AUV). The LiDAR will map the morphology (3-D surface) of the substrate and macroalgal canopy, as well as detect and characterize the macroalgal biomass. Important parameters in designing such a LiDAR are the elastic and fluorescent reflectance properties of Arctic macroalgal targets. Here we present the results of laboratory measurements of the polarized bidirectional reflectance distribution function (BRDF) measurements for both elastic and inelastic scattering (fluorescence), with a particular emphasis on the near-exact backscattering configuration of our LiDAR. Models and in-situ measurements demonstrate two competing approaches for laser detection of macroalgae at a distance: the fluorescent return from laser excitation at 532 nm versus differential absorption from two elastic laser returns (e.g., 473 nm and 532 nm). Spectrofluorescence properties of Arctic macroalgae and the value of using polarization optics are also evaluated.

INFECTION OF EASTERN CANADIAN SEALS WITH THE ZOONOTIC PROTOZOAN PARASITES TOXOPLASMA, NEOSPORA, AND SARCOCYSTIS

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Seal meat and organs are very important parts of the diet of the Inuit in Canada and elsewhere. Seal meat is also available at retail in Canada's Maritime Provinces, and it is offered in restaurants in metropolitan areas such as Toronto and Montreal. The meat is high in long chain Omega-3 fatty acids, which are important for the prevention of heart attacks and infant brain development, and they lessen the symptoms of post-partum depression. However, when fresh seal meat is eaten raw or undercooked, parasitic zoonotic infections of the animals may pose a health risk to consumers. Toxoplasma gondii is the most prevalent parasite infecting humans and other warm-blooded animals worldwide, causing the disease toxoplasmosis. In most healthy adults, the infection is either asymptotic or will not cause serious illness. Most susceptible to the infection are fetuses and immunocompromised individuals who both face potentially debilitating and life threatening consequences. Neospora caninum is closely related to T. gondii. In contrast to T. gondii with felines as the definitive host, dogs are the definitive host for N. caninum. While the parasite mainly leads to neurological diseases in dogs and cattle, N. caninum was found in 18% of patients with neurological disorders. Sarcocystis primarily infects muscles and lymph nodes of the intermediate host. Humans can serve as definitive hosts for S. hominis and S. suihominis, which are acquired from eating undercooked beef and pork, respectively. Humans can also serve as intermediate host for other Sarcocystis spp., likely acquired by ingesting sporocysts from contaminated food or water and the environment. Infections in humans cause the disease sarcosporidiosis, which is generally asymptomatic. Four seal species are harvested for seal meat in Canada: ringed seals (Pusa hispida), harp seals (Pagophilus groenlandicus), hooded seals (Cystophora cristata), and grey seals (Halichoerus grypus). While ringed seals are most commonly consumed locally by Inuit communities, the latter three seal species are commercially hunted and sold to restaurants. Seals are harvested in a government regulated sustainable manner and, as they are wild animals, seals grow up without the addition of growth hormones or antibiotics. In this study, 124 tissue samples from 81 seals comprising the four above mentioned species were collected from eastern Canada, more specifically from the Nunavik Region of Quebec and from the Maritimes. Twenty three ringed seal, 8 hooded seal, 21 harp seal, and 29 grey seal samples were tested for the prevalence of Toxoplasma, Sarcocystis, and Neospora using nested PCR followed by Sanger DNA sequencing. Toxoplasma was detected in 26% of ringed seals, 50% of hooded seals, 43% of harp seals, and 31% of grey seals. Sarcocystis was found in 4% of ringed seals, 13% of hooded seals, 14% of harp seals, and 3% of grey seals. Neospora was only detected in ringed seals from Nunavik, with a prevalence of 26%. Our results show that zoonotic protozoan parasites are prevalent in eastern Canadian seals, and that consumption of raw or undercooked seal meat or organ tissues may pose a risk of infection to consumers.

DEVELOPING ONE HEALTH STRATEGIES TO ENHANCE SUBSISTENCE FOOD SECURITY IN A CHANGING ARCTIC

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Subsistence food resources are vital for the health, cultures and economies of rural and Native communities in the Arctic. The current warming of the Arctic is posing unprecedented threats to maintenance of subsistence lifestyles and food security in rural communities in the circumpolar North through several pathways. We define subsistence food security as availability of and safe access to healthy local subsistence resources for rural communities. Potential threats involve changes in abundance and distribution of subsistence species, safe access to subsistence resources, and health of subsistence species - including increasing risks of zoonotic disease transmission and biotoxin transfer from subsistence species to humans. Understanding, preparing for, and responding to these changes will require interdisciplinary, integrated, and collaborative approaches such as those inherently relevant to the One Health concept. Following recommendation from a One Health workshop held in 2017 in conjunction with the Arctic Council ministerial meeting in Alaska, a working group of experts was convened to consider emerging risks to subsistence food security in the Arctic. The working group is identifying emerging risks from zoonotic agents and biotoxins, developing a process to engage stakeholders to consider priorities for research and monitoring, and coordinating collaborations to develop One Health research hubs and networks at local, regional, and circumpolar level. The overall goal is to establish 1-3 demonstration projects each focusing on a selected food security theme, and each engaging local communities in observation and building youth education opportunities for participating communities. We envision the first project sites to be located in Alaska, and using them as templates to expand community-based One Health hubs broadly across the circumpolar North. The demonstration projects are intended to serve as a platform to strengthen community-researcher connections and circumpolar collaboration venues in the One Health framework.

PERMAFROST DYNAMICS AND MERCURY SPECIATION IN PAIRED HIGH ARCTIC LAKES

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Mercury (Hg) is an environmental contaminant of rising concern within the past few decades, in particular through the bioaccumulation of Hg within Arctic ecosystems. Increases in Arctic air temperatures are expected to affect Hg methylation through increased microbial activity and permafrost degradation. Thawing permafrost and permafrost disturbance have shown increases in particulate bound Hg to water bodies and may increase substrate availability for microbial Hg methylation through the release of dissolved/particulate organic carbon (DOC/POC). The impact of rising temperatures and subsequent thermal and physical perturbation of permafrost are therefore important processes when considering Hg speciation in a changing climate. The Cape Bounty Arctic Watershed Observatory (CBAWO) has been monitoring total (Hg) and methylmercury (MeHg) concentrations in two paired watersheds and downstream lakes since 2007. These paired (West and East) lakes allow for the investigation of the influence of climate change and permafrost dynamics on Hg speciation in the lakes, where subaqueous slumping events in 2009 have led to elevated turbidity in West Lake. Since 2009, East lake has remained comparatively clear and Hg concentrations and speciation have remained stable. The mechanism responsible for the differences in Hg concentrations and speciation between these two lakes is unclear, where future monitoring and measurements intend to identify how permafrost dynamics and subsequent changes in turbidity influence the temporal and spatial variability of both THg and MeHg at CBAWO.

WHEN RUN-OFF MEETS PERMAFROST: THERMAL EROSION CHANGES ARCTIC BIOGEOCHEMICAL CYCLES

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Permafrost of Arctic environments plays a major role in the long-term storage of organic carbon, nutrients, pollutants, and pathogens. Permafrost disturbance is expected to trigger several feedbacks to the global climate system by altering biogeochemical cycles and functions of tundra ecosystems. Widely observed in permafrost environments, thermal-erosion gullying is one of the most rapid permafrost degradation processes. On Bylot Island (Nunavut) this process is initiated by concentrated infiltration of runoff water into sinkholes, which evolve into tunnels expanding into the permafrost, especially into ice-wedge networks. The gullies are created by the collapse of the roof of these tunnels and induce major changes in landscape morphology. 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. The main objective of this study is to quantify the spatial and temporal variation in global discharge, organic carbon, nutrient and suspended sediment fluxes throughout a hydrological season, along thermal erosion gullies of an Arctic ice wedges polygon field. To investigate those variations, daily water sampling along thermal erosion gullies of different development stages, associated with water temperature, electrical conductivity (EC), pH and velocity measurements, were conducted during two summer field campaigns. Subsequent laboratory analyses include dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) concentrations, ion concentrations (including inorganic N), isotopes and suspended sediment concentrations. This study provides a first continuous fine scale analysis of heat and mass transfer by rapid permafrost degradation. We show the determinant role of snowmelt and highlight the significant contribution of rainfall events to soil erosion and mass transfer to downstream aquatic systems such as lakes, rivers and ultimately the sea.

REGIONAL-SCALE METHANE SOURCES AND VARIABILITY IN THE MACKENZIE-BEAUFORT DELTA, CANADA

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In this study we sought to gain a better understanding of methane (CH_4) sources and variability in the Mackenzie-Beaufort Delta region during winter conditions. In early April 2018 we conducted regional-scale surveys across the Northwest Territories (NWT), from the southern border with the Yukon Territory, to the Arctic Ocean. The surveys were conducted mainly on roads and seasonal ice roads, using a Los Gatos Ultraportable Greenhouse Gas analyzer mounted in a truck, recording mole fractions of CH_4, CO_2, and H_2O at 1Hz. Survey routes were replicated 2-6 times. We also supplemented road-based work with backcountry snowmobile surveys to investigate areas of interest. In the mountainous upland peel plateau bounding the southern extent of the Delta, few methane sources were present and background mole fractions of CH_4 were sustained at near global background average values. In the lowland Delta south of Inuvik, CH_4 was comparatively enhanced, especially overnight. In this area we observed hundreds of small localized methane enhancements of 10-100 ppbv, generally where hydrologic networks were known to bisect the road. Methane was also frequently emitted from cracks in ice roads along larger river channels. The distribution of anomalies suggests a biogenic source, during a period before spring thaw when biological communities are typically assumed to be inactive. This interpretation is supported by Keeling plot analysis of $d^{13}CH_4$ from several Tedlar bag samples, and from good positive correlation between CH_4 enhancements and Landsat-8 thermal bands for the dates of sampling. To the north of Inuvik, we observed different patterns. The most significant enhancements, and the largest observed in the study, were recorded in proximity to geologic faults north of Inuvik, and abandoned natural gas exploration wells from which significant established reserves have been documented. We interpreted these as natural geologic seeps, which have been noted by other researchers using other measurement approaches. Isotopic indicators in this area were not definitively fossil in origin, but CH_4 enhancements and Landsat-8 skin temperature were uncorrelated, and suggestive of an abiotic source. More regional studies of this nature, in different seasons, and with onboard isotopic analysis, would help further define source types, and emission intensity, in this interesting region.

PROTECTING CARIBOU AND THEIR HABITAT IN NUNAVUT

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Barren-ground caribou provide food, drive local economies and support Inuit cultural practices. Most caribou herds in the Arctic are declining, including severe declines in the Bathurst and Baffin Island barren-ground caribou herds. Caribou now face unprecedented threats with climate change affecting habitat quality, grazing availability, parasites and pathogens prevalence, and predator dynamics — exploration and development of mining, oil and gas, and energy production projects in the Arctic are also increasing. Additionally, caribou are challenging to manage because of the large spatial scales that they occupy and the mobile nature of their calving grounds, which can cross inter-jurisdictional boundaries. The Nunavut Wildlife Management Board has a discretionary role to protect caribou and their calving grounds throughout Nunavut, by providing input in the Nunavut Planning Commission's Nunavut Land Use Plan. Exclusion of industrial activities from calving ground benefits caribou herds; however, may negatively affect economic potential for northern communities. Here we present a synopsis of viewpoints of stakeholders, and current and planned initiatives of the Nunavut Wildlife Management Board and its co-management partners, aimed at protecting caribou habitat in Nunavut. Actions taken so far include the Nunavut Wildlife Management Board's contribution to the draft Nunavut Land use Plan, its position on the protection of caribou calving and post-calving grounds, and the creation of the Habitat Management and Protection Program. We demonstrate that cooperation and trust between co-management partners will be crucial to protecting caribou and their habitat.

THE GREEN IGLU: THE SOCIAL, HEALTH AND ECONOMIC IMPACTS OF A GREENHOUSE IN NAUJAAT AND ARVIAT NUNAVUT.

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Food insecurity affects up to 68% of residents in Nunavut with women and children at highest risk while the Canadian average is 8% (Statistics Canada, 2016; Huet, Rosol, & Egeland, 2012). The study of food security provides insight into the political, economic and social context in which they exit (Knezevic, Hunter, Watt, Williams, & Anderson, 2013). However, there is very little research that focuses on Arctic Indigenous communities who historically depended on fishing, hunting, and gathering of traditional or country food as there main source of nutrition (M. Beaumier et al., 2015). The socioeconomic structures that have created serious health and economic failures in northern Canada begin with Colonialism and remain embedded in the social structure today (Grimwood, Doubleday, Ljubicic, Dondaldson, & Biangy, 2012). The Canadian government does not have a food security policy as of 2018. Recent studies suggest that at least one meal a day consisting solely of country foods is needed to be considered food secure in Canada's North (King, H, 2018). Research on food insecurity and the changes in the food systems are important to develop as baseline data to track the changes that occur (M. Beaumier et al., 2015) The blend of western food sources and traditional country food is the norm for most Inuit families with non-nutrient dense food the most affordable choices. Access to fresh healthy food is limited to the availability in retail stores and the ability to purchase high cost foods. There are many times when the store produce shelves are bare, and residents are reliant on highly processed foods to meet their needs. The introduction of a green house capable of growing throughout the year will increase access to fresh healthy alternatives at a lower cost. This paper examines the impact of greenhouses on Naujaat and Arviat Nunavut during 2018. It will explore the produce grown in Naujaat, the yield, and cost to produce the crops. A comparative analysis of food costs from local retailers and the farmers market will be used to assess the impact of the family economics. The paper will also examine the effect on the community with the key factors being the impact on the social structure of food sharing, an increase in health-conscious foods and influence on the ability to increase hunting and fishing due to a decrease in food costs.

ENVIRONMENTAL CONTAMINANTS IN RINGED SEALS (PHOCA HISPIDA) FROM THE CENTRAL CANADIAN ARCTIC: EVALUATING TRENDS IN RELATION TO SEA ICE IN THE GULF OF BOOTHIA

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Given their circumpolar distribution and central role in Arctic marine ecosystems, ringed seals (Phoca hispida) have proven to be useful indicators of spatial and temporal trends in environmental pollutants. Accordingly, contaminants in ringed seals have been examined at locations throughout the Canadian Arctic for several decades; however, to date, little information has been collected from seals harvested in the Gulf of Boothia. Thought to be a particularly productive region of the Arctic, the Gulf of Boothia experienced little change in the extent of annual sea ice and preferred ringed seal habitat between 1980-2000 . It also continues to support one of the highest densities of polar bears in the circumpolar Arctic. Despite this recent period of apparent stability, increasing annual temperatures are predicted to cause future declines in sea ice concentration throughout the Arctic, including in the Gulf of Boothia. These climate-mediate changes in sea ice conditions, along with possible shifts in the availability of prey and increased human traffic, may lead to increased contaminant burdens among ringed seals. We analyzed ringed seal liver and muscle tissue for toxic metals including mercury and arsenic, while blubber was analyzed for persistent organic pollutants (ΣHCH, ΣCHLOR, ΣDDT, ΣPCB), to assess possible relationships between contaminant burdens in ringed seals and annual sea ice conditions in the Gulf of Boothia. Using samples collected as part of a community monitoring program in Kugaaruk, Nunavut, contaminant concentrations were examined with respect to age, sex and duration of the open water season during the year preceding sample collection. The average concentrations of contaminants found in ringed seals generally fell within the ranges reported previously for other locations throughout the Canadian Arctic. Total mercury concentration did not differ with age or among age classes; however, female ringed seals were found to have higher mean concentrations than males. Conversely, ΣHCH, ΣDDT, and ΣPCB increased with age for males, while concentrations in female seals decreased or remained approximately uniform with increasing age. There was significant inter-annual variability in sea ice concentration during the study period (2012-2016); however, the length of the open water season did not appear to directly influence contaminant burdens in ringed seals. Our results both increase the spatial extent of environmental contaminants research in the Canadian Arctic and offer further insights into how sea ice dynamics may influence the accumulation of environmental contaminants in Arctic food webs.

TIDAL DYNAMICS OF THE KITIKMEOT SEA AND THEIR SEASONAL VARIATION: RESULTS USING YEAR–LONG CURRENT METER DATA FROM DEASE STRAIT AND TIDAL MODELS.

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The Kitikmeot Sea is the heart of the Northwest Passage within the southern Canadian Arctic Archipelago. Our Kitikmeot Sea Science Study (K3S) has been exploring the oceanography of the region and evaluating the impact of tidal straits on the ecosystem. Among other instruments, the K3S deployed a year–long Acoustic Doppler Current Profiler (ADCP) in Dease Strait near Cambridge Bay. The currents and pressure data are analysed to show the seasonal variations in the amplitude and phase of the tidal constituents. Tidal currents and elevation show a seasonal damping of over 50 % from ice–free summer months to ice–covered winter months. Specifically, velocities along the major axis of the tidal current ellipse decrease from summer to winter from 0.28 m/s to 0.08 m/s and 0.12 m/s to 0.05 m/s for the amplitude of the K1 and M2 tidal constituents, respectively. The amplitudes of the elevation K1 and M2 tidal constituents decrease from summer to winter, 0.04 m to 0.01 m and 0.18 m to 0.09 m, respectively. The K1 tide has a phase change of 50 ° and the M2 phase shifts by 10 ° during the year. The wintertime tidal decrease is hypothesized

to be a result of a combination of sea ice friction, as the primary tidal wave moves through the Northwest Passage from Baffin Bay, and sea ice blockage in Victoria Strait, where thick ice accumulates over the shallow sill of the strait. To examine these hypotheses a simple 1d analytical model was employed as well as an FVCOM barotropic tidal model that includes seasonal variation in sea ice friction and strait blockage. The thickness and friction of sea ice in Victoria Strait are independently varied to show which factor dominates the observed seasonal change in tides. Within the Kitikmeot Region, the large seasonal modulation of tides due to sea ice needs to be implemented in tidal predictions (e.g. WebTide), in order to accurately predict the tides. With increasing length of the ice–free seasons, tidal currents and range are larger during longer portions of the year. In narrow and shallow channels stronger tidal currents will amplify vertical mixing, enhancing upward heat and nutrient fluxes, which promotes greater formation of polynyas and elevated biological production, impacting the region's ecosystem.

THERMOKARST LAKE EXPANSION AND CARBON MOBILIZATION IN POLYGONAL TUNDRA OF OLD CROW FLATS, NORTHERN YUKON.

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The expansion and drainage of thermokarst lakes respond to climatic trends and are an important part of the permafrost carbon feedback. The effects of climate on total lake area in thermokarst lowlands vary from region to region and may be monitored via remote-sensing, but it is difficult to interpret changes in lake area in terms of volumes of permafrost thawed and organic carbon released from permafrost. This is because the rates of subaerial and sublacustrine permafrost degradation associated with lake expansion, as well as the distribution of organics in the sediment profile, vary across Arctic lowlands due differences in environmental conditions. This research links changes in lake area with tridimensional estimates of permafrost degradation, and assesses associated changes in permafrost carbon storage at the landscape scale. The study area was a zone of polygonal tundra within Old Crow Flats (OCF), YT, a 5600 km2 Arctic peatland located in an inland basin separated from the Arctic Coast by mountains. The research objectives are: 1) to use remotely sensed imagery to assess rates of lake expansion and characterize the relation between lake size and shore erosion rates in the study area; 2) to use modelling in combination with ground temperature measurements and observations of talik geometry to estimate volumetric rates of permafrost degradation beneath expanding lakes; 3) to use field measurements of shore bank height and samples of permafrost to estimate organic carbon content where permafrost degradation is imminent. Results indicate that, between 1951 and 2011, lake expansion encroached on the surrounding tundra at an average rate of 0.27 km2 a-1. The total lake expansion during this period is approximately equal to the total lake area lost to catastrophic drainage in the 1060 km2 study area. Permafrost thaw occurred beneath the areas that became part of the lakes, and this loss of permafrost was compensated by the aggradation of permafrost in drained basins. However, lake expansion occurred via the erosion of organic-rich permafrost banks varying in height between 0.5 and 4 m, representing an additional loss of permafrost. Due to bank erosion alone, approximately 430 000 m3 a-1 of sediment fell in the lakes of the study area annually. This represents an input of organic carbon into the lakes of 0.22 Tg C a-1, of which 0.15 Tg C a-1 was stored in permafrost prior to being thawed during bank erosion. Comparatively, a doubling of active layer depth over the entire study area in the next 20 years would lead to the thawing of 0.01 Tg C a-1 of organic carbon previously stored in permafrost, less than one tenth of what would be released via bank erosion if current erosion rates are sustained. While current climate models with carbon budgets focus on active layer deepening as the main mechanism of permafrost degradation associated with carbon mobilization, these research results highlight the importance of considering thermokarst lake expansion as a tridimensional process when quantifying the permafrost carbon feedback in Arctic lowlands.

EVALUATING DINSAR DISPLACEMENT DATA USING FINE-SCALE GEOMORPHOLOGICAL MAPPING AND FIELD BASED STUDIES ALONG THE INUVIK TO TUKTOYAKTUK HIGHWAY CORRIDOR, WESTERN CANADIAN ARCTIC

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Northwestern Canada is one of the most rapidly warming regions on Earth. Changes in air temperature, precipitation, ice/snow cover, wildfire regimes, and vegetation all have substantial implications for permafrost stability. Terrain subsidence is expected to be the most widespread process to transform this landscape and it is likely to intensify. However, detecting and tracking this long-term environmental change beyond point measurements requires innovative monitoring strategies developed from remote sensing methods. Differential interferometric synthetic aperture radar (DInSAR) is a remote sensing technique that detects centimeter scale displacements in elevation. In permafrost terrain, the patterns of surface displacements are attributed seasonally to heave and settlement of the active layer, and, over longer time-scales, permafrost degradation or aggradation as a result of changing local conditions or climate change. The Northwest Territories Centre for Geomatics has produced RADARSAT-2 DInSAR data (2013-2017) along the Inuvik-Tuktoyaktuk Highway (ITH) corridor, a new 138-km highway over continuous, ice-rich permafrost that traverses forest through to low-shrub tundra. Our research goal is to evaluate the accuracy of these displacement products using fine-scale geomorphological maps and field-based studies to examine the sensitivity of different geomorphic terrain types to thaw across a climatic and permafrost ground temperature gradient. Complementary field data, collected from a network of sentinel monitoring stations and stable benchmarks installed along the ITH, includes: A) surface displacement measured by heavemetre and from repeat unmanned aerial vehicle derived terrain models; B) near-surface ground temperatures; C) active layer thickness; D) soils and surface cover; and E) climate and snow data. Together this information supports a multi-scale assessment of landscape change, and will be valuable as a long-term monitoring tool to evaluate infrastructure performance, and to track surface displacement related to seasonal thaw and permafrost degradation.

DIVING BEHAVIOUR AND HABITAT USE OF THE CUMBERLAND SOUND BELUGA WHALE (DELPHINAPTERUS LEUCAS)

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The threatened beluga whale (Delphinapterus leucas) population in Cumberland Sound, Baffin Island, Nunavut, was commercially hunted until the 1970's and has suffered severe population depletion as a result; thought to once number as many as 8,500 whales the population is currently estimated at just over 1,000 whales. While harvesting of the population still occurs at a rate of about 40 landed whales per year, there are other threats to the population that are harder to quantify, such as those associated with a decrease in sea ice cover and a change in prey species related to warming ocean temperatures. These threats may prove especially deleterious to this beluga whale population because of their site-fidelity. Previous data suggests they undergo only small migrations within Cumberland Sound and do not breed with other stocks. In order to better understand the declining Cumberland Sound population, we propose analyzing telemetry data from 1998-1999 and 2006-2008 to examine how beluga distribution changes seasonally and how it may have changed between these two time periods. Environmental data such as ice coverage, bathymetric features, and temperature, in addition to known distribution of prey species, will be used to determine if the migrations of whales between seasonal habitats is influenced by any of these external factors. Dive parameters such as time at depth and maximum dive depth will be explored and compared to dive behaviour of healthy beluga populations in the High Arctic and Western Hudson Bay, and to a similarly threatened beluga population in Eastern Hudson Bay. These analyses will determine if dive behaviour is correlated with population health (e.g. if whales in Cumberland Sound are diving more frequently and spending more energy on foraging than whales in non-threatened populations). Belugas are critically important both as predators in their ecosystem and as an important food source for Inuit communities. This research will allow for more effective management and conservation strategies for the Cumberland Sound beluga population.

LIBERATING ARCTIC BOTANICAL BIODIVERSITY DATA AT THE CANADIAN MUSEUM OF NATURE

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Core to the polar research information spectrum are the millions of biological and geological specimens in natural history collections. These specimens represent biodiversity data documenting the distribution of species in time and space; they serve as vouchers for the datasets that underpin scientific conclusions, allowing future workers to confirm or revise identifications; and they are sources of new data, such as genetic information. Most natural history museums face the massive “big data” challenge of databasing and imaging their collections, allowing them to be widely discovered, shared, used and reused in research and outreach. Many also possess backlog material: specimens collected and stored, sometimes many decades ago, that have never been accessioned or prepared for long-term use, and that are consequently not discoverable or available for study. The Canadian Museum of Nature houses over 300K Arctic specimens – the largest Arctic natural history collection in Canada – but data for only a subset are currently accessible online. To correct this, the National Herbarium of Canada is engaged in a project to digitize, georeference and image its Arctic plant, moss and lichen specimens, according to global standards that facilitate collection data sharing and integration. We are also processing important Arctic backlog material, including 3025 Canadian Arctic specimens collected in the 1970s to the 1990s at great expense that were never mounted or formally acquired.

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 necessary to accommodate environmental research, frequently spending time on the land participating in hunting, fishing, gathering, and trapping activities. However, opportunities for youth to engage in similar research relationships are limited. An erosion of land-based knowledge, attributed to a variety of educational, social, and economic factors, presents challenges to maximizing research benefits for Inuit youth. A potential result is that newer generations of environmental leaders and young researchers are not encouraged and trained within current research efforts. However, Nunavummiut believe that researchers have the responsibility to include Inuit youth in environmental research and enhance their scientific literacy through research engagement. Given that Northern scientific research may generate unrecognized opportunities for greater youth engagement and benefit-sharing, this research seeks to explore pathways for Inuit youth to develop scientific literacy through land-based activities linked to environmental research, the role of researchers in enhancing scientific literacy, and the process and outcomes of youth engagement in environmental research. This presentation will focus on preliminary findings of the research, which is being conducted in partnership with the community of Pond Inlet, Nunavut.

IMPLEMENTATION OF A HABITAT QUALITY INDEX FOR THE PEARY CARIBOU USING SNOW GEOPHYSICAL PROPERTIES RETRIEVED FROM SATELLITE REMOTE SENSING AND MODELING.

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Significant climate variability and change have been observed in the Arctic over the last four decades. In this region, the temperature warming is estimated at +1.06°C/decades, while it is estimated at +0.45°C/decades for the rest of the planet and +0.24°C/decades in Canada. Thus, patterns of negative anomalies in mass balances and spatial snow cover are observed, with a significant impact on the cryosphere response to climate change. Consequently, an increase in the occurrence of rain-on-snow (ROS) is observed. This phenomenon is known to limit the capacity of the Peary caribou (Rangifer tarandus pearyi) to reach their food on the ground underneath the snowpack through the formation of an ice crust. Other features, such as wind crusts or surface melt-freeze crusts have similar effects and the quality of the snowpack is a major cause of the population decrease observed over the last 5 decades (70%) of Peary Caribou. Currently, there is no available assessment of future grazing conditions for the Peary caribou. Our project aims to provide a snow data baseline for the horizon 2100 using a modeling approach. Ultimately, the aim of this project is to produce a habitat quality index for the Peary Caribou in Northern Canada. Given the vast study area in the Canadian Arctic Archipelago combined with scarce in-situ meteorological information, new technologies such as remote sensing and modeling will be required. To detect the presence of the ice layers and ROS events, passive microwave satellite data will be used and coupled with in-situ measurement of surface-based radiometers in order to validate the Snow Microwave Radiative Transfer model (SMRT). Then, a model inversion will allow the retrieval of snow properties trough satellite data. In parallel, the snow cover will be simulated using the "Outils de Spacialisation de SNOWPACK en Arctic" (OSSA), a tool that uses weather reanalysis data, land cover and numerical elevation data to spatialize snowpack simulations, which was developed in our lab. The model will provide snow microstructure information such as density and depth. Combining snow simulations and satellite observations will allow to assess the quality of the snowpack with regards to the Peary caribou foraging conditions. Along with spatial vegetation data, a habitat quality index will be developed to help better predict future migration and survival chances of the species. This method can be applied to past data to observe trends or on future forecasts

NESTING SPACE PARTITIONING AMONG THE COLONIAL SEABIRDS ON SMALL ISOLATED ROCKS – DOLGAYA AND VYSOKAYA (KURIL ISLANDS, NORTH PACIFIC)

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Dolgaya and Vysokaya (23 and 42 meters high) are the biggest Rocks of the Kamennye Lovushki Islands – four main rocks with numerous reefs covered by water during high tides and heavy storms. They are located in the region of high biological productivity – Kuril Islands. At least seven species of northern colonial seabirds regularly breed there: slaty-backed gull (SBG), and black-legged kittiwake (BLK; Laridae; Charadriiformes); tufted puffin (TP), pigeon guillemot (PG), and whiskered auklet (WA; Alcidae; Charadriiformes); pelagic cormorant (PC; Phalacrocoracidae; Pelecaniformes), and Arctic fulmar (NF; Procellariidae; Procellariiformes). The Kamennye Lovushki Islands is also one of the few sites in North Pacific where northern fur seals and Steller sea lions (Otariidae) breed sympatrically – their number exceeds twelve thousand individuals. The land area suitable for reproductive activity of birds is very limited. Visual observations and collection of panoramic photos were carried out during May–July of 2007–2010. Detailed counts were performed at some sites only, due to inaccessibility of the areas occupied by the rookery. The spatial analysis, using GIS, was performed to assess nesting space partitioning among the species. The total number of each species did not exceed several hundreds of nesting pairs, except for the TP – their number were over the thousand pairs. The SBG occupy the tops of the Rocks covered by grasses, sharing the upper slope with the NF and TP (which nests in burrows). The WA occupy a lower tier, PG – the bottom of the cliff, BLK and PC mostly breed on vertical rocky cliffs. Despite the niche separation, the space was extremely limited and additional breeding sites were only clearly available for the PG and probably for the WA, however the extensive predation by SBG was the cause of additional pressure on the breeding colony of WA. For other species, additional breeding site could be obtained through the competition or choosing the wrong breeding strategy. The SBG are active commensals of the rookery of pinnipeds and in conditions of abundance of food and the lack of places to nest near the center of the colony, some gulls began to build nests directly on the rookery – on low rocky areas and reefs. In such cases breeding was not successful. Almost all species were experiencing disturbance caused by pinnipeds, especially the SBG, as well as predation by ravens and birds of prey. On the next stage of the study data on population dynamics will be considered in the spatial model for more accurate assessment. According to the preliminary results, this model site could be used in assessment of nesting space partitioning among the northern colonial seabirds breeding sympatrically in the southern part of their ranges under conditions of limited space, effects of climate change and other environmental factors.

"IT DEPENDS…:" CONSIDERING INUIT-IDENTIFIED METRICS IN CONTEXT FOR MONITORING AND RESPONDING TO CLIMATE CHANGE IN THE CIRCUMPOLAR NORTH

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Climate change and associated environmental shifts continue to occur at unprecedented rates across the Circumpolar North. Northern communities, governments, researchers, and public health professionals have identified the need to develop new approaches for monitoring and measuring the impacts of climate change on population health to inform public health research and practice that is linked with broader climate change adaptation strategies. Within this context, many Inuit communities across the North have called for the development of Inuit-determined climate- and environment-related metrics to use in monitoring and response systems that are grounded within Inuit-specific definitions of and priorities for living and thriving within changing environments. The goal of this research was to characterize how climatic and environmental metrics are understood, developed, and used by Inuit in Rigolet, Nunatsiavut, Canada to guide and enhance monitoring of and responses to the impacts of climate change on Inuit wellbeing. In addition, this research sought to explore and describe socio-cultural factors, personal preferences, and other contextual considerations that influence how Rigolet Inuit interpret and use metrics for decision-making related to enhancing and sustaining wellbeing amidst increasing climate change. In-depth, semi-structured interviews were conducted by community research leads with community members in Rigolet between January and November 2018 to identify characteristics of Inuit-determined climate- and environment-related metrics in relation to Inuit wellbeing. Qualitative data from the interviews and debriefs were gathered, co-analysed using thematic analysis methods, and co-interpreted using iterative, collaborative team-based approaches to ensure emergent findings and interpretations were grounded in the perspectives and lived experiences of Rigolet Inuit. Metrics were conceptualized by Rigolet Inuit as any environmental and climatic observations that were important for "capturing information" related to one or more of the following: 1) assessing current conditions in the surrounding ecosystem, or "the land;" 2) understanding changes, patterns, and trends in observations; and 3) informing decisions based on these observations to keep themselves and each other "safe and secure" amidst dramatic and rapid climate change and variation. The ways in which these metrics were interpreted and used depended on a variety of personal, socio-cultural, economic, and technological considerations. Rigolet Inuit emphasized the importance of understanding the interconnectedness between metrics when assessing and monitoring the impacts of climate change and associated environmental shifts on wellbeing and ways of living. The pathways through which climate change can impact population health are often context-specific. It follows, then, that priorities and strategies for monitoring and responding to climate change impacts on Northern communities and environments will also vary depending on socio-ecological contexts. Findings from this research offer deeper understandings of how community-led development of relevant metrics can inform the design of appropriate, effective actions for climate change adaptation. In turn, these understandings can help guide the development of climate- and environment-sensitive public health indicators that are reflective of and responsive to community needs and priorities.

HATCHING TIME OF BOREOGADUS SAIDA IN HUDSON BAY; FURTHER TESTING OF THE FRESHWATER WINTER REFUGE HYPOTHESIS

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The eggs of Arctic cod (Boreogadus saida) hatch in spring under sea-ice cover in time with ice-breakup. The length of B. saida at hatching time is 4-8 mm, the larvae feed on zooplankton in the surface layer until they grow to 30-35 mm. At this size they descend to become fully pelagic species. If larvae are larger at ice break-up they are better able to avoid predation from birds and other fish, a larger size also enhances winter survival. It is to be expected that individuals that hatch earlier and have a longer growing season would be selected for and that there is an evolutionary push for cod to spawn earlier if environmental conditions allow. While the temperature in saline waters falls below freezing, the temperature in under-ice river plumes stays around 0C thus providing good environmental conditions for egg survival, fast development and eventually feeding success. The theory that arctic cod spawn in brackish water to enhance larval survival is called the freshwater winter refuge hypothesis. This hypothesis has been tested for arctic cod in several arctic seas and results supported this hypothesis most strongly in Hudson Bay. However, data in previous studies was collected in mid to late summer and therefore there was little evidence to show whether arctic cod use under-ice brackish water in winter for spawning. In this study we look at spawning time of arctic cod captured in early spring on the 2018 CCGS Amundsen BaySys mission to further test the freshwater winter refuge hypothesis.

ARE TODAY'S FISH "14C OLD" IN THE NORTHERN MOST GREAT LAKE (LAKE HAZEN) IN THE HIGH ARCTIC?

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Fish are an important source of food but are also integrators of terrestrial processes and contaminant pathways. Lake Hazen is a large (538 km2; 265 maximum depth) inland lake in Quttinirpaaq National Park, Nunavut at the northern end of Ellesmere Island with terrestrial inputs dominated by glacial fed rivers. Inputs from streams fed by snowmelt and active layer thawing are minor. Recent work has shown that Lake Hazen and its watershed have undergone rapid and unprecedented change within the past decade, spurring a new intensive research effort on the lake and watershed. The whole lake water residence time has decreased by about a factor of four, concomitant with increases in glacial river discharge. Lake Hazen is now consistently ice-free for part of the summer and both glacier ablation and lake sedimentation rates have increased dramatically. Further, the lake is no longer at steady state with respect to hydrologic or chemical inputs. Lake Hazen is an ultra-oligotrophic lake with rates of primary production that are exceedingly difficult to measure by traditional methods. However, the lake hosts a population of non-anadromous Arctic char (Salvelinus alpinus) with fork lengths up to 70 cm and upper age limits approaching 35 years. Two populations exist and can be differentiated based on 15N. Potential effects of climate change on fish sustenance are uncertain. Terrestrial dissolved carbon in the form of dissolved organic carbon (DOC) and dissolved organic carbon (DIC) entering the lake has a 14C age that is relatively "old". In tandem, both the DOC and DIC within Lake Hazen are 14C "old". We present analysis of 14C of fish collected in several years between 1992 and 2017. Given the recent observed increases in glacial runoff, do Arctic char record changes in the carbon cycle? Are the Arctic char becoming "older" ?

IMPACT OF ENHANCED MOSS COVER ON THE CARBON BALANCE OF A MESIC HIGH ARCTIC ECOSYSTEM

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Simulated climate change experiments throughout the High Arctic have shown increases in percent vegetation cover in response to warming. These changes, however, have not been consistent across all vegetation types. At the Cape Bounty Arctic Watershed Observatory (CBAWO), Melville Island, Nunavut, seven years of warming led to a significant increase in plant cover, with mosses showing the greatest response (Arruda 2016). Enhanced moss cover has also been shown at other International Tundra

Experiment (ITEX) sites in the Canadian High Arctic. Little is known about how changes in moss cover might alter the net carbon balance of High Arctic ecosystems. We investigated differences in carbon exchange processes in a High Arctic mesic tundra environment at the CBAWO. Static chamber (20 cm diameter) measurements of net ecosystem exchange (NEE) and ecosystem respiration (ER) were made on homogeneous patches of moss, Arctic willow (Salix arctica) and representative patches of mixed vascular plants common to this mesic ecosystem. Measurements were made across two days, with a significant rainfall event occurring between the two days. Overall, NEE was almost three times higher (greatest uptake) under S. arctica compared to moss-dominated areas. During the first set of measurements under drier conditions, mosses were a net carbon source to the atmosphere, whereas the two vascular plant areas exhibited net carbon storage. Photosynthetic rates (GPP) were 10-fold higher under S. arctica compared to mosses, but following rainfall the differences in rates were muted (three-fold higher). Mosses responded strongly to the rainfall, storing carbon at a rate similar to the other vascular non-woody vegetation in the area, but at a much lower rate than S. arctica. Our results suggest that enhanced moss cover could reduce net rates of ecosystem carbon storage in the High Arctic, and make the carbon balance more responsive to short-term fluctuations in soil moisture.

PARTICIPATORY RISK COMMUNICATION: INUIT YOUTH-GENERATED MESSAGES FOR COMMUNITY HEALTH PROMOTION

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Arctic community residents are often the recipients of health information from a variety of sources, many of these originating outside of their community or region. The source of the information, and community members' trust in the source have been shown to influence message reception and acceptance. To make informed health decisions, Arctic residents need appropriately designed, framed and delivered information. This is even more critical among Arctic Indigenous youth, in consideration of the evolving nature of communication pathways and modes becoming more common and the significance of many health issues facing Indigenous youth today. Research conducted with Indigenous youth has demonstrated that messages conceived and delivered by youth appear to be trusted and effective for Indigenous communities in conveying information, impacting positive behaviours and promoting healthy lifestyle choices. Leading the development of messages also promotes critical thinking on lifestyle risks, and increases the confidence, capacity, and self-efficacy of youth involved. 'Participatory risk communication' therefore seems to have great potential as an effective health promotion intervention for both Indigenous youth and their communities. The purpose of this participatory research project is to enhance our understanding of the role and value of Inuit youth-led risk communication processes for promoting community health and well-being. The project is engaging Inuit youth in Nunavik in a process of health issue identification, message development and communications delivery for other youth and community members in the region. Each phase of the process is being documented, from the establishment of the research relationship, review of the current state of knowledge of important youth health issues in the region, choices of youth health priority for communication, framing of health information message, and finally its delivery. Through the use of semi-structured interviews and small surveys the project is exploring the value of this experience for youth involved in message development and delivery (i.e. Indigenous youth wellness, 'voice', confidence, capacity, leadership skills and self-efficacy), and the value/impact on youth receiving these messages in the communities (i.e. perception, understanding, acceptance, and action/response related to messages). The project hopes to inform future health communication processes in other Inuit and Arctic Indigenous regions and communities and promote the role of youth as effective communicators.

REGULATING MARITIME OCCUPATIONAL HEALTH AND SAFETY IN THE CANADIAN ARCTIC GATEWAY

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The Canadian Arctic Gateway is vital to the country's long-term economic future. With climate and environmental change in the Arctic, a dramatic decline in sea ice has been observed. The opening of the Arctic is expected to significantly increase maritime traffic, as well as expanding access to fishing resources in this area. The increased maritime activities in polar waters will increase occupational health and safety risks for both seafaring and fishing communities. Environmental sensibility and challenging navigation conditions require special safety and environmental standards in Canadian polar waters. Ice and low temperatures in Arctic waters also impose threats to navigation safety and the health and safety of maritime workers. Extended hours of darkness and daylight also disturb human biological rhythms and affect crews' health and performance. The lack of infrastructure restricts safety communication and emergency response, making both navigational safety and crew members' lives even more vulnerable. In the current Arctic governance structure, occupational health and safety involved in the Arctic shipping and fishing are regulated through four layers: international, regional, national federal and national provincial. At the international level, the International Code for Ships Operating in Polar Waters (IMO Polar Code), promotes standards for maritime safety and the prevention of vessel-source pollution in polar areas. The IMO has also adopted standards for the training of merchant seafarers and has received proposals for model training courses. Following the adoption of the Polar Code, the IMO is now considering extending its reach to vessels that do not fall under the International Convention for the Safety of Life at Sea (SOLAS), including fishing vessels. However, in the context of Canada, maritime occupational health and safety regulatory power is shared by both of the federal and provincial governments. Safety of vessels, equipment, training for certified seafarers and fishers fall into federal jurisdiction. Seafarers occupational health and safety issues are regulated federally, but fishing occupational health and safety issues are subject to different provincial standards. Different scales of fishing, ranging from indigenous artisanal fisheries to large commercial fisheries, may also impose potential regulatory challenges to ensure health and safety of Arctic maritime activities. This presentation draws on a research program adopts socio-legal interdisciplinary methods, including legal doctrinal analysis of statutes and case law, and qualitative interviews with key informants from federal and provincial governments, representatives of industrial stakeholders, indigenous communities and seafarers and fishers with Arctic maritime experiences. The research program explores occupational health and safety challenges faced by Canadian maritime workers involved in Arctic shipping and fishing activities. This presentation focuses on the findings from the analysis of current occupational health and safety standards applicable to Canadian Arctic shipping and fishing activities, and inquires whether functional equivalence of health and safety protection for seafarers and fishers is a desirable and a feasible choice for Canadian Arctic governance, taking into accounts of the next stage development of international maritime safety standards, including Polar Code Phase 2 and related amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW).

TRICHINELLA NATIVA INFECTION IN ARCTIC FOXES (VULPES LAGOPUS) FROM INUVIALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES, CANADA

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Trichinella spp., a zoonotic parasite that can be transmitted through consumption of infected meat, has been reported from people and wildlife in the Canadian North. Terrestrial carnivores are important reservoirs of Trichinella spp, and can be considered potentially useful sentinel species for monitoring the risk of human exposure through consumption of wild or "country foods." We examined tongues collected from 39 Arctic foxes trapped in and around Sachs Harbour, Banks Island and Ulukhaktok, Victoria Island, Northwest Territories, Canada. The samples were processed using a digestion method to recover larvae, which were then identified using multiplex PCR. Trichinella spp. larvae were found in 7 of 39 (18%) foxes. Mean intensity was 63 larvae per gram of muscle tissue (range: 0.5 – 261). Multiplex PCR identified only T. nativa (T2), a northern adapted wildlife species that is resistant to freezing. Higher prevalence was observed in foxes aged >1 year versus those aged □ 1 years ([25%; 4/16] vs [13%;3/23]), in males versus females ([24%; 5/2]1 vs [11%; 2/18]), and those from Banks Island versus Victoria Island ([36%; 5/14] vs [8%; 2/25]). However, no statistically significant association was observed between age, gender, harvest location and T. nativa infection (Fisher's exact test; $p > 0.05$), probably due to small sample size. Our findings indicate that Arctic foxes could serve as potential sentinels for the presence of T. nativa in wildlife in the Canadian North.

INUIT KNOWLEDGE OF RINGED SEALS AS INDICATORS OF SALINITY CHANGE IN SOUTHEASTERN HUDSON BAY

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Observations of the cumulative effects of environmental change in eastern Hudson Bay date back to the late 1970s and the construction of the James Bay hydroelectric project. Hydroelectricity development has led to an increase in the amount of total freshwater released into James Bay and Hudson Bay, as well as a shift in the timing of this release. Peak freshening prior to hydroelectricty development in the region used to occur with spring snow and ice melt, between May and July, but now occurs between late December and March when demand for hydroelectricity is at its highest in southern Québec. This shift in peak freshening has led to a persistent, contiguous layer of less saline surface water in James Bay and eastern Hudson Bay. More recently, the effects of climate change have led to additional impacts on the salinity of surface waters in the region. To understand these cumulative effects of environmental change in eastern Hudson Bay over the past 50 years, the communities of Kuujjuaraapik, Umiujaq and Inukjuak in Nunavik, and the community of Sanikiluaq on the Belcher Islands of Nunavut, have established a Community-Driven Research Network in collaboration with the Arctic Eider Society. This collaboration has included monitoring of wildlife, sea ice, and oceanographic conditions based on local priorities and Inuit knowledge. Hunters in each community have deployed salinity/temperature profilers, working with researchers to collect ice core and water samples, systematically documenting increasingly fresher surface water across the region in winter. Given a lack of baseline data from which to evaluate these changes over time, communities have proposed an integrative approach to documenting Inuit knowledge of indicators of environmental change to provide historical context, and to facilitate the interpretation of results from community-driven research programs. Interviews with Inuit Elders and other experienced land-users were conducted in 2017 in the four partner communities, and co-analysis of the results of these interviews began with communities in the spring of 2018. This poster provides an overview of the changes in salinity observed by community members, as indicated by changes in ringed seal buoyancy in winter months. In the early 1980s, hunters in the Kuujjuaraapik region began to observe seals floating at sub-surface levels in winter (late December to March) - a time of year when seals typically float on the surface due to the accumulation of fat stores throughout the fall. Elders describe these sub-surface levels as becoming progressively deeper, and that, by the late 1980s, widespread losses of winter seal harvests were common. Additionally, hunters have observed similar changes since the 1990s further north in the region, particularly around the communities of Umiujaq and Sanikiluaq. These changes may be driven by the continued, progressive stages of hydroelectricity development, by the compounding effects of climate change, or both. Hunter observations of other indicators of salinity changes are discussed alongside observed changes in seal buoyancy. We highlight the importance of understanding Inuit perspectives in terms of the significance of salinity changes to Inuit, and in relation to identifying priorities for further research.

REASSESSMENT OF THE BIODIVERSITY OF ARCTIC MARINE UNICELLULAR EUKARYOTES

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Previous studies have assessed the biodiversity of Arctic marine pelagic and sympagic unicellular eukaryotes. However, these studies paid less interest to small eukaryotes (<20 µm) and were mostly focused on large eukaryotes (>20 µm), and on cells exhibiting a solid exterior casing, like the siliceous frustules of diatoms and the cellulosic plates of thecate dinoflagellates. Recent studies showed extensive blooms of the prymnesiophyte Phaeocystis pouchetii (3–8 μm) in Svalbard fjords during spring and in the eastern Canadian Arctic during summer, urging the need for more consideration of small eukaryotes (<20 μm) in Arctic biodiversity assessments. Researchers from the Canadian Museum of Nature (CMN) are continuously studying the biodiversity of Arctic marine communities. With more than 127 000 algae samples (>3 500 marine), the CANA collection of the CMN is invaluable and so much could be learned by linking the current state of Arctic marine biodiversity to such historical data. However, the description of the vast majority of species in the CANA collection is very incomplete. For instance, descriptions are rarely supplemented with illustrated drawings or light micrographs, and the taxonomic data have not been entirely checked for authorship, synonymy and spelling errors. Consequently, the central aim of our project is to refresh, update and enrich the CANA collection using state-of-the-art microscopic facilities, molecular approaches and fresh samples collected from fieldwork. We specifically intend to: (1) target labeled species (e.g., Chaetoceros sp. 1) and unidentified taxa (e.g., Actinocyclus spp.) among the CANA algae collection and complete taxa identification following the latest development in the systematics and classification of marine unicellular eukaryotes; (2) use molecular techniques and ongoing sampling to help in the identification of targeted small eukaryotes, primarily diatoms (e.g. species from Fallacia and Navicula genera); and (3) enhance the CANA collection by identifying pan-Arctic regions where data on phytoplankton and ice algae taxonomy are sparse or non-existent, and describe the eukaryotes of these regions using fresh samples from field work. In the actual era of unprecedented changes in the Arctic, our research project is highly relevant as it will deepen our understanding of the biodiversity of marine unicellular eukaryotes, not only in the Canadian Arctic but also at a pan-Arctic scale. Such knowledge is essential in order to assist the circumarctic countries in developing conservation strategies and monitoring plans of marine biodiversity. Furthermore, the scientific publications that will emanate from our work will increase the scientific and public awareness on the existence of such a unique algae collection at the CMN.

CONTAMINANTS AND HEALTH MONITORING IN RINGED SEAL NEAR POND INLET, NUNAVUT

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As a resident of Mittimatalik (Pond Inlet) all my life, I have been noticing changes in weather, sea ice, marine mammals, land wildlife and fish. There are some changes that we cannot tell just by our "naked" eye and that we, as Inuit, need to seek more to find out the unnoticeable things impacting our environment. With our country food we especially need to know if the animals that we hunt or fish are being affected. There is a pressing need to do more testing of our food in the North, the scientific way. However, I usually say that "there can't be any science done in the North if you don't have any indigenous knowledge". In my home community of Pond Inlet, there are more and more cruise ships coming up each year causing more disturbances to marine mammals. In regard to industrial shipping (mining), ships are constantly moving back and forth to the iron ore mine port in Milne Inlet. The mine and the port can also release contaminants to the land and the sea. Through the oceans, the Arctic is also connected to all other regions of the world and can carry and bank contaminants that can be absorbed by wildlife and Inuit. In this research project, I wanted to test the contaminants concentration in and the health condition of natik (ringed seal), our primary country food. I've been working with research mentors from ARCTIConnexion, University of Prince Edward Island and Environment Canada to address my research questions. In the spring and fall of 2017 and 2018, I hunted with my assistants and mentors and collected morphometric measures and samples (liver, blubber, muscle, blood, fur, and others) on about 50 seals with more to come. We did not waste the meat that we took samples from. We shared it to the community and whatever we don't keep like the guts, we gave it to the dog team owners and we used the skin for clothing. We looked at body condition, concentration of mercury, trace metals and Persistent Organic Pollutants, as well as the presence of infectious agents (Brucella, Leptospira, Toxoplasma, and others) in the tissue of the seal. We also ran a series of interviews in Inuktitut with the Chair of the Mittimatalik Hunters and Trappers Organization, active hunters, and elders including a group of women. The interviews involved discussion and mapping of the seal habitat and migration patterns. We documented seal uses in the past, changes in population and numbers, meat, fur and blubber quality, contaminants sources, and the potential causes of change such as climate, shipping and mining. In this presentation, I will show the results of the contaminants and health monitoring as well as the highlights of the work conducted with community members. I am grateful to the people who helped me in my community and to my mentors.

TERMINAL EXTENT AND ELEVATION CHANGE OF THE KASKAWULSH GLACIER FROM 1899 TO 2017, YUKON, CANADA

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The St. Elias Mountains, located in southwestern Yukon and southeastern Alaska, have witnessed rapid recent glacial retreat, becoming one of the largest contributors to sea level rise outside of the ice sheets over the past decade. However, little is currently known about how these recent losses fit into the long-term (century+) patterns of glacier retreat in this region. This study focuses on the Kaskawulsh Glacier, one of the largest glaciers in the St. Elias Mountains, which has a uniquely long record of its change available since the end of the 19th century. In order to understand how the Kaskawulsh Glacier has changed from 1899 to 2017, a collection of Landsat satellite imagery, historical photography, and digital elevation models (DEMs) were compiled. Using historical terrestrial photography taken by the first geologists to map this region (dating back to the years 1899/1900), aerial photography (collected since 1956), and Landsat imagery (collected since 1972), the changes in extent and area of the glacier terminus were mapped. In regards to changes in mass balance, three DEMs were collected from 1999, 2007, and 2017, and used to compute a DEM difference map to illustrate the changes in thickness across the glacier, and to quantify these changes by region (e.g. terminus, ablation zone, accumulation zone). Taken together, these measurements indicate that the Kaskawulsh Glacier's terminus has decreased by 14.68km2 (nearly half of the area which existed in 1900) and lost 0.48m in elevation each year since 1999.

IMPACT OF ENDOCRINE DISRUPTING CHEMICALS AND CLIMATE CHANGE ON INCUBATION BEHAVIOUR AND EMBRYONIC PERFORMANCE OF COMMON EIDERS (SOMATERIA MOLLISSIMA)

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Wildlife are experiencing multiple sources of anthropogenic change at a continually increasing rate, resulting in organisms facing multiple stressors at once which may contribute a cumulative or additive impact, increasing the overall vulnerability of organisms to environmental changes, especially those already highly sensitive to change, such as Arctic species. Two key stressors currently affecting Arctic species are the direct and indirect effects of human-induced change by means of increases in temperature and rising levels of contaminants, respectively. Endocrine disrupting chemicals (EDC) are substances used as pesticides, herbicides, and industrial chemicals such as persistent organic pollutants (POP), mercury, and lead, and have been shown to have impact on incubation behaviour through reduced nest attentiveness. Although we expect direct and indirect effects of climate change on breeding females to have significant downstream negative effects on developing embryos, few studies have examined possible synergistic effects of increases in exposure to elevated temperatures climate change and EDC. Common Eiders (Somateria mollissima) in East Bay, Nunavut, will be examined for EDC concentrations throughout the reproductive period (arrival to late-incubation), in addition to equipped with incubation and ambient temperature monitoring equipment to determine combined effects of EDC and ambient temperature on incubation consistency. Determining the concentrations of EDC in circulating blood within and across reproductive stages will uncover key times where contaminant concentration is elevated due to the mobilization of lipid stores, resulting in negative impacts on critical reproductive stages such as incubation. Furthermore, assessing the interactive impacts EDC concentrations and variation in climate on key parameters influencing offspring development (incubation behaviour and temperature, nest and incubation temperature) will allow for a more comprehensive understanding of the impacts of climate change on embryonic fitness, essential for continued recruitment in populations stressed by anthropogenic impacts.

DEVELOPMENT AND IMPLEMENTATION OF A COMMUNITY-BASED CATCH MONITORING PROGRAM FOR ATLANTIC WALRUS (ODOBENUS ROSMARUS ROSMARUS) IN HALL BEACH, NUNAVUT

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Atlantic walrus (Odobenus rosmarus rosmarus) are highly valued by Inuit. The subsistence harvest provides a traditional source of food and maintains Inuit cultural traditions, including the transfer of specific knowledge from experienced hunters to younger generations. Within the Nunavut Settlement Area, wildlife harvesting activities are co-managed with Inuit in accordance with the Nunavut Agreement and with regulations and policies of the Fisheries Act. This Community-based Catch Monitoring (CBCM) program was initiated in 2017 and is based in Hall Beach, Nunavut, one of the main walrus harvesting communities in Canada. The CBCM program is a co-management partnership involving the Hall Beach Hunters and Trappers Association, local walrus hunters, the Qikiqtaaluk Wildlife Board, and Fisheries and Oceans Canada. Over three years, the CBCM program aims to collect information from the local walrus harvest to support the conservation and sustainable use of walrus, and incorporate traditional Inuit knowledge into local and regional decision-making. This will provide co-management organizations with dependable, timely and accessible information necessary to ensure the walrus fishery is managed in a sustainable way. Information collected includes biological samples from harvested animals (tissue samples and other morphometric data), location and date of harvest, landed catch data, struck and lost data, habitat information as well as other important ecological area information. The long-term goal is to continue and eventually expand this CBCM program to other walrus-harvesting communities in Nunavut.

A 23 000 KM TRANSECT: NEW ARCTIC PLANT AND LICHEN COLLECTIONS FROM THE CANADA C3 EXPEDITION

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Canada C3 was a 150 day marine journey from Toronto, Ontario to Victoria, British Columbia by way of the Northwest Passage. Based on the icebreaker Polar Prince, this expedition brought together a diverse group of Canadians to explore Canada's coasts while reflecting on the journey's core themes of Diversity and Inclusion, Reconciliation, Youth Engagement and the Environment. During the expedition's scientific program, shipboard researchers collected plants and lichens at stops along the journey to add new knowledge on the floristic diversity of Canada. Specimens will be deposited at the National Herbarium of Canada at the Canadian Museum of Nature. In all 1321 collections were made by 42 collectors. The majority of these (922) were made in the Canadian Arctic, and many were gathered from places where no or few botanical collections have been made previously (e.g., Cape Barrow, Nunavut; Tree River, Nunavut). Notable Arctic collections include the Arctic orangebush lichen (Xanthaptychia aurantiaca), a globally rare (G1) species, and a significant eastward range extension of the spruce muskeg sedge (Carex bigelowii subsp. lugens). All Arctic collections will contribute to the museum's ongoing Arctic floristic research, and all expedition specimens will serve as a scientific legacy to this epic voyage.

WE NEED TO TALK ABOUT ARCTIC ACCESS TO JUSTICE: CONFRONTING LEGAL BARRIERS FOR NUNAVUMMIUT

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When we talk about Arctic research, we often think of disciplines within Arctic science. But what about the field of law? Even when legal scholars do address the Arctic, discussions usually revolve around international law, environmental law, land claims, and other topics that tend to be of interest to the academic community. This project proposes that while these topics are indeed important, it is also crucial to study the "every day" legal needs of Nunavummiut that remain unmet and the legal barriers with which residents are confronted, particularly with respect to civil (non-criminal) access to justice. This includes domestic civil legal issues such as housing issues and employment rights. Is the current legal framework and justice system meeting the needs of people in Nunavut? Are Nunavummiut able to access their legal rights? If not, what needs to change? Based on the author's masters in law research on access to justice issues in employment law, her proposed doctoral law research on access to justice issues in domestic violence and housing, and her background experience living and working in Nunavut as a resident poverty lawyer and an access to justice project coordinator for the Law Society of Nunavut, this project aims to spark these discussions within the Arctic research community. After all, it is essential to recognize that the people living in the vast Canadian Arctic territory of Nunavut have real every day legal needs, and from a governance and policy perspective, greater efforts are required to assess how such needs can be better met.

BEYOND OUTREACH: BEAUFORT SEA BELUGA FACEBOOK GROUP AS A COLLABORATIVE TOOL FOR KNOWLEDGE CO-PRODUCTION

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Concerns about potential impacts of climate change and industrial activity, including increased shipping activity, led to a community-driven research priority to undertake a new beluga tagging program in the Inuvialuit Settlement Region, western Canadian Arctic. Tagging is a sensitive issue that requires strong communication, community support and engagement to ensure program success. During consultations for a new beluga tagging program, some community members expressed frustration over lack of reporting from past tagging programs that took place in the region. Results are shared with co-management boards, but not typically made more widely available to other community members. More recently, social media has become a powerful tool for sharing information online. Facebook is widely used in northern communities, and was suggested as an effective way to engage a wider audience in a discussion about a new beluga tagging program. In responses to this request, Beaufort Sea Beluga Facebook Group was created and administered through the Inuvialuit Joint Secretariat, in partnership with Fisheries and Oceans Canada. The target audience is Inuvialuit community members, but also others (e.g., youth, other researchers, or anyone with an interest in Arctic science or marine mammals). The goal is to engage community members in the beluga tagging project, increase transparency with respect to study design, methods and results, and to develop a platform to host an ongoing dialogue about research, monitoring and management of Eastern Beaufort Sea beluga whales in the Inuvialuit Settlement Region. Some benefits are that Facebook can be used to implement a long-term communications strategy (e.g., through scheduled posts) as well as support rapid communication, and engagement is measureable (e.g., number of 'likes' and comments). However, implementation requires a long-term commitment to site administration (e.g., creating content, responding to postings, dealing with negative or inappropriate comments). Also, not everyone uses or has access to Facebook, and traditional communications (public meetings, newsletters) and media (new articles, radio interviews) remain a complimentary approach. Overall, Facebook has proved a useful social media platform for science outreach, has increased awareness about the tagging project and made information accessible to a wider audience, and has facilitated the exchange of information between scientists and community members. In particular, maps of beluga tracking data encourage comments and generate dialogue. In some cases, group members have shared traditional and local knowledge and observations about beluga movement, diving and feeding behaviour. Facebook shows potential as a unique collaborative tool for developing hypothesis and interpreting results for the co-production of knowledge about Eastern Beaufort Sea beluga.

PLANT COMMUNITY COMPOSITION, STRUCTURE, AND FUNCTION ACROSS A BOREAL PRODUCTIVITY GRADIENT

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Plant functional traits offer insight into plant growth, function, and distribution, as well as the interactions between plants and their environment. The influence of environmental variables on plant traits has been well documented at large spatial scales, as well as within smaller regions. The rapidly changing climate in northern regions of Canada has inspired the need for increased modelling precision to better understand and predict changes in plant community composition and function, as well as carbon, nutrient, and water cycling in this sensitive region. Given that ~33% of global carbon is stored in boreal systems, it is critical to characterize the variability in community-based plant functional traits, especially those related to carbon cycling, to inform and parameterize climate change and resource cycling models. To this end, we have explored community-based plant trait variation at an established Smithsonian Institute Forest Global Earth Observatory (ForestGEO) plot near Fort Simpson, NT, where sampling areas were selected based on a randomly stratified design of low to high aboveground tree biomass, corresponding to thicker to thinner organic layer thickness (OLT), from the west to the east side of the plot. This plot also encompasses a mosaic pattern of frost table depths (FTD) ranging from relatively shallow (~40 cm) on permafrost plateaus to absent in wetland regions. Given these patterns of key environmental variables that can be expected to respond to ongoing environmental change, this site provides interesting opportunities to: 1. explore trade-offs among plant functional traits across a strong environmental gradient within this boreal peatland site; and 2. determine the key environmental and tree stand structure drivers of plant community function. Using structural equation modelling, we will explore hypothesized drivers of plant community function, including tree density, canopy cover, nutrient availability, OLT, and FTD. By better understanding how plant functional traits relate to small-scale environmental and stand structure gradients, our research will contribute significantly to the growing knowledge base regarding boreal plant community function, inform climate and resource cycling models on the responses of plant function to environmental gradients, and provide insight into how plant communities and function will respond to a rapidly changing climate.

WHITE GLACIER: INVESTIGATING CHANGING CONDITIONS IN THE ACCUMULATION AREA

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As a result of climatic warming glaciers in the Canadian Arctic are changing in thickness and extent, but to convert these changes to a volume change we need to know the density of the snow and ice being lost. Density information is therefore required for calculating sea level rise contributions, as a glacier can change in thickness without an equivalent change in mass as a result of increasing densification (particularly in the accumulation area). In particular, the refreezing of meltwater can result in densification as liquid water fills the pore spaces within firn. This can also create ice layers which inhibit future percolation, resulting in increased surface runoff. Increasing firn densification has been observed on Penny and Devon Ice Caps in the Canadian Arctic, but changes in firn have not been examined for more northerly glaciers. In this presentation, we report on the preliminary results of fieldwork to measure near-surface density changes in the accumulation area of White Glacier, Axel Heiberg Island, Nunavut. White Glacier is polythermal and a World Glacier Monitoring Service reference glacier with a near annual mass balance record going back to 1959. In order to investigate potential changes in the density of the accumulation area, ground penetrating radar (GPR) surveys were conducted in the spring of 2018 to repeat those done near-annually since 2013. The GPR data was collected using both 250 MHz and 500 MHz frequency radars pulled in a sled attached to a snowmobile, with measurements taken at transects both along the length of the glacier and across the accumulation area. GPR provides a non-destructive way to infer density from the thickness and extent of ice layers in the firn pack, and was validated against density measurements made in snow pits. The preliminary results of this radar work will be presented.

DIVE BEHAVIOUR OF BEAUFORT SEA BELUGA WHALES (DELPHINAPTERUS LEUCAS) IN RELATION TO SEAFLOOR DEPTH, ICE COVER, AND PREY DISTRIBUTION

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The Beaufort Sea is thought to be an important summer foraging ground for one of the largest populations of beluga whales (Delphinapterus leucas). Recent effects of climate change including alterations to the date of sea ice freeze-up, total sea ice extent, and a shift in the prey assemblage may be impacting the movements and dive behaviour of this population. Satellite-linked transmitters have been used to monitor the horizontal movements of this population during the 1990s and mid 2000s; however, there is little high-resolution information on dive behaviour available despite this being an important factor to determine the energetic consequences of diving for beluga whales. Recent improvements in the technology of satellite-linked transmitters now enable fine-scale questions about habitat-use, diving, and physiology to be answered. In July 2018, satellite tags were deployed on 10 beluga whales in the Mackenzie Estuary. Tags were programmed to collect time series data on dive depth and water temperature every 75s, and location (Fastloc-GPS) during surfacing events. This high resolution data enables in depth analysis of dive profiles, including time spent at each depth layer, on the surface, and ascent and descent profiles in relation to geographic location, bathymetry, and sea ice cover. Initial analyses indicate that depths between 400 and 600 m were targeted most frequently. Whales were diving almost exclusively to the seafloor in shelf and slope habitats, and to the mid-water column over the deep Arctic basin. These results will be evaluated in context with results from a summer fish survey to identify potential foraging activities on key species. Viscount Melville Sound, part of the Northwest Passage, appeared to be an important feeding ground for several of the whales between late-July and mid-August. The information from this study will be important in contributing to our understanding of the ecological significance of the various habitats used by beluga in summer through fall. The data provided here will also be used in habitat suitability- and bioenergetic modelling of Beaufort Sea beluga; which will allow prediction of their response to climate change.

THE EFFECT OF EARLY BREAK UP OF SEA ICE ON THE BODY CONDITION OF POLAR BEARS IN CHURCHILL, MANITOBA

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The period for which the sea ice is frozen is decreasing; congruent with the rising average global temperatures. A polar bear's (Ursus maritimus) diet consists mainly of seal fat obtained between late April and mid-July, allowing the bear to maintain its weight in the following months. If ice forms later in the season or breaks up earlier, polar bears are at a disadvantage as their hunting season decreases. Polar bear populations in the Western Hudson Bay region have been suggested to be declining and bears are coming off the sea ice in poorer body condition. The objective of our study is to investigate the relationship between a non-invasive estimate of bear body condition and sea ice break up. We used a facial identification program to identify individual bears from images collected in the fall in Churchill, Manitoba. We estimated body condition by deriving a body mass index ratio that we call the body condition index from photos taken of their body profiles. The data is limited in the sense that the bears are in the wild, therefore it is difficult to follow an individual bear year to year. Instead, the average body condition index of all the bears seen for each year was calculated along with the date of ice break up in the spring for six years, with an average of 20 bears per year. Future work will expand the program to use the Whiskerprint facial recognition software and database to track individual bears year to year.

PRESERVATION AND DEVELOPMENT OF MONUMENTS OF HISTORICAL AND CULTURAL HERITAGE: YAKUT ROUND DANCE OSUOKHAY

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In the Sakha (Yakutia) Republic much attention is paid to the state support of indigenous people of the North. Maintaining traditional values of all people living in the territory of the republic, strengthening of international stability, tolerance, civil peace and harmony - one of priority problems of the national policy pursued in the Sakha (Yakutia) Republic.Yakutia by right is considered the region which successfully keeps and develops ancient traditions of dancing art. One of phenomena of ethnic culture is circular round dance of Yakuts – osuokhay, remained within a ceremonial complex of a cult of the fertility Ysyakh connected with worship of heavenly deities of Ayyy.Studies of the ethnic history of the peoples of the Eurasian continent from the viewpoint of areal-contact and genetic relationships show that historically the formation of basic elements of the traditional Yakut culture, including Yakut round dance can chronologically be referred to early II thousand century B.C., when there had been formed a religious culture system of early nomads of Eurasia, presented by a ritual circle dance that symbolized a fertility cult. A round dance performed during the Yakut Ysyakh festival around the ritual tethering post serge and tied sacred horse ytyk had a semantic meaning. It meant rising of the sacred horse soul to heaven through the so-called special bridge, and a tethering post played a role of the bridge. Rising of the soul of the sacred horse was understood as an exchange that contributed to harmony destroyed by evil spirits. In myth- poetic tradition of the Yakuts there has been preserved evidence about other functional features of round walks. In one of the round dance songs a creation of the Earth is associated with rotation. The sacred center of the origin of a new pure space – “the hub of the Universe”- is the World Tree - Aal Kuduk Mas. In osuokhay round dance songs one can observe words calling to “dance, spin at the very place where the hub of the Universe is located and spins”. In the archival materials there are descriptions of ritual actions showing a remarkable comparison of round dancing with dal cattle pen. The closed form of the pen resembles a closed circle of the dance. The dal cattle pen is not simply a household construction but a symbol of own private space. According to historical legends about the first Ysyakh festival organizations, a Yakut culture hero Elley conducted a festive prayer inside the fence for cattle. In modern life of Yakuts preservation and development of circular dance plays an important role in the course of socialization of new generations and ethnic identification. Now osuokhy is connected with a subject of preservation and development activity of many public organizations, scientific researchers and educational institutions. The monument of historical and cultural heritage became the significant phenomenon of modern culture of Yakuts, it develops and gains new lines.

PATHOGENS AND HEAVY METAL CONTENT IN RINGED SEALS IN IQALUIT, NU.

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The nattiq, or Ringed seal (Pusa hispida) is a very important contributor to the diets of the Inuit people, such as on Baffin Island, in northern Canada. The abundance of seals, their nutritional value, and high costs of other food sources in the north keep this cultural practice thriving. Monitoring health parameters of the nattiq in northern regions is particularly challenging, and little has been done. Yet, these regions are currently experiencing rapid environmental changes, particularly associated with climate change, such as the movement of wildlife pathogens from southern regions. This movement of pathogens has been associated with the northward movement of other seal species, which are moving north with the continually receding ice, and has already been observed in northern Europe, Greenland, and Canada. In some cases, these pathogens can be zootonic and be transmitted to humans. In addition, northern Canada has the highest self-reported cases of enteric illnesses globally, making this staple food item essential to study to keeping Inuit informed of potential health risks that may be associated with seal products. The goal of this project is to get a picture of the current health status of the nattiq population in Frobisher Bay, Nunavut, through close collaboration between project investigators and community members. Aim 1: To identify current concerns of Iqaluit community members related to Ringed seal health. This includes collecting baseline information on the health of Ringed seals in the region of Frobisher Bay to understand and address potential health issues that may occur now and in the future, associated with environmental changes. Inuit Qaujimajatuqangit (IQ) will be collected and analyzed through open-ended semi-structured questions relating to Ringed seal abundance, health and changes they may have noticed. Aim 2: Determine levels of four heavy metals (total arsenic, cadmium, lead, total mercury) in ringed seal muscle and liver. Because of the Ringed seal's high trophic level, heavy metals bioaccumulate in the body, and may be exceeding safe consumption levels according to the Canadian Food Inspection Agency's (CFIA) regulations. Aim 3: Determine the level of exposure in 60 Ringed seals to some infectious agents. Other regions in the north have reported cases of infectious agents, which may have detrimental effects on wild animals and pose potential significance for the health of people who consume products from them. This mixed method approach will study the health status of the Ringed seals in Frobisher Bay. With the ultimate goal of getting a snapshot of Ringed seal health through the combination of IQ and western science.

GJOA HAVEN, NUNAVUT HARVEST STUDY

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As part of a collaboration between the Gjoa Haven Hunters and Trappers Association and Towards a Sustainable Fishery for Nunavummiut research project, researchers and community members have been running a comprehensive harvest study to examine the true economic cost of harvesting in Gjoa Haven. One of the main components of this study is to train and hire local facilitators to maintain equipment, administer surveys, and collect data. As of August 2017 two jobs were created in Gjoa Haven; a harvest study facilitator and a youth apprentice. Tasks include handing out and explaining the use of specific InReach GPS devices to hunters before they go out hunting or camping. The inReach devices work as a GPS and are able to track where the hunters are for both safety and research purposes. We are able to follow the hunters through a website called GeoPro, the inReaches send tracking intervals to the servers every ten minutes. The data is also transferred to our own Atlas website that uses Nunaliit cybercartography software so that we can observe harvests and hunter observations in real time. From tracking intervals, to what animals the hunters see and in what location, to the place name of where they are hunting. The Atlas has multiple search options so users can filter by hunter name, sign-out date and types of animals observed or hunted. After hunters return they are given a survey with questions regarding their trip; such as how much money was spent for that trip, what animals were seen and hunted, and what portion will they share with other households in the community or sell to the HTA or to other people. When the survey is complete we enter the data into a spreadsheet to keep it organized and to reference it when needed. In the past 13 months a total of 128 surveys were completed by local hunters. Using this information our research project will help determine exact costs of harvest to help us determine sustainable ways to sell and buy fish and other country foods. We are presenting the research process and partial results from the first year of our study.

COUNTING CARIBOU, DISCOUNTING HUNTERS: SPATIAL MARGINALIZATION THROUGH PARTICIPATORY DEMOCRACY IN WESTERN NUNAVUT

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Under Nunavut's model of consensus government, public hearings are central to participation in a deliberative democracy. The timing and location of hearings involve significant and contested considerations across the vast territory. The spatiality of participation can serve to marginalize those publics most affected by environmental policy decisions. Spatial marginalization was evident when the Nunavut Wildlife Management Board invited Hunters and Trappers Organizations from four Kitikmeot communities to caribou hearings in June 2016 to discuss a proposed Total Allowable Harvest. The hearings were held in Cambridge Bay, the administrative and economic centre of the Kitikmeot region. In situ observation during the hearings coupled with a content analysis of hearing transcripts and interviews with attendees suggest that decisions on participation space affect access materially because of who can be there in place to participate, and socially because of the place characteristics of participation. Participants can also be constrained by being out of place, cleaved from the affective support of their communities. To nurture inclusive participation, it must be recognized that spatial choices and space design are not neutral.

1981 TO 2070: AN ANALYSIS OF CLIMATE CHANGE'S EFFECT ON 90 YEARS OF SIMULATED, REGULATED ENSEMBLE DISCHARGE TO HUDSON BAY

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This work will focus on the presentation and discussion of the trends, trend significance and spectral analysis of the ensemble discharges from the regulated basins draining into Hudson Bay, 1981-2070. The interdisciplinary BaySys group of projects aims to separate the relative impacts of climate change and regulation on Hudson Bay. To do so, discharge simulations using the HYPE hydrological model (Lindstrom et al., 2010) of the Hudson Bay Drainage Basin (HBDB) have been run at a daily time-step from 1981 to 2070 using a climate ensemble from CMIP-5. Ultimately, these hydrological simulations will be used as the input to the NEMO sea-ice model (Ridenour et al., submitted) used to quantify climate change's and hydroelectric regulation's joint and individual effects on sea-ice in Hudson Bay. Since the hydrologic calibration of the overall HBDB land-mass (MacDonald et al., 2018), particular attention has been paid to development of new regulation routines in the Nelson-Churchill River Basin (NCRB) (Tefs et al., in prep), operated by Manitoba Hydro and other provincial and inter-jurisdictional water boards. The combination of these regulated discharges to Hudson Bay from the NCRB with discharge from the La Grande Rivière Complex (LGRC), modelled by Hydro-Québec (Guay, 2016) allows for the complete analysis of the regulated discharge to Hudson Bay. These two hydroelectric complexes together account for 57% of the gauged drainage area (1,778,000 km2) and 41% of the gauged discharge (200 km3/year) (Déry, 2011) to the bay. Changes in the flows are analyzed for the full simulation period and compared between three climatic periods: 1981-2010, 2021-2050 and 2041-2070. This analysis examines the seasonal and overall changes of discharge using trend and significance tests as well spectral wavelet analysis.

IDENTIFYING RELATIONSHIPS AMONG CATCHMENT LAND COVER CHARACTERISTICS, ACTIVE LAYER PROPERTIES AND LAKE HYDROECOLOGY IN OLD CROW FLATS, YUKON, CANADA

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Ground-based measurements indicate widespread increasing ground temperatures across northern regions during recent decades. There have also been associated changes in land cover and hydrological conditions across lake-rich landscapes, however, additional studies are required to investigate relations among these integrated landscape components. For instance, more research is required to determine the influence of shrub vegetation proliferation and fire on lake-rich permafrost environments. Our research investigates these relationships in Old Crow Flats (OCF), Yukon, which is a lake-rich Arctic landscape widely regarded for its cultural and ecological integrity. We use a combination of remote-sensing, in-situ soil moisture and active layer thickness (ALT) probe measurements, and vegetation sampling to investigate ground cover characteristics among six plots spanning various land cover types over the 2017 and 2018 spring/ summer seasons. Preliminary results show high late thaw-season variability in ALT among tundra/bog (mean = 16 cm), shrub/spruce (mean = 35.34 cm), and burned (mean = 54.02 cm) sites. Soil moisture in-situ volumetric water content measurements, with 20 cm probe depth, show similar late-thaw season variability among tundra/bog (mean = 58.77%), shrub/spruce (mean = 43.44%), and burned (mean = 47.55%). Ongoing analysis will incorporate use of unmanned aerial vehicle high-resolution aerial photography and additional remote-sensing products (acquired as part of NASA's Arctic-Boreal Vulnerability Experiment airborne campaign) to refine maps of the catchment characteristics influencing the lakes and rivers spanning OCF that have been monitored in collaboration with Parks Canada since 2007. Integrated approaches being developed here will enhance our knowledge of the complex relations affecting lake-rich permafrost landscapes as climate continues to change.

MODELLING POLAR BEAR HABITAT SELECTION USING A BEHAVIOUR-CENTRIC APPROACH

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Identifying factors that underlie organisms' distribution is fundamental to understanding their ecology and to predicting their sensitivity to environmental change. Studies on animal distributions typically assume animals' presence reflects important habitat, effectively equating all behaviours (e.g., foraging, mating, resting, and travelling). However, habitat selection is behaviour-specific, and the significance of a habitat depends on which factors limit individual fitness. Foraging success governs the energy allocable to maintenance, growth, and reproduction, making it central to their fitness. I propose to study polar bear (Ursus maritimus) habitat selection using a behaviour-centric modelling approach. Polar bears face a significant threat from climate change, which has been extending the sea ice-free period and reducing ice volume and cover. Reduced sea ice has led to increased fasting and energy expenditure, decreased body condition, and reduced abundance in some populations. Using satellite tracking data of Western Hudson Bay polar bears, I will model habitat use for foraging and non-foraging behaviour. Recent research suggests polar bears travel crosswind when engaged in olfactory search, offering new means with which to identify foraging. Habitat use and movement relative to wind will be modelled as functions of wind speed, ice concentration, and rates of ice drift. This research will help develop species distribution modelling methods and expand biological understanding of an ecologically and culturally significant Arctic predator.

THE ECOLOGICAL FUNCTIONING OF THE STUCKBERRY VALLEY LAKES

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Even the world's most northern ecosystems have been affected by climate warming, and High Arctic lakes are excellent indicators of this environmental change. Ellesmere Island is at the northernmost limit of Canada, and regime shifts towards taxa associated with longer growing seasons and warmer conditions have already been documented there. It has been projected that the northern coast of Ellesmere Island will experience the greatest annual warming in Arctic North America over the next 80 years, so it is imperative to study its ecosystems to better understand their functioning and future responses to environmental change. We are studying the ecological functioning of a series of four northern Ellesmere Island lakes in Stuckberry Valley (82º54 N, 66º56 W) to give insight into High Arctic ecosystems and geosystems and their role in the global climate system. The lakes, unstudied until first sampled in the spring of 2017, revealed a surprising diversity of ecosystem types. Shallow lakes (7-9m deep) had hypoxic to anoxic waters below spring ice, while deeper lakes (27-49m) contained fully oxygenated water columns. In the spring of 2018, water column profiles of temperature, oxygen, and conductivity were taken, as well as water chemistry samples taken from various depths in each lake. High performance liquid chromatography (HPLC) pigment analysis will be used to understand the phytoplankton community structure of the lakes. The community composition and structure will be analyzed in relation to each lake's physical and chemical qualities in order to better understand the ecological functioning of High Arctic lakes. These lakes present a unique opportunity to study polar aquatic ecosystems. As part of a multidisciplinary project combining researchers from several fields of study, this research will address a knowledge gap about the ecological functioning of High Arctic lakes, and pave the way for on-going and future paleolimnological studies on that will further the understanding of aquatic ecosystem response to climate warming.

TEMPERATURE TOLERANCE IN AN ARCTIC FRESHWATER FISH IN RESPONSE TO CLIMATE CHANGE

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Temperature is the most important environmental factor influencing fish abundance and distribution but, as temperatures rise globally, the consequences for fishes remains largely unknown. In this study, I used populations of ninespine stickleback (Pungitius pungitius) from the northern and southern parts of their range in a common environment to characterize thermal traits in association with varying temperatures. Cold tolerance differed between populations but heat tolerance did not. Furthermore, juveniles demonstrated less tolerance for temperature extremes. When incubated at elevated temperatures, populations exhibited higher plasticity in cold tolerance compared to heat tolerance. Plasticity in heat tolerance was associated with a number of trade-offs. The data suggest that cold tolerance is locally adapted and phenotypically plastic while heat tolerance is conserved and phenotypically restricted in this species. This study highlights the need for the inclusion of various life stages, time scales, and biotic interactions in climate change research to better predict its impacts on arctic fishes.

SIMULATION OF ECOSYSTEM CARBON CYCLE IN NY-ÅLESUND, NORWEGIAN HIGH ARCTIC UNDER ENVIRONMENTAL CHANGE

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The recent environmental change, an especially climate warming trend which is widely observed in the Arctic, is likely to profoundly influence ecosystem carbon cycles. Quantitative investigation of carbon pools and flows are essential to predict the impact of climate warming on Arctic ecosystems. Since 1994, we have clarified the pattern of ecosystem carbon cycle and the factors controlling the cycle in Ny-Ålesund, Svalbard, High Arctic Norway. At first, we investigated major carbon pools and flows within the glacier foreland of Austre Brøggerbreen (East Brøgger Glacier) in Ny-Ålesund. Vegetation cover and soil carbon pools tended to increase with the progress of succession though development of vegetation cover and accumulation of soil carbon appeared to be very slow. However, a non-negligible amount of organic carbon is distributed in soils of the latter stages of succession (Yoshitake et al. 2011). Photosynthesis of vascular plants such as polar willow (Salix polaris), was the major pathway of carbon fixation. In contrast, cryptogams (mosses and lichens) contributed the major proportion of phytomass in the latter stages but their net primary production was much smaller than that of the vascular plants because of available water limitation (Nakatsubo et al. 2005). Using observations of carbon cycle processes, we constructed a simple process-based model to assess how the carbon balance will be altered by ongoing climate warming and possible biological changing factors. Model analysis indicated that rising temperature did not always have positive effects on carbon sequestration because of enhanced respiration in the later part of the growing season under low light condition (Uchida et al. 2016). I will also discuss other factors which could affect carbon cycle.

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 changes are of particular concern for northern populations that depend in large part on the Arctic Ocean for their subsistence as food supply. This ocean is affected more rapidly by climate change than any other ocean. This project within the BriGHT program (Bridging Global change, Inuit Health and Transforming Arctic Ocean), focus on the benthic food wed, particularly on species consumed directly or indirectly (by eating the predator of the benthic prey) by Inuit populations. The primary source of food for many benthic organisms is changing from ice algae to phytoplankton because of the loss of the ice cover in the Arctic. Since ice algae produce fatty acids that have important roles in the reduction of cardiovascular diseases, the change in food source is affecting the abundance of fatty acids in organisms and thereby could have an influence on Inuit health. Our project aims to determine if abundance of fatty acid, selenium and carotenoid, and their quality in organisms changes with the variation in food source among different areas (eastern Hudson Bay, Hudson Strait and Ungava Bay). We will characterize the fatty acid, selenium and carotenoid abundance found in benthic organisms, walruses and common eiders. Walruses and common eiders are considered because they feed directly on benthic organisms and are part of the traditional diet of Inuits. It should contribute to better understanding the impacts of climate changes on the benthic food web.

POST-MIGRATION AND PRE-DEPARTURE PHYSIOLOGICAL CHANGES IN A HIGH-ARCTIC BREEDING SHOREBIRD

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Opportunities to study phenotypic transitions between migration and reproduction in Arctic-breeding birds are rare in part because logistical constrains in the spring and fall often limit access to field sites. Therefore, basic data such as condition on arrival, body mass variation during migratory recovery or pre-departure are often impossible to obtain. Here, we present preliminary data on the period of arrival, in early spring, and pre-departure, at the end of summer, in Ruddy Turnstones (Arenaria interpres) captured at the northern edge of their breeding range in Nunavut (Canadian Forces Station Alert, 82°N). Daily captures were conducted in 2018 using potter traps around the station from May 30 to June 13, time at which birds scattered on the tundra for breeding, and from August 2 to 25, corresponding to the pre-departure period, during which birds are expected to gain mass. First results show that recently arrived birds loose muscle mass in the weeks following arrival, potentially as these tissues are used as a protein source to rebuild reproductive and digestive organs. Birds also showed a clear pattern of mass gain in the weeks preceding departure in August, which is consistent with a period of fattening to fuel-up for long distance migration. Furthermore, hematocrit levels, a measure of blood oxygen carrying capacity, were higher at pre-departure than at arrival, which suggest physiological preparation for sustained exercise. Future work in the coming years will detail physiological condition from blood markers, digestive constraints and changes in metabolic performance during these critical but little known transition periods.

NEW RESULTS OF THE VERY HIGH-RESOLUTION UAV SURVEYS OF THE YUKON COAST: BORDER TO KING POINT

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Climate models indicate the highest warming rates for the high latitudes, especially for the Arctic. Recent estimates indicate that the release of previously frozen organic carbon and its transformation into greenhouse gases may push global climate warming above the 1.5 °C targeted in the COP21 Paris Agreement (Schuur et al., 2015). Despite efforts to include carbon fluxes from permafrost degradation in climate models, the lateral fluxes of organic matter from land to sea are still not accounted for (Vonk and Gustafsson, 2013). 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 significant erosion rates (Fritz et al, 2017). 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 ranging 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 expose coasts to wave action, extending the erosion into the shoulder seasons. Changing climate will also modify the contribution of terrestrial erosion, e.g. thermokarst, gully erosion and retrogressive thaw slumps (Fritz et al., 2015, Ramage et al 2017, 2018, Irrgang et al 2018). Understanding the current processes and both inter- and intra-annual dynamics of coastal erosion in the Arctic is essential to better predict future coastal erosion rates and hence to improve carbon and contaminant flux estimates. Following previous research by the Geological Research of Canada and the Alfred Wegener Institute, in July-August 2018, we resurveyed several long-term monitoring sites from the Canada-US border to King Point: Border, Clarence, Nunaluk, Herschel's slumps A, B, C, D and Tina's, Stokes West, Kay Point and King Point. Traditionally the repeat surveys were conducted using a DGPS survey along fixed transects that cross-cutted each site. In 2018, we have partially repeated the DGPS surveying and surveyed all sites with a SenseFly RTK ebee UAV with a S.O.D.A. camera and a Trimble R4 base station, allowing for preliminary model accuracies of ci. 10 cm. The poster shows the results of the 2018 surveys and first comparisons with data from previous seasons, including a discussion of the main results and methodological adjustments that may be needed for the

2019 surveys. This research is integrated in the H2020 European Union project Nunataryuk - Permafrost thaw and the changing Arctic coast, science for socioeconomic adaptation.

DEVELOPMENT OF A SNOW DEPTH MAPPING APPROACH USING RADAR SATELLITE DATA AND MULTISOURCE IN-SITU DATA

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Significant warming has occurred in the Arctic over the past four decades at a much faster rate then the rest of our planet. Negative anomalies of spatial and temporal trends snow and permafrost are now relatively well documented. Those trends lead to a series of strong climate-related feedbacks, which in turn contribute to the arctic amplification that is currently observed. More specifically, changes in snow depth and distribution lead to changes in the spatial patterns of landscape freeze/thaw cycles, which in turn have a significant impact on how the cryosphere responds to climate change. While recent research efforts attempted to monitor soil thermal state from space, lingering uncertainties remain with regards to the various processes governing changes in snow and permafrost spatial and temporal distribution. In this context, this project proposes to develop a snow depth mapping approach combining satellite radar data and in-situ snow geophysical measurements. More specifically, we present a methodology to map snow at high spatial resolution using a recently-developed spatialized snow simulation method using the SNOWPACK model. This simulation platform will be forced with a precise DEM and continuous meteorological observations available on Herschel Island. Snow height, microstructure and density will be simulated at a 250, 500 and 1000m and outputs will be compared and validated using field measurements acquired during annual field campaigns. Since the model is not suited to Arctic snow conditions, we will use the Groot Zwaaftink et al. Antarctic version of SNOWPACK that showed promising improvements in preliminary work within our group. The simulations will allow the production of spatially-distributed snow information that will be used to develop a snow depth mapping algorithm using TERRA-SAR data. The available frequency at 9.6 GHz will allow a proper penetration depth in dense arctic snowpacks, while decreasing the sensitivity of the backscatter to large depth hoar layers. A statistical retrieval approach of depth using field measurements, model outputs and satellite observations will be developed and applied regionally in Qikiqtaruk (Herschel Island) where soil thermal data are available. This will improve our empirical understanding of the effect of snow variability on freeze/thaw timing.

ASSESSMENT OF LATE WINTER SNOW DISTRIBUTION FOR TUNDRA ENVIRONMENTS USING HIGH RESOLUTION REMOTE SENSING

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Arctic tundra environments are characterized by a spatially heterogenous end-of-winter snow distribution resulting from wind transport and deposition over the winter months. Large spatial variations in snow depth, density and snowpack microstructure result in localized concentrations of water storage across the landscape and is strongly influenced by topography and vegetation cover. Understanding the high-resolution distribution of snow across tundra environments is important as the snow accumulation typically accounts for over half of the annual precipitation and is the dominant driver of the hydrological system. However, our ability to accurately measure snow at high-resolution scales in this type of environment has proven difficult using spaceborne, and traditional snow survey methods. To address this issue, and to provide an accurate late-winter snow depth map for validating on-going remote sensing and modelling efforts as part of the World Meteorological Organizations' Polar Prediction Project, a series of fixed-wing Unmanned Aerial System (UAS) flights and in situ snow surveys were conducted ~50km north of the town of Inuvik, NWT in March 2018. Snow depths were mapped using airborne structure-from-motion photogrammetry methods for a total of 9 study areas, ranging in size from 0.5 to 2 km2, covering a representative sample of topographic and vegetation land cover types over 25 km2 of tundra environment. Extensive ground validations of the UAS snow depth maps using RTK GPS and GPS-enabled snow depth probes revealed strong relationships between the UAS GPS-surveyed snow surface and the in situ measurements. The efficiency and accuracy of the UAS snow depth mapping demonstrated in this study allow for a detailed analysis of micro-scale snow depth distributions across the tundra landscape, and will be made available to be used as inputs or for validation of future hydrology and remote sensing studies of arctic tundra snowcover.

SEED DISPERSAL AS AN EXPLANATION OF SPATIAL VARIABILITY IN SHRUB EXPANSION AT THE TREELINE- TUNDRA ECOTONE OF THE NORTHWEST TERRITORIES

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The arctic is undergoing dramatic increases in primary productivity. This change has been largely attributed to proliferation of shrubby vegetation, driven by warming summer temperatures. The resulting shift toward a shrub-dominated landscape could have important consequences on surface energy distribution and hydrology, however there is a great degree of spatial variability in this expansion, making future rates and patterns of spread difficult to predict. Spatial variability in shrub expansion is generally associated with increased productivity at the bottom of slopes and within water channels. These observations are often hypothesized to be caused by increased resource availability associated with the downslope movement of water and plant available nutrients, though our recent studies of Alnus viridis (green alder) at the treeline- tundra ecotone of the Northwest Territories do not support this hypothesis. While the majority of alder recruitment occurs in lower slope positions directly downslope of alder patches, these patterns of recruitment are not associated with either nutrient or soil moisture gradients, suggesting an alternative mechanism driving seedling establishment. Considering the low viability of alder seed in this region, germination may only result in significant establishment if a microcosm were to accumulate large numbers of seed. Here, we test whether patterns of alder recruitment are explained by two mechanisms of seed dispersal: 1) transport of seed by way of preferential water flow paths and 2) accumulation of seed in snow drifts associated with the predominant wind direction. In order to test these mechanisms, we deployed seed traps throughout three alder shrub patches at the Trail Valley Research Station 50km north of Inuvik, NT. Traps were placed in a grid formation with rows and columns separated by 15m and deployed in the fall of 2016 to ensure capture of alder seed fall. Seed traps were then collected after snow melt in the spring of 2017 and seedling counts were performed in the vicinity of each trap. Because alder generally release their seed after snowfall, seed density was also measured by way of snow cores in the spring of 2017 in order to elucidate the pattern of seed distribution before snowmelt. For each alder patch around which seed traps were deployed, we developed two spatially explicit models of seed distribution using a LiDAR based digital elevation model and orthoimagery of shrub patch locations; one predicting seed accumulation from preferential water flow and one predicting accumulation from the predominant wind direction. Counts of alder seed from seed traps will be used to test each dispersal mechanism as predicted by the models. Alder seed density will also be compared to seedling density in order to test the validity of seed dispersal as a mechanism of spatial variability of alder expansion.

INFLUENCE OF PERMAFROST DISTURBANCES AND INCREASED TURBIDITY ON TRENDS OF MERCURY AND OTHER ELEMENTS IN 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 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 biogeochemical cycling. We are investigating whether these changes are also seen in bioaccumulation of mercury (Hg) and other contaminants in arctic char and the food webs of West and East Lakes. We hypothesize that increased catchment inputs of organic carbon and increased turbidity in West Lake will result in increasing Hg concentrations in landlocked arctic char (Salvelinus alpinus) and other bioaccumulative elements such as cesium (Cs) and rubidium (Rb). Arctic char have been collected annually at the end of July, from 2008 to 2018 (except for 2010), and analysed for a suite of 34 elements using ICP-MS, and Hg using USEPA Method 7473 with a Direct Mercury Analyser. Carbon (C) and nitrogen (N) stable isotope analysis showed that char have significantly more depleted δ13C in adult char (>200 g) in East vs West Lake (mean ± SD; -27.27±0.81 ‰ (N=98) vs -24.73±1.17 ‰ (N=97)) indicative of greater terrestrial and benthic carbon inputs to West Lake. Also δ15N is significantly lower in West Lake char (10.1±0.98 ‰ vs 11.2±0.50‰) 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 (geomean/range = 0.146 (0.036-0.581 ug/g wet wt)) compared to East Lake (0.079 (0.023-0.285 ug/g wet wt)) and this difference is even greater if results are adjusted for δ15N or length using analysis of covariance. Cs and Rb are also higher in West Lake char muscle (geomeans = 3.6 and 1760 ng/g wet weight, respectively) compared to East (2.1 and 890 ng/g). Condition factors (g*100/cm3) for adult char in West Lake have declined since 2008 and over the period 2011-2018 have been significantly lower (0.62±0.12) than those in East Lake (0.66±0.09) indicating they are thinner than fish of the same length in East Lake. This may be due to difficulty feeding in West Lake's turbid waters. Hg concentrations have declined steadily in East Lake char over the period 2008 to 2018 (averaging -6.7 %/yr) while increasing (5.3 %/yr) in West Lake from 2009-2018. Cs and Rb in char muscle have also increased significantly in West Lake since 2009 while showing no change in East Lake. The higher concentrations and increasing Hg, Cs and Rb, in West Lake char are consistent with higher inputs into West Lake resulting from extensive permafrost disturbance in the watershed as well as from higher suspended particulate concentrations in lake waters due to the turbidity.

FROST, FIRE, AND FLORA IN NUNATSIAVUT, LABRADOR

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Zones of sporadic discontinuous or isolated patches of permafrost are especially sensitive to changes in climate, since permafrost itself is a climatic phenomenon. Forest fires are a significant natural disturbance to permafrost and have increased in intensity and frequency throughout the boreal forest due to climatic warming. Forest fires promote thaw and degradation of underlying permafrost by removing vegetation and organic soil, altering the ground thermal characteristics. While many studies have examined the effects of forest fires on permafrost degradation, few studies have focused on the impact of post-fire shrub regeneration, especially in northeastern coastal forests. Improving our understanding of vegetation dynamics in these unique subarctic regions will be useful for interpreting the importance of forest fires for food and fuel sources for residents in the Nunatsiavut communities of Postville and Nain (Labrador, Canada). This research examines the role of post-fire shrub regeneration on frozen ground (both seasonal frost and permafrost) in the Beaver River (1995), Tikkoatokak Bay (2001), and Webb Bay (2004) burns in the boreal forest of Nunatsiavut. The impacts of post-fire vegetation regeneration on ground thermal characteristics were examined through direct current electrical resistivity tomography (ERT) surveys, performed across burned to unburned transitions. ERT surveys can be used to determine the presence or absence of frozen ground, with low and high resistivities corresponding to unfrozen and frozen earth materials, respectively. Frost probing and instantaneous temperature measurements were used to inform interpretation of the ERT surveys. Vegetation surveys, including shrub heights, shrub ramet densities, organic layer depths, and canopy cover estimates, were performed along the ERT survey lines. Overall vegetation distribution and composition of the study sites were also examined through a series of low-altitude aerial images, collected by an unmanned aerial vehicle. Our study detected the presence of late-summer frozen ground in parts of the unburned spruce-dominated closed canopy forest, associated with low ramet densities and heights of the dominant shrub, Rhododendron groenlandicum, and a thick organic layer. In the burned area, ground temperatures were higher, shrub densities were greater, R. groenlandicum were taller, and organic layer depths were thinner than in the closed canopy forest. Other shrub species (Salix planifolia, S. glauca, Betula glandulosa, and Alnus crispa) were not all present in all three study sites, but they tended to follow the same general distribution as R. groenlandicum when present. These observations suggest that post-fire landscape succession and associated shrub regeneration and organic material reduction promote the thaw and degradation of permafrost, particularly in sensitive, discontinuous regions like Nunatsiavut. The results of this study, combined with collaborative research on other aspects of post-fire ecosystem change (Lucas Brehaut: tree regeneration and Frédéric Dwyer-Samuel: vegetation community composition), will address the knowledge gap on the impacts of climatic warming on permafrost and ecosystems near local communities in Nunatsiavut.

PEOPLE, PLANTS AND CULTURE: A SYSTEMATIC REVIEW OF INDIGENOUS KNOWLEDGE OF VEGETATION CHANGE IN THE SOUTHERN CANADIAN ARCTIC

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Rapidly warming temperatures in Arctic regions have caused widespread environmental changes, including significant changes in vegetation. An understanding of vegetation change is needed in both biophysical and cultural contexts. Indigenous communities, along with Indigenous knowledge and perspectives, have largely been left out of academic studies of vegetation change. Academic studies of vegetation change often present aggregated results at National and global scales which have limited value in understanding local and regional changes experienced by northern and Indigenous community members. Limited scientific data of vegetation at local and regional scales currently exists, especially on time scales beyond satellite and aircraft-based remote sensing (~50+ years). This project intends to serve as an initial step toward enhanced understanding of the cultural context and significance of vegetation change in the Canadian north, and how this connects to broader environmental changes. The goal is to link and mobilize previously documented knowledge using a critical geographic approach including use of secondary data and archival research methods. A systematic review of existing materials available in the Prince of Wales Northern Heritage Centre in Yellowknife, NT was conducted in August 2018. This process identified a diversity of research, language, and cultural heritage work previously conducted that provides important insights into Indigenous knowledge of vegetation (and changes) in the Northwest Territories and Nunavut. Drawing on these materials we aim to contribute to (re-)centering Indigenous knowledge in vegetation research, with consideration for local place and cultural context from which the sources originate. This can serve to expand the broader academic conversations surrounding Arctic vegetation change, as well as a starting point for future community-based studies to learn the deeper connections, language, and nuances involved in people-plant relationships in northern Indigenous communities.

AN AERIAL INVENTORY OF ROCK GLACIERS IN JASPER NATIONAL PARK, ALBERTA

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Rock glaciers are large lobes of rocky debris commonly found within alpine permafrost in the Alberta Rocky Mountains. Alpine permafrost is of significant scientific interest as it encompasses a large area and exhibits unique responses to climate change. Rock glacier falls from these increasingly unstable mountain slopes can represent significant geohazards, which makes mapping the spatial distribution of these features and classifying their morphology important. They can also be used to identify and understand past climatic change in these alpine regions, with relict (fossilized) rock glaciers indicating a past climate formerly able to create and support these features. Although a common feature within the Alberta Rocky Mountains, information on rock glacier characteristics and distribution within this region is rather limited. The inventory is based on the aerial classification of rock glaciers using high-resolution satellite imagery available through Google Earth and in ArcMap, a geospatial processing program. Geospatial mapping and remote sensing techniques were used for the quantitative and spatial analysis of these features to create an inventory that classifies, quantifies, and characterizes the rock glaciers within this region. Classification of talus-derived and glacier-derived rock glaciers was done using morphological characteristics as the elemental method for identification. Digital Elevation Models (DEM) and optical satellite imagery were used to quantify various attributes such as shape, state, slope, aspect, and elevation. A digital database with the findings from this research will be made publically available for future research through the Alberta Geological Survey.

WHICH IMPACT HAVE CLIMATE AND SUPRAGLACIAL LAKES ON THE SURFACE VELOCITY OF BALTORO GLACIER FOR 1992-2017

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Baltoro Glacier is one of the largest glaciers in the Karakoram mountain range. Long-term monitoring of glacier dynamics provides key information on glacier evolution in a changing climate, which is essential for regional water resource and natural hazard management for example. However, detailed mass balance monitoring is not feasible on such large glaciers. In contrast, ice dynamic variations provide indications on mass transport and possibly the influence of other environmental parameters on the evolution of the glacier. Although velocity variations of the Baltoro Glacier during winter and summer are linked to seasonally enhanced basal sliding, little is known about differences in timing and magnitude of (intra-) seasonal velocity variations and their determining mechanisms. We presented time series of annual, seasonal, and intra-seasonal glacier surface velocities by means of intensity offset tracking applied on multi-mission Synthetic Aperture Radar (SAR) data for a period of 25 years from 1992 to 2017. Supraglacial lakes forming on the downstream glacier surface in summer were mapped from 1991 to 2017 based on the Normalized Difference Water Index (NDWI), calculated of multi-spectral Landsat and ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) imagery. Additionally, precipitation data of the Tropical Rainfall Measurement Mission (TRMM) were used to derive the Standardized Precipitation Index (SPI) from 1998 to 2017. Linking surface velocities to the SPI confirmed a strong correlation between heavy precipitation events in winter and the magnitude and the timing of glacier acceleration in summer. A downstream extension of summer acceleration found since 2015 may be explained by additional water draining from an increased number of supraglacial lakes through crevasses that have been formed in consequence of higher initial velocities, evoked by strong winter precipitation. As supraglacial lake formation mainly depends on summer air temperature, stronger summer acceleration events in recent years may be indirectly related to global warming. Additionally, surge type surface velocity variations of the Trango Glacier influence the terminus part of Baltoro Glacier by retain during a surge and a traction afterwards.

DESIGNING SUSTAINABLE FOOD, WATER AND ENERGY SYSTEMS THROUGH THE LENS OF RESILIENCE TO IMPROVE FOOD SECURITY IN NORTHERN INDIGENOUS COMMUNITIES: A CONTAINERIZED AGRICULTURE CASE STUDY

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Food, water, and energy (FWE) are fundamental resources required to sustain human life and development. Unsustainable practices in FWE systems are already causing significant impacts to global, regional, and local ecosystems, including climate change, resource scarcity, biodiversity loss and ocean acidification amongst others. In traditional discipline driven studies, FWE systems have been considered independently, without attention to the feedbacks and interactions among system components, and with limited focus on scale. However, numerous complex tradeoffs and synergies have been observed among these systems, but the nature of these relationships is still poorly understood. The food-water-energy nexus promotes environmental health by situating FWE in a complex and integrated system, under the working assumption that healthy environments, sustainable livelihoods, and community wellbeing are directly related. Integrated systems thinking fosters interdisciplinary, systemic and appropriately scaled research, to better understand the linked social and ecological dynamics of FWE systems. Resilience theory offers an analytical lens that considers feedbacks and drivers, between resource components and across scales. Maintaining FWE security in northern

Indigenous communities has always been challenging due to remoteness and severe weather, among other social, economic and ecological factors. However, communities thrived in the north by utilizing traditional methods for food procurement such as hunting and fishing. Traditional subsistence methods is now compromised due to the cumulative effects of climate change, extreme weather events, environmental degradation, and expensive food and fuel imports, amongst other socio-economic factors. For communities to adapt to changing socio-ecological conditions a shift in governance and planning for security is required. This presentation focuses on a case study involving a containerized hydroponic system utilizing solar power with a complementary open garden and greenhouse at the Kluane Lake Research Station in Yukon Territory. A northernized, off-grid containerized growing system has the potential to produce food in season and to extend production into the colder, darker months when the outdoor growing season is over and existing food storage capacity in the rural north is limited. Through this project we propose to increase the variety and quality of fresh produce available in the Kluane Lake area, and to advance research on and knowledge about crop varieties, including Indigenous plants, that can be sustainably grown in an off-grid containerized hydroponic system across the north. Installing this system in a controlled environment, provides the flexibility to experiment with this system to better suit the needs of northern communities, and complement existing food systems. This system has broad implications for northern and Arctic communities in Canada and Alaska. This case study is part of a larger research project to develop an integrated FWE system and resilience framework that is cross-scalar and supports decision-making, governance, and planning.

MOBILIZING INUIT QAUJIMAJATUQANGIT FOR SEA-ICE SAFETY: A SIKUMIUT CASE STUDY TO SUPPORT INUIT SELF-DETERMINATION IN RESEARCH

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The purpose of this project is to support Inuit self-determination in research through a case study in Mittimatalik (Pond Inlet), Nunavut. The goals of the project are to advance Inuit research leadership, decision-making, knowledge, approaches and capacity building. Sikumiut means "people of the sea ice" in Inuktitut, and is the name of the 12-person management committee in Mittimatalik that governs the SmartICE community-based sea-ice monitoring program (see www.SmartICE.org). At a recent meeting, Sikumiut identified the need to document their Inuit Qaujimajatuqangit (IQ) of sea-ice to support safe sea-ice travel, assess the impacts of climate change and resource development, and to share this knowledge with the community and future generations. Sikumiut would like to: • Gather and utilize Mitimattalik sea-ice IQ that has been collected in previous projects by southern researchers; and • Use both reclaimed and newly documented sea-ice IQ along with satellite imagery to develop products that document the history and changes to sea-ice conditions around Mittimatalik. Sikumiut governs this project and will evaluate progress according to their IQ principles and extensive experience with sea-ice. To build research capacity, local Inuit youth will be hired and trained to conduct the research and the equivalent of 2 full-time youth will be hired for 6 months of the year (October to March) for the next 3 years. Youth will learn how to facilitate workshops, document sea-ice IQ, interpret satellite imagery, and create sea-ice maps to enhance local capacity for Inuit-led research. This presentation and poster will provide an overview of the initial work of this collaborative case study, and how it was developed to respond directly to Sikumiut's research needs. At the same time we aim to operationalize a research approach that reclaims Inuit leadership, builds Inuit youth capacity to conduct the research, and evaluates the research according to Inuit principles.

COASTAL MONITORING AND RESTORATION THROUGH KNOWLEDGE CO-PRODUCTION

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The NunatuKavut Community Council in partnership with the World Wildlife Fund – Canada have worked together to Co-produce observations regarding coastal change. Community based monitoring of riverine, estuarine and coastal landscapes has drawn on indigenous knowledge and western scientific approaches. One example of this includes the use of unmanned aerial vehicles (UAVs) to monitor locations in Southern Labrador identified through consultation with residents. Indigenous knowledge in tandem with western methodologies led to a successful beginning for the coastal restoration agenda in Southern Labrador. Future consultation and knowledge co-production will ensure further successes in meeting our goals.

A MULTI-VEHICLE DRONE TESTBED FOR SPACE SYSTEMS AND REMOTE SENSING VERIFICATION

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This paper presents an easily accessible multi-vehicle drone testbed, which will enable the development, validation, and qualification of new drone or satellite control hardware and algorithms without the need for costly launches, microgravity emulators or the need to obtain airspace permission to fly outside. The drone testbed consists of several copter-style drones and gimbals below each to allow six-axis control. By programming drones with a nested feed-forward control loop, a simulated dynamic environment is achieved, which will provide sufficient abstraction needed for independent spacecraft or drone control. Using this architecture, any type of dynamics can be emulated, including different gravity levels and/or air viscosities. For multi-spacecraft control investigations in Earth orbit, multiple vehicles and Hill's Equations can be used to represent the relative motion of one spacecraft with respect to another in neighboring orbits, which is difficult to replicate on Earth. This testbed will enable rapid development and verification of remote sensing technologies for the Arctic to be deployed on either drones or spacecraft.

THE ROLE OF TUNDRA SNOWPACK CHEMISTRY IN THE BOUNDARY LAYER BROMINE BUDGET AT EUREKA, CANADA

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The direct source of bromine during the so-called polar boundary layer springtime 'bromine explosion events' (BEEs) is not completely clear and remains a topic of debate. Sea salt aerosol (SSA), produced through sublimating salty blown snow particles over sea ice, has been found to be able to explain BEEs as well as associated ozone depletion events (ODEs) in modelling studies. However, this mechanism does not rule out the possibility of the snowpack acting as a direct bromine source. Both BEEs and ODEs have been observed at Eureka, Nunavut, Canada (80N, 86W), although it is located in a pristine site, less influenced by salts from young sea ice. It is therefore an ideal site to test whether local tundra snowpack, as proposed by other studies, plays a dominant role in boundary layer bromine, especially for BEE. During late February-March, 2018, we joined the intensive phase of the springtime Canadian Arctic ACE/OSIRIS Validation Campaign, during which enhanced ground-based measurement of BrO by MAX-DOAS, surface ozone, ozonesound and aerosols number density were measured. In total, we have more than 1,500 snow samples collected at 6 sites near Eureka weather station, covering land type of sea ice, offshore inland, and top of a mountain at a height about 600 m above the sea level. Basic snow physical and chemical characters such as density and salinity were measured on site. More than 1,200 snow samples were shipped back to the BAS ice core chemical lab for Ion Chronology (IC) analysis. We will report some of the preliminary result from the IC analysis, with a focus on Br- concentration and the time evolution of bromide in snow during an observed bromine explosion event. We aim, for the first time, to seek direct evidence to answer the key question of whether or not local snowpack is key in determining boundary layer bromine, especially during BEE.

VARIATION IN DIET AND WEANING AGE AMONG NARWHALS (MONODON MONOCEROS) USING STABLE ISOTOPE ANALYSIS OF DENTINE FROM EMBEDDED TUSKS

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Northward expansions of sub-Arctic species facilitated by continued Arctic warming may affect Arctic top predators both directly via diet and indirectly via weaning. Traditional knowledge and accumulating scientific studies on narwhals (Monodon monoceros) make them a promising indicator species to evaluate the impact of a warming environment on Arctic marine mammals. Male narwhals have one large erupted tusk on the left and one tusk that remains embedded in the jaw on the right, while females often have two embedded tusks. Tusks are metabolically inert since dentine laid down in annual growth layer groups (GLGs) do not alter once formed, and therefore can provide a chronological archive of dietary information throughout the animal's life. In this study, we use stable isotopes of dentine from narwhal embedded tusks to investigate whether narwhal diet and weaning age differ between sexes and among individuals over the past 30 years. Narwhal embedded tusks were collected near Pond Inlet, Nunavut, from 1982-1983 (n=31) and 2015-2017 (n=25). Isotopic profiles of carbon and nitrogen were constructed for each individual to compare feeding habits among narwhals over time. Weaning age was estimated through an abrupt decline in nitrogen isotopes over the first few GLGs. Results suggest the majority of narwhals are weaned between age one and two with some individuals being nursed until age three. Post-weaning, narwhals of the same sex show varied degrees of dietary overlap ranging from high to none, suggesting diverged feeding strategies are adopted by different sub-groups. Meanwhile, variation in isotopic niche widths indicates some whales are more generalized than others. Isotopic results across dentine GLGs also show clear cyclic patterns, potentially reflecting seasonal changes in diet and feeding intensity. Future analysis will explore variation in feeding habits and weaning over time and in relation to sex, growth, and individual. This study provides insight on how narwhals have been impacted by climate-induced resource shifts, and the potential for narwhals to adapt to food web changes in the future.

EXPERIMENTAL EVIDENCE FOR THE ROLE OF MINERAL WEATHERING WITHIN PERMAFROST CARBON-CLIMATE FEEDBACKS

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Among the most significant implications of permafrost thaw is the exposure and mobilization of previously sequestered organic and inorganic substrate into modern aquatic biogeochemical cycles. While CO2 released from microbial oxidation of permafrost organic carbon enhances climate warming, the degree to which chemical weathering of minerals exposed by thawing permafrost fixes this CO2 as bicarbonate – rendering it less susceptible to atmospheric exchange – is largely unknown. The Peel Plateau (NWT, Canada), where thermokarst mobilizes a massive amount of relatively mineral-rich tills into fluvial network headwaters, is an ideal setting to explore how the weathering of permafrost minerals can affect CO2 in streams. To do this, we investigated the effects of mineral weathering on aquatic CO2 and bicarbonate production by incubating sediments collected from five sources and three retrogressive thaw slumps on the Peel Plateau: (i) modern active layer; (ii) relatively organic-rich Holocene permafrost; (iii) relatively mineral-rich Pleistocene permafrost; (iv) permafrost thaw streams (a slurry comprised of ii and iii); and (v) older eroded material comprised of all sources (i–iv). Sediments were dried (20˚C), sterilized (200˚C, 12h), and incubated in sterile water for 168h at concentrations (1,800 mg L-1) and water temperatures (10˚C) that we observed in thermokarst-affected streams. After 168h, weathering of the deeper, Pleistocene-aged permafrost tills – and often thaw stream and eroded sediments – generated significant solutes (conductivity > 500 μS cm-1) and dissolved inorganic carbon (DIC = CO2 + bicarbonate + carbonate]; ~600 μmol L-1). X-ray diffraction (XRD) mineralogy revealed the Pleistocene tills and thaw streams had a higher proportion of primary minerals, including carbonates and sulfides. Further, ion trends suggest carbonate weathering by sulfuric acid (from sulfide oxidation) dominated the weathering trends of Pleistocene tills. In comparison, less weathering (conductivity < 200 μS cm-1) and less DIC (~250 μmol L-1) was observed in modern-day and paleo- (Holocene-aged) active layer soils, more characterized by silicate weathering and less by sulfide oxidation and carbonate weathering. Although weathering of all soils rapidly generated both CO2 and bicarbonate, soils with sufficient carbonates to neutralize sulfuric acid consumed some CO2 (as carbonic acid), offsetting the geogenic CO2 production by ~40% on average. These trends suggest that Pleistocene permafrost in the western Canadian Arctic may store a significant reservoir of weatherable, carbonate- and sulfide-bearing substrate and the interaction of these minerals drives DIC speciation in streams. As intensifying thermokarst exposes minerals on the Peel Plateau, the balance of geogenic CO2 release versus fixation as bicarbonate largely depends on the composition and degree of exposure of sulfide minerals, relative to carbonates. The eroded permafrost substrate that comprise large debris lobes within valleys of headwater streams further acts as immense, erodible stores of carbonate and sulfide, and will likely alter fluvial inorganic carbon dynamics for decades to centuries. Future work on CO2-bicarbonate dynamics farther downstream will further illuminate the likely significant role of mineral weathering within permafrost carbon-climate feedbacks.