Oral Presentation Abstracts

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ORAL PRESENTATION ABSTRACTS

SOCIODEMOGRAPHIC CHARACTERISTICS AS DETERMINANTS OF LEVELS OF EXPOSURE TO MERCURY (HG) AND POLYCHLORINATED BIPHENYLS (PCB) AMONG INUIT PREGNANT WOMEN FROM NUNAVIK, CANADA

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Introduction: Country food is a fundamental part of Inuit culture and a key resource for health and subsistence. However, it is also a pathway of exposure to environmental pollutants. These include mercury (Hg) and polychlorinated biphenyls (PCB) which are mainly found in fish and marine mammals. Generally, country food does not represent a significant risk for health for the general population, but particular attention is paid to pregnant women. Prenatal exposure to Hg and PCB through diet is shown to be associated with adverse effects on children's neurodevelopment. In Nunavik, public health authorities have monitored maternal exposure to Hg and PCB since 1992. Biomonitoring data suggest that maternal blood levels of Hg and PCB have significantly declined from 1992 to 2013. However, no studies have examined whether exposure to Hg and PCB was uniformly distributed among pregnant women from Nunavik or whether social disparities in exposure exist. Objective: Examine whether Hg and PCB blood levels among pregnant women from Nunavik vary by (1) personal income; (2) education; (3) region of residence; (4) exposure to regional public health recommendations on consumption of country food during pregnancy. Methods: Between 2011 and 2013, blood concentrations for Hg and PCB (dependent variables) were measured among 208 pregnant women. Information on personal income, education level, region of residence and exposure to country food consumption advices (independent variables) were collected through questionnaire. Associations between Hg and PCB blood levels and each of the selected independent variables were analyzed in separate regression models adjusted for age. Results: Hg and PCB concentrations were significantly lower among women with a higher education level. Significant regional disparities in exposure to Hg and PCB were also observed. Blood level concentrations of Hg and PCB did not vary by personal income or exposure to country food consumption advices. Conclusion: Social disparities in exposure to Hg and PCB exist among pregnant women from Nunavik. Level of education and region of residence are associated with elevated levels of exposure to Hg and PCB. This information is important to ensure the development of public health interventions that promote health equity and for identifying subgroups of the population who might be especially vulnerable. This study contributes to advancing knowledge on environmental inequalities in the Canadian Arctic.

THE WAY FORWARD: CANADIAN COAST GUARD'S NORTHERN MARINE TRANSPORTATION CORRIDORS INITIATIVE

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Due to melting sea ice, the Arctic is opening up and lending way to increased prosperity attracting economic and touristic activities in the region. However, the north is vast and operationally-demanding. Given its geography, and limited infrastructure, marine transportation is a critical mode of transportation. Consequently, the presence of chokepoints and challenging weather can impede navigation and potentially increase navigational risks and constrain economic development. While the current marine transportation system meets current demand, trends are suggesting that this situation is likely to change in the decades to come. A recent announcement identified $22.7 million over five years to strengthen marine safety and navigation in the Arctic. The investments will be directed to laying the groundwork for the development of a modern marine navigation system, additional science research, community engagement...
and more. Moving forward, the Canadian Coast Guard (CCG), the Canadian Hydrographic Service (CHS) and Transport Canada (TC) are working together on the Northern Marine Transportation Corridors Initiative to determine what the appropriate mix of navigational services, infrastructure, and emergency response services could be across Canada’s Arctic waterways; and in a way, is a solution to improving navigation safety and enabling Canada’s strategic advantage in the Arctic. As part of the initiative, CCG committed to undertake a general review of its levels of service and evaluate the advantages and disadvantages of the corridors with respect to its own services. In general the results show the benefits of servicing and maintaining corridors will reduce significantly the area where marine traffic will transit. However, there are some exceptions, such as SAR and Environmental Response incidents that would need to be investigated further. For example, adventurers transiting the Northwest Passage will need to be addressed as they are increasingly requiring assistance. Exploratory discussions on the concept, methodology and preliminary results have been held. These initial consultations with key stakeholders, including the marine industry, have resulted in positive feedback. Moving forward, CCG, CHS and TC, will engage a broader group of stakeholders including academics. The Northern Marine Transportation Corridors initiative is supported through science research, environmental information and data. However, we still require additional information and data in these areas. The purpose of the presentation is to provide an update on the initiative and have a candid conversation on where gaps are present and how we can work together to address those gaps through research, data and workshops. The presentation builds on previous engagements and seeks to build literacy and consensus around next steps for Northern Marine Transportation Corridors as a strategic approach to the Arctic.

THE SOCIAL DETERMINANTS OF HIGHER MENTAL DISTRESS AMONG INUIT

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Within the last decade, Inuit Tapiriit Kanatami has identified mental wellness as the single most important health issue for Inuit (Alianait Inuit-specific Mental Wellness Task Group, 2007). Understanding the complex arrangements of circumstances, behaviours and relationships that are associated with mental health—often termed social determinants—may provide a window for policy makers in addressing mental distress among Inuit. Using the 2012 Aboriginal Peoples Survey, this study examines the social determinants of higher mental distress among Inuit aged 18 years and over, living in Inuit Nunangat. Mental distress was studied using the ten-item Kessler distress scale (K10); and multivariate analysis was conducted using a logistic regression model.

RED BLOOD CELL FOLATE LEVELS IN CANADIAN INUIT WOMEN OF CHILDBEARING YEARS: INFLUENCE OF FOOD SECURITY, BMI, SMOKING, EDUCATION AND VITAMIN USE

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Background: Folate is a key factor in DNA biosynthesis and cell division. The knowledge that folate has an important role in reducing birth defects and improving other birth outcomes has evolved and strengthened over the last 30 years. Because of the known benefit of adequate blood levels of folic acid in reducing the occurrence of neural tube defects, Canada introduced mandatory folic acid fortification of cereal and grain products in November 1998. It was with the expectation that for women of childbearing years, folic acid fortification, in combination with a diet adequate in folate and a daily multivitamin containing 400 micrograms of folic acid, that target red blood cell folate (RBCF) levels of ~906 nmol/L to reduce birth defects would be reached. For the Inuit of Canada, where vitamin use has been documented to be low and access to folate rich foods limited, folic acid fortification may be a major...
source of intake. This study aimed to determine if the RBCF levels of Inuit women reached accepted target levels, important given the documented high rates of congenital anomalies and other adverse birth outcomes.

Methods: The International Polar Year, Inuit Health Survey, 2007-2008, included an evaluation of RBCF levels among 249 non-pregnant women of reproductive age. RBCF levels were assessed and compared across several variables, including: cigarette use, food security, and body mass index (BMI). Descriptive statistics, bivariate and multivariate linear regression analyses evaluated characteristics associating with RBCF status.

Results: Mean (SD) RBCF levels of 935.5 ±191.9 nmol/L reached proposed target levels (>906 nmol/L) to prevent congenital anomalies, however 47% of women had lower RBCF levels. Only 6.8% of women reported taking vitamin supplements. In bivariate analysis, non-smokers, higher education, higher income, food security, and higher BMI were each significantly associated with higher RBCF. In multivariate analysis, however, only higher BMI and vitamin use remained significant. On average, a 200 nmol/L higher RBCF was identified among vitamin users compared to non-users. Furthermore, vitamin use correlated positively with education, income, and inversely with food insecurity. Conclusions: Our results suggest that folate status is too low in a significant proportion of the childbearing population. Initiatives to improve food security, along with culturally relevant education on use of folate rich traditional foods, vitamin supplements, and smoking cessation/reduction programs may benefit Inuit women and birth outcomes.

IMPACT OF EXPERIMENTAL WARMING AND SNOW MANIPULATION FOR SEVEN YEARS ON VEGETATION IN THE CANADIAN HIGH ARCTIC

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Arctic regions are expected to experience an increase in both temperature and winter precipitation over the next several decades, with the potential to impact vegetation dynamics. To test this response, an experiment was installed at the Cape Bounty Arctic Watershed Observatory, on Melville Island, NU, in 2008 as part of the International Tundra Experiment (ITEX). Snow fences were erected to create areas of enhanced snow deposition, and open-topped chambers (OTCs) were installed to increase the air temperature. Unlike most ITEX sites to date, however, enhanced temperature and snowfall were combined in a full factorial design with eight replicates. As an added control, four plots were established well outside the snow drift area. Vegetation plots receive one of four treatments: unaltered (Control-Control (CC)), enhanced temperature only (Control-Warm (CW)), enhanced snowfall only (Snow-Control (SC)), and combined snow and temperature enhancement (Snow-Warm (SW)), plus the additional outer control plots (Outer-Control (OC)). During the 2015 growing season, phenology of four plant species (Ranunculus nivalis L., Potentilla vahliana L., Salix arctica P., and Saxifraga oppositifolia L.) was monitored. Events such as first green leaf, first flower bud, first flower open, and first leaf senescence were monitored by making repeated observations of individually tagged plants every two days. Additionally, plot greenness was monitored throughout the growing season using a specialized camera to measure the Normalized Difference Vegetation Index (NDVI). At the peak of the growing season (end of July) a vegetation survey was conducted within each plot in order to determine percent vegetation cover and species richness. Our results were used to 1) assess treatment differences in plant phenology, and 2) assess vegetation changes since 2009. I hypothesized that percent vegetation cover and species richness would be greatest in the SW treatments and increased since 2009. Initial analyses suggest that senescence occurred significantly earlier in OC plots than in all other treatments for all species. This suggests that the CC and CW plots may not be located far enough away from the snow drifts and are experiencing the same ‘late snowmelt’ effect as the SC and SW plots. However, R. nivalis and P.vahliana senesced significantly earlier in CW plots compared to SW plots. This is supported by the NDVI time series which shows that the OC plots were greenest early in the season and began to senesce much earlier and more rapidly than all other treatments. A two-factor repeated measures ANOVA will be used to assess whether these differences are significant and whether they occur between certain treatments at certain times throughout the season.

INVESTIGATING WIND-FORCED PROPAGATION OF OCEAN WAVES INTO THE PERIPHERY OF ARCTIC PACK ICE USING UPWARD-LOOKING SONAR

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The Arctic Ocean continues to transition towards a sea ice regime predominated by first-year sea ice cover. Key features of this process are declining trends in sea ice extent, thinning of the ice cover, and loosening of the ice cover via increased pack ice mobility. These changes are most notable during the summer and early autumn as declining sea ice cover is yielding large expanses of fetch within the Arctic basin, increasing the potential for large waves and ocean swell. These changes emphasize the need for better understanding of Arctic storm interactions with increasing duration and expanses of fetch in the Arctic basin, and subsequent implications for the sea ice cover. Synoptic-scale atmospheric circulation patterns drive wind forcing of both the ocean and sea ice cover through transfer of momentum, creating ocean waves and inducing sea ice drift. Large ocean waves may intrude into the pack ice, causing flexural swell and fracture within the ice cover, thereby affecting dynamic and thermodynamic processes in the sea ice cover. Ocean waves in the summer and fall were analyzed using available mooring data sets equipped with upward looking sonar (ULS) instruments located along and across the continental shelf of the Canadian Beaufort Sea from 2009 - 2011. These moorings were deployed as part of a multidisciplinary collaborative research program including Imperial Oil Resources Ventures Limited (IORVL), BP Exploration Operating Company Limited (BP), and ArcticNet. The ULS data provided the propagation of the waves within the ice pack as wave-induced movements of the sea ice using non-directional wave spectra and parameters, combined with ice drafts and ice velocities in varying types and concentrations of sea ice cover. Large wave propagation events within sea ice cover are identified and analysed from the ULS data record and documented in terms of surface wind forcing, ice cover characteristics, and available fetch. Wave modeling studies using surface wind fields and available fetch were conducted to determine the spatial distribution of the largest waves within the pack ice. From this and the ULS analysis, results will estimate the deterioration of the ice cover during and following wave propagation events.

DISTRIBUTION, PHYSICAL TRAITS, AND DIET OF ARCTIC SKATE, AMBLYRAJA HYPERBOREA (COLLETT 1879) (RAJIDAE), IN THE CANADIAN BEAUFORT SEA

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The Arctic Skate (Amblyraja hyperborea, Collette 1878) is a circumpolar, deep-water, chondrichthyan for which little is known in terms of morphology or life history. Prior to this study, few quantitative morphological descriptions of A. hyperborea had been reported globally, while only three occurrences had been documented from Canadian Beaufort Sea. In 2012 and 2013, 70 specimens of A. hyperborea were collected from the Canadian Beaufort Sea from 350 - 1500 m deep through benthic trawling operations conducted during the open-water season as part of the Beaufort Sea Regional Environmental Assessment (BREA) Marine Fishes Project. This study: 1) documents new occurrences of A. hyperborea in the Canadian Beaufort Sea 2) provides a contemporary, comprehensive species description of A. hyperborea, 3) tests for differences in morphology between sexes, maturity stages, and habitat and 4) performs a basic diet (i.e., gut content) analysis. Results of this study showed that certain morphological traits displayed greater variability than previously described (e.g., number of tooth rows and mid-dorsal spines), while traits previously thought to change throughout ontogeny (e.g., ventral colouration, dorsal fin morphology) were consistent across maturity stages. Gut content analysis revealed a diet composed mainly of epibenthic invertebrates (e.g., decapods, amphipods, mysids, isopods) and demersal fishes including Arctic Cod (Boreogadus saida), eelpouts, and snailfishes. This study provides updated distributional knowledge for A. hyperborea and the first detailed contemporary biological description of this species. The baseline information presented in this study acts as a foundation from which we can begin to understand the ecological role of this top predator in Arctic marine systems.
MAPPING, VISUALIZING, AND ANALYZING SPATIAL TRADITIONAL ECOLOGICAL KNOWLEDGE: MOVING BEYOND THE POINT, LINE, AND POLYGON

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The inclusion of Traditional Ecological Knowledge (TEK) is now a standard requirement for environmental and resource management decisions in the Canadian North. TEK is often inherently spatial; attempts to record this knowledge are often undertaken through participatory mapping using topographic maps and later digitized for use in geographic information systems. TEK not only incorporates spatial descriptors such as location and direction, but also the nuanced connections people have with the land, their sense of place. As such, TEK incorporates values, feelings, and meanings associated with specific places or journey experiences. The use of the standard vector data model with two-dimensional points, lines, and polygons linked to a relational database may not adequately convey this knowledge. This research examines the challenges that can arise in the digital mapping and visualization of TEK in the context of working with the Inuit community of Gjoa Haven, Nunavut. The goal is to adequately represent the concentration of collective understandings of caribou on and around King William Island based on Inuit TEK, while minimizing the loss of meaning and context. By exploring new techniques and approaches for integrating this experiential knowledge with scientific and technical data, our aim is to support complementary analysis to enable more locally representative resource and environmental planning methodologies.

SPATIAL MODELLING OF THE BIOPHYSICAL CONDITIONS WITHIN A NIVAL DRIVEN ARCTIC WETLAND AT CAPE BOUNTY, MELVILLE, ISLAND

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With a changing climate in the Canadian Arctic, the potential exists to see a shift within Arctic wetlands from a carbon sink to a source. Increasing temperatures can impact nival driven wetlands that rely on a strong hydrological input from melting perennial/late season snowpack. Soil moisture, soil temperature, active layer depth, and organic layer thickness are all key biophysical variables in predicting carbon flux trajectories in this environment. How these variables interact is crucial in delineating links between snowmelt and seasonal changes with wetland. Many Arctic wetland biophysical and carbon flux studies have high temporal resolution measurements but typically have only a few replicates and so spatial variability is low, not allowing for a detailed analysis of spatial patterns and variability. This study examines the spatial patterning of biophysical data within a 4 ha nival driven wetland for two growing seasons (2014 and 2015), each with differing nival conditions, at the Cape Bounty Arctic Watershed Observatory, on Melville Island. Abiotic parameters, of soil temperature, soil moisture, and active layer depths were measured with high spatial and temporal frequency for both seasons with the addition of CO2 and trace gas flux in 2015. The data was then spatially interpolated to create continuous spatial parameter models. The goal of this is to achieve a greater understanding of the responses of Arctic wetlands to seasonal and multi-year environmental change.

USING PHOTOLYTIC AND MICROBIAL DEGRADATION EXPERIMENTS TO UNDERSTAND THE QUALITY OF DISSOLVED ORGANIC MATTER AROUND YELLOWKNIFE, NORTHWEST TERRITORIES

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Dissolved organic matter (DOM) is a ubiquitous component of aquatic ecosystems and is comprised of thousands of different molecules. DOM plays a number of important roles within the environment, such as absorbing harmful UV-radiation in surface waters, acting as an intermediary for terrestrial carbon release to the
atmosphere, and providing an important energy source for microbes and biogeochemical reactions. Furthermore, DOM impacts drinking water quality by mobilizing heavy metals, as well as reacting with chlorine during water treatment to produce carcinogenic disinfection by-products. As such, DOM can become the number one determinant for drinking water treatment. This is of particular concern for the Northwest Territories, as large stores of carbon are stored in the subsurface as permafrost. With a warming climate, there is the potential for permafrost degradation to potentially mobilize these stores into surrounding surface waters. In these sub-arctic environments, subsurface and nearby ponds and creeks contain high amounts of DOM (concentrations ranging from 15 to 100 mg/L), while nearby rivers generally contain less than 10 mg/L over the year. Our research looks at how subsurface DOM degrades via two main natural degradation pathways: microbial and photolytic decomposition. Determining the effects of degradation on DOM quantity and quality will help understand what processes dictate DOM evolution along a degradation continuum. Samples were taken from a pond, creek, river, and subsurface of a peat plateau around Yellowknife, Northwest Territories. We used a 30-day microbial and photolytic experiment to measure degradation rates of DOM from different sources. Furthermore, we used a suite of DOM characterization techniques (size-exclusion chromatography, UV-visible absorbance, and DOC:DON ratios) to measure how quality changes with time. Results from the degradation experiment will be compared to what is found within the environment around Yellowknife to better understand how these processes ultimately shape the fate of DOM in sub-arctic environments.

SELENONEINE IS THE MAJOR SE COMPOUND IN BELUGA MUKTUK AND RED BLOOD CELLS OF NUNAVIK INUIT

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Background: Selenium (Se) is an essential element highly present in traditional marine foods consumed by Inuit, who exhibit one of the highest Se intake in the world. In fish and marine mammal eating populations, there is increasing evidence suggesting that the high Se intake may play a role in offsetting some deleterious effects of methylmercury (MeHg) exposure. In 2010, Yamashita and colleagues reported the isolation from bluefin tuna blood of a novel selenocompound - selenoneine - which was later identified in the blood cell fraction of Japanese fishermen and in some marine species. We developed an analytical method for the quantification of selenoneine in blood and tissues that was applied for the determination of selenoneine content in red blood cells of Inuit adults from Nunavik who participated to the 2004 Qanuippitaa Health Survey. The method was also used to quantify selenoneine in marine foods that are part of the traditional Inuit diet, starting with beluga muktuk, which contains very high Se levels.

Methods: The selenoneine standard was isolated from genetically modified S. pombe yeast cells overexpressing the egt+ gene (kindly donated by M. Yanagida, Dept. of Molecular Biotechnology, Hiroshima University), which were grown in the presence of selenate. After cell lysis, selenoneine was extracted and purified on a weak-cation-exchange solid phase extraction column. Red blood cells were mixed with a 10-fold volume of 50mM DTT solution for 1h followed by filtration on a 10kDa filter and selenoneine quantification by ion-pair liquid chromatography-inductively coupled tandem mass spectrometry (LC-ICP-MS/MS). For beluga muktuk analysis, we first removed the fat layer and the rest of the sample (skin) was ground in liquid nitrogen with a mortar and pestle, followed by cell disruption in a methanol-water mixture using a Bead Beater. After filtration on a 10 kDa filter and solvent evaporation, the resulting concentrated extract was analysed by LC-ICP-MS/MS.

Results: Through yeast-based biosynthesis, we obtained 100 mL of a selenoneine standard solution containing 0.91 µg Se/L. Results from Se speciation in red blood cells (pooled sample) showed that selenoneine and its metabolite methyl-selenoneine represented respectively 60% (1.3 µg Se/L) and 4% (0.08 µg Se/L) of the total
Se concentration (2.2 µg/L). The total Se content in one beluga muktuk sample analysed to date was 5.3 µg/g wet weight. The speciation analysis revealed the presence of selenoneine in the sample at a concentration of 2.6 µg Se/g, representing nearly 50% of the total Se concentration present in the sample. Conclusions: Our results to date suggest that selenoneine is the major form of selenium in red blood cells of Nunavik Inuit and in beluga muktuk, a traditional marine food highly consumed by this population. We are currently investigating the associations between selenoneine and selenoproteins status, as well as between these biomarkers of Se status, MeHg exposure and cardiometabolic outcomes in the Inuit population of Nunavik. Analyses other food items that are major sources of Se including beluga meat, seal meat, seal liver and arctic char are on-going. These data will improve our capacity to assess the benefits and risks of the traditional marine diet in this population.

ARCTIC SEABIRDS AS PROXIES OF HEALTH OF THE OCEAN – OR- A TALE OF TWO SEABIRDS

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Seabirds are better samplers of what occurs in the ocean than are any other type of sampling method. Seabirds are top predators, and sample from near the bottom of the food chain to near the top, at various depths, and in a myriad of geographic locations-both nearshore and offshore, over the continental shelf, along the shelf break, or in pelagic regions. Data collected over the past 40 years on the prey and on the reproductive success of dovekies and thick-billed murres give us information about how changes in the ocean can translate to changes in the entire food web, using seabirds as samplers, and thus giving us an idea of the ramifications of these oceanic changes. Dovekies and thick-billed murres studied over the past 20 years at various colonies, have had a radical change in their prey with respect to species, sizes, and energy content. There has been a concomitant decrease in breeding success of these seabirds. Other arctic seabirds, including thick-billed murres, also now have increased competition for prey from newly-arrived subarctic seabirds. Alterations in the foraging and breeding ecology of these birds reflect in turn changes that have occurred in their oceanic environment. New research shows that the heart of the whole ecosystem is a small diatom at the bottom of the food web. This diatom is unique in that it alone is able to create vital nutrients in the form of fatty acids that are transferred up the food web. These fatty acids in seabirds’ diets are necessary for chick growth, for high energy reserves, and for migration. Recent shifts in seabirds’ diets may reflect alternations in population numbers or distribution of this plankton, which in turn most likely have been driven by changes in oceanic conditions. Possible transformation of the oceanic environment of this plankton could have repercussions throughout the entire food web, and these changes might now have already begun to be widespread and ubiquitous.

THE BAYSYS PROGRAM - AND OVERVIEW UPDATE AND LINKAGE TO THE ARCTICNET HUDSON BAY IRIS

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The past century has seen significant hydroelectric development on rivers flowing into Hudson Bay, with more than 21,000 MW of annual production on the Nelson and La Grande river systems. Freshwater entering Hudson Bay is susceptible to modification, both in terms of water quality and quantity, through exchange processes in the watershed, and through climate forcing of the hydrological cycle both in space and time. A unique aspect of this system is the role that freshwater plays on both sea ice thermodynamic and dynamic processes within Hudson Bay. This freshwater-marine coupling affects all aspects of the Hudson Bay physical, biological and biogeochemical systems through the control which sea ice has on the exchange of light, heat and momentum in the marine system. This talk will introduce the Hudson Bay Integrated Regional Impact Study (IRIS) and the BaySys Project. The objective of the Hudson Bay IRIS is to contribute to the development and dissemination of knowledge needed to formulate adaptation strategies and national policies to help Canadians face the impacts and opportunities of climate change and modernization in the Arctic. For the Hudson Bay IRIS scientists and stakeholders will work together to publish an Impact Assessment Report. The Hudson Bay IRIS is a marine-focused assessment report on the current state of the Bay
and how climate change and development may affect all aspects of the marine ecosystem, including freshwater distribution, oceanography, ecology, and ice climate. The objective of the BaySys project is to provide a scientific basis to separate climate change and regulation impacts on the Hudson Bay system. It is a four-year (2015-2018) comprehensive study that integrates field-based experimentation with coupled climatic-hydrological-oceanographic-biogeochemical modeling. The results of the BaySys project will strongly influence science, industry, and policy in Canada. For the scientific community, the project will vastly expand knowledge of climate impacts on the Arctic system, in a region where there are substantial gaps and limitations in existing knowledge. For industries, such as shipping and tourism, an improved understanding of the future of Hudson Bay will help with strategic decision-making. As a final legacy, results from the Hudson Bay project will feed into an Integrated Regional Impact Study of Hudson Bay.

**IS SELF-RATED HEALTH ASSOCIATED WITH CLINICAL MEASURES OF HEALTH AMONG NUNAVIMMIUT?**

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Background: Self-rated health (SHR) is widely used as a measure of health status in population health surveys, including in Inuit health surveys conducted in Canada and Greenland. SHR has been found to be an indicator of mortality and morbidity in different populations worldwide. Yet very few studies have examined associations between perceived health and objective health measurements. One exception is a study conducted among Inuit in Nunavut, Nunatsiavut and Inuvialuit Settlement Region (ISR) showing poorer SHR to be associated with selected risk factors for cardiovascular diseases (CVD). A limitation of this study is that it did not consider variation of associations by sex and socioeconomic position. Yet, studies demonstrate that gender may influence SHR assessments, whereas other authors have argued that people’s assessment of their health is contingent on their social experience, such that socially disadvantaged individuals will not perceive and report the presence of ill-health. The current paper extends results of studies reported above by focussing on SHR and objective health measurements among Inuit in Nunavik. As Inuit populations live in different socioeconomic, political and environmental conditions across Canada and elsewhere in the circumpolar North, it is relevant to assess the validity of SHR among the circumpolar Inuit. The objective of this study is to assess associations between SHR and objective health measures, i.e. selected risk factors for CVD, in Nunavik and to identify whether these associations vary by gender and education level.

Methods: Cross-sectional data from 908 adults (18+ years) participating to the Nunavik Inuit Health Survey (2004) were analyzed. SHR was dichotomized into good health (excellent, very good or good health) vs. poor health (fair and poor health). Age-adjusted logistic regression models were used to examine associations between SHR and several risk factors for CVD: waist circumference, impaired fasting glucose, blood pressure, and cholesterol. Analyses were stratified by sex and education level (less than high school vs. high school completed). Results: People with higher waist circumference, impaired fasting glucose and with hypertension were significantly more likely to rate their health as poor SHR. In sex-stratified analyses, higher waist circumference was significantly associated with poor SHR among men only. In analyses stratified by levels of education, perceiving one’s health as poor was significantly associated with higher waist circumference and hypertension only among people with lower education. Conclusions: Although SHR appears, overall, to be associated with different objective health measurements among Nunavimmiut, the associations vary by sex and socioeconomic position. This may limit the use of SHR as a proxy for objective health measurements, especially when assessing social inequalities in health in the region. More in depth analyses are needed to understand associations between SHR and other health measures with relevance for preventive strategies in the region, and to assess the strength of SHR in predicting mortality among Inuit populations.

**UPWELLING/DOWNWELLING EVENTS ANALYSIS OVER THE MACKENZIE SHELF BREAK USING THE INDUSTRY/ARCTICNET EXTENSIVE MOORING ARRAY DEPLOYED FROM 2009 TO 2011 OVER THE SLOPE AND OUTER SHELF AREAS**

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The Mackenzie shelf break and slope area in the southeastern Beaufort Sea represents a region of interesting ocean dynamics. Locally, atmospheric forcing, sea ice cover and bathymetry (Mackenzie River canyon to the west) can have major repercussions on the local current dynamics and by the extension the biogeochemistry of the local sea water. On a more macro scales, major currents present over the area can also have a great impact locally and regionally. We present here a detail analysis of different events recorded over the region from July 2009 to September 2011 resulting from the Industry/ArcticNet collaboration program. We combine water properties and current measurements from eight moorings deployed over the continental slope (6 moorings) and the outer shelf (2 moorings) and surface wind data to clearly describe important episodic events. The ocean dynamics including upwelling and downwelling, inertial oscillations, eddy formation and propagation, and the wind-driven and stratification processes in terms of the upper mixed layer. The focus of this study is major upwelling events driven by north-easterly winds which represents a dominant ocean dynamical process observed over the region. Prior and post conditions for each major upwelling episode are analysed as well as along shelf variability in the context of the actual wind forcing and the role of the sea ice cover. With a large potential increase of the open water season in the Beaufort Sea in the near future, wind-induced phenomenon can potentially increase in frequency and amplitude of upwelling activity while at the same time raising the importance of understanding the combination of the different processes and their consequences on the ocean biophysical system on local and regional scales.

**INUIT YOUTH BUILDING BRIDGES BETWEEN GENERATIONS, COMMUNITIES AND WAYS OF KNOWING**

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Ikaarvik: Barriers to Bridges (laureate of the 2013 Arctic Inspiration Prize) supports youth leaders to work with their hamlets, HTOs and Elders in the Nunavut communities of Gjoa Haven, Cambridge Bay, Pond Inlet and Kugluktuk. Through their activities, youth leaders create the opportunity for communities to consider local environmental issues, prioritize their concerns and ultimately connect with the appropriate researchers to help answer the questions that are of critical importance to Inuit. In Pond Inlet, for example, Ikaarvik youth leaders identified changing ice conditions and shipping as two key research priorities and subsequently partnered with the SmartICE project to address them. SmartICE Pond Inlet in essence is a community-driven collaboration with university and government researchers that demonstrates how Inuit knowledge and science can work together to make sea ice travel safer, while improving ice monitoring and measurement technology. The SmartICE program, which was pioneered by Labrador Inuit in Nunatsiavut, is generating baseline information to support community decision making on sea ice use and is particularly relevant given current climate variability and proposed winter shipping. In the context of resource development and rapid environmental and social changes in the Arctic, Elders are telling their youth to prepare to lead. Many youth are interested in being the catalyst for their communities to effect positive change through scientific research. They also realize, however, that incorporation of Inuit Qaujimajatuqangit into the process of scientific research will accomplish something much greater than either one could alone.

**PLANNING TO ADAPT: CASE STUDIES FROM THE INTEGRATION OF LANDSCAPE HAZARD MAPS INTO DECISION-MAKING IN YUKON COMMUNITIES**

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Since 2010, the Northern Climate ExChange (part of the Yukon Research Centre at Yukon College) and its partners have been using geoscience approaches to map landscape hazards in Yukon communities. By March 2016, we will have created hazard maps for seven
communities. The maps we create, which focus on permafrost, surficial geology and hydrology, depict hazard risks in stoplight colours for easy interpretation, and are intended to support adaptation planning. Ultimately, we aim to create useful, informative tools for community and government decision-making that integrate landscape change and climate variability. Last year at the ArcticNet science meeting, we presented an overview of the communication approaches we have used in our efforts to support the integration of hazards maps in end-user decision making. We discussed our successes and failures, and the challenges and opportunities we have identified in developing clear, user-friendly and memorable communication products that keep our projects front of mind. This year, we propose to present examples of the ways in which hazards maps have been used by Yukon communities, First Nations, consultants and decision-making bodies. We have seen uptake of hazards maps throughout the territory, with both practical and policy-level applications. For example, in Burwash Landing, the local hazard map and related permafrost information helped a consulting firm redesign the installation and rigging for a wind monitor tower being set up in a high risk hazard area. In Old Crow, where a hazard mapping project is on-going, permafrost temperature monitoring is being used to assess the impact of new construction on frozen ground. Kluane First Nation has integrated hazards mapping in their strategic plan by including language that mandates that land use plans should be reconciled with the local hazard map. The Yukon Environmental and Socioeconomic Assessment Board is using results of hazards projects to support assessments of project applications. These case studies illustrate how applied science is integrated in local decision-making, and inform the approaches we take in developing and promoting project results. Our experiences will be useful for other researchers working with communities and northern decision-makers, and demonstrate the tangible impacts research efforts related to climate change adaptation can have locally.

UNEXPECTED LEVELS OF BIOLOGICAL ACTIVITY DURING THE POLAR NIGHT OFFER NEW PERSPECTIVES ON A WARMING ARCTIC

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The current understanding of Arctic ecosystems is deeply rooted in the classical view of a bottom-up controlled system with strong physical forcing and seasonality in primary-production regimes. Consequently, the Arctic polar night is commonly disregarded as a time of year when biological activities are reduced to a minimum due to a reduced food supply. Here, based upon a multidisciplinary ecosystem-scale study from the polar night at 79°N, we present an entirely different view. Instead of an ecosystem that has entered a resting state, we document a system with high activity levels and biological interactions across most trophic levels. In some habitats, biological diversity and presence of juvenile stages were elevated in winter months compared to the more productive and sunlit periods. Ultimately, our results suggest a different perspective regarding ecosystem function that will be of importance for future environmental management and decision-making, especially at a time when Arctic regions are experiencing accelerated environmental change.

THE CHANGING ARCTIC BIODIVERSITY

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Plants, animals, bacteria, and all other forms of life present in the Arctic form its biodiversity. These species are connected through a rich network of ecosystems that benefit humans in many ways. Since the beginning of ArcticNet, our research group has spent considerable time at many sites of the Canadian Arctic to assess status and trends in wild life. The scientific and traditional knowledge we have gathered demonstrates that Arctic biodiversity is changing. We thus attempt to answer three questions: What is changing exactly? Why is it changing? Why does it matter?

A TOOLKIT OF VISUALIZATIONS: MAKING SENSE OF ARCTIC SHIPPING INFORMATION

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A common belief is that with more information comes a better understanding. However, immense
Volumes of information and data can easily overwhelm traditional approaches to sense-making. New methods to ensure the proper analysis and interpretation of an increasingly diverse volume of information and data are required to improve the situation. We set out to study the risk of shipping in the Canadian Arctic, which included understanding the legal context and the players involved. We quickly faced a situation of surmounting information; we had to tread through legal texts and documents, we had to wrap our head around the mosaic of stakeholder interactions, and we had to sort through the endless shipping and ice data. Beginning with the legal aspects, we sought to organize the texts in a visual manner to allow easy access to the specific information we needed. After sharing our tool and receiving supportive feedback, we decided to take a similar approach to organizing and displaying our stakeholder database (qualitative information). We were also able to translate the ice and shipping data and the risk analysis into visual maps (quantitative data). Furthermore, we focused on ensuring our products were open-access, so as to facilitate future research and operations.

EU-POLARNET: CONNECTING POLAR SCIENCE WITH SOCIETY

Biebow, Nicole and EU-PolarNet Consortium

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The rapid changes occurring in the Arctic are significantly influencing global climate with consequences for global society. Arctic research has contributed critical knowledge to identifying the processes behind these rapid changes but, in contrast to lower latitudes, datasets from the Arctic Region are still insufficient to fully understand and more effectively predict the effects of change on our climate and society. This situation can only be improved by a more holistic integrated scientific approach, a higher degree of coordination of research and closer cooperation with all relevant actors on an international level. EU-PolarNet is a coordination and support action recently funded by the European Commission (EC) under Horizon 2020 with the aim to support and advise the EC in all topics related to the Polar regions and to implement a closer cooperation with partners from Canada and the US. It’s overall goal is to develop for the first time an Integrated European Polar Research Programme that is co-designed with all relevant stakeholders and international partners. This should be achieved by initiating an ongoing dialogue between policymakers, business and industry leaders, local communities and scientists to increase mutual understanding and identify new ways of working that will deliver economic and societal benefits. The presentation aims at informing Canadian researchers about the science planning process which is currently ongoing in EU-PolarNet.

CANADIAN IMPLEMENTATION OF THE ARCTIC MIGRATORY BIRDS INITIATIVE’S “CIRCUMPOLAR FLYWAY” WORKPLAN

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The Arctic Migratory Birds Initiative (AMBI): protecting Arctic lifestyles and peoples through migratory bird conservation is designed to improve the status and secure the long-term sustainability of Arctic breeding bird populations throughout their migratory range by establishing working groups organized by four flyways: East Asian-Australasian Flyway; African-Eurasian Flyway; Americas Flyway; and a newly-defined Circumpolar Flyway, which addresses species that spend their entire life cycles in or near the circumpolar Arctic. Each of the four flyway work plans builds on current CAFF programs, as well as existing bird and habitat conservation initiatives throughout the world. Canada lead the development of AMBI, and continues to lead and contribute as implementation progresses. This presentation will outline Canada’s involvement in the Circumpolar Flyway working group, review current priority objectives, key collaborators, and links to other conservation initiatives. The Circumpolar Flyway work plan focusses on snowy owls, seabirds and seaducks because they are the species that spend all or most of their time in the circumpolar Arctic. Conservation concerns for marine birds in this flyway include fisheries bycatch, sustainable harvest, identifying species distribution and habitat use in offshore marine areas, and marine habitat degradation where it is occurring.
SAAMI-INUIT YOUTH EXCHANGE AS A WAY TO RE-AWAKEN AN INTEREST IN CARIBOU HUNTING/REINDEER HERDING AND SUSTAINABLE PRACTICES AMONG INUIT AND SÁMI YOUTH

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In 2014 and 2015, Inuit students at Qamani’tuq produced letters and drawings that were sent and presented to Sámi youth of 2 schools in Sweden. They exchanged and wrote back to one another with the possibility of establishing a longer-term friendship and facilitate real exchanges between Inuit and Sámi youth in the form of videos, photos, letters and personal visits. The researchers gave presentations on both sides at Qamani’tuq schools about the Sámi culture and reindeer herding practices and in the Saami schools about caribou livelihood. This awakened great interest in the audience, who found it fascinating to see the similarities and differences between the two cultures. The Inuit classes produced a booklet for Sámi youth that documents caribou hunting practices at Qamani’tuq and pose questions about Sámi culture and share about their own lives and traditional practices. The community of Qamani’tuq (Baker Lake, Nunavut), has traditionally depended on caribou hunting and fishing. Today, caribou hunting still plays a central role in daily life, and there are many uses for caribou meat, skin and bone. At the same time, mining development is impacting the region and raising concerns about possible impacts on caribou herds. Another challenge is the widening cultural gap between Elders and Youth, which can make it difficult to share and keep alive the traditional knowledge about caribou livelihoods. It is for this reason that our TUKTU participatory research project works together with community members to explore four key topics: youth futures, caribou and land, mine impacts, and Elders’ knowledge. On the Sámi side, the reindeer herders are facing similar issues: new mining sites have been explored on the reindeer migration areas or Samebys. This year, we are « starting small » with a simple exchange of letters and images. But in the long run, it is our hope that the Inuit-Sámi youth exchange might re-awaken an interest in caribou hunting/reindeer herding and sustainable practices among Inuit and Sámi youth. We also hope to foster an appreciation among the students for their own culture and for the common challenges and opportunities that Indigenous peoples across the Arctic share. In the long term, we envision a number of follow-up initiatives such as a shared Sámi-Inuit website in which students could post photographs and videos as well as an opportunity for personal visits between the two communities. The exchange program could focus on a variety of topics such as: ways of ensuring sustainable hunting/reindeer herding, the impacts of mining development on caribou/reindeer and subsistence lifestyles, the meanings of Inuit/Sámi identity for youth today, or ways to keep Inuit/Sámi language and culture alive. The establishment of a personal visit is not entirely simple, but we would like to keep this possibility in mind as a long-term objective.

LIFE AFTER MEADOWBANK: EXPLORING GOLD MINE CLOSURE SCENARIOS WITH THE RESIDENTS OF QAMIN’TUQ (BAKER LAKE), NUNAVUT

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Mining development in the Canadian Arctic is commonly portrayed as a source of jobs and development for Northern communities. Yet its broader impacts on community well-being, especially after mine closure, remain understudied. We will present post-mining scenarios as envisioned by the Inuit community of Qamini’tuq (Baker Lake, Nunavut), in anticipation of the Meadowbank gold mine’s anticipated closure. Study participants rated mine closure impacts on the “Well-Being Wheel”, an evaluation tool they co-designed with the authors with five axes: Family Life, Jobs, Food Independence, Health and Learning (all intimately bound with caribou-based subsistence lifestyles). Participants also explored best-case and worst-case outcomes. All scenarios highlighted far-reaching impacts on diverse aspects of Inuit well-being. A pessimistic scenario signified a sudden surge in unemployment, with stresses on mental health, family life and food security. An optimistic scenario promised new business development, social service support, and the resurgence of caribou herds. We conclude that in Qamini’tuq, mining has failed to produce lasting “social and economic development” when we consider its holistic impacts on well-being and subsistence lifestyles. Yet participatory scenario construction may foster effective cross-sector collaboration in anticipation of mine closure. We recommend the strengthening of essential social services and local caribou livelihoods as a strategy to improve post-mining outcomes.
REGIONAL ASSESSMENT OF SEABED GEOHAZARD CONDITIONS CANADIAN BEAUFORT OUTER SHELF AND UPPER SLOPE
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The Environmental Studies Research Fund in collaboration with the Panel on Energy Research and Development and the Geological Survey of Canada funded a study to investigate the regional distribution of seabed geohazards on the outer Beaufort Shelf and upper slope. ArcticNet, Imperial Oil Ltd, BP, Chevron, ConocoPhillips, Shell, ION/GXT and the GSC provided legacy geological, geotechnical and geophysical data as the basis for the study. The research was conducted both by contract and within the GSC. The Arctic Institute of North America generated a catalogue and library of relevant reports, maps and data at the University of Calgary. Fugro GeoSurveys and the GSC conducted the geological and geophysical research while Michelmore Engineering and the GSC compiled the geotechnical component. With hydrocarbon exploration extending beyond the shelf edge and down slope, it became evident that little was known about the nature and distribution of seabed instability conditions in deeper waters. The regional study extended from the central Beaufort west to include the Mackenzie Trough and Yukon margin. Water depths ranged from 100 m at the shelf edge to 1500 m down slope. Ground truth data included borehole, piston, gravity and box core sediment sample analyses (stratigraphy, sedimentology, physical and dynamic properties) from seabed to 6 m with rare data to 100 m. Acoustic data included multibeam sonar, subbottom profiles, single and multichannel shallow reflection seismic data to 1000 m below seabed. Data analysis and interpretation led to the identification and mapping of a wide range of geohazard conditions. These included low strength sediments, slope instabilities and failures, mass transport deposits, ice scouring by glacial, berg and sea-ice regimes, mud volcanism, fluid venting, pockmarks, faulting, folding, subsea permafrost, gas hydrates and shelf edge erosion. These geohazards occur at and below seabed to depths greater than 1000 m. A geological chronostratigraphic model of the outer shelf and upper slope for the central Beaufort region was developed to provide a spatial and temporal framework to determine the distribution, age and recurrence rates of geohazards. Instability features and processes mapped on the outer shelf and upper slope appear to be less than 25,000 years old.

CAMERA TRAPS AS A MONITORING TOOL FOR LARGE MAMMALS IN THE CANADIAN ARCTIC - STRENGTHS AND WEAKNESSES
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Camera traps are becoming increasingly popular as a monitoring tool for large mammals. Cameras are a cost effective and low maintenance passive sampling technique, but few studies have been conducted with them in Arctic environments. During the last five years, we have tested the use of camera traps in tundra environments of the Northwest Territories and Nunavut at six locations, using >400 cameras. We report on the strengths and weaknesses of this monitoring method through featured analyses to examine the timing of wildlife movement, habitat selection, distribution of wildlife groups and collaboration with holders of Traditional Knowledge. We also discuss methodological issues of effort, habitat selection, capture probability, sample size, and deployment. We conclude that cameras can be an effective tool for monitoring wildlife for a sub-set of wildlife questions.

OVER WINTER CHANNEL BED TEMPERATURE REGIMES GENERATED BY CONTRASTING SNOW ACCUMULATION IN A HIGH ARCTIC RIVER
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We report experimental results from one year along and adjacent to the channel bed of a High Arctic river. A network of temperature loggers was deployed 5 cm below the ground surface in areas where the terrain suggests varying snow accumulation patterns. The maximum winter difference between air and near-surface temperature ranged from 0 to +30 °C during the 2012-13 winter season, and shallow near-surface freezing conditions were delayed for up to 21 days in some locations. Cooling to -10 °C was delayed for up to 117 days at one site, suggesting that the near-surface environment hosted thermal conditions where microbial activity could occur for an extended period compared to soils on the surrounding landscape. Modelled TTOP (temperature at the top of permafrost) indicates that permafrost at high-snow accumulation locations can be up to 7 °C warmer than those with low snow accumulation. This thermal evidence for an ameliorated bed environment indicates the potential for substantial extended microbial and biogeochemical cycling during the early winter. Rapid thaw of the bed during initiation of snowmelt the following spring also indicates a high degree of hydrological connectivity. Therefore, the thermal environment may play a contributing role to the biogeochemical and aquatic cycling in High Arctic rivers.

CIRCULATION MODES AND CHANGING WATER SEASONAL CIRCULATION MODES, WATER MASSES AND FJORD-SHELF EXCHANGE IN AN ICE COVERED NE GREENLAND SILL FJORD

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Greenland’s fjords connect the Greenland Ice Sheet to the ocean and therefore their hydrography is determined by the interplay between freshwater input, fjord-shelf exchange, atmospheric forcing and brine release due to sea ice growth in winter. Changes in these driving forces affect the circulation within fjords and in the coastal waters. Limited knowledge exists on circulation of high latitude fjords, especially during the winter months, when a continuous ice cover is in place and input of freshwater is low. This presentation discusses our study on the role of the fjord-shelf exchange on the circulation modes of a high arctic fjord during the ice covered period. Analysis shows that high tidal current velocities drive efficient mixing at the sill and saline water is constantly pumped from offshore into the fjord. The dense water input initiates a gravity driven cell circulation mode in the fjord that deepens with time. By the end of winter it has outflow in the top 45 m, above sill depth, and inflow from sill depth to approximately 150 m. The circulation controls oceanic heat flux to the landfast ice in the fjord interior and enables us to explain the ice thickness distribution typically found in fjords with shallow sill, with thicker ice at the fjord’s mouth than at its head.

MARINE FISH POPULATIONS IN THE KITIKMEOT REGION

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ArcticNet’s Western High Arctic Integrated Regional Impact Study (IRIS 1) indicated an urgent need for an inventory and expansion of existing information on the marine ecosystems of the Kitikmeot region. To help closing this knowledge gap, we documented marine fish populations in the region by using ichtyoplankton and fish samples combined with hydroacoustic data recorded by the CCGS Amundsen along its course between 2004 and 2015. Arctic cod (Boreogadus saida) accounted for 85% of the ichtyoplankton collected (n = 894) in the Kitikmeot from 2005 to 2014, with the remaining individuals belonging to 6 families and 11 species. The abundance and biomass of Arctic cod were estimated from hydroacoustic data, separately for the epipelagic layer (0-100 m), where larval and juvenile fish concentrated, and for the mesopelagic layer (> 100 m), where the adults are known to occur. High biomasses of juvenile and adult fish were detected in Coronation Gulf, an area highly undersampled during the Amundsen annual expeditions. Over the 8 years analysed, the biomass of epipelagic (i.e. larval and juvenile) Arctic cod correlates negatively with
the date of ice breakup, suggesting that early ice breakup resulted in increase recruitment and growth of Arctic cod larvae. We hence forecast that the general trend towards longer ice-free seasons and warmer SSTs in the Kitikmeot will result in an increase of Arctic cod biomass in the short- to mid-term.

STRATEGIC PLANNING TO MAXIMIZE SOCIOECONOMIC OUTCOMES: THE VOISEY’S BAY NICKEL MINE AND THE LABRADOR INUIT

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The Voisey’s Bay Nickel deposit was discovered in the early 1990s in traditional Labrador Inuit territory, prior to the ratification of the Labrador Inuit Comprehensive Land Claim Agreement. For the Labrador Inuit, the proposed mineral development 35km southwest of Nain was recognized as holding significant potential to create socioeconomic benefits at a time when opportunities in the fishing industry were in decline. At the same time, the proposal generated several concerns for the Labrador Inuit. One prominent concern centred on sea ice breakage as a result of winter shipping. Another centred on the possible erosion of traditional subsistence lifestyles, especially given the potential for further loss of culturally significant species like caribou. Given this, the Labrador Inuit sought to find a path forward that would maximize local socioeconomic benefits and minimize ecological and cultural impacts. They did so through the strategic use of multiple, parallel planning processes including Modern Land Claim Agreements, Impact and Benefit Agreements, Environmental Assessment and, on occasion, litigation. The result of this was that the Labrador Inuit Association was able to effectively exercise their authority and co-develop a project that would benefit the modern Inuit market economy without significantly harming traditional economies or values. Operational for 10 years with a greater than 50% Inuit and Innu employment rate, the Voisey’s Bay mine is regarded as an exemplary case of large scale development conceived in partnership with its territorial hosts. Based on empirical research comprising technical document review, key informant interviews, and participant observation, this paper reviews the history and known socioeconomic outcomes of the Voiseys’ Bay development, paying special attention to how planning processes were strategically and effectively employed by the Labrador Inuit.

QUANTIFYING PROBABILITY OF OCCURRENCE OF THAW DEPTH - IQALUIT AIRPORT, IQALUIT, NUNAVUT

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Risk analyses, qualitative or quantitative, are used to design, and allocate monies for, linear infrastructure on permafrost. However, with changing climatic conditions, increasing infrastructure demands and the changes required of the infrastructure to adapt to this altered climate, infrastructure owners, operators and planners must possess tools which objectively aid their decisions. To this end, this paper presents a review of quantitative risk analysis methods with specific focus on their application to regions with ice wedge permafrost features. In order to conduct a risk analysis, two factors must be calculated or assigned for quantitative and qualitative risk assessments, respectively; first, the probability of occurrence of a hazard, and second, the cost associated with the hazard’s occurrence. The paper will review First-Order Second Moment (FOSM) reliability methods and Monte Carlo Simulation, and their application to determining the probability of occurrence of the depth of thaw observed at the Iqaluit Airport, in Iqaluit, Nunavut.

CLIMATE CHANGE AND HEALTH ADAPTATION PROGRAM FOR NORTHERN FIRST NATIONS AND INUIT COMMUNITIES

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The recent Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment stated that the changing Arctic environment will “bring risks for the health and well-being of Arctic residents resulting from injuries
and illness from changing physical environment, food insecurity, lack of reliable and safe drinking water and damage to infrastructure.” The IPCC’s Polar Region Chapter also stated that Indigenous holistic views of community and the environment are major sources of adaptation to climate change. One of the major recommendations from the assessment is the “co-production of more robust solutions that combine science and technology with Indigenous knowledge”. Health Canada’s Climate Change and Health Adaptation Program for Northern First Nations and Inuit Communities (CCHAP) was developed to build capacity in research by funding community-based projects to enable communities to develop health-related adaptation or action plans and communication materials that will help in adaptation decision-making at the community, regional, national and international levels with respect to human health and a changing environment. Central to the program is the concept that communities determine the areas of research that are of greatest importance to them; develop the tools and methods to adapt to these changes, incorporate scientific, traditional and/or local knowledge; and engage their community in the results they have developed. Since 2008, the CCHAP has funded over 95 projects across northern Canada focused on a range of issues common to most communities. Inuit and Northern First Nations communities are taking control of their own research agenda, and actively undertaking projects which meet the needs and priorities of their community in meaningful and locally-appropriate manners-research that moves from a community-based to a community-led framework. This allows communities to increase their overall research capacity, respond rapidly to research questions and needs that emerge, and actively create evidence-based health adaptation strategies to respond to the challenges of a rapidly changing climate. The CCHAP represents a significant Canadian contribution to the global effort by Indigenous communities to adapt to climate change. It is important to promote this research at all levels of government to empower communities to understand and make decisions on environmental changes that affect their health and their livelihoods.

GEOCHEMICAL PROPERTIES OF PERMAFROST DRAINING RIVERS IN THE CANADIAN ARCTIC ARCHIPELAGO

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Geochemical data for the majority of rivers draining into the Arctic Ocean are scarce, as previous studies have focused on major river systems with drainage basins stretching far south of the Arctic Circle. Here we present a unique dataset on the geochemistry of 26 rivers draining continuous permafrost watersheds in the Canadian Arctic Archipelago (CAA). Over the 2014 and 2015 summer seasons we visited rivers throughout the Northwest Passage, from Coronation Gulf in the west to Lancaster Sound in the east. Early results reveal diagnostic differences in the geochemical properties of these rivers, despite collecting samples at similar late season flow stage. We discuss the causes for these differences in terms of the drainage basin geology, permafrost cover, and precipitation characteristics of each watershed. We also carried out a time-series study of Freshwater Creek, a seasonally flowing river draining into Cambridge Bay. Samples were collected over two flow seasons, from ice break-up in June until low flow in late August. These data illustrate the seasonal range of an Arctic river’s geochemical properties and underscore the need for comprehensive geochemical measurements covering the entire flow cycle of CAA rivers. With observations collected over a broad geographic range and incorporating seasonal flow cycles, our study further explores the potential to use river geochemical characteristics as region-specific tracers of freshwater pathways in the CAA marine system. As the warming climate acts to increase permafrost thaw and precipitation north of the Arctic Circle, a change in the magnitude of terrestrial carbon and nutrient inputs to the ocean from permafrost draining rivers will be impossible to assess without these types of baseline data. A primary goal of this work is to establish a framework for community-based observations of local river systems and develop a long-term data set from which to assess future environmental change.
CLIMATE VARIABILITY, TRENDS AND PROJECTED CHANGE FOR THE EASTERN CANADIAN ARCTIC

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Reliable and authoritative information on observed and projected climate change is needed for developing successful adaptation strategies for northern communities, decision makers and stakeholders. This talk presents key aspects of the climate regime of the Eastern Canadian Arctic region (IRIS-2), its variability and change, and projected changes from climate model scenarios out to the period 2050. The IRIS-2 region is currently experiencing some of the most rapid warming in the Canadian Arctic with changes up to 0.75°C/decade in mean annual air temperatures since 1993. Climate station records show this rapid warming is linked to both natural climate variability and anthropogenic forcing. This recent warming is most pronounced in the fall and winter period with the coldest months warming at close to twice the rate of the warmest months. The warming pattern also shows a number of coastal “hot spots” where recent fall/winter season warming exceeds 1.7°C/decade. The regional warming has been accompanied by significant reductions in snow and ice cover: Baffin Bay has experienced some of the largest decreases in summer sea ice in the Canadian Arctic with 20% losses in the period from 1979-2008. Extensive reductions in river and lake ice cover have also been documented over the region with evidence that some high latitude lakes are shifting from perennial to seasonal ice cover for the first time in several millennia. There is also evidence that current mass loss from glaciers and ice caps is unprecedented in several millennia. Climate model projections show a continuation of currently observed trends with the largest warming in the winter and fall seasons with increases of ~4-8°C in air temperature and increases in precipitation of ~8-26% by 2050. The spatial pattern of warming is quite variable with the largest changes typically seen over southern land areas. Snow cover duration is projected to decrease by about one month with the largest changes to the start date of snow cover. Annual maximum snow depth is projected to change only slightly due to increased snowfall (15-35%) offsetting the shorter snow accumulation period. However, snow accumulation in the May-October period is projected to undergo large reductions from earlier melt and a later start to the snow season. Simulations from the higher resolution CanRCM4 model show the largest decreases in snow cover are projected to occur in the coastal zone. Projected changes in sea ice from a high resolution coupled ice-ocean model over the Canadian Arctic Archipelago (CAA) show declining sea ice concentration and thickness but no completely ice-free summers before 2100. Multi-year ice has undergone rapid decreases in recent years but is likely to remain a hazard for shipping for the foreseeable future. Projected changes in lake ice cover for 2050 indicate earlier break-up of 10-15 days and later freeze-up of 5-10 days, with 10-30 cm decreases in annual maximum ice thickness. Modelling studies of the future response of land ice in CAA suggest it is highly unlikely that the current glacier mass loss trend will reverse in the coming century, and that projected mass loss is irreversible in the foreseeable future.

INTERANNUAL VARIATION OF HIGH RESOLUTION TEMPORAL PATTERNS OF PHYTOPLANKTON BIOMASS MEASURED FROM A COASTAL CABLED OBSERVATORY IN CAMBRIDGE BAY, NUNAVUT

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Ocean Networks Canada has operated a fixed-point cabled, shore and subtidal (6 m depth) observatory in Cambridge Bay, Nunavut, since September 2012. All data are freely available in real-time at oceannetworks.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. A significant advantage of multiple high-resolution time-series measurements is the opportunity to identify the exact timing of seasonal events with an improved facility for characterizing their inter-relatedness (i.e. ice retreat and phytoplankton bloom timing). Our attention is focussed on the >3 year time series of phytoplankton biomass measurements. Pronounced phytoplankton blooms were observed in each year within two weeks of ice retreat. Notably, phytoplankton biomass
accumulated under the ice in April 2013 and 2014 (less so in 2015). This biomass increase was accompanied by concomitant dissolved oxygen production, suggesting active phytoplankton growth during those periods. We will discuss interannual variation of phytoplankton biomass in the context of irradiance, winds, ice dynamics and seasonally varying water properties.

ORGANIC CARBON DYNAMICS IN PERMAFROST THAW IN THE WESTERN CANADIAN ARCTIC

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Anthropogenic climate change has affected the Canadian Arctic cryosphere, accelerating the development of retrogressive thaw slumps (RTS) across the Peel Plateau, NT, Canada. Retrogressive thaw slumps result from the thawing of ice-rich permafrost and develop due to ablation of ground ice exposed in the slump headwall; numerous environmental factors influence their continued development. The Peel Plateau, which is comprised of ice-rich glaciogenic materials, and local soil profiles that are rich in inorganic materials, exhibits a high occurrence of RTS activity. As a result, RTS activity in the Peel Plateau is predicted to alter the carbon dynamics of receiving waters in ways that contrast with thermokarst impacts in other Arctic regions containing organic-rich soils. Here, we explore the effects of environmental conditions on the delivery of dissolved organic carbon (DOC) to impacted stream systems, and the susceptibility of DOC delivered to streams as a result of RTS activity to biological degradation. Pristine streams demonstrated higher concentrations of DOC (14.9 mg/L) than streams originating from slump runoff (11.0 mg/L). However, DOC from RTS streams was more susceptible to bacterial degradation, with an average 8.8% DOC consumed over a 28-day incubation period, versus 3.1% for DOC from non-impacted sites. We further examined the spectral and isotopic characteristics of RTS-affected and pristine streams to explore how differences in DOC composition may affect its decomposition. RTS provide pathways for DOC previously inaccessible for biogeochemical processing while stored in permafrost, to become environmentally available, creating a relatively novel input source for the global carbon budget.

UPDATED INSIGHTS INTO THE INORGANIC CARBON CYCLING AND BIOGEOCHEMICAL PROCESSES OF AN ARCTIC INLAND SEA (HUDSON BAY)

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Hudson Bay receives nearly one third of Canada’s river discharge and is an important habitat for a variety of species, yet little information exists regarding the state of the carbonate system, and thus the rates of air-sea CO2 exchange and ocean acidification, in this region. This study uses basin-wide measurements of dissolved inorganic carbon (DIC) and total alkalinity (TA), as well as stable isotope tracers (18O and 13C), to provide a detailed assessment of CO2 cycling processes within Hudson Bay. Surface distributions of carbonate parameters reveal the importance of freshwater input in the southern portion of the bay, and differences in both the timing and magnitude of freshwater inputs may largely explain the differences between the 2011 distributions shown here, and those measured by Azetsu-Scott et al. in 2005. Comparison of these two data sets also reveals the importance of sampling depth when analyzing Arctic surface waters. Furthermore, a strong regional dependence is found in the δ18O signature of river water, revealing multiple freshwater mixing lines, and deviations from these mixing lines can identify the relative importance of sea-ice melt and brine formation in different regions of the bay. At depth, the DIC concentrations increase and the δ13C of DIC decreases as the water circulates counterclockwise around the bay, suggesting the importance of biological remineralization in altering deep waters during transport.

“SCIENCE, ARCTIC COOPERATION AND THE UKRAINE CRISIS”

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After Russia’s annexation of Crimea in March 2014, it seemed that Arctic cooperation might break down.
Military exercises between Russia and Western states were suspended, and sanctions were adopted, including against Russian Arctic oil. Yet cooperation on science-related issues continued. The work of the Arctic Council’s task forces on black carbon and scientific cooperation was not interrupted. Norway and Russia continued to co-manage fish stocks in the Barents Sea. Russia, Denmark and Canada adhered to the science-based process for allocating continental shelves beyond 200 nautical miles from shore, under the UN Convention on the Law of the Sea. In September 2014, the Russian Academy of Science’s Akademik Sergey Vavilov was used in Canada’s search for the lost ships of the 19th century Franklin expedition. All of which raises the question: Can scientific cooperation help prevent the spread of an international crisis?

**ADAPTATION OF THE NORTH ALASKA HIGHWAY TO CLIMATE CHANGE**

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Highway and Public Works (HPW) Yukon and the Northern Climate ExChange (NCE), part of the Yukon Research Centre at Yukon College, have partnered to study impacts of current and anticipated climate change on a 200 km section of the Alaska Highway in the Kluane region. This project will allow HPW to develop and choose between strategies to maintain and rebuild the highway in cost-effective ways through the 21st century. The first stage of this project was to undertake a vulnerability assessment of this section of the highway. Using a combination of air-photo interpretation, geophysics, ground temperature monitoring and drilling, we found that 78% of the road is underlain by moderately to highly thaw-sensitive permafrost, whereas only 22% of the road has low sensitivity to permafrost thaw. Having identified the areas that will be experiencing the most damaging subsidence, HPW and the NCE are now developing a stabilization and remediation strategy. During this second phase, half a dozen sites have been characterized and evaluated in detail as potential candidates to implement large-scale adaptation design. The evaluation focuses on permafrost characteristics such as soil properties, ice content, temperature, and extent, but also site specific environmental factors such as drainage and geomorphology. At the end of this process, only one or two kilometer-scale sections will be selected to implement tailored adaptation methodologies. These pilot sites are intended to serve as standards to design road adaptations all across Yukon transportation network. Here, we present the results of the assessment of permafrost vulnerability for the northern Alaska Highway, as well as preliminary results of the evaluation of candidate sites.

**ECOSYSTEM RECOVERY AFTER THE ABANDONMENT OF A WINTER ACCESS ROAD IN NAHANNI NATIONAL PARK RESERVE, NWT**

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Subarctic ecosystems are experiencing rapid changes as a result of climate warming and larger and more frequent disturbances. There is considerable uncertainty regarding ecological trajectories following disturbance in forested ecosystems underlain by permafrost because their structure and function is controlled by strong feedbacks among soil conditions, vegetation, and ground thermal regime. Post-disturbance ecosystem recovery was studied in an area of discontinuous permafrost 30 years after construction and abandonment of a winter access road in Nahanni National Park Reserve (NNPR). Ecosystem recovery was examined by comparing disturbed (road) and undisturbed (adjacent to the road) sites in spruce muskeg, black spruce parkland, deciduous forest, and alpine tree line. Field data showed that disturbances to discontinuous permafrost terrain lead to large and persistent changes to community composition and vegetation structure. In spruce muskeg, permafrost thaw triggered by road construction increased soil moisture and facilitated a transition from spruce muskeg to sedge wetland. At alpine tree line, the removal of stabilizing vegetation and organic soil during construction almost completely limited revegetation along the road. Our findings show that landscape change in face of disturbance and climate warming will not be uniform across the subarctic, but will depend on variation in the abiotic controls that mediate ecological responses to perturbation. In terrain types where disturbance fundamentally alters ecosystem processes, the management of disturbance impacts in NNPR will be difficult.
REMOtELY-SENSED CHANGES IN THE PRIMARY PRODUCTIVITY OF CARIBOU SUMMER PASTURE: EVIDENCE OF FORAGE LIMITATION AT HIGH CARIBOU DENSITY?

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The migratory Rivière-George (RG) caribou herd of the Québec-Labrador Peninsula (Canada) has experienced a dramatic decline in population size since the population peaked in the early 1990s. The causes of this decline are not fully understood, but density-dependent changes in forage abundance are believed to be partly responsible. At high density, caribou foraging and trampling effects may be sufficient to reduce forage abundance, ultimately contributing to habitat deterioration and a potential reduction in population size. The RG herd has access to a large winter range, but is restricted to a relatively small summer range, suggesting that summer forage can act as a limiting resource for the herd at large population size. This study uses 10-day AVHRR image composites and the normalized difference vegetation index (NDVI) to examine the relationship between summer range primary productivity and RG herd caribou density over the 1991-2011 period. Brownian bridge home ranges are used to delimit the summer range and to identify core summer areas, where caribou foraging and trampling pressure is presumed greatest. A modelling approach relating NDVI to climatic variables is used to control for the climate signal and to isolate the influence of caribou foraging/trampling pressure on primary productivity. Areas exhibiting high caribou density were expected to exhibit productivity values lower than that predicted by the NDVI-climate model (i.e. negative model residuals). A significant negative relationship was identified between the NDVI-climate model residuals and RG herd population density for the historic summer range, suggesting that caribou foraging/trampling pressure may reduce primary productivity at high caribou density. However, this relationship was not apparent for the core areas, perhaps reflecting limitations in our caribou location data and the methodology used to define core summer foraging areas. Alternative approaches will be investigated. An increase in range productivity was observed during the 1991-2011 period of caribou population decline, but this positive productivity trend is largely explained by increases in growing season length, with only minor influence from changes in caribou abundance. Summer forage limitation likely contributed to the RG herd population decline, but our lack of caribou location and population size data pre-1991, during the period of population growth, restricts our ability to identify habitat deterioration associated with caribou foraging/trampling effects.

ASBESTOS HILL MINE: HISTORY AND LEGACY

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Natural resource development may cause more harm than good to communities in the North. As of now, little social science research has been conducted on the impacts of resource development on communities in Nunavik (northern Quebec). Consequently, we have yet to know if positive impacts outweigh the negative effects in this region. While the operational process of mining have large impacts on the economy, environment and communities, studies show that mine closure in Arctic communities have unfavourable effects due to the resource dependence realities of these remote and northern communities. Now, with the increase in mining in Nunavik, it is important that we understand better the history of mining, past issues and controversies in order to improve people’s lives in communities and to mitigate the negative consequences of resources economies. This past summer, the first social science research was conducted on the Asbestos Hill mine, the first mineral development project to operate in Nunavik. The Asbestos Hill mine was part of the larger mineral exploration and development phase that spread across the Canadian North in the 1920s, picking up speed shortly after the Second World War. This boom in mining and exploration was a key part of the modernization processes that revolutionized the Inuit way of life. In the 1960s, the large asbestos deposit at Asbestos Hill was discovered during this heavy Arctic exploration phase. The mine began production in 1972 after much encouragement from the Federal Government. The Asbestos Hill mine was seen as a means of bringing jobs and financial self-sufficiency to surrounding remote Inuit villages. During its operation, the mine hired many local Inuit from the villages of Salluit and Kangiqsujuaq. The lifestyle of the indigenous people was radically changed with the introduction of a resource
economy and wage labour. The Asbestos Hill mine introduced money, southern products, and French and English languages and cultures to Nunavik on a scale that Inuit had never experienced before. The mine’s closure in 1984 was offset and the impacts to the community were mitigated by the expected opening of the Raglan nickel mine, that brought with it jobs and economic benefits to the communities. Although there were many positive outcomes from the Asbestos Hill mine, such as employment and training for Inuit, as well as small-scale commerce from the selling of carvings and other art, the mine also left some negative environmental and social legacies behind. At the time of its closure, remediation of mine sites were not made mandatory by any government body. Consequently, all mine structures were left on site, along with uncovered tailing ponds. However, the largest impacts of the mine were social, as many products, employment training and experience, and ways of life introduced by southern miners continue to affect Inuit in Nunavik today. As a result, the Asbestos Hill mine’s lack of consultation and involvement with Inuit of Salluit and Kangiqsujuaq strongly influenced the creation of Canada’s first Impact Benefit Agreement (IBA) between the Raglan mining company and Inuit of Nunavik. Today, Inuit in Salluit and Kangiqsujuaq can clearly see the changes the communities and Inuit experienced between the pre- and post- Asbestos Hill mine, and the social, cultural, and economic changes they lived as a result of this first mineral development project on their homeland.

**IS THE INUIT SENSE OF PLACE STILL THERE?**

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Life on the land is important in the construction of inuit identity. With sedentarisation and changes of way of life, sense of place has been deeply affected. Formerly, Inuit were used to travel everywhere on the land for hunting, fishing and berry picking. Today, the younger generation is more used to spend time in villages than outside. Moreover, a way to promote landscape of the north is the creation of national park, which is a concept reflecting westerners relationship with nature. Nevertheless, Inuit’s holistic and animist view of nature and society is still relevant! This presentation deals with Inuit sense of place in the context of the creation of the Tursujuq national park in Nunavik, Québec. The methodology used native images making and semi-structured interviews conducted in Umiujaq and Kuujjuarapik (Nunavik, Québec). The research analyses different ways that Inuit relate to their land: (1) feeding the body, healing the soul; (2) ephemeral and adaptations; (3) greatness of nature and belonging; (4) socialized nature; (5) a changing word. Following the Inuit cosmology, this presentation contributes to have a better understanding of inuit sense of place, its construction and its recomposition.

**FIRST INDEX OF NARWHAL NEWBORN USING HIGH DEFINITION AERIAL PHOTOGRAPHY**

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Population and species management of long-lived species requires life history data such as female fecundity rate and newborn survival. Acquiring knowledge and understanding factors that explain the dynamics of a population in the wild are essential in population ecology, wildlife management, and conservation biology. The narwhal (Monodon monoceros), a medium size odontocete is a valuable food resource with social and cultural importance for Inuit communities. Narwhals have been listed as “near threatened” by the International Union for Conservation and the Baffin Bay population as “special concern” by COSEWIC in 2004. These conservation statuses are mainly due to lack of knowledge on population dynamics. In summer 2013, aerial photos were taken during surveys done by Fisheries and Oceans Canada covering different areas of narwhal summer aggregation in Nunavut. In this study, we used these high-resolution aerial photos to develop a decision tree to identify narwhal newborns, in order to calculate the first newborn indexes of two different summer aggregations: Eclipse Sound and Admiralty Inlet, Nunavut. This work gives valuable insight on population dynamics of a poorly knows species.
PARTICIPATORY MUSKOX HEALTH SURVEILLANCE AND INUIT KNOWLEDGE IN IKALUKTUTIAK, NUNAVUT

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Muskoxen (Ovibos moschatus) are an important source of country food and sport hunt related income for the Inuit in Canada’s North. Sustainable muskox populations contribute to northern food security and to support traditional Inuit culture. A muskox health surveillance program to establish health status and detect changes in health or disease in the population has been underway in the Kitikmeot region for six years on Victoria Island, Nunavut. It expanded in response to reports of a declining muskoxen population and summer ‘die-offs’ of muskox in 2010. Goals of this surveillance are to provide information about muskox health, to protect human and muskox health, and to provide information for muskox management and conservation. Our work used participatory methods to gather Inuit knowledge about muskoxen to be combined with western science for a more integrative and comprehensive surveillance program overall. Participatory approaches were used to gather Inuit knowledge about muskoxen, based on open communication and knowledge transfer using methods adapted to the northern context. Participants in the community of Ikaluktutiak, including hunters, elders and women, were selected through purposeful sampling during the summer of 2014. The sample size (N=30) was defined by thematic saturation. Semi-structured individual interviews were used to explore community perceptions on muskox abundance, distribution, health and disease over time, as well as the importance of muskoxen to the community. Interviews were recorded, transcribed and summarized using thematic content analysis. Small group interviews (N=7) were then conducted during the winter of 2014 to further explore themes identified from the individual interviews. Information from the interviews was brought back to the participants in summer 2015 for further discussion in small groups to ensure it accurately reflected their perceptions. The participatory methodology used will be described and the importance of incorporating Inuit knowledge into a muskox health surveillance program in the Kitikmeot region will be discussed.

ENVIRONMENTAL DIMENSIONS OF SEARCH AND RESCUE AND INJURY IN NUNAVUT

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This study examines the correlation between environmental conditions and search and rescue (SAR) incidents in Nunavut. Existing efforts to understand environmental risk factors for SAR incidents are constrained by limited data on when and where people are using the land, sea, and ice (exposure to risk). We present a novel method of estimating land use and exposure to risk using gasoline sales, and assess the influence of weather and external variables on rates of injury and distress. We compared weather and ice conditions during 290 SAR incidents to conditions during 831 non-incident days (controls) between 2013 and 2014. Daily ambient temperature, ice concentration, and ice thickness are shown to correlate with search and rescue rates across the territory during the study period. Ability to identify hazardous conditions and subsequent SAR risk may guide planning and prevention efforts in the region. Further, proxies for hazard exposure - such as gasoline sales - will be increasingly valuable as climate change continues to shape the risk environment for land, sea, and ice users in the Arctic.
NEW ACTION FOR ARCTIC SHOEBIRDS IN THE AMERICAS- THE ARCTIC MIGRATORY BIRDS INITIATIVE

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Arctic-breeding birds travel the globe in the course of their annual cycles, and for many species, conservation issues occur outside of the Arctic. In the Americas flyway portion of the Arctic Migratory Birds Initiative, we are undertaking conservation action for these species at locations throughout their annual hemispheric migrations. AMBI recently received funding to undertake a series of conservation actions that will • Identify arctic locations where shorebird habitat will persist under changing climate; • Identify and establish new shorebird reserve network sites at key locations in Canada, the United States, and Mexico • Enumerate site-specific threats and begin to address these threats This presentation will describe each of these projects, look ahead to other proposed conservation action items that are being planned under the AMBI- Americas flyway program, and discuss collaborative research and conservation opportunities that exist for ArcticNet participants. NOTE TO PROGRAM COMMITTEE: This presentation, along with abstracts submitted by Victoria Johnston and Amie Black, are intended to form the backbone of an ArcticNet AMBI session. Our vision is to follow the presentations with a facilitated discussion among presentors and session attendees, to answer questions about the AMBI and to generate collaborative opportunities among arctic researchers, and resource managers (including Aboriginal governments and co-management boards).

MARINE NUTRIENT SUBSIDIES TO THE TERRESTRIAL ENVIRONMENT OF COMMON EIDER NESTING ISLANDS IN THE CANADIAN ARCTIC

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Nutrient fluxes across ecosystem boundaries can have pronounced effects on ecosystem dynamics, but these interactions can be difficult to untangle in complex systems. Island systems are a ideal places to study nutrient subsidies as they have finite bounds and are separated by physical space. In particular, the arctic island archipelagos of Hudson Strait are severely nutrient limited, mostly undisturbed, and have been surveyed historically since the 1950’s. This area harbors many species of seabird, including the Common Eider (Somateria mollissima), which nests in large colonies on offshore islands in this region. Through foraging on benthic invertebrates and returning to these colonies, these birds may be artificially providing marine nutrients to the terrestrial environment of their nesting islands through excretion, with possible large-scale bottom-up consequences on primary productivity, trophic structure, and overall biodiversity.

Using freighter canoes and local Inuit guides we sampled vegetation, soil, and invertebrates on 25 islands and 6 mainland sites in the areas near Cape Dorset, Nunavut and Ivujivik, Quebec over the previous two summers (2014-15). Using stable isotope techniques, we aim to show the extent and level of nutrient subsidies to these colony islands is substantial, and has the potential to have ecosystem-level effects. We also aim to model basic habitat requirements across the Hudson Strait region. The Common Eider is a local and internationally relevant species that is harvested across the Canadian Arctic that is facing increasing predation pressure from Polar Bears (Ursus maritimus) due to cascading effects of climate change. This project is part of a multi-disciplinary research effort to investigate this trend and to attempt to predict possible outcomes, and is the result of collaborations with Environment Canada, Baffinlands Iron Mine, Oceans North, PEW charitable trust, Nunavut Inuit Wildlife Secretariat, Carleton University, many HTOs and communities in the Hudson Strait region, and the Canadian Museum of Nature.

THE WHOLE COMMUNITY GOT A TASTE, AND SHARED: INUIT NARRATIVES OF ECOLOGICAL KNOWLEDGE AND BELUGA WHALES IN ULUKHAKTOK, NT, CANADA

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During June and July 2015, we interviewed 28 Inuit in Ulukhaktok, NT, to document Ulukhakomiut knowledge and hunting practices of beluga whales (Delphinapterus leucas). Prior to summer, 2014, when hunters landed 33 belugas, these animals were uncommon in the waters around the settlement and only rarely hunted. In this paper, we report on the narrative analysis of our interviews, focusing in particular on: (1) Inuit understandings of proper hunting practices and local abundance of beluga whales; (2) how experience and participation in beluga hunting informs Inuit identity and promotes cohesion, both locally and regionally; and (3) how preexisting knowledge and practice is applied and adapted to hunting a species for which there is a limited history of interaction. The research is part of the ArcticNet Project Knowledge Co-Production for the Identification and Selection of Ecological, Social, and Economic Indicators for the Beaufort Sea.

CANADIAN TRADE IN POLAR BEARS FROM 2005-2014

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The hunting of polar bears and international trade in polar bear products have become headline news in recent years. This is due in part to well-publicized efforts by the United States to up-list the polar bear to Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Listing the polar bear on CITES Appendix I would prohibit international trade in the species for commercial purposes. Much of the attention on this issue has focused on Canada, which is the only country that allows commercial export of polar bear products. These products must originate from subsistence hunting by indigenous peoples. Therefore a prohibition on commercial exports of polar bear products would directly impact Inuit livelihoods. Shadbolt et al. (2012) concluded that the international trade in polar bear products (2005 - 2009) was not a significant threat to the species. This study expanded upon that initial work, and reviewed Canadian exports of polar bear hides and skulls exported from Canada were used to calculate the minimum and maximum numbers of bears exported. The number of bears exported in each year, on average, was 58% of the number of bears hunted in the preceding hunting season. This analysis supports the conclusion that trade in does not threaten the conservation of polar bears. Shadbolt, S., York, G., & Cooper, E. W. T. (2012). Icon on ice: international trade and management of polar bears Ursus maritimus. TRAFFIC and WWF-Canada.

SPATIAL PATTERNS OF DIFFERENT BIOGEOCHEMICAL COMPONENTS OF PRIMARY PRODUCTION IN THE LABRADOR SEA DURING MAY 2014 AND 2015

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The Labrador Sea (LS) is one of the few areas in the World Ocean where the atmosphere, the upper ocean and the deep ocean interact strongly. The central LS is a deep convection region where the water column can be mixed down to 2000 meters. This convection is a key process for heat and gas exchange and the LS acts as a conduit to the interior ocean, where carbon dioxide (CO2) can be sequestered for thousands of years. The exchange of CO2 between the atmosphere and the deep ocean is regulated by the physical pump and is modulated by the biological pump. During the spring phytoplankton bloom, high rates of primary production create a deficit of CO2 in the surface ocean leading to an uptake of CO2 from the atmosphere. A portion of the organic carbon created by this process escapes shallow respiration and eventually sinks to be decomposed in deep waters, leading to CO2 excess that can drive a flux to the atmosphere during deep winter convection. The biophysical interactions that initiate the bloom, regulate its magnitude and affect dominance by different functional groups of phytoplankton influence the function and efficiency of the biological pump. Like other high-latitude regions, the LS is exposed to the influence of rapid climate change on
As the main biogeochemical components of primary production and their relationships with different environmental variables across the water masses that populate the LS. During two expeditions of the CCGS Hudson in May 2014 and 2015, we measured in situ rates of nitrogen cycling and primary production at discrete stations using incubations with 15N and 14C isotopic tracers. These rate measurements were complemented by a detailed characterization of the physico-chemical environment (e.g., temperature, nutrients) and biological variables (e.g., particulate organic matter, pigments, taxonomy). Because discrete incubations limit the spatial coverage of measurements, we also performed high-resolution, underway measurements of hyperspectral, water-leaving radiance (ocean color) and net community production. The latter were made using an Equilibrator Inlet Mass Spectrometer recording O2/Ar ratios continuously along the ship’s track, a novel approach for the LS. The results reveal considerable variability between the two years and at diverse spatial scales within years. The comparison of different discrete and continuous approaches to measuring different components of biological productivity provides crucial insights into the functioning of the LS.

COHERENT LONG-TERM MONITORING OF POLAR REGIONS - A DECADE OF COORDINATION FOR THE SPACE AGENCIES AND THE POLAR SCIENCE COMMUNITIES

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Polar imaging activities and Polar interests are common to several space agencies in support of their policy mandate, science priorities and science community requirements. The Polar Space Task Group has been established under the auspices of the World Meteorological Organization. The PSTG provides coordination across Space Agencies to facilitate acquisition and distribution of fundamental satellite datasets, and to contribute to or support development of specific derived products in support of cryospheric and polar scientific research and applications. In order to assist with the collection and utilization of spaceborne synthetic aperture radar (SAR) data sets, the SAR coordination Working Group was subsequently formed by PSTG. The SAR Coordination Working Group (CWG) is focused on supporting polar science with the acquisition of synthetic aperture radar (SAR) data. Efforts to collect data by various space agencies are guided, in part, by thematic areas where SAR data is of particular value to scientific research. Four thematic areas have been identified: ice sheets, floating ice, permafrost and terrestrial snow. The SAR CWG works with scientists from around the world to understand their particular polar research topics and, to the extent possible, coordinates data acquisitions to meet their SAR data requirements. Teams of scientists with expertise in the four theme areas have discussed and documented the key science issues that are or need to be addressed. Their work is providing the basis for data acquisition planning and coordination. This paper/presentation describes the past decade of coordinated planning and data collection of large amounts of fundamental SAR dataset over the vast Polar Regions. The resulting dataset consists of multi-frequency imaging (X-, C- and L-Band) over Polar Regions ensuring a high frequency of revisit of thematically coherent and interoperable missions. The paper also highlights the space agency’s contribution to the development of data products in support of cryospheric scientific research and applications.

CLIMATE CHANGE ADAPTATION ASSESSMENT FOR TRANSPORTATION IN ARCTIC WATERS (CATAW)

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Transportation in the Arctic is currently being redefined in ways that will shape Canada for the next century. The potential for increased navigability of Arctic waters due to reduced sea ice is now intersecting with the global appetite for natural resources available in northern Canada, and visions of a new trade route through the Northwest Passage. Increased shipping activity is putting pressure on Canada to take action to ensure safety and security and to minimize environmental and human disasters. However, we lack a complete understanding of historic Arctic shipping trends and furthermore we have yet to generate a comprehensive understanding of the challenges, opportunities, and potential adaptation strategies for the Arctic shipping sector in Canada. These information gaps severely limits the ability of federal, territorial, and Inuit government decision-makers to identify or implement effective evidence-based policies to both manage and support shipping industry development. The Climate Change Adaptation Assessment for Transportation in Arctic Waters (CATAW) project was established in direct response to these challenges. Findings from the period 1990 to 2012 show that significant increases in vessel counts occurred for some vessel types (e.g., Government Vessels and Icebreakers, Pleasure Crafts, and Passenger Ships) on monthly and annual time scales coincident with declines in total, MYI, and FYI over the same time period. Shipping activity experienced modest increases annually between 3 and 8 vessels decade-1, the largest overall increases occurred early in the shipping season (June and July at 9 and 22 vessels decade-1 respectively), and at the conclusion of the shipping season in November at 13 vessels decade-1. A series of over 50 interviews with ship operators, relevant government agencies, and other experts and stakeholders were conducted to better understand historic shipping trends, to identify risks and opportunities of increased ship traffic, and to identify policy recommendations for effective shipping governance. Early results indicate that there are a number of drivers and limiters influencing ship traffic trends. Climate change, in comparison to other drivers of shipping change such as commodity prices, tourism demand, and technology enhancements, seems to play a relatively minor enabling role. Despite this finding, changing sea ice conditions present significant navigational and safety hazards for ships and thus require focused adaptation attention. A series of over 75 climate change adaptation options aimed at enhancing ship safety and effective sector governance were prioritized and evaluated for their affordability and implementability. Early results indicate strong support for enhanced policy and regulatory enforcement as well as a need for more research.

CHARACTERIZATION OF SLOPE MOVEMENTS OF THE INNER RING ISLANDS OF CLEARWATER LAKE, NUNAVIK, CANADA

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Clearwater Lake (Lac à l’Eau-Claire) (56°20’N; 76°17’W) is one of the several meteoritic craters on the Ungava peninsula (Nunavik, Canada), located about 115 km east of Hudson Bay. It is composed of two neighboring craters (CL-West and CL-East). CL-West is about 30 km in diameter, with a distinct inner ring of islands. Clearwater Lake is situated within the boundaries of the Tursujuq National Park. The region lies on granite-gneiss rocks of the Precambrian Shield while islands constitute a central uplifted area and are covered with impact melts (breccia). Deglaciation of the region occurred at approximately 6000 yr BP. From this period the reliefs of Clearwater Lake islands were exposed to the cumulative effects of heavy periglacial conditions and gravity processes on 50 to 200 m high slopes. The aims of this ongoing research are: - To inventory the range of slope processes (landslides, rockslides, screes, debris flows, snow avalanches, etc.) - To estimate their degree of activity by examining landforms they created (inherited versus active processes through inherited versus fresh landforms) - To date movements on slopes (both relative dating by lichenometry and plant cover, and absolute dating by dendrochronology since Picea mariana lives hundreds of years in the area, and 14C in stratigraphic deposits) - To estimate the runout of the processes and their distance to the lake water in order to document the risk for Cree camps and tourists in case a slope process event generates a wave by entering the outer lake shallow waters. The preliminary results we present here provide identification and classification of slope processes on the two main northern islands of Clearwater Lake, Les Foreurs and Bélanger. The main factors that would have contributed to generate these slope movements types and processes will be discussed.
MOLECULAR MICROBIOLOGY OF ACUTE GASTROENTERITIS IN CHILDREN UNDER 5 YEARS OF AGE IN NUNAVUT, CANADA IN 2014/15

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Background: Rotavirus gastroenteritis is a common cause of diarrhea in young children. The burden of illness among children residing in Nunavut is unknown. Rotavirus vaccine has been available in Canada since 2008, but has not been introduced in all Canadian jurisdictions including Nunavut. The purpose of this project is to characterize the burden of illness due to rotavirus and other viral pathogens in children under the age of 5 years who reside in Nunavut. Methods: Pediatric flocked swabs were collected from children under 5 years of age presenting with acute gastroenteritis to Health Centres in 5 communities across Nunavut. Samples were stored frozen until being shipped to St. Joseph’s Healthcare Hamilton Virology Laboratory for testing with a multiplex polymerase chain reaction (PCR) assay that detects 15 enteropathogens simultaneously (Luminex xTAG GPP®) as per manufacturer's instructions. Results: 39 samples were collected between September 26th, 2014 and June 22nd, 2015. Testing of one sample showed PCR inhibition. Of the remaining 38 samples 50% had at least one pathogen detected. Norovirus (n=9) and rotavirus A (n=5) were the most frequent pathogens detected. No cryptosporidium was detected. Discussion: Contrary to prior recent passive surveillance data from this region, this preliminary data would suggest that rotavirus may be relatively common in Nunavummiut children. Further study is needed to help inform rotavirus vaccine policy for the region.

MARINE DIVERSITY IN CANADA'S ARCTIC: INSIGHT FROM EXPLORATORY FISHERIES CATCH AND UNDERWATER VIDEO AROUND ARCTIC BAY AND RESOLUTE BAY

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Arctic ecosystems are currently experiencing ongoing changes in climate conditions, generating an urgency to collect the ecological information necessary to establish baseline data that will enable the assessment of future ecosystem change. However, many regions in the north remain understudied or unexplored, largely due to sampling limitations caused by seasonal ice coverage, high costs, and difficulty of access. In recent years, emerging commercial fisheries in eastern Baffin Island have prompted interest by numerous northern communities to explore local waters for potential fishery resources, providing a platform of opportunity for sampling in these remote Arctic waters. In August-September 2015, scientists from the Centre for Fisheries Ecosystems Research (CFER) of the Fisheries and Marine Institute of Memorial University partnered with the Arctic Fishery Alliance (AFA) to conduct an ecosystem survey in conjunction with the ongoing exploratory fishery in the waters adjacent to the communities of Arctic Bay, NU (ᐃᒡᐃᕕᒃ) and Resolute, NU (ᖃᐅᓱᐃᑦᑐᖅ). A total of 72 fishing sets (Arctic Bay n=40; Resolute n=32) were completed aboard the AFA fishing vessel Kiviuq I, with fishing gear comprised of longlines, whelk pots, and two sizes of shrimp traps. Fishing occurred at depths between 11m and 797m, and each gear was outfitted with a temperature logger. A CTD and vertical tow ring-net were deployed at various sampling stations (n=24) to assess oceanography and community composition. A baited remote underwater video platform was used (n=14) throughout the area for characterization of bottom substrate, and to provide an additional method for detecting species that may not be encountered in fishing sets given the available gear types. Over 90 species were encountered, with fishing catch largely dominated by invertebrates, including brittle stars, whelk, and shrimp. Greenland sharks were commonly encountered in both longline sets and as active foragers on the baited camera footage. These results provide insight to the diversity and ecosystem structure within the Lancaster Sound region, and emphasize the benefits of community and fishers
engagement to provide vessels of opportunity to access currently understudied areas in the north.

THE CAMBRIDGE BAY OCEAN OBSERVATORY: A COASTAL CABLED LABORATORY FOR REAL-TIME SCIENCE

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Ocean Networks Canada operates a fixed-point cabled observatory in Cambridge Bay, Nunavut. Installed in 2012, the observatory includes both in-water and atmospheric data sensor arrays to monitor the atmosphere-ocean boundary layer environments. The observatory measurements include a standard weather station, downward irradiance, above and below surface cameras, as well as an ocean-based (6m) acoustic ice profiler, water temperature, salinity, dissolved oxygen, chlorophyll fluorescence, turbidity and most recently, PAR, pH and pCO2 sensors. The science these sensors support ranges from sea-ice thermodynamics to benthic ecology. The presentation will provide a detailed review of the observatory systems, assessments of the operational performance, the sensor suites, the various time series recorded since 2012, and summaries of the scientific achievements. All data from the observatory is freely available for download from the Ocean Networks Canada web site (oceannetworks.ca).

MAJOR ADVANCEMENT IN THE BREEDING PHENOLOGY OF AN ARCTIC SEABIRD IN 2015 IN RESPONSE TO RECORD SPRING WARMTH AND EARLY SNOWMELT AT BARROW, ALASKA

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Barrow, Alaska has been one of the most rapidly warming locations in the Arctic, with mean annual temperature increasing 2.8°C in the last four decades. In 2015 Barrow experienced its warmest May on record, averaging -2.2°C, nearly 5°C above the average for the last 90 years. Snowmelt at the NOAA Barrow Observatory occurred on 28 May, the second earliest date since records began some 73 years ago. The only earlier year was 2002, when snow disappeared on May 24. In response to the extremely early snowmelt, the first egg at a black guillemot breeding colony on Cooper Island, 35 km east of Barrow, was laid on 8 June. The Black Guillemot is an arctic seabird that, in northern Alaska, breeds in ground-level cavities. Female guillemots do not ovulate until spring snowmelt allows access to nest sites. The first egg in 2015 was the earliest in the 41 years the Cooper Island colony has been monitored and five days earlier than the previous record. The correlation of snowmelt at the NOAA Barrow Observatory and the first egg at the Cooper Island black guillemot colony is high (t2=0.6, p<0.01) over the last four decades. The first egg in the colony is laid, on average, 11 days after snowmelt is recorded in Barrow. Both snowmelt and the date of the first egg have seen significant advancement over the last four decades with guillemots now initiating breeding approximately ten days earlier than in the 1970s. While regional warming and resulting earlier snowmelt has benefited guillemots by providing a longer annual snow-free period in which to raise their young, it has also decreased guillemot breeding success. Significant increases in the rate and extent of summer ice retreat and concurrent increases in sea surface temperatures have reduced the availability of Arctic cod (Boreogadus saida), the guillemot’s preferred prey, in nearshore waters.

FIRST OCEANOGRAPHIC OBSERVATIONS ON THE WANDEL SEA SHELF IN NORTHEAST GREENLAND: TRACING THE ARCTIC OCEAN OUTFLOW THROUGH THE WESTERN FRAM STRAIT AND THE GLACIER-OCEAN INTERACTION DURING WINTER

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The first-ever conductivity-temperature-depth (CTD) observations on the Wandel Sea shelf in North Eastern Greenland were collected from the land-fast ice in April-May 2015 as a part of the Arctic Science Partnership during the first research campaign at the Villum Research Station. The CTD profiles deeper than 100 m are used to reveal the origin of water masses and determine the extent to which these water masses have interacted with ambient water from the continental slope and the tidewater glacier outlet from the Flade Isblink Ice Cap. The subsurface water layer from ~20-70 m depth is comprised of freshened water (30-32 psu) that is likely associated with the Pacific Water outflow from the Arctic Ocean through the western Fram Strait. The underlying cold low halocline layer centered at ~80 m (33 psu) separates the Pacific Water layer from a deeper (<140 m) layer of modified Polar Water that has interacted with the warm Atlantic water outflow through Fram Strait. The Atlantic water layer with temperature above 0°C is recorded below 140 m depth. Over the outer shelf, the low halocline layer shows numerous cold density-compensated intrusions indicating lateral interaction with an ambient Polar Water mass across the continental slope. Below the low halocline layer, the colder and turbid water intrusions were observed at the front of the tidewater glacier outlet. On the temperature-salinity plots the CTD profiles from the glacier outlet comprise the mixing line that is different from the ambient water and seems to be conditioned by the ocean-glacier thermal interaction. Our observations of Pacific Water in the subsurface layer are set in the context of upstream observations in the Beaufort Sea and downstream observations from the Northeast Water Polynya, and clearly show the modification of Pacific water during its advection across the Arctic Ocean from the Bering Strait to Fram Strait. Moreover, ambient water over the Wandel Sea continental slope shows no low halocline layer indicating the different origin and pathways of the on-shore and off-shore branches of the Arctic Ocean outflow through the Western Fram Strait.

**HIGH RESOLUTION STUDY OF TEMPORAL VARIATION OF MARINE BENTHOS IN CAMBRIDGE BAY, NU (ARCTIC)**

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Arctic marine benthic communities are good ecosystem change indicators because of their longevity and sessile mode of life. However, very few high-resolution and long-term studies have been undertaken to assess their temporal variability in benthic abundance and community structure. The objective of this study was to quantify seasonal variations in benthic faunal abundance and diversity, at a high temporal resolution, using the Ocean Networks Canada seafloor cabled observatory located at 6-meter of water depth, in Cambridge Bay, Nunavut. Faunal composition and abundance were determined using an underwater HD video camera mounted on the instrument platform. The camera acquired 5-minute videos of the seabed at 2-hour intervals. The instrument platform was also equipped with a suite of water property sensors (temperature, conductivity, dissolved oxygen, salinity, fluorescence, ice cover and turbidity), recording data continuously in near real time. Here we present preliminary results from data extracted from the videos, randomly selected from the archive for the period between December 2012 and November 2014. Seawater property data were also included in the community analysis for the same time period. Results show that faunal abundances, mostly represented by cerianthid anemones and sabellid polychaetes, peak during summer months for the year 2013, but not for 2014. However, faunal diversity does not vary significantly between seasons. Seawater temperature coupled with chlorophyll a and salinity explained most of the variation in benthic faunal abundance. Observatory studies of this type provide insight into larger scale benthic community processes in coastal Arctic waters.

**PRESERVING SEA-ICE, MANAGING POWER PLANTS: BALANCING FUTURE AND PRESENT IN AN ARCTIC COASTAL COMMUNITY**

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Communities are faced with complex decisions on a daily basis concerning facilities and development permissions. Often these decisions are not fully contextualized, and relations to other concerns, such as health and sustainability are not fully considered. There
is an opportunity to consider relocating community power generators as diesel power plants are replaced or upgraded. Knowledge of environmental change processes would be helpful. Coupling locally-held, qualitative knowledge of environmental change and combustion histories with direct observations of physical phenomena and processes of environmental change at other Arctic sites results in a conceptual model capable of integrating local, qualitative, shared perceptions of particular changes in the environment with multidisciplinary regional science. This case reports observations relevant to changing local sea ice conditions, utility site decisions, and long-term local and regional energy strategies. Needs for accessible platforms for community engagement and enhanced multimedia representation and visualization of data are examined through community responses.

ACCLIMATION POTENTIAL AND CARDIO-RESPIRATORY PERFORMANCE OF ARCTIC COD (BOREOGADUS SAIDA), A KEY FOOD WEB SPECIES IN THE ARCTIC OCEAN

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The threat to the Arctic ecosystem and its fishes from climate change cannot be overstated. Of particular concern is Arctic cod, Boreogadus saida, a key component of the Arctic food web. This is the first temperature comparison study to assess different levels of thermal acclimation to water temperatures 1, 3.5 and 6.5°C using heart rate (ƒHmax), absolute aerobic scope (AAS) and upper critical temperature (CTmax) indices. Ectotherms can adjust the rates of metabolic functions when kept at a new temperature (Franklin 2007, Bremer et al. 2007, Chen et al. 2013). This is termed thermal acclimation. An acute temperature change typically results in an exponential change in the measured rate functions (ƒHmax, AAS and CTmax in this study). In terms of polar fishes, it was once thought that they were so stenothermal that they could not acclimate. However, it seems that the studies on Antarctic fishes were too short and longer acclimations produce compensatory changes (Franklin 2007). Other studies have examined the difference in oxygen consumption (MO2) of B. saida after short and long term acclimation to holding conditions (Holeton 1974, Stephensen et al. 1994, Hop and Graham 1995). When the data are corrected for weight and plotted together there is a linear relationship between oxygen consumption and acclimation temperature. Combined with ƒHmax and CTmax, these data suggest temperature compensation is possible in B. saida beyond what they normally experience in the wild - similar to some Antarctic fish species (Portner et al.2000; Lannig et al. 2005; Seebacher et al. 2005).

RETHINKING THE TOP OF THE WORLD: ARCTIC PUBLIC OPINION SURVEY (VOL 2)

DuBois, Carolyn

11 Church Street, Suite 400

Rethinking the Top of the World: Arctic Public Opinion Survey (Vol 2) provides an empirical perspective on issues related to Arctic security, environment, and economy. Building on a study conducted in 2010, this study examines how the Arctic is understood by the public, determines contributors to public understanding, and solicits preferences and principles to consider in both public policy and private sector decision-making. This presentation will provide the results of this study which covers topics including: quality of life in the North; southern residents' understanding of the North; most pressing issues facing Arctic regions; awareness of the Arctic Council; and perceptions of international disputes. The survey of 10,000 respondents in countries with Arctic territory reveals major differences of opinion on various issues including threats facing Arctic regions (climate change; cost of living; foreign ownership). This study was commissioned by the Munk-Gordon Arctic Security Program based in Canada and the Institute of the North in Alaska, and conducted by EKOS Research Associates.
MACKENZIE DATASTREAM: INTRODUCING A PILOT FRESHWATER DATA SYSTEM
DuBois, Carolyn
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Mackenzie DataStream is an open access platform for exploring and sharing water data in the Mackenzie River Basin. DataStream’s mission is to promote knowledge sharing and advance collaborative, evidence-based decision-making throughout the Basin. This presentation will introduce Mackenzie DataStream which was developed through a public-private partnership between The Gordon Foundation and the Government of the Northwest Territories, who share a commitment to supporting community engagement in water management. Mackenzie DataStream—which was developed with input from northern communities and institutions—currently provides a platform for users to access, visualize and download full water quality datasets collected by 22 communities in the Northwest Territories as part of the NWT-wide Community-Based Monitoring program. This program generates information about changes in dissolved metals, turbidity, temperature, chlorophyll-a as well as oil and gas chemicals (hydrocarbons). Longer-term Mackenzie DataStream will incorporate datasets collected by other groups within the basin. The cloud-based software’s flexible design allows for the accommodation of a wide variety and volume of data. Mackenzie DataStream was first launched in Dettah, NWT in November and will be making its southern premier at Arctic Change 2015.

ARCTIC ECOZONE+ STATUS AND TRENDS ASSESSMENT: THE FIRST NATIONAL ASSESSMENT OF CANADA'S TERRESTRIAL AND FRESHWATER ARCTIC ECOSYSTEMS
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The Arctic Ecozone+ Status and Trends Assessment (Arctic ESTA) is part of the national ecosystem assessment developed by the federal, provincial and territorial governments through the Canadian Councils of Resource Ministers. The main, national-scale assessment was published in 2010. Technical thematic reports (including reports on climate trends, permafrost and caribou) and ecozone+-scale reports were produced from 2009 to 2015. The last set of reports, including the Arctic Ecozone+ report, was approved for release in 2015. The Arctic ESTA reports on the Northern Arctic, Southern Arctic and Arctic Cordilleran terrestrial ecozones. The “+” added to “ecozone” indicates that boundaries were updated from the 1995 national ecological framework. ESTA reports can be downloaded at www.biodivcanada.ca. Highlights from the Arctic ESTA are discussed in the context of key findings of the national ecological assessment report. Key findings are arranged by themes: biomes, human/ecosystem interactions, habitat, wildlife and ecosystem processes, and science/policy interface. Examples: Biomes-Wetlands •National: Past and ongoing loss and degradation in southern Canada •Arctic: Increased amount and extent of thaw lakes and ponds in moist regions (permafrost thaw, land subsidence and precipitation increase); reduced extent/disappearance in drier, northern areas (warmer summers, deeper active layer and earlier snow/ice melt). Biomes-Tundra •Arctic: 20% decline since 1982 of land area with climatic conditions that support tundra; tundra plant communities changing—trends since 1980 include taller plants, more shrubs, fewer lichens, less bare ground. Trends and future change predicted by experimental plots—including more shrubs, less species diversity, increased height of most plants, and less moss, lichen and bare ground cover. Human/ecosystem interactions: Protected areas •National: Increase in extent and representativeness of protected areas network; percent protected below target in developed areas and the oceans •Arctic: Increase in protected area extent of over 7% from 1992 to 2009, bringing total amount protected to 11.3% of the Arctic Ecozone+ (but only 6.7% of Northern Arctic); much of the growth of protected areas related to the settlement of land claims Human/ecosystem interactions: Contaminants •National: Decline in concentrations of legacy contaminants (such as PCBs and DDT) over past 10 to 40 years; concentrations of some newer contaminants (such as some flame retardants) increasing in wildlife; mercury increasing in some wildlife in some areas •Arctic: Trends consistent with national findings; an issue of concern in Arctic due to potential human health effects, especially for aboriginal people. Contaminant levels in fish and wildlife below levels that cause widespread effects on their health, with possible exceptions, including some polar bear
populations Habitat, wildlife and ecosystem processes: Primary productivity •National: Increased on 20% of vegetated land area of Canada over the past 20 years, and in some freshwater systems •Arctic: Increased on 12% of Arctic Ecozone+ land area and decreased on only 0.1% of area (based on NDVI); strongest trend in Southern Arctic. Studies on Ellesmere and Blyot islands show large increases in tundra biomass over the past 20+ years. Lake sediment cores from several studies show rapid increases in lake productivity since the late 19th century, leading to changes in algal species assemblages

USER-INSPIRED BASIC RESEARCH - COMMUNITY AND END-USER MONITORING OF ADVERSE MARINE AND WEATHER STATES IN THE EASTERN BEAUFORT SEA

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In Fall 2013 University of Victoria Professor David Atkinson and his team received funding from a Federal Government program called “Marine Environmental Observation, Prediction and Response Network (MEOPAR)” to conduct a three-year project focussing on how the weather can negatively affect ocean transportation issues in the Eastern Beaufort Sea region. The project is based on a “user-inspired” research approach that aims not only to understand the nature of the problematic weather events identified by communities and stakeholders but to develop scientific products from this user input that are of benefit to society. This is accomplished by working closely with three coastal communities (Ulukhaktok, Tuktoyaktuk and Sachs Harbour), industrial/marine shippers, and operational/emergency response groups (collectively, “end-users”) to have them identify specific occurrences of problematic weather or wave events that interfere with any form of marine transport in the Western Canadian Arctic. For example, weather affects marine activities directly through impacts on the ocean to create waves and swell. Most northern communities around the Arctic are very dependent on sealift to bring fuel, heavy equipment, and building materials. Weather patterns and dangerous waves that interfere with sealift are of great concern. In this study, problematic weather events identified by communities and stakeholders are linked to broader atmospheric patterns. Summaries of the storm and impactful weather events identified will be provided to Environment Canada. Coastal wave energy totals will also be calculated and provided for community construction use. A bottom pressure instrument has been installed to observe wave and swell conditions. This presentation will focus on the approach followed in engaging community and stakeholders and in building partnerships. It will also give an overview of milestones to date, analysis and results of problematic weather events that interfere with marine transport activities. The presentation will be an opportunity to discuss some of the key issues identified by communities and stakeholders, lessons learned, and challenges and opportunities.

ARCTIC SEABIRDS WORK HARDER TO GAIN LESS WHEN SEA-ICE MELTS EARLIER

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Ice provides a key habitat for Arctic food webs and earlier ice melt can negatively impact many Arctic animals, especially at the receding southern edge of the range. If negative impacts are due to bottom bottom-up effects, with ice-associated prey being rarer or more difficult to capture, then predators would be expected to either expend more energy and/or gain less energy when foraging. To examine how earlier ice melt affects the costs of obtaining food for an Arctic seabird, we monitored the demography, diet and foraging behaviour of thick-billed murres (Uria lomvia) between 1987 and 2013. The proportion of the main ice-associated prey, Arctic cod (Boreogadus saida), in the diet of seabirds declined over 27 years and, within each year, with time since 50% ice coverage. In years when Arctic cod was seldom observed in murre diets, offspring grew slower while adults delivered less energy per day, weighed less and had lower overwinter survival, despite expending more energy, spending more time submerged and spending more time at the bottom phase of each dive. Predator behaviour acted as an early warning signal for demographic changes demonstrating that a warmer Arctic increases the costs and reduces the gains associated with foraging for pagophilic predators.
UNDER ICE FLUXES OF DISSOLVED OXYGEN, HEAT, AND SALT MEASURED DURING THE ICE ALGAE BLOOM PERIOD

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Recent research into sea ice gas dynamics has shown that sea ice is not an impermeable barrier to gas exchange (e.g. Loose et al. 2009). The liquid (brine) and gas (bubble) inclusions contained within sea ice appear to allow some gas transport, both convectively due to density instabilities within the highly-saline brine system, and diffusively through both the brine and gas inclusions. Furthermore, recent developments in sea ice biogeochemistry (Miller et al., in press) have shown that many gas species undergo significant modifications within the ice itself. This means that sea ice may play an active role in cycling climatically important gases (e.g. CO2, CH4, DMS) with the atmosphere. However, interesting gas dynamics are also thought to be occurring at the ice-ocean interface; for example, Rysgaard et al. (2007) suggested that CO2 rejected from growing ice may be exported to depth, acting as a sea ice carbon pump. It is therefore important to investigate gas transfer at this often unconsidered “water surface”. In this presentation, we will describe our recent efforts to develop a multi-channel underwater eddy covariance system. This system is capable of directly measuring ice-ocean exchanges of salt, heat, momentum, and oxygen. By combining these measurements, we aim to assess the physical and thermodynamic processes that control gas exchange beneath sea ice. We present results from recent laboratory and field experiments, and discuss how this research may inform a wide variety of topics, including ice algae production, brine convection, and gas transfer at the ocean-ice interface. References Loose, B., W. R. McGillis, P. Schlosser, D. Perovich, and T. Takahashi (2009), The effects of freezing, growth and ice cover on gas transport processes in laboratory seawater experiments, Geophys. Res. Lett., 36, L05603, doi:10.1029/2008GL036318. Miller et al. (in press), Methods for biogeochemical studies of sea ice: The state of the art, caveats, and recommendations, Elementa, doi: 10.12952/journal.elementa.00038. Rysgaard, S., R. N. Glad, M. K. Sejr, J. Bendtsen, and P. B. Christensen (2007), Inorganic carbon transport during sea ice growth and decay: A carbon pump in polar seas, J. Geophys. Res., 112, C03016, doi:10.1029/2006JC003572.

EMERGING EFFORTS TO STUDY THE MARINE CARBONATE SYSTEM IN THE SOUTHERN WATERWAYS OF THE KITIKMEOT REGION (NEAR CAMBRIDGE BAY)

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The waterways that make up the southern portion of the Kitikmeot Region - Coronation Gulf, Dease Strait, and Queen Maud Gulf - are largely unstudied with respect to biogeochemical cycles. However, past glimpses (e.g. Pind, 2013) have shown a large influence of river runoff in the area, which elevates dissolved CO2 (pCO2), and impacts the relative concentrations of total alkalinity (TA) and dissolved inorganic carbon (DIC). Through projects funded by ArcticNet, MEOPAR, and POLAR, and with assistance from Ocean Networks Canada (ONC), the Arctic Research Foundation (ARF), and the Canadian High Arctic Research Station (CHARS), we are presently developing a measurement network centred on Cambridge Bay that will provide unprecedented insight into the marine carbonate system in this region. At Cambridge Bay, a series of instruments have been placed on the ONC underwater cabled observatory, which will provide continuous measurements of pH and pCO2. Those measurements will be validated by discrete water samples, collected by CHARS technicians, and analyzed in our laboratories for DIC/TA content. On the R/V Martin Bergmann - a coastal research vessel operated by ARF and stationed in Cambridge Bay - an underway pCO2 system will be installed to provide spatial context for measurements made at the ONC observatory. A meteorological station installed this
summer on a small island in Dease Strait will eventually be used to directly observe air-sea CO2 exchange using micrometeorological techniques. Finally, our ongoing efforts on the CCGS Amundsen will provide pCO2, DIC, and TA measurements during its twice-annual transects through the area. In this presentation, we will describe in greater detail each of these initiatives to measure the marine carbonate system in the southern waterways of the Kitikmeot Region. Preliminary data will be presented, showing how unique and interesting this area is, and how its study will help us understand carbon cycling on Arctic shelf seas.

THE DECLINE OF BARREN GROUND CARIBOU HERDS AND POSSIBLE RELATIONSHIPS TO CHANGING SNOWPACK STRUCTURE

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While population cycling of northern barren ground caribou is a natural occurrence the recent reduction of almost two thirds of circumpolar herds comes at a time when climate warming is having notable impacts on the ecosystems upon which these species depend. While climate change is a continuum the recent forcing including changes in the hydrological cycle may have significant consequences for the probability of population recovery. For example shifts in normal precipitation patterns have produced over the past two summers a significant number of large forest fires. The question is can caribou herds, with these climate factors imposing challenges, rebound to numerically healthy populations? Shifts in the greening up of the calving grounds are no longer coincident with period of calving, leading speculation as to whether the caribou can build up sufficient fat reserves before migrating south to the winter foraging grounds. This Bathurst herd is the focus of this study and since 2003 the herd has declined by approximately 97% (from ~475,000 to ~16,000). This study examines the potential impact of changing snowpack conditions during the winter months on this herd from 1996 until 2013 utilizing Globsnow and collared caribou data and passive microwave emission which can provide indication of ice lens formation. As winter lasts for 6-7 months and the prime food source of caribou is lichen, changes to snowpack structure (depth, density, formation of ice lenses or snow crust) instigated by increasing incursions of warm air into the subarctic can potentially increase their energy requirements to extract food.

CHARACTERIZATION OF HAZARDOUS ICE USING SATELLITE AND UPWARD LOOKING SONARS

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Ice can pose a hazard for operations (e.g., transportation, shipping, surveillance, offshore oil and gas exploration) and for infrastructure (e.g., ports, pipelines, offshore structures). There is an increasing need for fine-scale characterization of hazardous ice conditions. This information is of interest to both industry and government agencies. Spaceborne SAR sensors are being used for near-real-time monitoring of the regional ice conditions, while satellite-derived ice information products typically rely on the interpretation of analysts, sometimes supported by semi-automated tools. However, validation of data products remains a challenge due to limited or no ground truth. Operated from subsurface moorings located below the sea ice canopy, the upward looking sonar (ULS) instrumentation, consisting of the Acoustic Doppler Current Profiler (ADCP) and the ASL Ice ProfilerTM (IPS), provides accurate measurements of ice draft and velocity continuously. Since the mid-1990s, these instruments provided data in support of research and industrial programs in the Arctic Ocean and marginal ice zones. Analysis of ULS datasets allow us to make inferences regarding the ice conditions that are used as input to the engineering design of structures and the development of operational support programs through detailed characterization of potentially hazardous ice features, i.e. large keels, hummocky ice, multi-year ice and general ice features with large mass. In a recent study (2013-15), we used the two different views of the sea ice canopy, one from below with the ULS, and the other from above with the spaceborne SAR to (1)
calibrate and validate satellite-based ice data products using continuous measurements obtained from ULS instruments, and (2) integrate the information from the two data sources to generate a more comprehensive view of the ice conditions. We focused on the development and assessment of analysis techniques for high spatial resolution polarimetric RADARSAT-2 imagery and corresponding ULS datasets in the Beaufort and the Chukchi Seas, and NE Greenland. We assessed a wide variety of polarimetric products for their ability to provide information about ice draft and ice type. Using datasets from different locations where different types of hazardous ice dominated, and using IPS measurements as validation, we showed that some polarimetric products were the best and most consistent estimators of draft across ice types. An estimated ice draft map was generated using satellite data. SAR classification methods were assessed using ULS-based hazardous ice types. Although the agreement between SAR and IPS was generally good with respect to the detection of deformed first-year ice, it was less consistent for multi-year ice (MYI). Finally, we showed that compact polarimetry mode of the upcoming Radarsat Constellation Mission should achieve a similar level of sea ice characterization to that which is possible with RADARSAT-2 quad-polarized data. The results of this project provide the basis for developing very high resolution satellite-derived sea ice drafts and ice types in near real-time, which are particularly important for operational support for Arctic activities. The funding and RADARSAT-2 data were provided by the Canadian Space Agency. The permissions to use ULS datasets were granted by the owners and/or their program partners including the Department of Fisheries and Oceans Canada (DFO), NOAA, Shell, Statoil, and NTNU.

A LARGE-SCALE SURVEY OF ARCTIC OCEAN METHANE (CH4) AND NITROUS (N2O) DISTRIBUTIONS DURING SUMMER OF 2015

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Quantifying the distribution of greenhouse gases in the Arctic Ocean water column is necessary to understand potential biogeochemical climate feedbacks. As the Arctic Ocean warms, methane (CH4) may be released from destabilizing gas hydrates on the continental shelf, while the thaw of subsea permafrost may supply organic matter that fuels microbial methanogenesis and denitrification, which produces nitrous oxide (N2O). While previous measurements of CH4 and N2O have been reported in Arctic waters, no study to date has measured water column distributions of these gases over a widespread area in the Arctic within a single sampling season. This synoptic coverage is important to provide a snap shot of spatial CH4 and N2O variability. We collected Arctic water column samples on three separate cruises in the summer and fall of 2015, covering a ~10,000 km transect from the Bering Sea to the Labrador Sea. Our sampling transect provided a large-scale, three-dimensional view of CH4 and N2O concentrations across contrasting hydrographic environments, from the deep oligotrophic
waters of the deep Canada Basin, to the high productivity continental shelf regions. Preliminary results show persistently high CH4 and N2O concentrations, coupled with a general trend of increasing concentration nearer to the sediments. This points to sedimentary sources for both methane and nitrous oxide. In the Chuchi Sea, we observe an additional methane maximum between 20 and 40 metres depth, suggesting localized in-situ water column production. Relationships between gas concentrations and other hydrographic variables will be discussed. Our work contributes new insight into the cycling of two important climate-active gases in the Arctic Ocean, and provides a benchmark against which to compare future measurements in a rapidly evolving system.

FOOD FROM HERE THERE, FROM US AND THEM; CHARACTERIZING THE FOOD SYSTEM OF RIGOLET, NUNATSIAVUT

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Communities in the Canadian North face many challenges in accessing traditional and market foods. These challenges are attributed to a complex combination of factors including social, economic and environmental shifts, colonial legacies, and the remote geography of communities. Despite these challenges, communities across the North are resilient in maintaining food as a core element of their culture and identity. It is therefore essential to search beyond generalized experiences, to gain a contextual understanding of communities and the intricacies of their local food systems. This presentation discusses a project that adopts such an approach in characterizing the food system of Rigolet, Nunatsiavut. Conducted in partnership with the Rigolet Inuit Community Government, and a community-based research team, the project examines community members’ preferences, harvesting, purchasing, sharing, and consumption of both wild (country) and market foods in an effort to answer the research question What is the story of food in Rigolet, Nunatsiavut? Photo card interviews were conducted with 48 participants, from 27 households in May and June 2013, followed by four phases of month-long food inventories from August 2013 through May 2014, during which 22 households documented all store purchases and wild food harvests. In this presentation we will discuss Rigolet’s mixed food system; drawing from food categories used by Nutrition North, the Inuit Health Survey, and Canada’s Food Guide - First Nations, Inuit, and Mètis, 13 categorizations of food are used to examine the composition of participants’ diets. These results will be further contextualized by an overview of the key social, economic, political, and environmental factors identified by participants that are affecting their diets and the community’s food system. Characterizing Rigolet’s food system in this way has furthered understandings of the system’s current strengths and weaknesses, and how the community has responded and can continue to respond in the future to the varied factors that affect the quantity, quality, and variety of foods that are available.

ARCTIC RISK MANAGEMENT (ARMNET) NETWORK: LINKING RISK MANAGEMENT PRACTITIONERS AND RESEARCHERS ACROSS THE ARCTIC REGIONS OF CANADA AND ALASKA TO IMPROVE RISK, EMERGENCY AND DISASTER PREPAREDNESS AND MITIGATION THROUGH COMPARATIVE ANALYSIS AND APPLIED RESEARCH

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The Arctic Risk Management Network (ARMNet) was conceived as a trans-disciplinary hub to encourage and facilitate greater cooperation, communication and exchange among American and Canadian academics and practitioners actively engaged in the research, management and mitigation of risks, emergencies and disasters in the Arctic regions. Its aim is to assist regional decision-makers through the sharing of applied research and best practices and to support greater inter-operability and bilateral collaboration through improved networking, joint exercises, workshops, teleconferences, radio programs, and virtual communications (e.g. webinars). Most importantly, ARMNet is a clearinghouse for all information related to the management of the frequent hazards of Arctic climate and geography in North America, including new
and emerging challenges arising from climate change, increased maritime polar traffic and expanding economic development in the region. ARMNet is an outcome of the Arctic Observing Network (AON) for Long Term Observations, Governance, and Management Discussions, www.arcus.org/search-program. The AON goals continue with CRIOs (www.ariesnonprofit.com/ARIESProjects. php) and coastal erosion research (www.ariesnonprofit. com/webinarCoastalErosion.php) led by the North Slope Borough Risk Management Office with assistance from ARIES (Applied Research in Environmental Sciences Nonprofit, Inc.). Funding from the US Embassy in Ottawa is making possible presentations at conferences. The constituency for ARMNet will include all northern academics and researchers, Arctic-based corporations, First Responders (FRs), Emergency Management Offices (EMOs) and Risk Management Offices (RMOs), military, Coast Guard, northern police forces, Search and Rescue (SAR) associations, boroughs, territories and communities throughout the Arctic. This presentation will be of interest to all those engaged in Arctic affairs, describe the genesis of ARMNet and present the results of stakeholder meetings and webinars designed to guide the next stages of the Project.

CABLED OBSERVATORIES AND CITIZEN SCIENCE FOR ARCTIC COMMUNITIES: OCEAN NETWORKS CANADA'S CAMBRIDGE BAY OBSERVATORY AND "COMMUNITY FISHERS" PROJECTS

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The extreme environmental conditions, logistical challenges, sheer geographical size, and length of coastline are just some of the challenges that scientific research, government, and industry face when trying to understand and serve the Canadian Arctic. These defining attributes are also part of what sets the Arctic apart from the rest of Canada and the world. They are also strong reasons why effective coordination between communities and researchers are needed to affect relevant change. As one of the most rapidly changing regions on the planet, with respect to the physical, economic, and social environments, the Arctic has perhaps the greatest need for the dispersal of real-time monitoring stations. Real-time data access not only provides the ability to make real-time decisions regarding safe winter transport (for hunting, fishing, and tourism), safe shipping, and potential updates to existing science programs, but also provides community members and students with the easy and immediate access that is often lacking from long time-series data collection programs. Ocean Networks Canada has been maintaining a cabled sub-sea “Community Observatory” in Cambridge Bay, Nunavut since September of 2012. Real-time environmental data has now been streaming for over three years and all of it is archived and freely accessible on the Ocean Networks Canada web portal (Oceans 2.0) where it can be viewed, plotted, and downloaded. Aside from the growing acceptance of this system within the Cambridge Bay community there is also a growing interest from the research community which has been demonstrated by the growing number of instruments that are hosted on the sub-sea platform and the increasing number of research papers which reference the data. With each passing year of maintenance, the installation has attracted more and more attention and is now hosting over a dozen different sensors and is acting as a test-platform for new (or new to the arctic) technology. The Cambridge Bay Community Observatory has also helped to inspire the collaboration with the University of Manitoba's Churchill Marine Observatory as well as Ocean Networks Canada's wide distribution of multi-parameter observatory sites along the coast of British Columbia. The aim of all of these installations is to provide baseline and ongoing scientific data, improve marine safety, drive new economic benefit to Canada, and support First Nations and Inuit priorities. Working with scientists and technical staff from the Department of Fisheries and Oceans and with the Pacific Salmon Foundation, Ocean Networks Canada has now also stepped in to a major supporting role of capturing and delivering high quality data for a robust “citizen science” program using their “Community Fishers” mobile application. The goal is provide a range of instruments and monitoring capabilities that will complement the wide range of existing monitoring programs. So far, these improved data collection methods have proven to work reliably in the Arctic and are necessary for capturing strong baseline data sets and providing instant access to environmental conditions. Data and research are being integrated in to college and secondary school programs and activities. Individuals and organizations are strongly encouraged to discover what freely accessible data is currently available to support their efforts and to provide input into what instruments and methods would be the most valuable to communities and research.
HOW TO EVALUATE CLIMATE CHANGE ADAPTATION IN A PERMAFROST ENVIRONMENT: A PILOT STUDY USING THE TERRAIN ANALYSIS PROJECT IN ARVIAT, CANADA

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Climate change is a complex global problem and whilst rooted in environmental changes, its impacts will be experienced throughout human and environmental systems. Long-term climate models project a retreat of permafrost extent with rising temperatures, which will have major impacts on infrastructure and development in Arctic communities. As a result, climate change adaptation - the process of adjusting to actual or expected climate and its effects to moderate or avoid harm or exploit beneficial opportunities - related to permafrost degradation is already underway in Arctic communities. However, despite being recognised as a required part of effective adaptation, current monitoring and evaluation of adaptation initiatives at the community level is lacking, particularly in an Arctic context. This research builds on previous literature on adaptation tracking and evaluation, to create an adaptation evaluation framework which we empirically apply to a community level adaptation initiative focused on Arviat, Nunavut. The presentation will profile emerging findings and examine the methodology developed for evaluating adaptation initiatives in Arctic communities.

RE-ANALYSES OF A LONG TERM INFRARED SPECTRAL SUNRISE DATA SET RECORDED AT EUREKA, NU, 2000-2008

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The existence of a comprehensive data archive offers the opportunity to re-analyze that data-set with new and improved techniques not available initially. For portions of the 14 years from 1994 to 2008, a Bomem DA-8 high resolution Fourier Transform Spectrometer (FTS) recorded high-resolution solar absorption spectra of the atmosphere at one of the sites of what is today called the Polar Environment Atmospheric Research Laboratory (PEARL) located at approximately 80N, 86W near the Environment Canada (EC) Eureka Weather station on Ellesmere Island. This FTS was operated by EC and the Meteorological Research Institute (MRI) of Japan during either the spring or fall of each year. Presented here is a partial re-analysis of the spring (late February to early April) data sets recorded from 2000-2008 using current software techniques and molecular parameters that are both much improved from those available at the time the data set was recorded. In addition, we have derived ozone total columns and partial columns and investigated the same for the symmetric and asymmetric 18-O substituted ozone isotopomers 16O-18O-16O and 16O-16O-18O, as well as other molecules important in ozone chemistry. The DA-8 was also a part of the Network for Detection of Atmospheric Composition Change (NDACC) and was replaced in 2008 by the Canadian Network for Detection of Atmospheric Change (CANDAC) Bruker IFS125HR FTS. The two instruments were operated concurrently for parts of two years before the DA-8 was removed and the IFS125HR became the instrument of record. We compare the total column amounts derived from both spectral data-sets during the overlap period to ensure that the two data-sets are equivalent during that time and the entire dataset can be considered as quasi-continuous. This project is supported by the Natural Sciences and Engineering Research Council (NSERC) and Environment Canada.

INDICATORS FOR SUSTAINABLE CIRCUM-ARCTIC COASTAL COMMUNITIES

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With unprecedented rates of change in climate, population, technological innovation, and externally driven shipping and resource extraction activity, small Arctic communities face a plethora of challenges to sustainability. Coastal communities are located at the biologically productive interface between terrestrial, marine, and atmospheric systems, which exhibit trends beyond the range of recent human experience. These communities are exposed to growing natural hazards and associated social, cultural, and economic risk, exacerbated in many cases by social, institutional, or governance barriers to adaptation. Inuit culture, traditionally tied to the coastal environment, remains a strong determinant of resilience in the modern Arctic, but confronts new realities in the coastal communities where the majority of Inuit reside today. The capacity to adapt and to implement adaptive measures is a critical determinant of individual and community health and well-being in the face of rapid change. It depends on a number of key factors including objectives (consensus or diversity of interests), perceptions of risk, and societal values (IPCC, 2013, Summary for Policymakers, www.ipcc.ch/report/ar5/wg2/). Knowledge is the key to successful outcomes, but how do individuals or institutional decision-makers identify and access the necessary knowledge to make the best choices in particular circumstances? One approach to identifying trends, assessing adaptive capacity, and measuring success is the use of indicators, co-designed by users (decision-makers at various scales) and tailored to the particular circumstances of individual communities, regions, or networks. Situational indicators (biophysical or social) are valuable tools for identifying the current status of environmental constraints and hazards, social and economic conditions, and individual health and well-being. Examples include changing sea level and ice conditions, geoindicators of coastal response (e.g. Lantuit et al. 2012, Estuaries & Coasts, 35, doi:10.1007/s12237-010-9362-6), or a range of social indicators, such as population trend, infant mortality, household income, consumption of traditional (country) food, cultural autonomy, language retention, or measures of fate control (Larsen et al. 2014, Arctic Social Indicators – ASI II: Implementation, Norden, doi:10.6027/TN2014-568). Another approach is the use of adaptive capacity indices (ACIs), which involve a “a systematic synthesis of key social, biological, and physical indicators that allow for targeted yet coordinated responses ... under changing conditions for the purpose of sustaining desired livelihoods and well-being” (Alessa et al. 2015, Sustainability Science, 10, doi:10.1007/s11625-015-0295-7). Effective ACIs require user involvement and availability of relevant information, which may come from a variety of sources, including conventional remote sensing, monitoring, survey and census data, and particularly from community-based observers and indigenous science. The relevance and utility of such co-produced ACIs also depend on adequate dissemination and availability of the resulting insights. There is as yet very limited experience in the development or application of effective adaptive capacity and sustainability indices in Arctic communities, a gap we aim to address collaboratively with network partners and other initiatives in the Circumpolar Arctic Coastal Communities Observatory Network (caccon.org).

CURRENT SURGES AND SEDIMENT EROSION NEAR THE SHELF EDGE IN THE CANADIAN BEAUFORT SEA: THE ROLE OF WIND AND ICE MOTION STRESS

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Results from tautline moorings deployed near the shelf edge (~150 m isobath) in the Canadian Beaufort Sea as part of the Beaufort Research Environmental Assessment (BREA) Program 2011-2015 provide evidence for the propagation of an eastward shelf-break jet carrying water of Pacific origin (or seawater with similar physical and chemical properties) along the upper slope. Recurring episodes of elevated current velocities in the jet (up to ~60-80 cm s-1) corresponded closely with sudden peaks in suspended sediments (up to >100 g m-3) in the near-bottom boundary layer (<10 m) as derived from the acoustic backscatter of down-looking high-frequency acoustic Doppler current profilers. These events implied sediment erosion from a local source followed by rapid advection or redeposition, thus possibly contributing to the cycling of approximately 21-41 t m-2
yr-1 of sediments near the bottom at the shelf break. Current surges were driven by intensified wind and/or ice motion stress associated with anomalously high (upwelling-favorable) or low (downwelling-favorable) pressure systems. Both upwelling and downwelling storms were able to generate an intensification of the shelf-break jet (and its reversal during upwelling-favorable conditions), but the net vectorial displacement of suspended fluxes indicated that resuspended sediments were primarily transported to the northeast along the shelf toward the Canadian Archipelago. Based on sediment trap data collected over the lower slope, resuspended particles at the shelf-break may contribute to the offshore export of organic and inorganic matter only during downwelling-favorable conditions, primarily through eddy shedding from the shelf-break jet as a result of baroclinic instability. Eddy formation processes appear to be topographically enhanced in the Mackenzie Canyon when compared to the outer central shelf, consistent with previous studies. In addition to sediment erosion at the shelf-break, mechanisms such as nearshore wave-driven resuspension forced by coastal storms and the cascading flow of dense winter water down the shelf (both able to entrain material from the benthic boundary layer toward the shelf edge) are needed to explain the temporal variability of sinking fluxes over the lower slope. Upcoming data from the newly-funded integrated Beaufort Observatory program (2015-2018) will provide further insights on the cross-slope and along-slope ocean circulation that drive fluxes of suspended particulate matter in the region.

DETERMINING THE SEASONAL IMPORTANCE OF CUMBERLAND SOUND AS A FORAGING HABITAT FOR BOWHEAD WHALES

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Changes in zooplankton species diversity and relative abundance are expected to occur as a consequence of climate change, which are predicted to affect the foraging success of bowhead whales. However, relatively little is known about bowhead diet and foraging ecology in the Eastern Canadian Arctic under current climate conditions. We applied multi-scale biologging and prey sampling techniques to understand the diet and foraging behavior of bowheads in Cumberland Sound, Nunavut. We equipped 24 bowheads with long-term satellite telemetry tags outfitted with time-depth recorders (2012-2013). We determined zooplankton density and species composition near whales in August 2013 and 2014 using conical mesh nets. Telemetry data demonstrated that Cumberland Sound is a seasonally occupied habitat with the highest occupancy of tagged whales occurring during summer (24% ± 9.2 SD) and fall (30% ± 4) and lowest during the winter (6% ± 3) and spring (12% ± 11). We found that animals spent the majority (≥75%) of their time conducting deep (150-180 m) square-shaped dives during August, which are characteristic of foraging. While surface waters were devoid of prey, vertical samples collected from depths >100 m contained high concentrations of late stage Arctic copepods (Calanus hyperboreus and C. glacialis). We also found that bowhead whales’ dive behavior changed seasonally and over diel time-scales. Whereby, during spring and early summer animals conducted significantly shallower feeding dives compared to late summer and early fall. For example, during June the average square-dive depth was only ~27 m ± 11 SD compared to September when dives were significantly deeper (~244 m ± 102 SD). This seasonal change in dive depth likely reflects changes in the vertical distribution of calanoid copepods, which are known to undergo diapause and overwinter at depth during fall and winter when phytoplankton availability is low. We also found that bowhead whale dive depth changed during the day and at night during late summer. For example, during August bowhead whales dove significantly deeper during the day (185 m ± 128 SD) and shallower at night (102 ± 122 SD). It is hypothesized that this daily change in dive behavior reflects the diel vertical migration of bowhead whale prey. Calanoid copepods are known to avoid brightly lit surface waters during day to prevent predation from visual predators such as fish and instead ascend to the surface after dusk to feed on phytoplankton. Large differences were not observed between day and night dive depths during the fall and this supports the hypothesis that zooplankton are undergoing diapause during this time in Cumberland Sound. Combined, these results suggest that Cumberland Sound is an important summertime feeding habitat for bowhead whales. Furthermore, it is hypothesized that bowhead whales are targeting energy-rich diapausing copepods during late summer and early fall.
EVOLUTIONARY ADAPTATION AND MIGRATION OF ARCTIC PLANT POPULATIONS IN RESPONSE TO CLIMATE CHANGE

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Arctic ecosystems are particularly susceptible to the impacts of a rapidly changing climate. Rising temperatures result in a shift of most favorable conditions for growth and reproduction to higher latitudes causing poleward migration of plant populations. Established local populations, at northern latitudes however, might adapt to the warming climate by phenotypic plasticity or evolutionary adaptation. If they end up being maladapted, gene flow from southern populations might provide a source of genetic material pre-adapted to warmer temperatures. However, lacking adaptation to non-climatic environmental conditions - for example photoperiod, biotic interactions, or edaphic conditions - might hinder the establishment of immigrating southern populations. In 2011, we established reciprocal transplant experiments at Alexandra Fiord, Ellesmere Island, Nunavut, Canada, to test for evidence of evolutionary adaptation in response to 18 years of experimental warming. Furthermore, we transplanted individuals raised from seeds from several southern and local populations of two Arctic tundra plant species into warmed (OTC) and control plots at Alexandra Fiord. With this set-up, we aim to test whether local populations will be able to adapt and survive or whether they will be replaced by immigrating southern populations at High Arctic sites under a future warmer climate. Phenology and growth measurements during four growing seasons showed indications of evolutionary adaptation but also that warming alone does not facilitate success of southern populations at northern latitudes. Furthermore, considerable quantitative genetic differentiation among populations (QST) may facilitate future adaptation to climate warming.

IRIS 3: CONTAMINANT PROCESSES IN HUDSON BAY

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The Greater Hudson Bay region (i.e. Hudson Bay, Foxe Basin, Hudson Strait) is undergoing significant environmental and meteorological change. Freshwater inputs to Hudson Bay and James Bay are increasing. Temperatures over part of the region are rising. Contaminants exposure in various biota is also exemplifying change, associated with transitioning environmental and ecological conditions. Contaminant concentrations and their interactions have been studied in the North because, ultimately, marine mammals (indigenous country foods) are exposed to contaminants and can impact the health of Northerners. How this exposure will change with a transitioning climate and the onset of increased industrial and shipping activities in the North is a topic of increasing scientific investigation. With respect to the Hudson Bay Integrated Regional Impact Study (IRIS), our presentation will speak to issues including (1) the sources and sinks of contaminants, (2) physical and biogeochemical controls on contaminant pathways, (3) concentrations and trends of contaminants in marine life, and (4) projected changes in contaminant cycling and exposure to the marine ecosystem.

NUTRITION NORTH CANADA: WHY RECENT CHANGES TO THE FEDERAL FOOD SUBSIDY PROGRAM WON’T TELL YOU ANYTHING NEW

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In July 2015, the federal government announced a new point-of-sale system which provides northern consumers with information about the Nutrition North Canada (NNC) subsidy on their grocery receipts. The measure is designed to provide greater transparency and accountability in how the federal retail subsidy operates. This presentation reports findings from an analysis of publicly-available documents from government websites. Websites and online databases were hand-searched for information published since the implementation of NNC 2011. Content analysis was performed on 34 publications, including NNC fiscal reports and biennial retailer compliance reports. Results indicate that information provided on the new point-of-sale receipts
has been available on the NNC website since 2011. The new measure does not represent a step toward greater accountability. Rather it is simply a public relations initiative designed to provide the appearance of greater transparency without substantive program change.

**SEASONAL SOIL CARBON EMISSION RESPONSES ACROSS A SHRUB COVER GRADIENT IN THE LOW ARCTIC**

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Atmospheric warming is expected to cause important shifts in tundra vegetation composition, especially expansion of shrub species. This shift can affect ecosystem annual carbon balance in various ways, one of which is to alter soil carbon emissions. Here, the influence of increased shrub cover on both growing season and cold season soil carbon emissions were investigated at three sites (mixed tundra, dwarf shrub and low shrub) along a gradient of increasing shrub coverage in Canadian low Arctic tundra. Results showed that in growing season 1) soil respiration rate (SR) was significantly higher at the low shrub site, and the difference between the mixed tundra and dwarf shrub sites was small and 2) 5cm soil temperature and 12 cm soil moisture decreased with increased shrub coverage, however, SR variations within each site were closely correlated with soil temperature and moisture (0.719<R²<0.936, P<0.01). 3) across the three sites, soil physiochemical properties, such as soil nutrients and soil bulk density, more strongly influence respired CO2 than soil microclimate factors such as soil temperature and moisture with increasing shrub coverage. In cold season 1) accumulated soil carbon emission was lowest at the dwarf shrub site (37 CO2 C m-2), around two times higher at the mixed tundra site (69 CO2 C m-2), and almost 3 times higher at the tall shrub site (110 CO2 C m-2). 2) the variation of cold season carbon emission correlated with soil temperature differences which were attributed to the interaction between snow depth and shrub coverage. Together, increased shrub coverage was associated with greater soil carbon emissions in both growing season and cold season, which might offset the increased carbon uptake with increasing plant productivity, thus give a positive feedback to climate warming. Meanwhile, the sensitivity of respiration to different shrub coverage underscore the importance of shrub expanding level in predicting soil carbon emission under climate warming.

**COULD LONGER ICE-FREE SEASONS INCREASE ARCTIC COD (BOREGADUS SAIDA) GROWTH AND RECRUITMENT IN THE CANADIAN BEAUFORT SEA?**

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Arctic cod (Boreogadus saida) represents a key species of the Beaufort Sea ecosystem and comprises 95% of the pelagic fish assemblage. Despite its importance, the spatial distribution and age class dynamic of arctic cod remain unknown. Hydroacoustic surveys conducted from 2010 to 2014 allowed documenting inter-annual variations in distribution, size, abundance, and biomass of the species. Mean annual abundance and biomass estimated with kriging techniques were compared to the date of the ice breakup and to the mean sea-surface temperature (SST) measured by remote-sensing to test the hypothesis that longer ice-free seasons and warmer SST in spring enhance growth and recruitment of epipelagic age-0 arctic cod. Mean standard length of age-0 arctic cod at the end of August was positively correlated with mean SST in spring, during the initial growth season. Abundance and biomass within the epipelagic layer of age-0 arctic cod were significantly higher the years that ice breakup occurred earlier, which also corresponded to warmer SST. The biomass of early-stages of arctic cod was significantly higher in the southern Beaufort Sea than in the north and biomass of older individuals was significantly higher in the Amundsen Gulf, confirming the ecological importance of embayments for the species and its marine mammal predators. The limited sample size (i.e. five years) highlights the importance of conducting annual acoustic
surveys in the Beaufort Sea to increase the time series and validate the relationships observed here.

**BRIDGING THE GAP BETWEEN MONITORING AND MODELING APPROACHES TO BETTER UNDERSTAND ARCTIC FOOD WEBS UNDER GLOBAL PRESSURES**

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Ecosystems are connected to each other at local to global scales. One of the current challenges facing scientists is to determine how global perturbations such as climate warming affect ecosystems in a connected world, but a world whose connections between ecosystems are also being modified. In the Arctic, examples of modifications in large-scale connections between ecosystems are demographic explosions and collapses of migrating populations such as snow geese and caribous, respectively. Although the impacts of climate warming and of connections on the functioning of ecosystems are intensively monitored, we still lack a modeling framework to predict how climate warming will affect ecosystems in a connected world. We developed theoretical models that generate predictions about the strength of trophic interactions and the fate of some populations of conservation concern in a warming and connected Arctic. Our first model showed that the strength of top-down forces relative to bottom-up forces increases with the level of connection between ecosystems and decreases with increasing temperatures. Our second model showed that the effect of predator (arctic foxes) on prey of conservation concern (shorebirds) generally increases with climate-induced collapse in cycles of the preferred prey (lemmings), but only when a migrating species supported by agricultural activities in temperate ecosystems (snow goose) is available for the arctic predator. Our results illustrate how bridging the gap between monitoring and modeling approaches will contribute to better predict the functioning of ecosystems in a warming and connected Arctic.

**THE FOUNDATION - ARCTIC CHARTING**

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The Canadian Hydrographic Service (CHS) is responsible for providing marine navigational products and services in Canada. Given that shipping accounts for the vast majority of the goods moving within the North, nautical chart products are the foundation to the marine transportation infrastructure and the Arctic supply chain. This presentation will highlight some of the unique challenges of charting in the North and outline the strategy to minimize the risks to navigation in Canada’s Arctic waters.

**BUILDING A RESEARCH AGENDA FOR ARCTIC ENTERIC INFECTIONS RESEARCH**

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Background: Recent data from Nunavut and Nunatsiavut suggest the prevalence of acute gastrointestinal illness is more than 2 to 3 times that of communities in southern Canadian and other developed countries. There is also emerging data to suggest that the microbiology of these infections is quite different from other areas of Canada. Research on this topic in northern locations presents unique opportunities and challenges that are not encountered in southern Canada. We sought to bring together individuals with diverse backgrounds with an interest and stake in enteric infection research in the Canadian Arctic. Methods: A diverse multidisciplinary group of experts including epidemiologists, microbiologists, primary care practitioners, social scientists, and public health experts were invited to attend
a two day workshop in Iqaluit, Nunavut. Attendees had either research, clinical or public health experience in Nunavut, Nunavik and/or Nunatsiavut. The ultimate 18 member panel was tasked to 1)Identify, develop and rank research questions in terms of urgency/importance; 2) Determine which research methods would be ideal/possible in these communities in order to answer these prioritized questions; 3) Share preliminary data and experience across the regions and disciplines/backgrounds in order to inform the discussion. The project received partial funding from a CIHR Planning and Dissemination Grant.

Results and Discussion: Key priorities identified included: determining the burden of acute and chronic infections across populations in northern regions, identifying sources of infections and possible influences related to climate change, develop methods for rapid identification and amelioration of gastrointestinal outbreaks that occur in remote communities, and improving diagnostics, preventative measures and clinical management of infections in the North. Children were identified as a group particularly vulnerable to impacts of these infections and the possible links between food insecurity and enteric infection burden were also highlighted. Several regionally appropriate study designs were proposed by the group that would help address these priorities. A framework of research priorities and appropriate research tools was developed.

**CONTRASTING INTERSPECIFIC BOREAL SHRUB GROWTH RESPONSE TO CLIMATE, FERTILIZATION AND HERBIVORY**

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Proliferation of tall shrubs has been documented across the circumpolar Arctic and alpine tundra, and strongly linked to warming temperatures. However, less is known about changes in forest structure dynamics below treeline. Recent studies have linked ecological responses of tundra ecosystems to interactions between global change drivers and dynamics of herbivory pressure. Shrubs are a key component of the boreal ecosystem and food web, composing a main winter food source for snowshoe hares (Lepus americanus). In order to understand future changes in boreal forest ecosystem dynamics, we must first disentangle the contrasting influences of changing climate, nutrients and herbivore abundance on shrub growth and habitat structure. We used dendrochronological methods to assess the relative importance of shrub growth to: 1) climate variables (spring and summer temperature and precipitation), 2) a 1988-1994 NPK fertilization experiment, and 3) fall hare density. We studied an average of three decades of annual growth of three boreal shrub species (Betula glandulosa, Shepherdia canadensis, and Salix glauca). We found contrasting interspecific responses. Betula glandulosa growth correlated with fertilization and Shepherdia canadensis with precipitation. Both of these species were also impacted by canopy cover by white spruce (Picea glauca). Salix glauca growth did not strongly correlate with any of the factors tested for radial growth, but instead responded to fertilization structurally with increased height. By understanding the response of plants to climate change, we can better predict coming changes in the structure of boreal habitat of culturally integral species such as snowshoe hares. In the Yukon Territory there is a community of trappers whose livelihoods depend on furbearer populations. If climate change is altering the boreal food web by changing predator-prey dynamics, then understanding why is key. This research will improve our understanding of climate, nutrient, and plant-herbivore interactions to boreal forest community dynamics and biomass accumulation under future warming and disturbance regimes.

**DIVERSITY AMONG MARINE RESOURCE USE OBJECTIVES ACROSS CO-MANAGEMENT AGENCIES IN THE INUVIALUIT SETTLEMENT REGION, CANADA**

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The Inuvialuit Settlement Region (ISR), situated in Canada’s western Arctic, was established in 1984 under the Inuvialuit Final Agreement (IFA), which is a comprehensive land claim agreement between the Government of Canada and the Inuvialuit people. In order to fulfill the Inuvialuit’s resource-related rights as per the IFA, a complex co-management scheme was established; where management of renewable and non-
renewable resources in the ISR is shared among local users as well as territorial, federal, and international agencies. Currently, each agency has identified resource use objectives for the ISR in order to meet the needs of their respective agencies and the obligations set forth by the land claim; although there is no streamlined approach among agencies and objectives are communicated in vastly different formats and documents. This study identifies all co-management agencies that share marine resource related responsibilities in the ISR to demonstrate how they work together. Next, we compile and streamline marine resource use objectives outlined in relevant co-management documents to demonstrate overlap among objectives and identify priorities. Finally, objectives are categorized into groups to determine the scope of each objective (i.e., ecological, economic, etc.) and the specificity of objectives (i.e., whether objectives are specific with measurable targets or broad and unmeasurable). Results show the majority (69%) of management objectives are concentrated at higher operational levels, meaning they cannot be measured and may not lend themselves to mandated monitoring of marine resources. In addition, categorical association shows objectives related to ecology are more prevalent (318 of the 479 objectives) than social (137), economic (78), cultural (83) or governance (140) related objectives, with 36% of objectives having more than one association. It is believed that the ecological emphasis by many co-management agencies may be due to the large number of agencies responsible for managing ecological resources, as established in the co-management structure. We present this research as a first step to identifying regional priorities for monitoring programs across the ISR and finding ways to coordinate monitoring activities across agencies.

UNDER-ICE CIRCULATION IN AN ARCTIC LAKE: OBSERVATIONS FROM TWO FIELD SEASONS IN LAKE KILPISJÄRVI, FINLAND

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High spatial resolution CTD profiles and Acoustic Doppler Current Profiler velocity measurements show significant rotational basin-wide circulation under ice in May of 2013 and 2014 at Lake Kilpisjärvi, Finland (69°01’N, 20°49’E), a seasonally ice-covered, Arctic lake with negligible through-flow. These observations add to the growing understanding of the relationship between thermal distribution and circulation under ice. In 2013, a high-pressure horizontal density anomaly with vertically paired rotating circulations was observed. The estimated maximum magnitudes of the cyclonic and anti-cyclonic azimuthal velocities were 0.03 and 0.02 m s\(^{-1}\). The Rossby radius (R\(_{ri}\)), the horizontal length scale at which rotational effects become as important as pressure effects, was estimated to be \(\sim 160\) m and the Rossby number (Ro), the ratio of the centripetal acceleration to the Coriolis acceleration, \(\sim 0.2\). It is hypothesized that this circulation was driven by heat flux at the shorelines from warm incoming streams causing a density flow down the slopes to the centre of the lake where the flow converged. This flow was balanced with a shoreward flow beneath the ice. These flows were modified by the earth’s rotation that resulted in the rotational circulation observed. In 2014, a cyclonic, low-pressure horizontal density anomaly was observed near the centre of the lake and was vertically paired with a weak anti-cyclonic anomaly in the top 10 m (mean depth of the lake is 19.5 m). The estimated azimuthal velocities had maximum cyclonic and anti-cyclonic magnitudes of 0.006 and 0.003 m s\(^{-1}\). The anomaly was estimated to have R\(_{ri}\) \(\sim 240\) m, with Ro \(\sim 0.12\). It is hypothesized that this circulation was driven by sediment release of heat to the overlying water causing a tilt in the isopycnals near the shores of the lake that caused an inward pressure force that was balanced by the Coriolis force and, to a lesser extent, the centripetal acceleration force. The 2013 observations were made immediately prior to ice-off, and the 2014 observations were 12 days prior to ice-off. This time difference allowed for significantly different ice and snow conditions, and the addition of warm inflows that forced the circulation closer to the ice-off date.
ASSESSING CLIMATE CHANGE VULNERABILITY THROUGH INUIT QAUJIMAJATUQANGIT (INUIT KNOWLEDGE), ABORIGINAL KNOWLEDGE AND WESTERN SCIENCE IN THREE ARCTIC NATIONAL PARKS

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Adaptive management in Canada’s national parks is an integral part of caring for ecological integrity and diversity in a rapidly changing climate. Climate change effects on marine and terrestrial species and their habitats resonate to nearby Inuit communities. Inuit Qaujimajatuqangit (IQ, Inuit Knowledge) and Aboriginal Knowledge (AK) reveal important information about the extent and severity of climate change and its effects on subsistence living. When used in conjunction with western science (including monitoring) and an assessment of adaptive capacity, a measure of vulnerability to climate change can be projected. Parks Canada is undertaking climate change vulnerability assessments (CCVAs) for Tuktut Nogait, Ukkusiksalik, and Auyuittuq national parks under the auspices of a pilot study entitled ‘Understanding Climate-Driven Ecological Change in the North’. The collaborative pilot study involving Inuit Knowledge Working Groups, local hunters and trappers, Joint Park Management Committees, park managers, and researchers will assess the known and potential vulnerability of selected terrestrial and marine species and their habitats to climate change. In addition, the effects of climate change on the Penny Ice Cap in Auyuittuq will be assessed. Climate change is recognized as an important issue in each park. This presentation describes how vulnerability will be projected using IQ and AK in conjunction with western science and an evaluation of the adaptive capacity of nearby communities and the Parks Canada Agency. It is anticipated that pilot study results and recommendations will help Inuit communities and the Parks Canada Agency respond adaptively to the social and ecological conditions that will emerge over the next 30 years.

THE DEVELOPMENT OF CLIMATE SCENARIOS FOR THE CANADIAN ARCTIC

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Developing climate scenarios, namely plausible future trajectories for variables like temperature, precipitation and wind, is a challenge for the Canadian Arctic. First, our ability to characterize the current climate in the Arctic is more difficult than for mid-latitudes due to sparse observing networks and large differences between gridded interpolated products and reanalysis. Second, there is large uncertainty in the magnitude and timing of the simulated climate change signal in the Arctic due to the complexity of processes and feedbacks involved in that region. In this presentation, we discuss how observational products and model simulations are combined for producing meaningful climate scenarios, in link with our 2015-2018 ArcticNet project. Principles and methods are illustrated with results from specific objectives of the project. For example, methods have been identified for adequately considering temperature-precipitation correlations at coastal sites. Also, diverse wind products are explored for developing 6-hourly wind scenarios to subsequently model sea wave and sea ice over Hudson Bay. Finally, the importance of considering uncertainty is emphasized, and links with other projects are discussed.

A NEW NETWORK OF SITES TO INVESTIGATE GROUND THERMAL REGIME AND SURFACE SUBSIDENCE IN THE TUNDRA OF THE SLAVE GEOLOGICAL PROVINCE

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We present a new network of measurement sites to investigate ground thermal regime and surface subsidence over time. It is situated in the tundra of the Slave Geological Province, near Lac de Gras, where few previous permafrost measurements exist. The region contains layers of icy till, which are susceptible to modification upon thaw. Ground thermal data provides infrastructure planners, industry and regulators an advantage in designing projects, anticipating impacts and planning mitigations. Temperature measurements in boreholes are complimented with distributed measurements of near-surface ground-temperature as well as surface observations suitable for parameterizing land-surface models. This will enable effective evaluation of computer models simulating permafrost thermal regime and ground-ice loss. A high number of sites have been instrumented in order to investigate the influence of topography, surface material, vegetation, and snow cover on permafrost conditions. This will help to better understand the representativeness of results, and more generally, the landscape-scale variation of permafrost characteristics. Accurate surveying with redundant local benchmarks at the measurement sites provides a basis for quantifying surface subsidence and corresponding ground-ice loss over time. This is an important element of understanding longer-term subsurface heat uptake and possible geomorphic changes associated with this. For this project, we have instrumented 43 boreholes of 1 m to 12 m depth with temperature probes and loggers in July 2015. At each site, this is complemented by four distributed measurements of near-surface ground temperature, a description of surface and vegetation characteristics, measurements of soil thermal properties, as well as laser-scanning and terrestrial surveying of the surface. This presentation provides a synopsis of the instrumentation and data handling strategy as well as insight based on the first month of data.

ICE THICKNESS IN THE NORTHWEST PASSAGE

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Recently the feasibility of commercial shipping in the ice-prone Northwest Passage has attracted a lot of attention. However, very little ice thickness information actually exists. We present results of the first-ever airborne electromagnetic ice thickness surveys over the NWP carried out in spring 2011 and 2015 over first-year and multiyear ice. Results show modal thicknesses between 1.8 and 2.0 m in all regions. Mean thicknesses over 3 m and thick, deformed ice were observed over some multiyear ice regimes shown to originate from the Arctic Ocean. Thick ice features more than 100 m wide and thicker than 4 m occurred frequently. There are few other data to compare with to evaluate if the ice of the Northwest Passage has transitioned as other parts of the Arctic have. Although likely thinner than some 20 or more years ago, ice conditions must still be considered severe, and the Canadian Arctic Archipelago may well be considered the last ice refuge of the Arctic. These results have important implications for the prediction of ice break-up and summer ice conditions, and the assessment of sea ice hazards during the summer shipping season.

BUILDING INDIGENOUS YOUTH RESILIENCE THROUGH STRENGTHENING TIES WITH THE LAND AND COMMUNITY: EVALUATION OF A CULTURALLY FOCUSED INTERVENTION IN NAIN, NUNATSIAVUT

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Going Off, Growing Strong (GOGS), Aullak, Sangilivallianginnatuk in Labrador Inuttitut, is a program in Nain, Nunatsiavut designed to build resilience among a group of Inuit youth facing widespread social, cultural and economic change. The overarching goals of the program are to: 1) enhance individual and communal resilience and the wellness of a group of ‘at-risk’ Inuit youth; 2) build social connections between the
youth and other community members; and 3) transmit environmental knowledge, skills and values from experienced harvesters to participating youth. Within a participatory action research framework, we use directed content analysis (DCA) to analyse data collected from semi-structured interviews with family members, teachers and staff associated with GOGS youth participants at the culmination of the first cohort of the program. The qualitative evaluation process, including the structuring of outcome domains, development of interview guides, conduct of interviews and implementation of results was conducted through a collaborative process. Across five developed domains - cultural connectedness, social connectedness, mental and physical wellness, self-esteem and behaviour - respondents reported that the GOGS program had a positive effect on the youth participants in this first cohort. The results have implications for the evaluation of intensive interventions aimed at improving the mental and physical wellbeing of Indigenous youth. Our data highlight the strengths and challenges of the GOGS program and support its proposal as a promising community-based practice.

PIQQUSILIRIVVIK INUNGUINIQ – BECOMING A WHOLE PERSON

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This presentation discusses Piqqusilirivvik, the post-secondary Inuit Cultural Learning Facility in Nunavut offering programs in Clyde River, Baker Lake and Igloolik. Opened in 2011, Piqqusilirivvik is a place of learning excellence that enriches and strengthens Inuit culture and enables students to learn from Elders and to deeply understand Inuit language, values, culture and heritage. Piqqusilirivvik was envisioned with the land as a major teaching environment where learning takes place through observing and doing in an Inuit way with activities that follow the seasons of the year and traditional hunting and gathering patterns. While completing four months of learning in a residential context, the students focus on personal fulfillment and finding direction for their future life paths with Elders providing counseling and guidance. Inunnguiniq is a key concept in the Inuit Qaujimajatuqangit framework of values adopted by the Government of Nunavut. It involves the process of socialization and education described within Inuit cultural contexts. Inunnguiniq involves an Inuit cultural expectation that every child will become capable so that they can be assured of living a good life. Inunnguiniq helps students enrolled in programs at Piqqusilirivvik to learn about respect, by fostering good spirit and serving and providing for family and community. Decision making through consensus is stressed, as is the development of skills through practice and working together for a common cause. Being innovative and resourceful in seeking solutions, and respecting and caring for the land and animals is critical. Students live together as a harmonious group, learning to resolve differences and discovering how to learn by example. Piqqusilirivvik provides many opportunities to talk and listen, not only in formal classroom situations, but also by learning through interactions with Elders during the day and evenings.

SEASONAL AND INTERANNUAL PHYSICAL DYNAMICS OF THE LAST EPISHelf LAKE IN THE CANADIAN ARCTIC

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The recent thinning and loss of rare Arctic epishelf lakes, ice-dammed tidal freshwater layers overlying seawater, has been identified as an indicator of regional climate change. However, the seasonal physical dynamics of epishelf lakes have not previously been studied and factors influencing epishelf lake evolution over various timescales are not well understood. We present a decade long field study of changes of the Milne Fiord epishelf lake, the last deep epishelf lake in the Canadian Arctic. Between 2004 and 2014 water column profiles revealed the lake thinned to 50% of its initial depth (from 18.3 m to 9.3 m), however observations from a multi-year ocean mooring reveal that the depth change was neither linear nor monotonic over time. The depth of the lake varied significantly seasonally, increasing in depth up to 33% (3.3 m) during summer inflow each year, followed by thinning over fall and winter as inflows cease and freshwater drains under the ice shelf. The magnitude of summer depth increase was strongly dependent on the volume of meltwater production, which was highly correlated
to air temperature. Despite the seasonal depth increase, the lake thinned each winter past its minimum depth the previous year. The interannual decrease is strong evidence that the ice dam is thinning and the ice shelf is in a state of negative mass balance from surface and/or basal ablation. As well, the landward edge of the ice shelf, in contact with the epishelf lake, has undergone significant fracturing and retreat, while the seaward edge of the ice shelf has remained relatively stable. The breakup of the inner ice shelf is likely driven, in part, by submarine melting due to the warm water of the epishelf lake, which maintains a year-round subsurface temperature maximum a few degrees above freezing due to the strong salinity stratification under perennial ice cover. The area of the epishelf lake has increased as the ice shelf retreats down fjord, however its total volume has decreased. A rapid drainage event recorded in mid-winter 2011/12, when the lake thinned by >2 m in less than 24 hours, indicates the lake is highly sensitive to episodic changes in the integrity of the ice shelf. At current rates of thinning the epishelf lake will be lost by 2025, but continued breakup of the ice shelf suggests this could occur sooner.

**ATLANTIC WALRUS - THE FORGOTTEN SEAL OF THE CANADIAN ARCTIC**

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Walruses are harvested by Inuit for subsistence purposes throughout much of their range in Canada, Greenland and Alaska. Once widely distributed in the eastern Canadian Arctic, and down the Atlantic coast, the Atlantic walrus population now appears to be restricted mostly to northern Hudson Bay and the Canadian Arctic Archipelago. Their gregarious nature, narrow trophic niche and restricted seasonal distribution make walruses vulnerable to large local takes and environmental changes. Because abundance information is limited, harvest advice has been calculated until now using a simple formula developed data-poor situations, referred to as the Potential Biological Removal (PBR). PBR is easy to calculate and only uses a single abundance estimate to calculate allowable harvests. Harvest levels based on this standard approach pose little risk to conservation, but since resource-users were not included in its development, PBR may also impose a ‘cost’ to hunters in lost harvesting opportunities. Instead, we suggest using state-space models that combine observation data with a process model based on biological principles to describe the dynamics of the population. Uncertainty in both the observation data and the biological model can be included using Bayesian methods. This framework allows us to examine changes in the population trajectory and to evaluate, through simulation, the risk of different harvest strategies. A model fitted to survey and harvest data extending back to 1954 for two walrus stocks in the eastern Canadian Arctic showed that the Hudson Bay-Davis Strait walrus stock declined to a minimum in the early 1990s, but has since recovered, while the Foxe Basin walrus stock has remained stable. To date, harvests of these two stocks have not been limited, but there is international concern regarding their sustainability. The state-space modeling approach suggests that higher harvests than currently reported could be sustained with little risk to conservation (<5%), while estimates of allowable harvests based on PBR would restrict harvesting, imposing a ‘cost of lost harvest opportunity’ to stakeholders.

**“ARCTIC HOTSPOTS”: HOW SEA DUCK AND PELAGIC SEABIRD NUTRIENT SUBSIDIES TRANSFORM COASTAL ISLANDS IN THE EASTERN ARCTIC**

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Energy and nutrient fluxes across ecosystem boundaries can exert profound direct and indirect effects on the dynamics of the recipient systems, especially in nutrient-poor Arctic environments. The protein-rich diet of seabirds brings large amounts of feces-derived nitrogen and phosphorus to aquatic and terrestrial coastal ecosystems, which have implications for primary production, trophic structure, biodiversity, and heavy metal and contaminant biomagnification. The Hudson Bay and Hudson Strait region support internationally
significant populations of pelagic seabirds and sea ducks, particularly thick-billed murres (Uria lomvia) and common eiders (Somateria mollissima). Fundamental ecological knowledge from this region is pertinent to understanding the influence of these birds on coastal islands and their historical connection to the landscape including the establishment and ontogeny of their habitat. From 2013-2015, we sampled over 50 ponds and lakes located across 22 islands in Hudson Bay and Hudson Strait. We have analyzed the water chemistry and diatom assemblages collected from rock substrates located across a gradient of bird-affected and pristine reference lakes. These bioindicators help track the main water chemistry variables (e.g., nutrients, conductivity) distinguishing lakes across the region, as well as identify key taxa associated with bird-impacted lake conditions. In addition to diatom assemblages, $\delta^{15}$N of surface sediments further differentiates sites receiving bird subsidies from reference sites. We analyzed total mercury and metal concentrations within surface sediments to determine whether these differ between bird species and nesting densities. Paleolimnological research, including the analysis of dated sediment cores for aquatic microfossils, sedimentary chlorophyll-a, and stable isotopes has been completed to determine the long-term linkages between seabirds and aquatic food webs. Little is known about the historical connection of seabirds to the Arctic landscape, including the timing since colonization, transformation to a nutrient-rich landscape, and the potential interaction between seabird nutrient subsidies and climate change. This research aims to determine how nutrient contributions obtained from marine ecosystems alter lakes in the Arctic and may enhance production at these sites with longer growing seasons.

FOODBORNE, WATERBORNE, AND ZOONOTIC ENTERIC DISEASE: ECOHEALTH SURVEILLANCE FOR ENVIRONMENTAL HEALTH

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Recent research uncovered the highest rates of self-reported enteric illness (i.e., diarrhea and vomiting) reported in the world to be the Canadian North. Infectious diarrhea and vomiting can be caused by contaminated drinking water (i.e., waterborne disease), contaminated food (i.e., foodborne disease), or person-to-person contact. To reduce the high rates of diarrhea and vomiting in Northern Canada, we must identify these pathogens causing illness to understand what pathogens are responsible for illness and how people contract the illness. The goal of this project is to create a participatory, community-based surveillance system to understand, respond to, and reduce the burden of foodborne and waterborne enteric pathogens in Iqaluit, Nunavut. This information will be important to help understand why rates of diarrhea and vomiting in Northern communities appear to be high. Northern collaborators will contribute to all phases of the research design, data collection, analysis, interpretation, and results dissemination process. The research team will work with Northern partners to use the research results to develop potential public health response options to reduce the high rate of illness. This poster outlines the proposed data collection framework, and an overview of how a transdisciplinary team came together to conduct this research through a systems approach.

ASSESSING CONSERVATION RISKS TO POPULATIONS OF AN ANADROMOUS ARCTIC SALMONID, THE NORTHERN DOLLY VARDEN (SALVELINUS MALMA MALMA), VIA ESTIMATES OF EFFECTIVE AND CENSUS POPULATION SIZES

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Natural populations are currently facing myriad threats to their persistence in a rapidly changing global environment, necessitating conservation strategies that maximize both their preservation in the present and their ability to adapt to future environmental conditions. Demographic and genetic components of extinction are significant threats, and indicators of their severity are the census population size ($N_c$) and the genetically effective population size ($N_e$). The effective population size pertains to losses of genetic variation owing to genetic drift. The census population size, however, is the parameter typically considered in fisheries management scenarios but given the importance of both $N_c$ and $N_e$ to the assessment of the relative risks of extinction due to demographic and genetic factors there has been an increased appreciation for understanding the link between these two parameters. Here, we assessed microsatellite DNA variation in four anadromous northern Dolly Varden (Salvelinus malma malma) populations from Canada’s western Arctic region to (1) examine connectivity and contemporary gene flow (dispersal) (2) estimate contemporary $N_e$ and test for associations with $N_c$ and (3) employ an Approximate Bayesian Computation (ABC) approach to further estimate gene flow patterns and to test for historical reductions in population size. Overall, we found evidence for moderate to large contemporary effective sizes, suggesting that there are no imminent risks associated with genetic stochastic factors that could heighten extinction risk in these populations. Our analyses showed that these populations are currently, and have been in the recent past, strongly isolated from one another and likely have undergone a substantial bottleneck consistent with a founder event associated with post-glacial colonization. Moreover, estimates of contemporary and long-term $N_e$ appear to vary considerably among populations, but could only be marginally be linked with $N_c$ and estimates of the ratio $N_e / N_c$ were generally low (overall $N_e / N_c$ of 0.043). Together, these analyses provide a comprehensive and quantitative assessment of the potential genetic and demographic risk status of Arctic anadromous salmonids and contribute towards a genetic and demographic monitoring program.

**PRODUCTION AND DEGRADATION OF DIMETHYLSULFIDE WITHIN LOWER-TROPHIC LEVEL SYMPAGIC AND PELAGIC POLAR MARINE ECOSYSTEMS: A 1-D MODEL STUDY AT RESOLUTE PASSAGE**

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In polar regions, sea ice provides an important habitat for microalgae. During the spring melt season, primary production at the base of Arctic sea ice plays several key roles in both the sympagic and the pelagic ecosystems. For example, sea ice algae can be a food source for zooplankton, and they can also seed the bloom of phytoplankton in the water column. Ice algal production is also accompanied by the generation of dimethylsulfide (DMS), a climatically-relevant gas that can modify the radiative properties of the atmosphere. To simulate the production, degradation, and emission of DMS over the Arctic Ocean, we have developed a coupled sea ice-ocean lower-trophic level ecosystem-DMS(P) model. In this study, we will present the results of 1-D model experiments conducted for Resolute Passage of Canadian Arctic Archipelago in recent year(s). The topics for discussion will include the model evaluation and model sensitivities to uncertainties in model parameters, observations, and environmental constraints.

**A SOCIAL MEDIA NETWORK AND INTERACTIVE KNOWLEDGE MAPPING PLATFORM FOR THE NORTH: DEVELOPING THE TOOLS NEEDED TO MEANINGFULLY ENGAGE COMMUNITIES IN RESEARCH AND ENVIRONMENTAL STEWARDSHIP**

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The Arctic Eider Society (AES) has been building a collaborative network of Community-Driven Research (CDR) programs that are committed to addressing the environmental, economic and sociocultural issues affecting communities among the overlapping jurisdictions of Nunavut, Nunavik and the Eeyou Marine Region.
in east Hudson Bay. Coordinating research activities, managing data and meaningfully engaging communities across regional boundaries remains a major challenge for northern research networks. To overcome these challenges, the AES is using our expertise and capacity in multi-media and communications to develop a social media network and interactive knowledge mapping platform (IK-MAP) designed with and for northerners. The goal of IK-MAP is to develop a compelling user friendly social network that helps bring together new and existing tools for northerners, and integrates traditional knowledge and scientific research towards action for communications, training, education and environmental stewardship. IK-MAP will be developed in collaboration with communities, scientists, interactive media specialists and our Google Earth partners. The platform aims to provide the tools to support the near-real-time exchange of knowledge between communities, and between communities, researchers and decision-makers, to develop more meaningful and representative environmental stewardship initiatives. IK-MAP will be open source and provide a central place to integrate a wide variety of online tools for the north. Several IK-MAP functionalities will be refined and tailored through an evolving partnership with Carleton University researchers including 1. Participatory mapping tools and an evaluation project working with second year Nunavut Sivuniksavut students and 2. Developing functionalities and further expanding the Inuit siku (sea ice) Atlas Inuktitut terminology resources to allow features including the ability to tag photos, media and comments using Inuit terminology about sea ice ecosystems. A variety of map layers responsive to various devices and northern bandwidths will be available including traditional place names, sea ice imagery, and interactive media including 360 video and the first Google Street View imagery of remote sea ice habitats. IK-MAP will be accessible to non-expert users, will incorporate tools for interpreting results, training hunters in consistent research and monitoring techniques, and will be integrated with lesson plans from our Arctic Sea Ice Educational Package project allowing results and content of IK-MAP to be a key part of culturally relevant lesson plans for northern schools. In summary, the vision of IK-MAP is to provide the tools to integrate a wide range of knowledge towards action for communications, education and developing capacity for communities and stakeholders working together towards environmental stewardship for Hudson Bay and across the Arctic.

**SEASONAL EVOLUTION OF ACTIVE LAYER FORMATION IN SUBARCTIC PEAT PLATEAUX AND IMPLICATIONS FOR DISSOLVED ORGANIC MATTER COMPOSITION AND TRANSFER**

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Peat-accumulating wetlands are ecosystems whose rate of photosynthetic production of organic matter is greater than that of its decomposition, resulting in a build up of soil organic matter that may take centuries to fully decompose. Carbon (C) stocks within these ecosystems are a function of inputs from photosynthesis, and losses from heterotrophic decomposition. Due to the short growing season and overall cold climate of boreal and tundra regions, C has been accumulating within these landscapes, mostly in soil organic matter, since the last glaciation. Climate change, predicted to result in rising temperatures and increased precipitation, has begun to degrade the underlying permafrost of peat plateaux. Hydrologically, permafrost below the active layer acts as an impermeable layer, similar to bedrock, limiting the movement and storage of groundwater to the seasonally thawed active layer. The presence of seasonal ice in the active layer reduces the hydraulic conductivity and available storage capacity, significantly reducing water infiltration, and potentially increasing the occurrence of surface ponding. Accumulated water in surface pools maintains soil moisture levels for longer periods of time, and are often the locations of the deepest thaw depth due to the downward transfer of latent heat aided by the increased thermal conductivity of the peat in the presence of water. Understanding the linkages between the hydrology, the energy balance, and chemical release into surface and groundwater is essential to predicting the response of these landscapes to future climate change. To examine how Northern peatlands are responding to recent warming, two study sites (62° 27' N, 114° 31’ W; 62° 33’ N, 114° 00’ W) outside of Yellowknife, NT, were instrumented between October 2012-October 2013 to monitor groundwater carbon chemistry, ground thermal and moisture regimes, organic matter decomposition rates, and active layer development over an entire summer period. An integral precursor to site-wide degradation,
surface microtopography has been identified as a major determinant in the future evolution of peat plateaux into permafrost-free, bog-like environments. A Biochambers laboratory peat monolith experiment replicating the climatic conditions of a hummock and a depression in the natural system revealed that during the spring freshet while the ground remains frozen, the largely ice-free hummocks function as water contributors to ice-rich depressions, acting as water catchments. This transfer of water aids in the mobilization of DOM from hummocks into depressions, where it potentially accumulates over long time periods and is susceptible to export as the peat plateaux degrade. The accumulation of water in depressions prevents complete freeze-back of the active layer in the winter, allowing microbial activity and DOC production to occur year-round. The formation of supra-permafrost taliks has also been observed as an outcome of trapped heat beneath the seasonally frozen active layer and above the permafrost table, which, over time, may form interconnected subsurface flowpathways for DOM export. As warming commences over time, it is thought that the physical and carbon chemistry characteristics of the degraded portion of the plateaux may act as a proxy for future landscape change.

IDENTIFYING PRIORITIES FOR INTERNATIONAL ARCTIC RESEARCH AND POLICY

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The International Arctic Science Committee (IASC) has organized three forward-looking conferences (1995, 2005, 2015) focused on international and interdisciplinary perspectives for advancing Arctic research cooperation and applications of Arctic knowledge. The 3rd International Conference on Arctic Research Planning (ICARP III) provided a framework to identify Arctic science priorities for the next decade; to coordinate various Arctic research agendas; to inform policy makers, people who live in or near the Arctic and the global community and to build constructive relationships between producers and users of knowledge. ICARP III built on the many comprehensive science plans that exist already and provided a process for integrating priorities for forward-looking, collaborative, interdisciplinary Arctic research and observing. It was an open process, with the opportunity for the Arctic community writ large to contribute to the overall objectives. Several overarching messages that emerged during the year of ICARP III activities were highlighted in the Toyama Conference Statement presented in April 2015 at ASSW. The Statement identified a number of overarching issues for wider discussion (http://www.assw2015.org/program/pdf/ASSW_Conference_Statement_FINAL.pdf). There needs to be a greater sense of urgency among decision-makers and awareness by the general public regarding the global importance of changes taking place in the Arctic. It is also critical to anticipate changes in the Arctic rather than respond to them, but to do this requires sustained observations and improved understanding of local, regional and global processes. The rapidly changing Arctic initiates changes that cascade through the global system impacting weather, commerce and ecosystems in the more temperate regions. Linkages across disciplines, scales, and diverse knowledge systems must be addressed in future research activities. Understanding the vulnerability and resilience of Arctic environments and societies requires increased international scientific cooperation. More effective use must be made of local and traditional knowledge by engaging northern and Indigenous communities in setting priorities, the co-design and co-production of research, and the dissemination of this knowledge. It is essential to build long-term human capacity to support relevant observations and research. Finally, new markets for Arctic resources and associated activities, including trade, tourism and transportation, will likely emerge faster than the necessary infrastructures on land and sea. The final ICARP III Report identifies the most important Arctic research needs and a roadmap for research priorities and partnerships, and will contribute to the proposed International Polar Partnership (IPP).

THE NUNAVUT PERMAFROST DATABANK-CENTRALIZING NUNAVUT PERMAFROST FOR NORTHERN DECISION-MAKING

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The Government of Nunavut’s Climate Change Section is developing a centralized Permafrost Databank
that will house permafrost data for Nunavut by 2016. This databank will make permafrost data, in its various forms, more accessible to practitioners. The major components of the project include collecting permafrost temperature data from various sources (including governments, academia, and industry) and integrating it into an online interface. This databank is being designed for user-friendly accessibility and is intended for Nunavut researchers, government and community decision makers, as well as the general public. Due to the varied formats and sources of data, the databank will be developed as a geo-referenced map, linking to other online forums that contain key permafrost data, publications, or references. This project is not intended to duplicate existing work or databases, but rather to compile and centralize these sources into one centralized location. The Government of Nunavut is in the development phase of this project and welcomes feedback on its design and data sources before the Permafrost Databank is released in 2016.

COMMUNITY ENGAGEMENT IN CAPE DORSET, NUNAVUT: A LESSON IN SHARING CLIMATE CHANGE INFORMATION WITH NUNAVUT COMMUNITIES

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Changes in permafrost stability are greatly affecting Nunavut's communities. Adapting to these impacts is becoming more apparent at the community level. Due to the rocky landscape and poor drainage systems in Cape Dorset, maintaining current infrastructure and planning for future development is proving to be challenging. In the summer of 2015, the Climate Change Section of the Government of Nunavut hosted community climate change engagement activities in Cape Dorset to collect and share information around a map that shows suitability of land based on ground movement. Getting feedback on the map will ultimately ensure that it is developed at a level that is both user-friendly and practical for all. General discussions throughout the week focused on how infrastructure is affected by changing permafrost and how these changes influence current and future development in the community. These activities included meetings, site visits, school activities, and community-wide events and engaged members of the community, including the Hamlet of Cape Dorset, the housing sector, elders, youth, and the general public. The week's activities fostered collaboration between the various groups, and it was encouraging to see information being shared between the research world and practitioners at the municipal and territorial level. Other examples of partnership building including community based practitioners and participating in local radio evenings. These and other engagement activities are an excellent example of different groups coming together to discuss climate change adaptation in unique and engaging methods.

COORDINATION OF MULTI-STAKEHOLDER OBJECTIVES WITH RESPECT TO MARINE RESOURCE MANAGEMENT IN THE INUVIALUIT SETTLEMENT REGION, CANADA

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The use of indicators as a monitoring tool has increased globally within the recent years. Indicators can be an important tools for management of resources, however selection of indicators requires clear management objectives. To ensure efficiency and desired outcomes from monitoring programs, coordination among managing agencies is ideal to reduce cost and increase efficiency, especially in the Arctic. Here, we present the process of coordinating management objectives across all regional managing agencies within the Inuvialuit Settlement Region (ISR). We outline the process of knowledge co-production and the integration of all perspectives at the regional level to develop core objectives to suit multi-agency stakeholders and the local communities. The general steps presented are: (1) concentration of core documents from regional management agencies, (2) identification of priority objectives, and (3) selection of final core objectives through multi-stakeholder meetings. Inclusion of management, communities, science, and industry through the Beaufort Sea Partnership platform allows for multiple perspectives to be incorporated into the generation and validation of core regional objectives. Through literature reviews, and a series of formal and informal meetings, core objectives were identified as priorities for management across co-management agencies. We present this core set of objectives as a step to streamlining monitoring efforts across the ISR, and to select indicators against in future research endeavours.
COMBINED EFFECTS OF OCEAN ACIDIFICATION AND ENHANCED IRRADIENCES ON ARCTIC PHYTOPLANKTON ASSEMBLAGES - WHY DO THEY NOT CARE?

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The Arctic Ocean is one of the regions most prone to on-going ocean acidification (OA) and climate-driven changes, including increased sea surface temperature, sea-ice melt and altered mixing regimes. However, the influence of these changes on Arctic primary productivity, phytoplankton ecology and elemental cycles remains poorly understood. To date, the impact of various environmental stressors on phytoplankton have largely been assessed in isolation, and only limited process-understanding was gained. In order to understand how OA and enhanced irradiances (resulting from sea-ice retreat and increased mixed layer stratification) will alter the species composition, productivity and ecophysiology of Arctic phytoplankton, we conducted two incubation experiments with natural plankton assemblages from Davis Strait (63°N) and Baffin Bay (71°N) during the Arctic-GEOTRACES summer 2015 campaign. Phytoplankton assemblages were exposed to 400 and 1200 µatm pCO2 at both 15% and 35% surface irradiance over two weeks. These incubations were monitored and characterised in terms of phytoplankton growth, nutrient usage, biomass stoichiometry, net primary production (NPP), photophysiology and species composition. Preliminary results indicate that the Subarctic Davis Strait assemblage exhibited light- and CO2-dependent growth rates and NPP, while there were no such differences between treatments in the Arctic Baffin Bay assemblage. The suite of physiological measurements conducted in this study will be exploited to provide a mechanistic understanding of the observed differences between phytoplankton assemblages. Results from our work will provide insight into the resilience of Arctic primary producers to climate-dependent environmental change.

IDENTIFYING HABITAT VARIABLES CRITICAL TO SEASONAL DISTRIBUTION OF BEAUFORT SEA BELUGA WHALES, DELPHINAPTERUS LEUCAS

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Climate change and associated impacts will dramatically affect Arctic marine mammals, as they are particularly vulnerable to changes that are sudden and unidirectional. Due to the large spatial and temporal variability in Arctic environments, many challenges exist in examining physical features and how they drive habitat selection of various Arctic marine species. Beluga whales (Delphinapterus leucas) are an important cetacean species that occupy the circumpolar Arctic year-round and are closely linked to ecological conditions in specific seasons. In the Western Arctic, the Beaufort stock of beluga whales winters in the Bering Sea and migrates to summering areas in the Beaufort Sea and Amundsen Gulf. Sea ice conditions are important determinants of the timing and movement of belugas into the Beaufort Sea and subsequent entry into the Mackenzie River Estuary. The summering aggregation in the estuary is important for the annual subsistence harvest of beluga whales by the Inuvialuit, western Arctic Inuit. As the summer progresses, belugas will shift their distribution offshore, where they are observed to occur widely and randomly. Despite past research and monitoring programs based in the Beaufort Sea region, much of our knowledge on seasonal movement and factors driving beluga habitat use remain unknown. Here we present a collection of work that aims to enhance our knowledge of beluga habitat use by examining environmental variables that significantly influence distribution patterns of belugas during two essential seasons. First, we associate spring conditions of sea ice, bathymetry and turbidity (as a measure of freshwater) with beluga locations along the Mackenzie Shelf. Second, using a model approach, we examine offshore beluga whale selection of late-summer
variables of sea surface temperature, chlorophyll a, bathymetry, and distance to shore. Given the changes to the marine environment associated with a changing climate, industrial development, and increased shipping, it is critical to continue identify important habitats for beluga and maintaining subsistence harvest opportunities. Understanding the importance of species-environment relationships is also underlined by the prediction that climate change will have greater impacts in polar regions and on migratory species.

LOCALLY ACQUIRED ALVEOLAR ECHINOCOCCOSIS IN AN IMMUNOCOMPROMISED PATIENT IN CANADA: CLINICAL PRESENTATION AND EPIDEMIOLOGIC INVESTIGATION

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Echinococcus multilocularis (Em) is a tapeworms commonly distributed in the Northern hemisphere that circulates between wild and domestic canids (fox, coyote and dog) and wild rodents. When its eggs (shed with canid feces) are accidentally ingested by humans, they develop into larvae that reach the liver where they may cause a severe disease (Alveolar Echinococcosis, AE). AE has an incidence of more than 18,000 cases across the world, mostly occurring in China (95%). In Europe the incidence is increasing (150/year), with higher risk for immunocompromised patients that are the first to show clinical signs (only 6mo after infection, vs 5-10 yy in normal patients). AE is rare in North America. Beside the outbreaks in Alaska in the ’50s, and several cases contracted abroad, only 2 cases were reported so far of locally acquired AE infections (1928 in Manitoba, and 1977 in Minnesota, US). Em exists in 3 strains: Asian, European and North American, the latter considered the least pathogenic due to the limited number of cases. In March 2013, a 49 year old from rural west central Alberta woman, kidney transplanted in July 2012, was found with multiple hepatic lesions on imaging. Biopsy demonstrated Em infections, ultimately confirmed by molecular analyses and immunohistochemistry. Patient’s IM serology was positive, but patient pre-transplant serology and donor’s serology negative. On mebendazole/albendazole, the lesions have shown decreased activity. Preliminary molecular results also seemed to suggest that the infection was caused by the European strain of Em, although the patient had no travel history that could explain infection in Europe. Nonetheless, this is consistent with recent data that indicate that the EU strain is common in coyotes and in some dogs in western Canada. Conclusions. AE may prove to be an increasing zoonotic problem in Canada; immunocompromised patients may serve as a sentinel population, to monitor the emergence of this disease.

ICE NUCLEATION MEASUREMENTS OF PARTICLES FROM THE ARCTIC MICROLAYER

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Mixed-phase clouds consist of both supercooled liquid water droplets and ice crystals. The main process by which ice crystals form in a mixed-phase cloud is heterogeneous ice nucleation on ice-nucleating particles (INPs). Hence INPs can affect the properties of clouds and therefore can affect the Earth’s radiative forcing and hydrological cycle. The Arctic is a region of particular interest due to the enhanced warming observed in this region compared to average warming observed globally. The sea-surface microlayer (SML) contains material that could potentially act as INPs. This material could be ejected into the atmosphere through a bubble bursting mechanism and could affect cloud formation. This research aimed to investigate the ice nucleating ability of SML and bulk sea-water samples taken on the Amundsen 2014 campaign. The main conclusions were threefold; 1) most SML and bulk sea-water samples contained ice-active material, 2) for the stations that showed high ice nucleation activity, the INP origin was likely to be biological and 3) for some of the stations that showed high ice nucleation activity, the INP size was between 0.02 μm and 0.2 μm.
DISSOLVED ZINC IN BAFFIN BAY AND THE CANADIAN ARCTIC ARCHIPELAGO

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Zinc is a trace metal micronutrient for marine phytoplankton whose dissolved distribution in the global ocean is highly correlated with silicic acid. Depth profiles of dissolved Zn show low values in surface water driven by biological uptake and elevated concentrations at depth due to remineralization of sinking particulates. While Zn is generally not a limiting nutrient in the marine environment, Zn availability can influence the species composition of marine phytoplankton communities through taxa-dependent variable nutrient demands. Due to its ubiquity in anthropogenic material, Zn is one of the most contamination prone trace elements and therefore Zn can be used as an indicator of appropriately clean practice in sample collection and handling. Here we present dissolved Zn concentrations measured in Baffin Bay and the Canadian Arctic Archipelago during leg 2 of the ArcticNet/GEOTRACES 2015 research cruise onboard the NGCC Amundsen. Depth profiles show surface Zn values are depleted, consistent with biological uptake in surface waters, and concentrations increase with depth. Zinc concentrations in the archipelago display a mid-depth maximum situated near the $\sigma_\theta = 26.5$ isopycnal. Dissolved Zn was higher in water likely of Pacific origin (negative N*, lower salinity) and lower in waters sourced from the Atlantic (positive or near-zero N*, higher salinity). Zn concentrations decrease along isopycnal surfaces as waters are modified flowing eastward through Parry Channel to Lancaster Sound and then toward the North Atlantic via Baffin Bay. Isopycnals shoal along this transit, which supplies Zn to the euphotic zone where it can be taken up by phytoplankton. Conversely Zn concentrations remain relatively stable along isopycnal surfaces in the westward flowing waters on the northern side of Parry Channel. The impact of biological and physical processes within the Canadian Arctic Archipelago on Zn cycling and transport will be discussed as well as the relationship between dissolved Zn and other nutrients such as silicic acid in the context of global average relationships.

LACTATING NORTHERN FUR SEAL FEMALES IN A DECLINING POPULATION COMPROMISE EITHER ON FORAGING EFFICIENCY OR PUP FEEDING RATES DURING THE BREEDING SEASON

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Efficient extraction of energy from the environment is key to the survival and reproductive success of wild animals. Understanding the ratio of energy gained to energy spent of different foraging strategies (i.e., foraging efficiency) can shed light on how animals cope with environmental changes and how it affects population trajectories. I investigated how female foraging strategies during the breeding season impact the foraging efficiencies and reproductive successes of northern fur seals breeding on St. Paul Island, Bering Sea, Alaska. Twenty lactating females of each species were captured and equipped with biologging tags to record GPS locations, depth and tri-axial acceleration. Energy expenditure for each foraging trip was measured using the doubly-labeled water method, and energy gained while foraging was determined from 1) diet composition (scat hard-parts and DNA) and blood C and N stable isotope ratios; and 2) numbers of prey capture attempts (from head acceleration). Fur seal females employed two foraging strategies with very different efficiencies (~1.4 vs ~3.0) that were associated with different foraging habitats.
and diet qualities. Females with the most efficient strategy (3.0) have more energy overhead to allocate to their pups but they also undertook longer foraging trips than the other lower-efficiency group (1.4), and thus fed their pups ~25% less frequently. As a consequence, northern fur seal females from the declining population of St Paul Island had to compromise between the rate of energy acquisition or the frequency of pup feeding on land. Resulting reductions in energy intake or time allocated to nursing pups can ultimately lower survival of young-of-the-year which heavily rely on energy supplied by their mothers during the breeding season.

ONE HEALTH AND ZOONOTIC PARASITES IN THE CANADIAN NORTH - PRIORITIES AND PERCEPTIONS

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One Health can be defined as a coordinated, collaborative, interdisciplinary and cross-sectoral approach that recognizes that the health of humans, animals and ecosystems is intimately connected. One Health practitioners seek to collaboratively address shared challenges to the health of people, domestic animals, and wildlife. One Health is a living concept in Canada’s North, where Inuit are strongly connected to the land and wildlife, and these connections are critical to their health, food security, and culture. However, arctic ecosystems are undergoing marked changes (climatic and anthropogenic) and the direction and routes of transmission of zoonotic diseases are neither static nor clear-cut. I’ll discuss three case studies where animals play different roles in transmission of zoonotic parasites such as Trichinella nativa, Toxoplasma gondii, and Giardia spp. Through these case studies, we will explore challenges in engaging the broader One Health community, and the importance of a balanced risk-benefit approach to zoonotic parasites in the Canadian North. Successful actions within a One Health framework have in common a perception of risk (i.e. perceived threat), there is something practical that can be done about it (perceived feasibility), and there is support from stakeholders at multiple levels (i.e. communities, policy-makers, and researchers). These case studies highlight the challenges and future needs for surveillance, diagnostics, and community-based research at the human/animal/environmental interface in northern and Indigenous communities in Canada.

INUIT PARTICIPATION IN NORTHERN RESEARCH: LEARNING FROM YOUTH INVOLVEMENT IN NANIVARA

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Research in Canada’s North is markedly moving more towards community engagement and ensuring knowledge mobilization, which is fundamental to opportunities for greater education and a sharing in the creation of knowledge. This is particularly important in Nunavut where people under 30 years old make up the majority of the population and where education is perceived as central to resolving many of the current economic and social problems. Studies that imply a focus on community participation, however, often seek out Elders and older community members to act as guides, interpreters and camp cooks. Youth are typically excluded from research activities, specifically those that involve developing the project design, collecting data and analyzing results. The innovative work of Nanivara (I found it): Naujaat/Gjoa Haven History Recovery; a Community Development Project serves to break this pattern of engagement by directly including youth as researchers into their own communities’ histories. By pursuing their own interests in hunting, sewing and language revitalization, the youth in Naujaat and
Gjoa Haven, Nunavut, are actively involved in a truly participatory research process. Drawing on conversations with youth from these communities, insights and understandings concerning where they believe research in Nunavut is required are explored. Their insights and ideas are of relevance to those of all academic disciplines invested in ethical and meaningful Inuit involvement in northern research.

TAKING ARCTIC BIRD CONSERVATION TO LOWER LATITUDES: THE ARCTIC MIGRATORY BIRDS INITIATIVE

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Arctic-breeding birds travel the globe in the course of their annual cycles, and for many species, conservation issues occur outside of the Arctic. We need to look beyond the Arctic regions to ensure a sustainable future for these species. The Arctic Migratory Birds Initiative (AMBI), a project of the Arctic Councils Conservation of Arctic Flora and Fauna working group (CAFF), is designed to improve the conservation status and secure the long-term sustainability of declining Arctic breeding migratory bird populations. The AMBI works along four international flyways to address three major issues affecting arctic migratory birds: habitat loss and degradation, especially of intertidal areas; unsustainable harvest; and marine by-catch. Priority species are identified for each flyway. The AMBI workplan describes specific priority actions that are proposed within each flyway. This presentation will briefly describe the AMBI initiative; action items that are being implemented currently, and collaborative research and conservation opportunities that exist for ArcticNet participants. NOTE TO PROGRAM COMMITTEE: This presentation, along with abstracts submitted by Rob Clay and Amie Black, are intended to form the backbone of an ArcticNet AMBI session. Our vision is to follow the presentations with a facilitated discussion among presenters and session attendees, to answer questions about the AMBI and to generate collaborative opportunities among arctic researchers, and resource managers (including Aboriginal governments and co-management boards).

HARVESTING TO PREVENT HUNGER IN NUNAVIK

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The importance of food insecurity in Inuit communities is now well recognized but informed actions to be taken still require a clear understanding of the status and the determinants of food insecurity at the household, community and regional scales. In Nunavik, a previous study based upon the household Qanuippitaa? How Are We? 2004 public health surveys in Nunavik reported a diversity of community scale food insecurity (as measured by one question asking about a lack of food in the month prior to the survey) levels ranging from 9% to 51%, while the overall regional rate was 24%. Yet, little was revealed about the determinants of food insecurity in Nunavik and their relative importance. Based upon data from the same household questionnaire, in conjunction with the individual questionnaire of the Qanuippitaa? How Are We? 2004 survey, the present study investigates the relative importance of determinants of reported household lack of food in Nunavik using generalized linear mixed models and model selection, based upon information criteria, while accounting for redundancy in explanatory variables. The results provide strong evidence for a negative relationship between a reported household lack of food in the month prior to the survey and a synthetic index positively associated with seasonal harvesting frequencies reported by the household respondent. After controlling for different sources of methodological biases, our analyses did not indicate strong support for other social, economical, demographic and geographic determinants of food insecurity that were hypothesized to explain the pattern of answers within Nunavik communities and households. While often focussing on differences in food insecurity rates between regions, sub-regions or communities, one should not exclude consideration of common underlying causes of food insecurity acting at the household scale, as illustrated here. Nonetheless, due to the complex spatial and temporal dynamics of wildlife ecology and determinants of human-wildlife interactions (i.e. harvesting availability and access), the underlying mechanisms influencing harvesting participation and
success can differ significantly between households, communities and sub-regions and should be taken into account.

**MOBILIZING INUIT QAUJIMAJATUQANGIT IN NARWHAL MANAGEMENT THROUGH COMMUNITY EMPOWERMENT: A CASE STUDY IN NAUJAAT, NUNAVUT**

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This research examines the relationship between government regulations and the use of Inuit Qaujimajatuqangit (IQ) through a case study focusing on narwhal harvesting in the community of Naujaat, Nunavut. Since Fisheries and Oceans Canada (DFO) introduced a community quota system in 1977, the responsibility for hunting management decision-making has shifted to government (specifically, DFO), rather than hunting communities. This shift corresponds with changes in the use of IQ within the community. Interviews with relevant individuals in Naujaat (including hunters, elders, and representatives from the Hunters and Trappers Organization) were conducted to provide insight into the nature of these changes, allowing the relationship between government-based management policies and community perspectives to be characterized. The findings are used to identify opportunities for improving the relationship between community use of IQ and government management programs, culminating in specific recommendations for the relevant management bodies in Nunavut. These recommendations can enhance the fisheries management regime in Naujaat through better understanding of best practices for inclusion of Inuit priorities and Inuit participation in the management process. This research is part of the SSHRC-funded Fisheries - Western and Indigenous Knowledge Systems (Fish-WIKS) partnership project, which aims to understand the relationship between western and indigenous knowledge systems in the context of Canadian fisheries policy.

**FIELD OBSERVATIONS OF ACTIVE LAYER THAW DEPTH IN THE CONTINUOUS PERMAFROST ZONE OF THE CANADIAN ARCTIC**

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Temporal and spatial patterns of active layer thaw depth were measured during the 2015 thaw period at a small test basin in the Canadian arctic. Measurements were obtained at eight creek hill slope transects and two tundra site grids within the Siksiik Creek Basin located 45 km north of Inuvik within the Beaufort-Mackenzie Delta Region in the Northwest Territories. The landscape is characterized by a microtopography of mineral silt and clay hummocks divided by organic interhummock channels which are underlain with continuous permafrost. Thawing of the active layer occurs annually in the spring and continues into early fall. Field observations obtained in this study show a high degree of spatial and temporal variation in thaw depth across the basin. Thaw depth was significantly deeper in the hummock areas than in the adjacent highly organic interhummock areas and thus correlates to soil type. Variations in thaw depth >50 cm were observed over distances <5 cm indicating a highly heterogeneous distribution of thaw which makes drainage estimation difficult. Observations from this study are used to inform the development of improved hydrological prediction techniques and contribute to the understanding of controls on active layer thaw in continuous permafrost environments.

**TRACKING BIODIVERSITY AND CLIMATE CHANGE IN YUKON’S ARCTIC: A STANDARDIZED VEGETATION CLASSIFICATION FOR THE TOOLKIT**

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A standardized vegetation classification provides scientists and stakeholders with an ecological framework for communication of study results and ecological observations on the land. The Yukon Government is developing an arctic vegetation classification, to be integrated into the Canadian National Vegetation Classification (CNVC), that incorporates ecological ground plot data collected across the low arctic. The classification draws on a harmonized classification database constructed during International Polar Year (2007-2011), which includes data from over 3,000 complete vegetation plots sampled in the western arctic over the past five decades. The classification process has involved collaboration with colleagues in Alaska and Canada and a peer review. There are 44 new arctic vegetation associations proposed for the CNVC, with descriptions of related site, soil and vegetation characteristics. The western arctic vegetation classification is a valuable tool for researchers and land managers to organize ecological knowledge and is an integral component of ecosystem mapping currently underway on the Yukon North Slope. Researchers investigating biodiversity and vegetation change in the western arctic may incorporate these standardized vegetation associations to report results.

**SEABED STABILITY ON THE BEAUFORT SLOPE: SEDIMENT GEOTECHNICAL CHARACTERIZATION AND GEOLOGIC CONTEXT**

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A program of geotechnical sediment piston core sampling focusing on slope stability was spurred by recognition, from a suite of data types, of ubiquitous marine landslides (many large), seabed expressions of fluid and gas overpressures, and glacial sedimentation pulses. Improved distribution, magnitude and frequency toward prediction of such failures by the GSC-A is facilitated by the ArcticNet Seabed Mapping Program (continuation under P. Lajeunesse, Laval) and with significant hydrocarbon industry and private sector collaboration together with support from other government departments. Sixteen cores (<8 m long) were collected during CCGS Amundsen 2009-14 programs and a 14m core from a 2013 USCGS Healy expedition. Cores targeted un-failed (parent) sediments, deeply failed scar floors, previously failed deposits and fluid or permafrost-affected glacial and post-glacial sediments. The geotechnical analyses (tabulated and graphically presented) are combined with geological analyses and a seismo-stratigraphic - morphologic setting in a GIS-based geotechnical database. In general, the sediments on the Beaufort Slope are high plasticity clays (CH) with compression index ranging from 0.40 to 0.63. The normalized strength ratio is 0.25. Consolidation tests indicate the sediments show apparent overconsolidation in the upper 2 m and normal consolidation to 8 m. Significant overconsolidation is only recognized in one core with exhumation at the base of a deep slide scar. An example of underconsolidation arises from a de-glacial sedimentation blanket at the mouth of Mackenzie Trough (13.5m sub-seabed, 665m water depth). The sequence comprises a late-glacial (ice distal) blanket burying a much thicker unit thought to represent a period of heightened efflux, possibly from a more nearby glacier margin. This mud sequence continues well beyond the shelf break where it is also analysed at a deep site (355 sub-seabed, 1536m water depth). The surficial units are similar thickness at both sites but the underlying unit is twice the thickness at the deep site. The deep water site yields normal consolidation (slight apparent overconsolidation). However, the core only reaches to ¼ the stratigraphic depth of the shallower water site. The shallow site, situated on near flat-lying seabed, penetrates close to or into the thick unit and represents the oldest (non-failed) of all analysed sediments. It yields underconsolidated values below 9m. Infinite slope equilibrium analysis suggests that the sediments are statically stable on slopes with angles of < 6° (thus unstable at steeper slopes and/or thicker burial). Indeed, mass failures are common where the same sediment sequence lies on slopes steeper than this in deeper water areas to the north. It is possible that the deeper-buried glacial sediment was pre-conditioned for failure susceptibility. This is further corroborated with regional observations from seismic profiles that this unit has failed frequently elsewhere. Significant challenges remain. The most failure susceptible sediments (30-40m below seabed) are generally inaccessible to piston coring. While pre-conditioning for failure may result from rapid glacier-fed deposition and burial, a sedimentological, chronological framework needs improvement. Later influence of migrating gas and fluids from multiple sources is not yet directly tied to failures, and their triggering, presumably through seismicity, lacks basic tectonic and geometric understanding.
LATE GLACIATION IN THE EASTERN BEAUFORT SEA: CONTRASTS IN SHALLOW DEPOSITIONAL STYLES FROM AMUNDSEN GULF, BANKS ISLAND SHELF AND M’CLURE STRAIT

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Amundsen Gulf and M’Clure Strait were the major glacial outlets to the Beaufort Sea. Amundsen Gulf has abundant shallow (3.5kHz) sub-bottom profiler coverage, yet the first sub-bottom coverage in M’Clure Strait was collected by ArcticNet Seabed Mapping Program (P. Lajeunesse, Laval) in 2015. Though coverage is sparse, supplemented with 2011 USCG Healy data there and across the Banks Island Shelf, it allows a preliminary insight into the latest glacial events. Recent land-based and short marine core work allows inference of a Last Glacial Maximum (LGM) reaching the shelf break at both trough mouths and a deglacial event chronology; absolute chronology is yet available for LGM deposits. Beyond the shelf break, the depositional record was largely lost through mass failures. Shelf-based stratigraphy and geometry of tills and till-like blankets, slope-based glaciogenic debris flows (GDFs), iceberg turbates and stratified glacimarine mud blankets allow initial deciphering of glacier extent, direction, and margin dynamics. Amundsen Trough mouth has a single thin till-like blanket, GDF time equivalents on the slope and a complex younger sequence of tills and flow tills on the trough flanks (>50m thick), locally interbedded with stratified glacimarine muds. More than ten stacked till-like units along the southern flank (far fewer on the northern), represent a combination of basal till, lateral moraines, ice stream flank erosional remnants and ice-margin deposits recording frontal fluctuations punctuated with plume sedimentation. The mid- to inner Banks Island Shelf has a sea-level low-stand constrained terrace at 40-50 m depth built up to 50m thick. It comprises crudely prograding (0.5° to 1°) and locally channelized glacially-derived muds, with basal-transgressive and sub-littoral components. Seaward, is a thick (20+m), structurally complex stratified glacimarine blanket, fully iceberg turbated on its upper surface and with local buried morainic mounds or megascalar glacial lineations (MSGLs). Its outermost margin has flutes and ice-marginal flow tills. This and an erosion bench demonstrate broad splaying of both Amundsen and M’Clure ice streams across the bank. Direct glacial deposition from island-based ice is still in question. The M’Clure trough floor exhibits a smooth, broadly uniform surface interpreted as the glacial erosional surface (GES) unconformity sculpted by the last ice sheet. Three stratigraphically different facies overly the GES: 1. The lower is acoustically attenuating and has a constructional geometry suggesting a moraine-like or MSGL origin, similar to Amundsen Gulf, but thinner and with little till-stacking. This, and sparse GDFs on the slope, indicate a short-lived shelf-break position and simple retreat pattern. 2. Overlying this is a thin, near-continuous blanket forming the surficial unit. Only in the deepest basins, below 520m (shallower westward) does otherwise ubiquitous iceberg scouring abate, revealing the originally stratified blanket. This enables its differentiation from till. It is a glacimarine mud, deposited from plumes with ice-stream calving and retreat, completely turbated by icebergs. 3. Locally, and the thickest of all, (0-30m) are mounded deposits with acoustically transparent and homogeneous character, post-dating the main calving event. Their geometry and stratigraphic position suggests very late stage, localized and rapid deposition but a meltwater versus glacial re-advance is not yet clear.

TUHTU AND CLIMATE CHANGE: INUIT HUNTING ON SOUTHERN BAFFIN ISLAND

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Up to this point there has been relatively little research that has examined human-caribou interactions in the context of multiple stresses. Previously the focus of management studies has been on the co-management structures and their function. By addressing community interactions with caribou on Southern Baffin Island in the context of changing access, climate-driven caribou population changes, and a number of management frameworks and institutions, this study aims to develop a baseline understanding of the sustainability of caribou harvesting in the Iqaluit region. Drawing attention to caribou as a major source of country food, and one of the Arctic species that will potentially be profoundly impacted by climate change, the study will be a resource for land-use planners and policy-makers on the importance of preserving biodiversity and sustainable northern ecosystems from ecological, cultural and food security perspectives. This study will help to refocus attention on sustainable harvesting and co-management as a key adaptation and resiliency strategy in the face of a rapidly developing climate.
changing Arctic. The presentation will discuss some of the findings from this ongoing study of the caribou-human relationship based around Iqaluit, Nunavut. Working closely with community members, and building upon over 6-years of previous research in Iqaluit, this research examines how hunters are adapting their behaviors to changing access to harvest areas and variations in caribou populations. This will be considered against the backdrop of adaptive changes within the territorial institutions and organizations that are engaged in wildlife management.

TEMPORAL AND SPATIAL VARIATIONS IN COASTAL DYNAMICS AND THEIR CONTRIBUTION TO LAND LOSSES ALONG THE YUKON COAST, CANADA

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The Arctic is warming. This results in longer open-water periods during which waves can interact with the shore, and extends the duration in which the land and the sea are exposed to positive temperatures. Increasing active layer depths compound the effectiveness of wave action on the coast that is often composed of ice-bound and fine-grained sediments. As permafrost soils contain approximately twice as much carbon as is currently circulating in our atmosphere, the Arctic is one of the key areas requiring study to better understand global climate change processes. Due to the fact that permafrost coasts make up one third of the World’s coasts, their dynamics are of particular interest. We investigated spatio-temporal shoreline dynamics of the Yukon Coast which is characterized by very ice-rich soils and a variety of coastal landforms. Over one hundred aerial photographs from the 1950’s, the 1970’s, and the 1990’s were georeferenced on the base of GeoEye and WorldView satellite imagery from 2011. By digitizing the shoreline for each time step and performing analyses using the Esri ArcGIS extension DSAS (Digital shoreline analysis system), we classified regions according to their rate and variability of coastal erosion. Some regions are very dynamic, showing phases of fast acceleration and deceleration of coastal retreat, others appear to be very stable with little change through time. Such regions may be directly adjacent. By coupling these spatial coastal dynamics data with LiDAR (Light Detection And Ranging) data from 2012 and 2013, we calculated the volumetric erosion along the Yukon coast. Additionally, we investigated infrared theodolite and real time kinematic GPS measurements from eight coastal monitoring sites maintained by the Geological Survey of Canada, covering the last 20 years. Together, these data allow us to measure coastal evolution over the last 60 years. The temporally better resolved ground survey data indicates that coastal erosion rates, in general, show a decelerating trend over the last 20 years. However, within the last three years rates of coastal erosion along some sites (e.g. the Yukon-Alaskan Border and Stokes Point West) are increasing at unprecedented rates up to 18 m/a. These first results will help to quantify the amount of carbon released by coastal erosion along the Yukon coast and identify the contribution of coastal processes operating along the Yukon coast to regional and global nutrient cycles.

EMERGING MUSKOX HEALTH ISSUES IN THE CANADIAN ARCTIC: AN INTEGRATIVE APPROACH TO ASSESSMENT AND MANAGEMENT


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Author note to scientific committee: This paper is intended to provide an overview of results to date from our ArcticNet funded program ‘Monitoring and managing muskox health for food security and ecosystem
and socio-economic resilience: integrating traditional, local, and scientific knowledge'. This is a large and multi-disciplinary project with several components that will be impossible to cover in a regular 15 minute time slot. If accepted, would it be possible to be allocated a double slot in the program to present this research? I know this is a big and unusual request, but we feel that this is the best way to present this work this year. Abstract: Muskoxen are integral to the culture, food system, economy, and ecosystem health in the Arctic. In recent years, emergence and range expansion of lungworms, together with widespread mortalities of muskoxen on Victoria and Banks Islands and concomitant population declines, have raised concerns about the health and sustainability of these animals. Additionally, this decline in muskox health and abundance has had socio-economic impacts and is contributing to ongoing food safety and food insecurity concerns across the Canadian North. Since 2008, we have worked within a multi-disciplinary team and used a combination of local, traditional, and scientific knowledge, to advance our understanding of muskox health and resilience. Through this work we have begun to (i) establish baselines for muskox health, including infectious disease, contaminants, genetics, and stress, (ii) identified and tracked the invasion and expansion of lungworms, (iii) characterized an emerging zoonotic bacterium, Erysipelothrix rhusiopathiae, that has been associated with multiple unusual mortality events for muskoxen, (iv) documented local knowledge on muskox health and changes in health, including zoonotic pathogens and shifting population trends, (v) developed new diagnostic tests for detecting disease exposure, (vi) and established the initial framework for muskox health surveillance program that integrates multiple knowledge systems. Our team includes beneficiaries, community residents, local organizations, outfitters, and wildlife co-management agencies of the Inuvialuit and Kitikmeot regions, as well as a multidisciplinary team of academics. Our work aims to collaboratively evaluate and monitor the health of muskoxen, understand their resilience to change, and use this information to pro-actively inform wildlife management, public health, and land-use policy and decisions.

REGULAR VETERINARY SERVICES PROVIDE A PATHWAY TOWARDS IMPROVED HUMAN AND ANIMAL HEALTH AND WELFARE IN REMOTE REGIONS OF THE CANADIAN NORTH

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Dog health, welfare, and overpopulation, are increasingly recognized as important issues influencing the social and physical health of people in remote and marginalized communities of developed nations. In the Canadian Arctic, the role of dogs is in a state of transition from a history of working animals to 'companion animals', yet in many cases the local experience and knowledge on care and welfare of dogs in this new role is limited. This, together with minimal or no access to veterinary services and animal husbandry education, has lead to significant issues regarding dog welfare, dog population control methods, and dog-related health (zoonoses) and safety (dog attacks) of people in remote regions. In response to community concerns, in 2008, we began a program to deliver veterinary services to isolated communities of the Sahtu Settlement Region, NWT, Canada. The program is a collaborative effort among communities, local schools, government, and the Faculty of Veterinary Medicine, University of Calgary and includes regular service delivery as well as a substantial youth education and participation component and training of future veterinarians. Initial uptake of services was low due to a variety of social and cultural barriers, but has increased substantially. From 2008-2012 the number of dogs brought to clinics doubled and the number of clients tripled. We have observed substantial improvements in a variety of health indicators for dogs over this time period, including vaccination status, sterilization rates, male:female ratio, and body condition. Importantly, there has been a noticeable shift in attitudes, a stronger human-animal bond observed, and grass-roots community support of the clinics has grown substantially. Our goal is to establish a mechanism for ensuring long term, regular, preventative veterinary care and animal and public health education in a
sustainable manner. The implementation of the program, along with the political, social, economic, and cultural facilitators and barriers, will be discussed.

**WINTER ESTUARINE PROCESSES IN THE COASTAL CORRIDOR IN SOUTHEAST HUDSON BAY AND EFFECTS OF ENVIRONMENTAL CHANGE**

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Arctic double estuaries are considered to be uniquely sensitive to environmental change because of sensitivity to both ice and ocean processes, and to the quantity and distribution of freshwater. The coastal corridor in southeast Hudson Bay is a prominent double estuary, which may have been impacted by changes in river runoff due to hydroelectric development (Nelson River, La Grande Complex) and/or by climate-related changes in recent decades, such as a longer open water season in Hudson Bay. In summer, the coastal corridor is the key transporter of freshwater from major source areas (rivers) in southern Hudson Bay and James Bay, northward to Hudson Strait. In winter, the annual ice cover is formed and ice also grows rapidly in regions of recurring open water (polynyas, flaw leads). Ice production withdraws freshwater and leaves behind enhanced amounts of brine, causing the system to act as a “negative” estuary (waters become denser by cooling and the addition of salt). These processes generally deepen the pycnocline throughout the winter and continually increase the salinity of the surface-mixed layer while keeping its temperature at freezing. In 2015, studies were initiated under ArcticNet in partnership with community researchers and the Arctic Eider Society to begin developing an understanding of how the interactions between river runoff, ocean upwelling and sea ice modify water masses and circulation in southeast Hudson Bay. In this presentation, new preliminary data are presented and compared to observations collected in the late 1970s, which represented 'natural conditions', prior to hydroelectric development of the La Grande Complex, and to predictions that were made concerning possible impacts on the marine environment from the development. Additional oceanographic data that extend into winter and into brackish James Bay are crucial for developing an understanding of the functioning of the double estuary in this region in this time of ongoing environmental change.

**ADAPTATION READINESS AND THE BIG PICTURE IN NUNAVUT: AN EVALUATION OF THE CURRENT STATE OF ADAPTATION, ITS KEY LINKAGES AND BARRIERS**

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It is well known that Arctic regions are presently experiencing some of the most significant climatic changes and expected future impacts. This has resulted in an increasing recognition that adaptation will be unavoidable. There is evidence that adaptation is underway in some northern regions, but despite this there is little known on actual experiences with planning for adaptation or attempts to characterize whether human systems are adequately prepared and ‘ready’ to adapt. All levels of government, the private sector and Non-Governmental Organization decision-makers, researchers, and practitioners are increasingly interested in what factors are essential for adaptation to take place and whether their institutions, planning, policy processes and governance structures are adequately structured and prepared to facilitate adaptation. To address these concerns, we characterize and evaluate adaptation readiness in the northern Canadian territory of Nunavut to create a big picture understanding of the adaptation landscapes across scales and locations. In doing so, we also ask: What are the key linkages facilitating adaptation? What interactions are occurring across multiple scales? What are the key barriers preventing adaptation from occurring and how might these be overcome as Nunavut moves forward? To evaluate the adaptation landscape in Nunavut, we empirically apply the Ford and King (2015) Adaptation Readiness Framework at the community, territorial and national scale and assess seven overarching factors we believe are necessary for adaptation to take place: political leadership, institutional organization, decision-making, stakeholder engagement and public support, usable science, Inuit Qaujimajatuqangit, and funding. Key informant interviews (n=50) were conducted with various government and other important stakeholder
organizations from the national, territorial and selected community levels and analyzed within the framework. The results will highlight a multi-scalar picture of key linkages and barriers to successful adaptation, identify areas of prioritization and where adaptation is lacking and discuss status of adaptation readiness overall. This information can be used to inform decision-making surrounding policy creation and planning for adaptation in Nunavut, as well as guide resources to most needed areas and highlight potential areas of maladaptation.

INTERNATIONALISM VERSUS NATIONALISM: THE ARCTIC AND CHINA’S MARITIME POLICY

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China is not an Arctic country, but it is so important to Arctic affairs that it was admitted into the Arctic Council as an observer in 2013. This recognition is a reflection of the extent of China’s economic success since Deng Xiaoping’s market-oriented economic reform in the late 1970s. This reform put an end to Maoist isolationism and brought China back into the international community, in addition to bringing China and the rest of the world tremendous benefits through international collaborations. Among these collaborations was China’s commitment to Antarctic affairs, which it demonstrated by joining the Antarctic Treaty System in 1983 and which paved the way to its commitment to Arctic affairs in the late 1990s. Nonetheless, the original driving force behind China’s polar explorations was nationalism. This is the force that gave birth to modern China, while also resulting in many territorial disputes. Among the significant disputes are those in the East and South China Seas, which may ignite an unwanted conflict between China and the United States. China’s maritime policy, which covers its Arctic and Antarctic policies, is therefore inconsistent: it is based on nationalism in its neighbouring seas but on internationalism elsewhere, especially in the Arctic and Antarctic. As China has significant stakes in Arctic affairs yet is not Arctic country, its engagement in the international governance of the Arctic is an opportunity for China to find other approaches to solving territorial disputes through close observation of the international governance process. The Arctic Council is therefore a platform that may facilitate future planning of China’s maritime policy.

INUIT CULTURE AND EDUCATION IN ULUKHAKTOK, NWT

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There is a longstanding desire among Inuit and some northern educators to better integrate Inuit culture and modes of learning in education. At present, efforts to include Inuit culture in education can be described as ad hoc or add-ons to a Euro-North American schooling system, which puts many Inuit in internal conflict trying to live according to two value systems that in some ways contradict themselves. Inuit leaders and education decision makers recognize the need to make formal education relevant to Inuit students. Several attempts have been made to better represent Inuit culture and modes of learning in education. However, there is a need for an Inuit-led response to the desired aspects and modes of learning to be included in the formal education system. The proposed research seeks Identify what aspects of culture and modes of learning Inuit desire to have included in education and examine how these are, represented in the formal education system in Ulukhaktok, NWT. The aim will be accomplished through three objectives: (1) Identify what aspects of culture and modes of learning Inuit desire to have included in education; (2) Document and describe strategies that are currently in use to try and represent Inuit culture and modes of learning in education; and (3) Compare findings and identify opportunities for to contribute to current educational renewal efforts in Ulukhaktok and the NWT. The research will be conducted in partnership with community members in Ulukhaktok, NWT following recommendations for community-researcher relationships outlined by ITK and community protocols. Data will be collected using surveys, semi-structured interviews and focus groups with community members, educators and Inuit students at Helen Kalvak Elihakvik (school). The research is part of ArcticNet Project 1.1 Community Adaptation and IK-ADAPT (Inuit Traditional Knowledge for Adaptation to the Health Effects of Climate Change) supported by CIHR).
USING NON-INVASIVE REMOTE SENSING TECHNOLOGIES TO DOCUMENT AND MONITOR SURFACE AND SUBSURFACE CHANGES TO FROZEN ARCTIC ARCHAEOLOGICAL SITES: A CASE STUDY FROM SOUTHERN BAFFIN ISLAND, NU

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Since 2013, we have tested the effectiveness of using non-invasive remote sensing technologies to document and monitor surface and near-surface phenomena at several complex prehistoric hunter-gatherer sites located in the interior of southern Baffin Island. Based on our results, we aim to develop a multi-component survey methodology that can be used to measure annual surface slumping, frost-cracking, and erosion on these sites. Arctic archaeological sites yield some of the most ideal conditions for preserving delicate organic artifacts made of bone, ivory, antler, and soft tissues. However, as climate change impacts intensify, the permafrost that has encased these perishable artifacts is now failing, leaving them as well as artifacts in the overlying active layer, susceptible to irreparable damage and loss of information. Using a combination of terrestrial lidar, ground penetrating radar, and magnetometry, we are able to measure surface changes as an indicator of how extensive subsurface permafrost degradation might be within a site, and therefore decide how to effectively record and excavate those areas most at-risk. This paper discusses the development of our survey methodology, the challenges we have encountered with various applications, and our plans for future use on Baffin Island.

MONITORING ENVIRONMENTAL CHANGE IN THE MACKENZIE DELTA REGION: LOCAL OBSERVATIONS AND PARTICIPATORY MULTIMEDIA MAPPING

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The Mackenzie Delta Region is a dynamic environment that is ecologically and culturally significant. This area is experiencing environmental changes that are expected to increase in magnitude with continued climate warming and additional anthropogenic stressors. In some areas changes are occurring so rapidly that maintaining an accurate inventory presents a significant challenge. Inuvialuit and Gwich’in land users in the region are in an excellent position to assess ongoing changes in the environment and contribute to long-term monitoring. The central objective of this research is to document Inuvialuit and Gwich’in observations of the environment. To accomplish this, we combine participatory photography and video with semi-structured interviews that focus on participants’ knowledge of the land. Participant observations, photos, videos, and interviews are organized into web-based maps maintained by the University of Victoria (https://gwichin.knowledgekeeper.ca and https://inuvialuit.knowledgekeeper.ca/). Between 2010 and 2015, we have worked with 70 monitors to record observations across Inuvialuit and Gwich’in territories. In the first four years of the project, monitors highlighted a number of environmental changes including: sites of permafrost degradation, changes to fish habitat, altered weather patterns, declines in muskrat populations, altered hydrological conditions, and the effects of human disturbances on terrestrial ecosystems. During the past two years, program activities have focused on specific research priorities identified by program monitors. In one of these projects, we assessed the cumulative effects of environmental change on wildlife harvesting by conducting 20 semi-structured interviews with land-users from the communities of Aklavik, Inuvik, and Tuktoyaktuk. Interviewees were asked to describe the impact of a variety of different environmental perturbations on hunting and trapping in the region, and consistently indicated that wildlife harvesting is being impacted by both climate change-related and human-caused disturbances. In another project we explored muskrat habitat and population dynamics in the Mackenzie Delta by conducting 10 interviews with
land users involved in muskrat harvesting. Preliminary analysis of our interviews suggests that water levels and spring flooding strongly influence muskrat populations, but indicate that changes in muskrat populations have not occurred in all areas of the Delta. Our experiences to date show that monitoring programs built around local observations linked to geo-referenced multimedia significantly improve our capacity to detect the impacts of environmental change. These initiatives also contribute to northern planning and decision-making and guide research by identifying key areas or topics for further study.

FEASIBILITY AND PRELIMINARY OPTIONS FOR AN INTERNATIONAL NORTH POLE SCIENCE STATION

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After a brief review of the political and scientific rationale for international cooperation at the North Pole, we discuss the feasibility of setting up a collaborative and cross-disciplinary scientific station at the pole, for monitoring and to support research given the rapidly changing environmental conditions. We also explore qualitatively engineering options for implementation and suggest avenues for gathering national and international support for the creation of a North Polar scientific station.

NATIONAL COORDINATION OF THE POLAR DATA MANAGEMENT COMMUNITY IN CANADA

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As the importance of data and their proper management are increasingly recognized, the Canadian polar data community has grown in size, capability, and complexity. As a result, the need has grown to identify and connect the various organizations which produce, steward, and support polar data in Canada. In May 2015, a Canadian Polar Data Workshop was held in Ottawa, Ontario to facilitate conversation between the variety of groups involved in Arctic and Antarctic data management and to present options for coordination of our activities. The Workshop agenda was crowd-sourced through a six-week national consultation on polar data, in the form of an online survey answered by individuals from 30 organizations. The Workshop was attended by 44 people, and 6 additional individuals joined remotely. Presentations were made on data management topics and challenges, including data sharing, access, preservation, interoperability, policy, funding, and partnerships. In addition, national coordination and contributions to the international polar data community were discussed at length. The primary outcomes are creation of a report on the Workshop and the landscape of polar data activities in Canada, new opportunities for networking and collaboration, and a position paper representing the views of the community and significant issues. One partnership strengthened by the Workshop deliberations is the Canadian Consortium for Arctic Data Interoperability, CCADI, whose members are actively working on new proposals and collaborations to build an Arctic data sharing network in Canada. The position paper, once approved by the community, will be actively shared with government agencies, academia, northern Canadian organizations, funding bodies, and other stakeholder groups with connections to or responsibility for management of polar data in Canada. The long-term goal is to design and implement, through consensus of the participants, a national management plan and structure for coordination of our activities and systems. Through this new structure, links within Canada and internationally will be established to create a robust technical infrastructure and human network for optimal stewardship of Canada’s polar data resources. The model to be established will take lessons from the successes of other data communities and will ideally serve as an example of good practice for other sources and repositories of scientific data.

COUPLED TERRESTRIAL-AQUATIC CLIMATE IMPACTS ON THE WATERSHED OF THE HIGH ARCTIC’S GREAT LAKE (LAKE HAZEN, NUNAVUT)

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The Arctic is undergoing rapid climate change as demonstrated by increasing air temperatures, changes in precipitation patterns, permafrost degradation, and decreased sea ice extent and thickness. However, the impacts of this changing climate on Arctic lakes, especially larger lakes, are not well understood. Lake Hazen is the largest lake (by volume) north of the Arctic Circle and integrates a large watershed that is extensively glaciated. Because of its large size, Lake Hazen may be less sensitive, or slower to respond, to climate change compared to smaller lakes. We will present data on various physical, chemical and biological parameters, spanning ~15 years for observational data and ~100+ years for paleolimnological data, to determine how, and to what extent, climate change is impacting Lake Hazen and its watershed. We will show that the lake and its catchment are experiencing concerted changes that link that the various components of the watershed. Recent warming and temperature increases have been observed in air, glacier ice-surface, soil active layer and lake surface water. This warming has resulted in the mass-balance of glaciers within the watershed to switch from net accumulation to net loss, which in turn has dramatically altered lake hydrology and the delivery of sediments to the lake. For example lake water levels are significantly higher post-2007 compared with the previous decade, and discharge at the lake outflow has increased by a factor of four, on average, over the same time period. Sedimentation rates have increased by an order in magnitude in parallel to these changes, accompanied by a shift in sediment geochemistry. Lake ice cover is also decreasing, and the occurrence of ice-free conditions is becoming more frequent. The lake sediment record shows that the longer-term trend of decreasing ice cover, and increasing growing season length, has profoundly altered algal communities within the lake. These changes have important implications for in-lake processes that pertain to ecosystem productivity, and the cycling of carbon, nutrient and contaminants. Finally, these results demonstrate that even more resilient ecosystems such as very large lakes are exhibiting regime shifts and entering new ecological states.

DYNAMICS AND PERSISTENCE OF RABIES IN THE CANADIAN ARCTIC


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Rabies persists throughout the circumpolar Arctic and infections pose an ongoing threat to the health of people and domestic animals in the North. The Arctic fox (Vulpes lagopus) is the primary reservoir for rabies in the Arctic, and a major pathway to human exposure is the behaviour of rabid foxes attacking and infecting domestic dogs, which in turn may bite and infect people. Each year in the communities of the Canadian Arctic, contact with rabid foxes and cases of dog aggression result in expensive interventions to prevent possible threat to human health and further spread of rabies. Little is known about the epidemiology of this zoonosis but rapid anthropogenic changes occurring in this region (e.g. resource development and climate warming) may act to
increase exposure and spread. This study explores the dynamics of rabies in the Arctic fox across the Canadian Arctic using spatial and temporal modelling approaches to: 1) identify factors underlying the transmission and persistence of rabies in Arctic foxes, 2) explore how rabies dynamics may be affected by anthropogenic changes (climate warming and northern development) occurring in Arctic ecosystems, and 3) provide new tools to predict the timing and spread of outbreaks and assess surveillance and control strategies. We argue that a mathematical modeling approach is useful for understanding complex dynamics of rabies risk exposure along the interface between wildlife, domestic animals, and people.

SPATIALLY EXPLICIT MODELLING OF SHRUB EXPANSION IN UMIUJAQ, NUNAVIK

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Global warming has caused a sudden increase in shrub cover and growth in tundra ecosystems during the last decades. This seemingly circumpolar shrubification process has been observed throughout northern North America, Scandinavia and Siberia. In Nunavik, evidence of this shrub expansion arises from aerial photography, dendrochronological analyses, and satellite-based NDVI data. Although shrubification is most likely caused by increasing temperatures, the main drivers of shrub expansion at the landscape scale are still poorly understood. Our knowledge as to how shrubification will impact northern ecosystems in the future is therefore limited. In the region of Umiujaq (Nunavik), aerial photography comparison shows a shift from lichen-dominated areas to shrub-dominated ones between the beginning of the 1990’s and 2010. The aim of our project is to identify the main landscape-scale drivers of shrub expansion in Umiujaq and anticipate future changes in land cover in two areas spanning respectively ca. 2.5 and 7 km² using spatially explicit Markov models of vegetation change with a 5m x 5m resolution. Aerial photography-derived vegetation maps of 1990 and 2010 were used to define variables related to the spatial arrangement of vegetation that might explain transition probabilities between different land cover classes. In addition to vegetation-related variables, LiDAR data from the region were used to derive a digital elevation model (DEM) from which a series of topographic variables were obtained. These vegetation-related and topographic variables were used as inputs in multinomial logit models in order to identify those variables affecting transition probabilities between different land cover types between 1990 and 2010. The best models were then used to calculate transition probabilities used as inputs in spatially explicit simulations in order to predict changes to occur in Umiujaq over the following decades. Our results indicate that both vegetation-related and topographic variables are useful in predicting vegetation change in the Umiujaq using a combination of multinomial logit models and Markov models. When used in combination, these variables could predict the 2010 vegetation map from the 1990 map with ca. 70% accuracy. Maps showing areas most likely to become shrub-dominated in the decades to come were generated in order to visualize the extent of the predicted shrubification. Field surveys were conducted in the summer of 2015 in order to validate the results obtained from the spatial modelling. Over 250 sites were surveyed in order to assess their likelihood of changing to shrub cover over the next few decades. Percentage cover of the different land cover classes in 3m x 3m and 9m x 9m plots was noted, and newly established shrub individuals or plantlets were counted. Analysis of the field surveys is ongoing but should indicate whether vegetation change projections for the next decades are realistic according to observations made on the field. Observations in the field seem to underline that shrubification in lichen-dominated areas occurs mainly through clonal propagation, whereas shrub species germinate readily in wet herbaceous sites. The vegetation change model generated could be used together with models representing other processes influenced by vegetation (permafrost thaw, snow cover, wild berry productivity, etc.) in order to model these processes over the following decades.

THE LAKE TROUT MERCURY PROJECT: FROM NUNAVIK LAKES TO NUNAVIMMIUT HEALTH

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The Qanuipitaa? Nunavik Inuit Health Survey (IHS) conducted in 2004 identified high mercury (Hg) exposure among Nunavimmiut. Using IHS measures of country food consumption combined with Hg biomonitoring data in country foods, we concluded that beluga meat is the most probable source of Hg exposure in Nunavik, particularly in the Hudson Strait villages. Subsequent studies identified older/bigger lake trout as an additional potentially important dietary source of Hg in Nunavik. Since the IHS questionnaire did not include a specific question about lake trout consumption and few data are available on lake trout Hg concentrations throughout Nunavik (which vary by lake, fish age, etc.), it was not possible to estimate lake trout contribution to Hg exposure. Community consultations from May to June 2014 highlighted that lake trout is harvested by many communities, particularly at times of the year when other preferred fish such as Arctic char or brook trout are less available. As some women reported consuming elevated amounts of lake trout, maternity staff expressed concerns about counselling pregnant women, whose unborn child is most vulnerable to Hg. Overall, the objective of this project is to determine if lake trout is an important Hg exposure source and whether fish consumption recommendations, based on fish characteristics such as size, can be created to reduce Hg exposure among pregnant women. Specifically, we (i) examine relationships between fish growth parameters (length, weight and age) and Hg accumulation in lake trout harvested from a number of waterbodies commonly fished in Nunavik; (ii) determine concentrations of two beneficial nutrients in lake trout- omega-3 fatty acids (n-3) and selenium (Se)- in order to balance considerations of the risks and benefits of lake trout consumption; and (iii) provide updated data on self-reported lake trout consumption in pregnant women and Nunavimmiut population. Five Nunavik communities agreed to participate and sampled lake trout from each of their 2-3 most important fishing lakes (N = 149). Results show that larger and older lake trout often contain high Hg. Hence, one should consume smaller and younger lake trout to minimize dietary Hg intake; at this stage, it is not possible to pinpoint precisely the fish size above which Health Canada’s fish Hg guideline (0.5 ug/g) is breached. Considering the size of fish commonly caught with gillnets, the technique commonly used by Inuit for subsistence fishing, getting fish that are small enough to be low in Hg (<56cm) is unlikely and is mostly confined to line fishing. Conversely, like many marine fish species in Nunavik, lake trout is a good source of both Se and n-3 fatty acids. Data from a 2014 study of pregnant women in Nunavik show that lake trout is the 3rd most frequently consumed fish/seafood reported by pregnant women after Arctic char and molluscs; however, only 20% of pregnant women sampled reported consuming lake trout more than once a month and nearly all did so only 1-3 times a month. After consultation with Nunavik Regional Board of Health and Social Services, our preliminary conclusion is that interventions regarding lake trout consumption should be targeted to at-risk women on a case-by-case basis, when high blood Hg and/or excessive consumption of country foods known to be high Hg (e.g. beluga meat, lake trout) is a concern. More results from community surveys on lake trout consumption patterns are expected shortly.

PAST LAKES AND FUTURE CLIMATE - SEDIMENT CORES REVEAL PERMAFROST DYNAMICS IN CENTRAL BEARINGIA

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Periglacial landscapes are highly dynamic in terms of permafrost aggradation and degradation. Effects of freezing and thawing processes are not only directly observed in inhabited Arctic regions by destructed infrastructure but also play a key role in the global climate system as potential carbon sink or source. For example, under warming conditions carbon stored in frozen deposits becomes available for microbiological decomposition by thawing and contributes to the positive feedback mechanism of carbon dioxide release and warming. Another important contributor of greenhouse gas emissions is methane produced in anaerobic conditions of shallow arctic lakes. In this study we present two case studies of paleo-archives from thaw lakes on northern Seward Peninsula (western Alaska, central
Beringia). Beringia is of particular interest as it formed the land bridge between Eurasia and North-America allowing the first humans to migrate to America. By applying radiocarbon dating and various sedimentological, biogeochemical and micropaleontological methods on permafrost sediment cores from drained lake basins, a complex landscape history was revealed. The first study of a 400-cm long permafrost core archived more than 45,000 years of sediment deposition including mostly terrestrial phases, but also a wetland phase and tephra deposition as well as a final lacustrine phase. The lake forming the today’s basin persisted only for the last 300 years before it drained in spring 2005. An earlier wetland formed at about 44,500 to 41,500 years before present did not result in a lake formation due to the fact that a 1 m thick layer of tephra (presumably from the South Killeak Maar eruption) deposited on top of the wetland and serving as a thermal isolator of the underlying permafrost. The second study was based on a 350-cm long record of lacustrine sediment except for the surficial terrestrial peat which formed after the lake drained around 1,060 years before present. The sediment core archives several generations of thaw lakes going back to 12,700 years before present. Here, a deep first generation lake drained partially about 9,500 years ago but persisted until 1,060 years ago as a shallow second generation lake. The refreezing of lake sediment after drainage is captured by the isotopic composition of intrasedimental ice. $\delta^{18}O$ and $\deltaD$ clearly indicate the modern but also paleo-active layer after lake drainage as well as an open talik system due to the presence of a modern thaw lake next to the coring site. Both case studies demonstrate the interaction of late Pleistocene to Holocene climate variations, regional environmental dynamics and local disturbance processes. The complex nature of permafrost landscapes which are at the same time sensitive to rapid climate change is emphasized by paleoenvironmental investigations as presented here.

**NUNAVUT WILDLIFE MANAGEMENT BOARD’S COMMUNITY-BASED MONITORING NETWORK**

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The Nunavut Wildlife Management Board’s Community-based Monitoring Network brings together respected Nunavummiut harvesters to share their knowledge and observations about wildlife. Rather than rely on interviews to collect this information, participants are trained to use customized software on hand-held computers to record travel routes, wildlife sightings, harvests, Inuit Qaujimajatuqangit and other observations while out on the land. For three years, harvesters in Sanikiluaq, Arviat and Cambridge Bay, Nunavut, participated in the program. In total, harvesters in these three communities recorded over two million waypoints, and data records on over five thousand wildlife harvests and two thousand wildlife observations. This presentation will give an overview of the Community-based Monitoring Network and show some examples of how the data can be used to improve local, regional, and territorial wildlife research and management practices in Nunavut by ensuring that researchers and decision-making bodies have up-to-date information directly from those who spend the most time on the land.

**PARTICIPATORY MAPPING REPRESENTATIONS: SPATIAL FEATURE SELECTION, INTERPRETATION, AND MEANING IN AN INUIT KNOWLEDGE CONTEXT**

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Participatory mapping is commonly used in projects across the Arctic as a tool for Inuit to document, represent, and share their cultural and environmental knowledge by drawing places, routes, or areas of importance on available maps. However, relatively little critical discussion has arisen regarding the diversity in how individuals may choose to represent spatial features, and how this influences the spatial representations resulting from participatory mapping initiatives. This has consequent implications for the interpretations and meanings derived from research working within an Inuit knowledge context. This paper will discuss the use of participatory mapping within interviews in Gjoa Haven, Nunavut, in the summers of 2012 and 2013. The context of interviews and mapping activities focused on learning about caribou from Inuit Elders and hunters in Gjoa Haven, including: caribou herds, ranges, migrations, and hunting. Other associated elements of contributors’ oral history, and experiences with other wildlife or travel, were also recorded on maps as part of emergent discussions.
In this context, points, lines, and polygons were used in diverse ways to depict various spatial aspects of the knowledge and experiences that people were sharing. In this presentation, select examples will be shared and discussed in an effort to develop important considerations in moving towards more culturally meaningful spatial representations of Inuit knowledge.

WHAT DO THE BELUGA WHALES ALREADY KNOW? - HABITAT MAPPING WITHIN THE KITTYGARYUIT AREA

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Targeted seabed mapping has become vital for effective management of marine resources. An important tool in moving towards ecosystem based management to provide a better understanding of the relationships among marine seabed characteristics, marine mammals, fish, and localized oceanography. Determination of specific seabed habitats is typically performed by combining and interpolating across multiple marine-based data sources. Visualizing the spatial distribution is fundamental to our understanding of marine ecosystems and our ability to manage human activities to deliver effective sustainable development and maintain marine ecosystem function. We investigate defined ‘hot spots’ of beluga (Delphinapterus leucas) habitat use in the Mackenzie Estuary, within the Tarium Niryutiat Marine Protected Area. Here the eastern Beaufort beluga whales arrive in late June to form one of the largest summering beluga aggregations. These belugas are an important cultural and subsistence resource for the people of the Inuvialuit Settlement Region. The seasonal use of estuaries by belugas is observed in many populations and the purpose of the estuarine aggregations are not fully understood. Hypotheses of this habitat use behaviour include the feeding, calving, predator avoidance, molting stimulated by warm fresh waters and/or promoted by bottom substrate type for rubbing. To better understand beluga habitat spatial use in these areas targeted seabed mapping using data from sidescan sonar, single beam echo sounders and sediment samples. In addition a number of seabed instruments (measuring: wave height and period, water turbidity, and salinity) were combined with a metrological station on land from June-August of 2014 and 2015. These data will be used to assess the temporal changes that may influence the patterns of beluga use and movement in the bay.

We focus our analysis in Kugmallit Bay, a bay within the estuary, previously thought to be relatively homogeneous in nature. The bay can be characterised by a very shallow (2-3 m) low sloping seabed that is dominated by silt based products from the Mackenzie Delta discharge. Our analyses indicate small pockets of cobbles (eroded from nearby glacial till dominated cliffs), a small channel (up to 9 m deep) extending out from East Channel, and an expansive sandy shoal (< 1m water depth). The updated high resolution 3 or 4-D mapping of beluga ‘hotspots’ within the Kittygaryuit Area has shown distinctive areas that can be interpreted as habitats or in this case the living resource and continued monitoring is crucial for regulators, harvesters and managers to make sound decisions regarding protection of belugas, their habitats and Inuvialuit hunting opportunities.

BELUGA ADAPTIONS TO CLIMATE CHANGE AND A SHIFTING PREY BASE: CASE STUDY FROM ULUKHAKTOK

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Beluga whales (Delphinapterus leucas) are generalists and as such may more easily adapt to ecosystem changes associated with climate change relative to other Arctic cetaceans. Multi-decadal trend analyses from the Beaufort Sea beluga harvest monitoring program reveal a decline in growth rates and a fluctuation in mercury trends. These patterns are consistent with a shift in the prey base hypothesized to be driven by regional scale climate variables. Determining their diet and preferred prey has been challenged by the high rate
(<90%) of empty stomachs observed in the harvest monitoring program. As such dietary biomarkers have been used to evaluate possible prey and have indicated the importance of Arctic cod (Boreogadus saida) as a key prey species. A recent shift in the summer distribution of this population resulted in the harvest of these whales in unlikely locations, such as Ulukhaktok, NT. Of those harvested, sixteen were sampled and had stomachs or stomach contents collected. Unlike belugas monitored in the Mackenzie Estuary for the past four decades, these whales all had stomachs containing partially digested prey. Early analyses of stomach contents reveal a diet consisting largely of young (age 1-3) sand lance (Ammodytes hexapterus). While sand lance is not new to the region it has not previously been considered a key forage species in the Beaufort Sea food web. Recent studies have found an increasing abundance of the larval form in the Beaufort Sea. Interviews conducted with hunters describe the observed feeding behaviour of belugas in the context of ecosystem shifts. Changes in beluga distribution within the Western Canadian Arctic may reflect prey availability and the search for alternative prey. These early findings support the ability for beluga to adapt to a shifting prey base; however, the longer term ramifications for the viability of this population are currently unknown.

SPECIES REPLACEMENT IN A SPACE FOR TIME TRANSECT FROM KENNEDY CHANNEL THROUGH KANE BASIN

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Species succession is a key concept in biological oceanography with well-established progression reported in for example across the North Atlantic. In contrast because of the difficulty of access and expense there have been no studies conducted in the Arctic that follow species changes over short time or space frames. During the 2014 ArcticNet Expedition, a north south transect was carried out to test the notion that species succession could be tracked from shortly after Arctic Basin waters exited from ice cover and were exposed to summer irradiance. These waters flow south through Kennedy Channel into Kane Basin towards Northern Baffin Bay. Using high throughput amplicon sequencing, we found that reads matching Chaetoceros species dominated the diatom communities in the sub surface chlorophyll maximum layer. There was an abrupt species shift between Kennedy Channel and Kane Basin, with the larger celled Ch. neogracile dominating Kennedy channel and the smaller celled Ch. socialis in Kane Basin. Both species fell into distinct Arctic clades consistent with both species having distinct Arctic ecotypes. In addition, we were able to discern several other related Arctic Chaetoceros clades with distinct biogeographical occurrences. While Ch. socialis is often reported from Arctic waters other similar species may have been under-reported because of difficulties in identification using light microscopy. This study highlights the utility of using environmental amplicon sequencing and provides intriguing evidence that the Ch. neogracilis is indicative of recent ice cover.

A SYNTHESIS OF THERMOKARST LAKE WATER BALANCE IN SUBARCTIC NORTH AMERICA FROM ISOTOPE TRACERS

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Thermokarst lakes are an important landscape feature in permafrost terrain, providing critical water resources and aquatic habitat, and serving as a key medium for biogeochemical cycling of carbon and other nutrients. During the past several years, numerous studies utilizing remote sensing imagery and other methods have documented that these generally shallow waterbodies are undergoing varied hydrological transitions, from surface area expansion to drainage and evaporative desiccation, in response to recent climate changes. However, there has not yet been an integrated study on the diversity of thermokarst lake water balances and their drivers, beyond the individual studies and landscapes. Here we provide a synthesis and snapshot of water balance conditions for ~350 thermokarst lakes across the subarctic region of North America. We assemble lake surface water isotope compositions measured during the past decade at four expansive lake-rich thermokarst landscapes including,
from west to east, Yukon Flats (Alaska), Old Crow Flats (Yukon Territory), northwestern Hudson Bay Lowlands (Manitoba) and Nunavik (Quebec). These landscapes represent the diverse characteristics of thermokarst environments in subarctic North America by spanning the boundaries between sporadic and continuous permafrost, and vegetation cover from closed forest to open tundra. Raw water isotope data illustrate a broad range of hydrological conditions with substantial variability along both latitudinal and longitudinal gradients. An isotopic framework will be established based on flux-weighted long-term averages of meteorological conditions for each landscape to quantify lake water balance metrics. Evaporation-to-inflow ratios and the isotopic composition of source waters for each lake will be determined using the coupled-isotope tracer approach. Controls on lake water balances, including the influence of source water inputs (i.e., snowmelt and rainfall) and lake evaporation, and how these vary (or are similar) among the four landscapes and with differing permafrost conditions, catchment vegetation and meteorological conditions will be discussed. As a contribution to the Arctic Development and Adaptation to Permafrost in Transition (ADAPT) program, results will further our knowledge of expected responses of these vast thermokarst landscapes to ongoing climate change.

HUDSON BAY INTEGRATED REGIONAL IMPACT STUDY: THE FRESHWATER SYSTEM

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Over the past century considerable change has occurred in the Hudson Bay system as a result of anthropogenic modification, and changes observed in climate. Freshwater plays a unique role in both the thermodynamics of sea ice and resulting dynamic processes and circulation within Hudson Bay. This freshwater-marine coupling affects all aspects of the Hudson Bay physical, biological and biogeochemical systems. Freshwater entering Hudson Bay is susceptible to modification via alteration of the watershed and physical processes within the watershed, and through changes in climate forcing over space and through time. The Nelson and La Grande river systems alone contribute more than 21,000 MW of annual hydroelectric production, altering the natural outflow of the freshwater system. The relative contributions of both climate change and regulation will be examined for the Hudson Bay watershed system through an integrated modeling approach that will couple climate, hydrologic and sea ice models. Contributions of freshwater to Hudson Bay will be modeled using the HYDRO (Hydrological Predictions for the Environment) continental-scale model and calibrated to a contemporary sequence of observed streamflow throughout the watershed from 1981-2010. Once calibrated, the model will be forced with various future climate scenarios to project freshwater contributions to Hudson Bay for the 2030s and 2050s time periods. These freshwater projections are to be used as forcing for the NEMO sea ice model in order to evaluate impacts on sea ice formation, decay and breakup processes. The project is in its infancy, with this presentation focusing on team integration and logistics, model setup and calibration and historical streamflow trends to be used as the project baseline. This project is unique in that it takes a true systems perspective and multi-disciplinary approach to understanding observed and potential future changes in the Hudson Bay regime.

ASSESSMENT OF EXTREME PRECIPITATION INTENSITIES THROUGH POST-TREATED REANALYSIS: AN APPLICATION TO NORTHERN CANADA

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Assessing the climate of Northern Canada is challenging since few meteorological records are available for this region. Interpolated gridded datasets are also of limited use because network density was historically small and resulting values strongly depend on the interpolation method. Reanalysis therefore represent an interesting alternative. The objective of this study was to analyze the performance of reanalysis to represent the extreme precipitation for Northern Canada and investigate the possibility to use post-treated reanalysis series to estimate extreme precipitation intensities over these regions. Four reanalysis were considered: ERA-
Interim, MERRA, CFSR, and JRA55. Annual maxima series of daily precipitations from each reanalysis were first extracted with the corresponding series at stations. Daily precipitation intensities corresponding to 2-, 5-, 10-, and 20-year return periods were then estimated and each station value was compared to the value estimated at the closest reanalysis grid-point. Mean Square Errors (MSE), bias, Pearson correlation coefficient (PCC) and ratio of variances between estimated extreme intensities over all stations and corresponding reanalysis grid-point were estimated. Results shown that, globally, reanalysis, despite some important biases, adequately reproduced the observed spatial distribution of extreme precipitations. A simple post-treatment method was then applied to the extreme intensities estimated from reanalysis which results in significant improvement in the adjustments between observed and reanalysis extreme precipitation estimates. However no reanalysis outperformed systemically the other reanalysis. Therefore extreme precipitation estimates from the various reanalysis were combined and optimal weighing coefficients were estimated. Results revealed that combined estimates of extreme precipitation globally outperformed estimates obtained from single reanalysis. This approach is used to construct maps of daily extreme precipitation over Northern Canada with corresponding confidence interval.

CARBON-14 AS TRACER OF SOIL MOVEMENT IN EARTH HUMMOCKS: A CASE STUDY FROM WESTERN ARCTIC CANADA

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Involuted soil horizons and buried organic matter in the active layer and near-surface permafrost provide evidence that cryoturbation is occurring within the active layer in hummocky terrain. Though there is little evidence to support timescales of hummock formation, several development theories exist, including the convective cell equilibrium model and the sudden collapse model. Here, we test whether the rate of soil mixing in hummocks can be estimated using carbon-14. In summer 2013, a series of trenches were dug across well-developed hummocks at two sites near Inuvik, NWT. Active layer and permafrost samples were analyzed for distribution of organic matter and carbon-14. Pending results aim to provide evidence relating to the convective cell/equilibrium model or the sudden collapse model. Establishing rates of cryoturbation in the active layer of permafrost-affected soils could have significant implications in sequestering carbon, including trace metals and contaminants that are absorbed onto the organic matter.

NORTHERN EXPOSURE: THE ROLE OF POLICY ENTREPRENEURS IN SPURRING CLIMATE POLICY INNOVATIONS FOR HEATING AND ELECTRICITY IN CANADA'S ARCTIC

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The Canadian Arctic is witnessing the effects of climate change first-hand and these changes are occurring rapidly. Across the Arctic, these rapid changes are having profound effects on supply chains and infrastructure for their electricity systems (among other sectors). For years, fossil fuels have been a primary fuel source for electric power generation and space heating needs at the residential, commercial and community levels in Canada’s Arctic. However, increased recognition of the problems that dependency on fossil fuels bring, as well as the need to confront human induced climate change has forced an appraisal of the state of energy production and usage in the Arctic. These conditions have created a policy window; galvanizing various actors (e.g. political leaders and government officials, NGO groups and consultancies and communities) to introduce and foster support for climate governance innovations. These policy entrepreneurs - be they individuals, organizations, or states -- capitalize upon this situation to invest their efforts towards realizing objectives (Kingdon 2011; Mazzucato 2014). It is within this context that a series of climate policy innovations have emerged. These activities include mechanisms through which to engage within energy policy planning processes and experimentation with a gamut of renewable energy technologies and efforts to understand energy usage (e.g. community energy plans) which has resulted in a wide variety of alternative energy deployment and energy conservation initiatives over the last several years. However, some contend that vested interests, including historical legacies institutionalizing networks, infrastructure and supply chains for diesel in isolated communities, or support for extending centralized large-scale hydro-based
systems in grid-tied communities further, are providing a counter-weight to these mushrooming climate policy innovations. An important question is thus to what extent entrepreneurship plays a role versus broader features found on the societal landscape including those endemic to a location, and/or dynamics within these ‘windows’? In other words, to what extent does entrepreneurship bring about and sustain climate governance innovations? And are these lines of delineation so distinct? Following research done in Canada’s North in 2014-2015, interim findings yielded the insights, which are explored in this paper. Firstly, while direct public policies aimed at energy savings and deploying alternative energy technologies are important in triggering these energy system changes, more effective activities occurred when local champions were present. This suggests that a systemic approach toentrepreneurships and climate governance is warranted that accounts for localized factors and circumstances as well as the breadth of issues facing the territory as a whole. Secondly, Northerners indicated the importance of having a ‘made in the North’ approach to energy supply and demand, highlighting ‘mismatches’ between options being proposed by those in the South for the Arctic (e.g. financial and technical models based on Southern specifications) and the reality of the North. This insight underscores the need for policy makers and practitioners to account for the local context; paying attention to the socio-technical ‘fit’ of technologies and policies, to ensure that time and spaces are provided for these policy innovations and their implementation.

**CHANGING SNOW HYDROLOGY IN THE WESTERN CANADIAN ARCTIC**

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Many aspects of the arctic snowcover are changing rapidly in response to a warming climate and changing precipitation regime. This has dramatic impacts on permafrost, ecosystems and water resources. Here we will focus primarily on the hydrological implications of these changes, with an emphasis on past changes to temperature, precipitation, snowfall and discharge over the past decades. We will also describe recent field observations at the Trail Valley Creek research watershed south of Tuktoyaktuk, NWT, in the Western Arctic, and outline modelling activities aimed at understanding key aspects of the hydrology. This paper will outline these changes, consider the complex interactions that may be resulting in a delay in streamflow in spite of increasing air temperatures, and outline future research required to better understand these changes.

**ICE WEDGE DEGRADATION AND CO2 AND CH4 EMISSIONS IN THE TUKTOYAKTUK COASTLANDS, NWT**

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Increases in air and ground temperature make soil organic carbon in permafrost environments highly vulnerable to decomposition and release. Ice-rich permafrost landscapes sensitive to thermokarst are likely to be especially susceptible to change. High-centred polygonal terrain is a form of patterned ground that may act as a large carbon source because thawing ice-wedges can increase ground temperatures and thaw depth. To evaluate the effect of ice wedge degradation on carbon flux, carbon emissions were characterized at two polygonal peatlands in the Tuktoyaktuk Coastlands, NWT. Opaque chambers were used to measure CO2 and CH4 emissions from 9 non-degraded polygon centres and 9 moderately-degraded troughs 4 times during the growing season. Wind diffusion models were used to characterize CO2 and CH4 emissions from 10 severely degraded melt ponds. An automated soil CO2 exchange (ACE) station (ADC BioScientific) was used to measure hourly CO2 flux at a single polygon centre. Our field data show that ice-wedge degradation results in increased ground temperature, deeper active layers, and increased CO2 and CH4 emissions. Contrary to our expectations, CO2 emissions were not limited by waterlogged conditions. Carbon flux was highly correlated with both air and ground temperatures in polygon centres and wet troughs. Our study shows that carbon emissions associated with ice wedge degradation are similar to other forms of thermokarst or anaerobic environments in the Arctic, and that emissions from these landscapes are likely to increase with rising temperatures.
AT HOME AND ON THE LAND: AN INTERACTIVE CLIMATE CHANGE RISK PLANNING TOOL FOR NUNAVUT COMMUNITIES

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As a result of rapidly changing climate, Nunavut’s landscape, weather and ice conditions are becoming less familiar and predictable to Nunavummiut. Permafrost thaw, increased amounts of unexpected storms, changing winds and sea ice conditions are some of the greater climate change issues that people are experiencing across the territory. These changes require innovative ways to adjust and adapt in order to reduce risks and ensure human safety both in home and on the land. The Climate Change Risk Planning Tool is an interactive, engaging and informative tool developed by the Government of Nunavut Climate Change Section that will help inform Nunavummiut of home and land-based risks due to climate change as well as provide them with adaptation measures, tips and relevant information that they can use to reduce their personal risks. Ultimately, the tool is aimed at engaging young hunters, youth and homeowners in a simple engaging way, and will be hosted on the Nunavut Climate Change Centre website as of March, 2016. The Climate Change Risk Planning Tool will ensure that Nunavummiut are better informed of climate change hazards and also have the information necessary to take actions that will improve public safety.

AKUTTUJUUK: AN INUIT EDUCATORS’ RESEARCH NETWORK TO MOBILIZE KNOWLEDGE OF BILINGUAL EDUCATION

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NB this abstract consists of two parts, a 100-word summary suitable for inclusion in the conference program and a more detailed description of the background of the presentation. Summary Bilingual education programs are key to improved educational outcomes and engagement of K-12 students in Inuit Nunangat. Akuttujuuk, the Inuit Educators’ Research Network, was created in 2014 to catalyze local engagement in developing, refining, and implementing such programs through the synthesis and mobilization of local knowledge and current research. Initial steps to establish Akuttujuuk, focusing on the technical platform, community engagement and knowledge translation will be presented. Detailed Abstract The National Strategy for Inuit Education (2011) identifies bilingual education as a key to improved educational outcomes and engagement of K-12 students in Inuit Nunangat. However, despite years of research documenting the extensive benefits of bilingual education (Baker, 2000; Corson, 1993; Cummins, 1998; Fuzessy, 1998; Hornberger, 2005; Taylor & Wright, 2003; Thomas & Collier, 2002; Tuafuti & McCaffery, 2005) and extensive efforts to implement and track the effectiveness of bilingual programs across Inuit Nunangat, evidence suggests that Inuit students are not realizing the benefits (Auditor General of Canada, 2013; Aylward, 2010; Berger, 2006). Further evidence indicates that successful bilingual education programs cannot simply be migrated from one context to another, but must be adapted and modified to respond to local conditions (May & Hill, 2005). Akuttujuuk, the Inuit Educators’ Research Network, was created in late 2014 as a participatory action research project to help address these issues. Building on informal networks established between Inuit educational leaders during the two iterations of the Nunavut MEd program (2006-2009 and 2010-2013), Akuttujuuk seeks catalyze local engagement in the processes of synthesizing and mobilizing local knowledge and practices with current research on bilingual education. The goal is better informed decision-making about the development, refinement, and implementation of successful bilingual education programs across Inuit Nunangat and a sustainable human and technological infrastructure that will last beyond completion of the research portion of the project in 2017. Akuttujuuk is supported by a web-based network infrastructure designed to function in the limited bandwidth available in most communities across Inuit Nunangat. This infrastructure consists of both publically accessible websites and discussion boards and private collaborative workspaces. It supports synchronous and asynchronous communication in Inuit languages and English. The private side of the network infrastructure enables network members to collaboratively share and generate new knowledge about bilingual practices and possibilities across Inuit Nunangat. That new knowledge will be based on a synthesis of the research literature on bilingual education and the experiences of network members with the models of
bilingual education in their local contexts. The public side of the network infrastructure will support wider access to and engagement with new knowledge generated. This presentation will focus on the initial steps taken to establish Akuttujuuk, addressing the technological design, strategies to engage and mobilize the initial network members, and the first steps toward collaborative knowledge creation.

**ANTHROPOGENIC NOISE IN THE ARCTIC MARINE SOUNDSCAPE: EFFECTS ON CETACEANS AND THE NUNAVUMMIUT**

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The Arctic is experiencing increased attention for resource development, as accessibility to the North improves due to global climate change. The subsequent rise in human presence and activity has led to increased anthropogenic noise in the relatively pristine Arctic marine soundscape, thus potentially impacting cetaceans. For millennia, the Inuit have relied on cetaceans for sustenance and are struggling to preserve their culture and traditions in the face of colonialism and resource development, which have been the major forces of change in the North. This situation presents an opportunity for Inuit to demand higher levels of participation and consultation on projects or activities that will change the marine soundscape and therefore impact their livelihoods and culture. Traditional knowledge about cetaceans can be used to inform development plans and influence guidelines and policies, in an attempt to minimize and mitigate the effects of anthropogenic sources of noise on cetaceans. The recent Federal court case in Clyde River, Nunavut, brought attention to the conflict that can exist between those who are pro development and resource extraction, and those who are more cautious due to social, cultural and environmental concerns. The Clyde River case was triggered by concerns over the potential impacts of seismic exploration on the marine mammals that are so vital to the Nunavummiut. It also addressed the Crown’s legal duty to consult Inuit and how to determine if consultation is meaningful and effective. This court case will be examined in detail to gain a better understanding of current issues, concerns and problems within the consultation process in the Canadian territories. Recommendations will then be made based on the results of a literature review and by examining the experiences of other Arctic Nations where there are similar interactions between industry and Indigenous peoples who want to preserve their traditional subsistence practices, all while highlighting the importance of the precautionary principle. The focus of the literature review is on the effects anthropogenic noise has on cetaceans and identifying the most effective mitigation techniques, as well as any major knowledge gaps.

**THE PHYSICAL & BIOLOGICAL DYNAMICS OF A LARGE NORTHERN LAKE (KLUANE LAKE, YT)**

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Terrestrial freshwater systems in northern environments, especially large lakes and their catchments, are particularly sensitive to the cumulative effects of climate-related changes (1)(2)(3). Small, climate-induced changes in these environments (whether physical, chemical, or biological) can be amplified into major shifts of limnological properties, resulting in consequences for water resources, biodiversity, productivity, nutrient cycling, and watershed ecosystem services (4)(5). Given these potential consequences, long-term monitoring of large northern lakes and their catchments is needed to improve our understanding of changes over time, for predicting possible regime shifts, informing decision makers and improving our ability to adapt to climate change. However, baseline data (including physical, chemical, and biological lake water properties) and an understanding of basic lake dynamics is required before long-term monitoring can begin to take place and any significant trends identified. Unfortunately, such baseline information is rarely available for many large northern lakes. Kluane Lake is the largest lake entirely within Yukon (~400 km2, 90m deep) and fed by a ~5400 km2 watershed (~1100 km2 of which is glaciated). Because of its size, depth, latitude, importance to First Nations, tourism, fishing, and proximity to resource development projects, Kluane Lake is an excellent model study system for large northern lakes. This study presents a novel and comprehensive baseline dataset of physical, chemical, and biological water parameters for Kluane Lake, YT in order to characterize basic lake dynamics over a spatial & temporal scale. Temperature, conductivity, turbidity, dissolved oxygen, chlorophyll a & nutrient (total nitrogen and total phosphorous) profiles were collected at 25 sites.

THE DEVELOPMENT OF A COORDINATED BIODIVERSITY MONITORING SYSTEM FOR CIRCUMPOLAR COASTAL ECOSYSTEMS

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The length of arctic coastlines is vast, and its productive coastal ecosystems support biodiversity of global conservation significance – biodiversity that is also central to the physical, commercial and spiritual well-being of the many communities situated along arctic coasts. In fact, almost all arctic communities are coastal, and range from the many small subsistence hamlets in North America and Greenland, through the fishing towns of Tromso in Norway and Dutch Harbor in Alaska, to urban centres like Murmansk in Russia. Arctic coastal communities are among the first in the world to experience the direct impacts of a rapidly-changing climate - rising sea levels, loss of protective shore ice, stronger storms from new wind directions with greater wave energy, and increasingly dangerous sea-ice, all of which are impacting safe travel, changes in the availability of country food, loss of cultural resources and direct loss of homes and other vulnerable infrastructure. These direct effects may be exacerbated by the cumulative effects of increased shipping and related industrial activities – activities that create new opportunities and complex challenges to coastal biodiversity, ecosystems and communities. To provide useful and timely information on the condition and expected changes and risks to coastal biodiversity for communities, governments, industries and others, the Coastal Expert Monitoring Group (CEMG) is developing a comprehensive monitoring program that will provide a standardized approach to monitoring change in coastal biodiversity and ecosystems across the circumpolar North. This coastal initiative is the last of four such programs conducted under the Arctic Council’s Conservation of Arctic Flora and Fauna Working Group (CAFF), Circumpolar Biodiversity Monitoring Program (CBMP). This presentation will provide an overview of coastal biodiversity in the context of increasing climate change and other issues and stressors, and will summarize ongoing international monitoring efforts along circumpolar coasts in preparation for the CEMG First Expert Workshop to be held in Ottawa in February 2016. At this workshop the CEMG will invite science and indigenous knowledge coastal experts to interact with knowledge users such as the shipping and mining industry, community re-supply shippers, government regulators and the communities themselves, to ensure the relevance and applicability of the program.

WATER SECURITY FOR NORTHERN PEOPLES: THREATS TO THE QUANTITY AND QUALITY OF ARCTIC FRESHWATER SYSTEMS

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Water is a fundamental component of the ecological integrity, economic development, and sustainability of northern regions. However, environmental change has altered fragile thermodynamic relationships of northern ecosystems by shifting seasonal transitions, altering precipitation regimes, reducing long term snow cover, and increasing the high sun season. This has exacerbated existing pressures on freshwater supply that have arisen from increased resource development, inappropriate or inadequate infrastructure, population stress, erosion of traditional knowledge systems and culture, and inadequate policy and management. Since water governance systems in northern Canada are under rapid evolution, we examine key vulnerabilities to both the quantity of accessible freshwater, and the quality of available freshwater resources for communities in Nunavut, Arctic Canada, within a water security framework. While the concept of water security is often approached from a human-centered perspective, we note the importance of understanding the biophysical evolution of freshwater systems in response to a warming climate, and the consequences of environmental change on an accessible clean freshwater supply for northern communities. We also compare information and experiences of the other northern regions to assess how water security is conceptualized and addressed across northern Canada, identifying biophysical and social vulnerabilities as well as subsequent implications for governance.

GLACIAL RUNOFF AS DRIVER FOR HIGH PRIMARY PRODUCTION IN GREENLAND'S FJORDS

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The fjords and coastal waters around Greenland form the interface between the open ocean and the Greenland Ice Sheet (GIS) and provide the stage for a complex interaction between glacial meltwater, calving icebergs and the ocean. With an estimated freshwater input of ~1000 Gt yr⁻¹, which combines both meltwater runoff and solid ice discharge, Greenland's fjords and shelves are strongly impacted by the GIS, and this freshwater input is expected to strongly increase with ongoing climate change. Yet the impact of high meltwater input on the carbon and nutrient cycling remains largely unquantified. To resolve the impact on biogeochemical cycling in Godthåbsfjord (SW Greenland), an extensive sampling was set up during the period 2012-2014 covering transects from the outer fjord to the glaciers. Measurements covering the full annual cycle of carbonate system, nutrients and primary productivity were collected alongside hydrographic measurements. High input of meltwater during summer months creates a strongly stratified system, where the surface water shows a distinct low saline water layer in the inner part of the fjord (salinity down to 5 in upper meter in inner part). However in addition to surface discharge of the glacier, subsurface melt plumes discharge from the glacier leading to rising buoyant plumes. These physical setting strongly influence nutrients and carbon dynamics with upwelling of nutrient rich water close to the glacier fuelling a high phytoplankton bloom. The research shows that glacial meltwater input impacts nutrient and carbonate chemistry in the fjord in a unique way creating a very dynamic system.

GRIZZLY BEAR POPULATION STATUS IN THE CENTRAL BARRENS OF THE NORTHWEST TERRITORIES: APPLYING DNA MARK RECAPTURE APPROACHES AND SPATIALLY EXPLICIT MODELING

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Barren-ground grizzly bears are at the most northern and eastern limits of the continental grizzly bear range. The Arctic tundra environment consists of harsh climates and low productivity that contribute to lower
reproductive rates and lower densities, which may make northern grizzly bear populations sensitive to human disturbance. In order to census bears, researchers have used live captures to mark bears and then recaptured bears using camera stations, aerial surveys, and hair removal and deoxyribonucleic acid (DNA) fingerprinting analysis. Most recently, hair removal and DNA fingerprinting have been used to mark and recapture bears. This latter method has several benefits because live capture of bears is unnecessary, individuals can be identified with a small risk of error, and hair removal sites are faster to set up and are checked less often than live-capture sites. Roots of mammalian hair contain sufficient DNA for analysis. We present results from a large scale regional Grizzly Bear DNA study in the central barrens of the Northwest Territories conducted between 2012 and 2013. The objectives for the two year program were to establish a baseline for the long term regional monitoring of the relative abundance and distribution of grizzly bears over time. Within the DNA Study Area, 113 cells were sampled for grizzly bear hair. Each cell was 12 km by 12 km (144 km2) for a total study area size of 16,272 km2. Cell size was dependent on several factors, including the need to maximize capture probabilities. Cells were sampled 6 times per year, and novel lures were used each session to prevent habituation to the sample sites. A total of 1,902 hair samples were collected during the 2012 survey period. From these samples, a total of 112 grizzly bear individuals were identified through DNA analysis, including 42 males and 70 females. During the 2013 field program, 4,709 samples were collected. A total of 136 grizzly bears were identified (60 males and 76 females), including 39 that had no previous detections in the regional database (22 males and 17 females). Eight grizzly bears identified in the study area were also detected in other DNA study areas in Nunavut. For the combined DNA dataset, the mean capture probability was 0.22 (range 0.14 - 0.35) in 2012, and 0.35 (range 0.28 - 0.43) in 2013. Based on Spatially Explicit Capture Recapture analysis, the expected number of male grizzly bears in the region was 59 (95% CI 43 to 81) in 2012 and 87 (95% CI 67 to 113) in 2013. The expected number of females was 102 (95% CI 85 to 122) for both years. The best model based on AIC likelihood estimated female density as 3.60 / 1,000 km2 (95% CI 2.85 to 4.56) in 2012 and 3.97 / 1,000 km2 (95% CI 3.17 to 4.98) in 2013. Male density was estimated as 1.96 / 1,000 km2 (95% CI 1.44 to 2.67) in 2012 and 2.85 / 1,000 km2 (95% CI 2.20 to 3.70) in 2013. These results suggest a stable population in the central barrens of the Northwest Territories relative to estimates for the Slave Geological province in the late 1990’s. Through effective partnerships, we demonstrate that DNA mark-recapture programs are a viable method to census grizzly bears in the Arctic to support management and conservation initiatives, and suggest a protocol for implementation.

**SCIENTIFIC KNOWLEDGE TO SUPPORT A CLAM FISHERY ASSESSMENT: HABITAT MAPPING IN QIKIQTARJUAQ, NU**

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Recently interest has been increasing in clams that are harvested in the intertidal zone, and by scuba diver at depth around the community of Qikiqtarjuaq, NU. As demand grows there is potential for clams to be sold commercially, which could benefit the community. Acquiring scientific knowledge on the clam population is of utmost importance, and is important for management applications of this fishery resource. The Government of Nunavut (GN) Department of Environment, Fisheries and Sealing Division, is currently evaluating the potential for the clam population to support a community-based commercial fishery. Siferd (2005) conducted an extensive survey of the clam population around Qikiqtarjuaq, which highlighted areas of high clam density and estimated metrics on sustainable fishing rates. These data have guided an effort by the Memorial University Habitat Mapping Group over the past three years to map benthic habitats in the area. Mapping habitats will allow for prediction of clam abundance in areas not sampled by Siferd (2005), identification of areas that may be sensitive to clam fishing, and identification of habitats that may be sensitive to climate change. Multibeam sonar data has been collected in this region since 2012, including bathymetry and backscatter data; when ground-truthed with in-situ samples, these multibeam data can be used to predict seabed type and habitat distribution in the
area. The Qikiqtarjuaq benthic habitat mapping project was co-designed by the Memorial University Habitat Mapping Group and GN Fisheries and Sealing Division, and represents a co-production of knowledge with the community of Qikiqtarjuaq. This summer concluded the final field season (of three) for collecting data on marine benthic habitats around Qikiqtarjuaq. Sampling in previous years has been stratified by clam density at a depth range of 10-40 metres; sampling during the 2015 field season was stratified randomly by depth, backscatter, and slope at a depth range of 10-200 metres. In total, 360 grab samples and 168 underwater camera drifts were conducted at 168 sample sites in order to ground-truth roughly 770 square kilometres of multibeam data collected by the MV Nuliajuk. Forty three four-minute vertical camera drifts were conducted in the 2015 field season for the purpose of counting clam siphons to add to Siferd’s (2005) photographic clam density data set. Eighteen dives were also conducted in the 2015 field season in order to collect Mya spp. clams and clam spat for morphometric and reproductive analysis. Observations made while diving, from underwater video, and from Siferd (2005) suggested that clams prefer soft, sandy sediments between 20 and 40 metres depth. Preliminary analysis showed that shallow (less than 40 metre) sandy sites inside Broughton Channel seem to contain the greatest density of Mya spp. clams in the region. By cross-referencing the above benthic dataset with the multibeam bathymetry and backscatter coverage it is possible to predict clam habitat distribution throughout the area and in deeper areas not accessible by scuba. The resulting maps of benthic habitat distribution will be invaluable to managers and stakeholders as the clam resource is developed and amidst changing oceanographic and climatic changes. References Siferd, T.D. 2005. Assessment of a clam fishery near Qikiqtarjuaq, Nunavut: Canadian Technical Report of Fisheries and Aquatic Sciences, Department of Fisheries and Oceans Canada.

INTEGRATING GENOMIC DATA AND ACOUSTIC TELEMETRY TO UNDERSTAND MIGRATORY BEHAVIOUR OF SEARUN ARCTIC CHAR (SALVELINUS ALPINUS)

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The community of Cambridge Bay in Western Nunavut is home to the most important commercial fishery for anadromous (searun) Arctic char in Canada. Ensuring sustainable harvest levels of this important economic and subsistence resource is crucial and requires a better understanding of the species’ migratory behaviour. More specifically, common dispersal between river systems makes defining management units challenging. We here combine three summers of acoustic telemetry data from 120 tagged fish with genomic data to understand how migratory behaviour shapes population structure and to help delineate stocks. We use a genotyping-by-sequencing approach to generate >5,000 SNP markers (after quality filters). Bayesian clustering approaches are used to identify genetically distinct populations and assess levels of admixture among putative populations. Individuals are then assigned to their most likely population of origin on the basis of their multi-locus genotypes, and these assignments are compared to patterns of dispersal and homing observed from the telemetry data, thus providing a tool to ground-truth the genomic approaches. We also conduct a multivariate analysis of variation in migratory traits among tagged fish, and we related this variation to genome-wide genetic variation. We discuss how this dual approach can inform fisheries management, and how genomics approaches can be used as a cost-effective way to describe migratory behaviour for other data-deficient Arctic char fisheries in Nunavut.

REVITALIZING INUTITUT AS PART OF A TEACHER EDUCATION PROGRAM IN LABRADOR

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Inuttitut is the language of the Labrador Inuit living in small coastal communities in Eastern Canada
(Andersen, 2010; Patrick, 2003). Today, spoken as the native language by only a small, rapidly dwindling group of elders, this language is the subject of an aggressive revitalization program (Andersen & Johns 2005; Andersen, 2010). Although the imposition of a provincial education system has been the greatest factor in the decline of Inuttitut (Andersen, 2009), it may also contribute to language revitalization. Inuttitut language classes are currently offered in the north coast schools, it is anticipated that many of the present Inuttitut teachers will face retirement in the next five to ten years. Unless aggressive measures are taken to train new teachers in preparation for this eventuality there will be few, if any, who can take over the task of ensuring that young generations to come will learn Inuttitut. Two initiatives lie at the heart of a language revitalization program. One is the Labrador Inuttitut Training Program (LITP) and the other is the Inuit Bachelor of Education (IBEd) program. The Torngâsok Culture Center has developed an Inuttitut language curriculum. It was launched in 2009 to develop a curriculum and support materials for teaching Inuttitut to adults (Gatbonton, 2014, White, Gatbonton, Nochasak, & Jararuse, 2012). Typically, adult language revitalization program are linguistics-based (Dorais, 2010; Johns, 1999; Mallon, 1991a, 1991b; Spalding, 1979). However, communities wishing to employ native speaking elders as partners in revitalizing the language find this pace too slow when viewed against the fast decline rate in the numbers of these elders (Hinton & Hale (2001; Sarkar & Metallic, 2009). Instead, Acquisition in Communicative Contexts of Essential Speech Sequences, an utterance-based approach focusing on teaching utterances with high re-use potential, was chosen as the method for the LITP. In September 2014, the Nunatsiavut Government partnered with Memorial University and the College of the North Atlantic to offer a community-based teacher education program: the IBED. A total of 15 students started the preparatory year, at the College of the North Atlantic, with 100% of students earning a seat in the Faculty of Education. The goal of the program is to train and certify teachers who will both carry on the task of educating Inuit youth as well as play a key role in Inuttitut language revitalization. The students are enrolled in both the LITP and the IBED. These two programs are being offered concurrently, the LITP by the Nunatsiavut Government and the IBED by Memorial University.

**A 1D MODEL APPROACH TO CARBON EXCHANGE IN THE AIR, SEA, AND ICE OF THE MARINE ARCTIC**

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Air-sea gas exchange is an important factor in determining the amount of carbon in the atmosphere, with global oceans serving as the largest reservoir of the climate’s carbon. One area of interest is the Arctic Ocean, where sea ice is prevalent. Traditionally, sea ice has been treated as an impermeable barrier to air-sea exchange in models. However, recent field work has shown that first-year sea ice can play an active and significant role in the exchange of carbon through chemical and physical processes, e.g. via preferential rejection of carbon during freezing. In addition, the sea ice provides an environment for ice algae, whose growth serves as a sink of carbon. These carbon pathways need to be represented in order to accurately model the marine Arctic carbonate system. The purpose of this study is to include physical and chemical effects on the carbonate system in sea ice formation/melting regions in the Canadian Arctic, and to incorporate sea ice algae into a working Arctic ecosystem model. The ecosystem model is coupled to the 1D General Ocean Turbulence Model for physical forcing along with sea ice implementation. The ecosystem component is comprised of two phytoplankton groups and two zooplankton groups, detritus, nitrate, ammonium, and silicate. Sea ice algae are limited by nutrients, light, and ice growth/melt rate. In the Arctic, an ice algae bloom typically occurs in late spring or early summer, when nutrients have not yet been depleted and snow and ice melt allows light into the lower ice column. Model development, validation, and sensitivity analyses are ongoing in order to tune air-sea-ice carbon exchange parameterizations to observations.
IS HIGH SE INTAKE FROM MARINE DIET DURING PREGNANCY AND CHILDHOOD MITIGATING THE ADVERSE EFFECTS OF MEHG EXPOSURE ON NEUROBEHAVIORAL DEVELOPMENT AT SCHOOL AGE?

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Prenatal exposure to methylmercury (MeHg) is associated with adverse effects on child development. The Inuit from Nunavik are among the most highly exposed populations on earth due to their high consumption of predatory fish and marine mammals, which can bioaccumulate high concentrations of this pollutant. In school age Inuit children from Nunavik, prenatal MeHg exposure has been related to poorer visual and intellectual functions and greater risk of behavioural and attention problems (1,2,3). Since fish and marine mammals are also exceptionally rich in essential nutrients such as selenium (Se), the Inuit also present the highest blood Se concentrations in the world. In fish-eating adult populations, there is increasing evidence suggesting that high Se intake may play a role in mitigating some deleterious effects of MeHg exposure (4,5). High Se may exert beneficial effects on the same health outcome affected by MeHg. In addition, Se may partially mitigate deleterious pro-oxidant effects of MeHg and/or directly bind to MeHg or to inorganic Hg following in situ demethylation, reducing its availability for target proteins and organs (6). Our aim is to determine whether high Se status in utero and during childhood can mitigate neurobehavioural effects induced by prenatal MeHg exposure in Inuit school age children. The Nunavik Child Development Study is a prospective mother-child cohort study enrolled at birth with children followed at 5 and 11 years of age. Hg and Se concentrations were assessed in cord and child blood by cold vapor atomic absorption spectrometry and inductively-coupled plasma mass spectrometry, respectively; cognitive and motor functions from direct assessment of the child; attention and behaviour problems by standardized teacher report; visual function through electrophysiological testing. Control variables with regard to child’s sex and age at testing, prenatal exposure to tobacco, alcohol, other contaminants and nutrients, socioeconomic status and family environment were documented through medical records, maternal interviews and blood biomarkers. The mitigating effects of cord and current Se blood status on the relation between cord and current Hg to the outcomes were examined using a series of multivariable regression models stratified by Se exposure. These analyses are underway.

DETERIORATION OF CANADA'S LARGEST ICE HAZARDS: AUTOMATED TECHNOLOGY AND REMOTELY SENSED OBSERVATIONS

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Ice shelves and floating glacier tongues are vast features of the Arctic coastal cryosphere that periodically calve large (several km long) tabular icebergs, or ‘ice islands’. These ice islands can, in turn, break up into numerous fragments that are comparable in extent to large icebergs but are relatively thin (30 to 110 m). Both icebergs and ice islands pose a risk to ships and marine infrastructure along their drift trajectories, which reach as far south as Newfoundland. To make informed policy and operational decisions to mitigate the risk associated with these ice hazards, it is important to understand how they drift and deteriorate. In this presentation, we describe three initiatives that use new technology to measure and monitor ice islands and icebergs. First, we demonstrate the use of a combination of structure-from-motion photogrammetry, laser scanning and multibeam sonar to survey the keel and sail of icebergs and ice island fragments. We found that the precision associated with tracking beacons/ground control points that were placed...
on the ice was an important determinant of uncertainty in the survey data and thus the ability of a particular surveying technique to detect deterioration occurring between surveys. For our second initiative we developed an automated system to measure ice island thickness using ice-penetrating radar. The radar takes measurements daily and relays them via Iridium satellite, while a weather station with a webcam monitors environmental conditions and surface ablation. Lastly, we are gathering ice island geospatial data from satellite imagery that is archived at the Canadian Ice Service into a comprehensive drift and deterioration database. Using thousands of Radarsat-2 scenes, ice islands are being digitized as they drift from source areas where they calve until they are no longer visible in the imagery. The data gathered from these field and remote sensing initiatives will be used to improve drift and deterioration models of ice hazards in Canadian waters, a necessity with the increased industrial interest off of Canada’s coasts.

DECLINING MERCURY IN LANDLOCKED CHAR IN HIGH ARCTIC LAKES: RESPONSE TO GLOBAL EMISSIONS OR IMPACTS OF CLIMATE CHANGE?

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As the only top predators in most high latitude Arctic lakes, landlocked char are good indicators of changes in inputs of mercury (Hg) and bioaccumulation of methyl Hg. Landlocked Arctic char have been collected annually for the past 10 or more years from 5 small lakes (<1 km2) near the community of Resolute Bay on Cornwallis Island (Amituk, Char, East, Hazen, and Resolute), in East and West Lake on Melville Island, and from Lake Hazen in Quttinirpaaq National Park on Ellesmere Island (82 deg N). Sampling in all lakes was carried out in late July or early August using gill nets (net size 32 mm). Collection numbers have typically ranged from 7 to 25 adult fish (>200 g) per lake. Temporal trend analyses and multiple linear regression modelling was conducted with length-adjusted Hg concentrations and climate variables. Statistically significant declines in length adjusted mercury concentrations in char muscle were found for 6 of 8 lakes (Amituk, Char, East, Hazen, North, and Resolute) Annual percent declines ranged from 4.6% (East Lake; 2005-14) to 19% (Char Lake; 2005-12). Small Lake and West Lake showed not significant trends. The percent declines were significantly inversely related to dissolved organic carbon (R2 = 0.58, P=0.03) but not particulate carbon (P=0.29), watershed-lake area ratio, or distance from the ocean. These declines are much more rapid than atmospheric Hg concentrations over the same period at Alert (north Ellesmere Is) which are about 1%/year (Cole et al. 2013). Prior to the mid-2000s Hg concentrations in char from lakes Resolute and Hazen, where we have long term data, appeared to be steady or increasing. Length adjusted Hg concentrations in Resolute and Hazen Lake were significantly correlated with values of the spring Pacific North-America (PNA) pattern and influential climate index in the Northern Hemisphere mid-latitudes (Hazen: R2 = 0.41, P=0.014, N=14; Resolute: R2 = 0.29, P=0.026, N=17). Results of the multiple linear analysis for each lake showed that prediction equations which included Previous Fall Temperature and PNA had strong predictive power. However, the temperature term was negative in each model, suggesting that higher temperatures result in lower Hg concentration in char. Evans et al. (ES&T 2013) also found temperature was consistently negative for Hg in lake trout from Great Slave Lake. The decline also partly coincides with higher summer and fall temperatures in the period 2004-2012. Higher temperatures are associated with earlier ice out and may result in dietary shifts for char.

A PROCESS-BASED INVESTIGATION OF MERCURY UPTAKE AND TEMPORAL EVOLUTION WITHIN EXPERIMENTAL SEA ICE

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Process-based studies of mercury (Hg) incorporation into sea ice are hindered by the discrete sampling techniques employed in the field. Yet the transition from a multiyear to a first-year Arctic sea ice regime has the potential to alter Hg biogeochemical cycling due to possible changes in its distribution and transfer between the atmosphere, cryosphere, and seawater reservoirs. As a result, a better understanding of Hg in sea ice is needed to inform projections of how future changes in the Arctic icescape will impact Hg loadings. We present a mechanistic, continual sampling study of Hg incorporation into experimental sea ice and the evolution of its distribution in growing ice. We measured Hg chemical species in experimental sea ice grown in the Sea-ice Experimental Research Facility at the University of Manitoba over two winter seasons. Despite high dissolved Hg concentrations in the starting experimental seawater relative to natural marine waters, Hg concentrations in sea ice were similar to those measured in Arctic and Antarctic sea ice. Furthermore, the controlled environmental settings allowed us to differentiate between the incorporation of particulate Hg into frazil ice and the scavenging of atmospheric Hg in surface crystals. Based on our measurements of Hg speciation during experimental sea ice growth we have developed a general model of Hg incorporation into sea ice and its temporal evolution. We use this model, together with limited published measurements of sea ice Hg, to discuss future changes in Arctic Hg reservoirs due to seasonal reductions in sea ice coverage.

THE CANADIAN CONSORTIUM FOR ARCTIC DATA INTEROPERABILITY: DATA SHARING AND ANALYSIS FOR ARCTIC RESEARCH AND NORTHERN COMMUNITIES

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The Canadian Consortium for Arctic Data Interoperability (CCADI) is working to connect Canada's Arctic research centres to make data and information more accessible, and to provide analysis, visualization, and mapping tools to facilitate scientific discovery through data mining and integration. Interoperable cyberinfrastructure among our institutes and online archives will allow data generated from northern Canada to be shared with stakeholder communities of researchers across all areas of Arctic science, with northern institutions, residents, organizations, decision makers, and international partners. The integration of Inuit TK and Western Science, following the concept of "two ways of knowing" is also a key objective of the CCADI. Arctic data are generated by many groups (e.g., academia, Indigenous communities and organizations, government, private sector, NGOs, etc.) with different needs and approaches to collection, analysis, control, access, and sharing. A system that establishes common standards or translation tools to support interoperability, and that enables appropriate data stewardship for sharing, access and use at different levels is essential. An integrated national Arctic data management system that facilitates information discovery, establishes metadata and data sharing standards, enables interoperability among existing data infrastructures, and that is accessible to the broadest possible audience of users will be a first for Arctic data in Canada and can provide a model for uptake by the international Arctic research and data management communities which are now considering new ways to
streamline the flow of and access to data across borders and cyberspace

THE ROLE OF PRESSURED ICE IN WINTER SHIPPING BESETTING EVENTS IN THE HUDSON STRAIT

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Pressured sea ice and ridges are serious navigational hazards for vessels traveling in the Arctic. Ice can come under pressure as a result of winds, tides and currents. When the ice converges, it forms ridges as blocks of ice pile up above and below the water surface. These conditions can cause vessels to become beset, which is a significant risk to the environment and operational revenues considering time lost, fuel burned, and possible ship damage. There have been few studies so far on the ship-scale implications of encountering hazardous ridged ice in the Canadian Arctic. Ridged ice is highly prevalent in the Hudson Strait region, which connects Hudson Bay and the Atlantic Ocean, where there is currently year-round shipping to service a mine in the region. In this study, logbooks from the MV Arctic, a regularly transiting ship, were obtained for its winter voyages (January, February, and March) from 2005-2014. The log notes include vessel location and whether or not the ship was beset at that particular point. Ship routes were digitized geospatially and besetting events were noted. The location and timing of the besetting events were investigated using cluster analysis. Results indicated frequent besetting event patterns, with a high number of besetting events occurring between Charles Island and the coast of Quebec, as well as the eastern entrance to the Hudson Strait. The ship was more likely to become beset in February and March than in January. The timing and location of besetting events was compared to previously identified ridge densities in the Hudson Strait. The ridges were digitized from RADARSAT-1 and -2 imagery for the winter months of January to March, 2005 to 2012. These results were used to construct a time series of the spatial and temporal distribution ridge densities in the Hudson Strait. When compared to the ridge density maps a strong correlation was discovered between besetting events and areas of high ridge density. There was also a significant correlation between the time ships spent beset and monthly ridge counts. These results demonstrate the use of observed ridges as predictors of where and when vessels may become beset or encounter difficulties. This is important information for ship captains and for the development of new shipping routes.

BIOME-SCALE PATTERNS IN TUNDRA PLANT TRAITS CORRESPOND WITH WARMING-INDUCED TRAIT CHANGE

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Climate warming is leading to dramatic changes in plant communities at sites across the tundra biome. However, it is the plant traits, not species identities, that directly drive ecosystem functioning. And thus, we currently do not know how community shifts are fundamentally altering the functioning of tundra ecosystems as a whole. Observed biogeographic patterns in plant functional traits can be used to predict changes in ecosystem function over time in tundra ecosystems. We used the TRY plant trait data base to assemble plant trait data for over 400 species and the ITEX community composition data base for ~30 sites between 1989 and 2014 from across the tundra biome. We used hierarchical Bayesian models to describe the variation in plant traits across climate gradients and over time. We found community weighted trait values associated with resource acquisition (high SLA, leaf N and low wood density) were greater in warmer sites versus colder sites across the tundra biome. Community-weighted canopy height data did not vary significantly along climate gradients, but intra-specific canopy heights were higher at warmer versus colder sites. We found increases in the same resource
acquisition traits (high SLA, leaf N and low wood density) with community composition shifts over time, indicating that biogeographic patterns closely correspond with ongoing temporal changes in tundra plant communities. Our findings indicate that the strong biogeographic patterns in functional traits across the tundra biome can be used to predict tundra vegetation change over time and the resulting shifts in ecosystem functioning. Thus, earth system models can directly incorporate the distributions of functional traits across tundra plant communities to understand tundra biome-level responses to climate warming.

**POTENTIAL IMPACTS OF ICE ISLAND FRAGMENTS ON BIO-PHYSICAL PROCESSES ON CANADIAN ARCTIC SHELVES**

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Ice islands in the open ocean can be surrounded by relatively high biological activity due to increased concentrations of limiting nutrients in the productive surface layer of the water column. Ice island melt water can enhance the delivery of these nutrients by favoring upwelling of marine deep waters adjacent to the ice island and/or through the input of nutrients sourced from the ice island itself. The objective of this study was to assess the potential impacts of ice islands on Arctic shelves, by characterizing the physical and biological oceanography of the water column surrounding a grounded ice island fragment near Resolute Bay, Nunavut. In particular, we hypothesized that the presence of the ice island would affect the near-field salinity and temperature profiles, and potentially primary producers. To address this hypothesis, we conducted a general survey of the physico-chemical properties (salinity, temperature, δ18O, nitrate, phosphate and silicate) along two transects: north-south (N-S) and east-west (E-W) in the vicinity of the ice island from August 11 to 29, 2014. Chlorophyll a (chl a) was measured at five depths (0, 5, 10, 25 and 50 m) adjacent to the ice island and at a marine station, 8 km offshore. A strong pycnocline with relatively warm and fresh surface water was observed at all stations in the study area due to sea ice melt. This surface layer was less distinctive directly adjacent to the ice island, suggesting induced mixing and upwelling in close proximity to the ice island. Nutrients, in particular nitrate, were depleted in the surface waters. Chl a biomass was not significantly higher adjacent to the ice island compared to 8 km offshore. High chl a concentrations, ranging from 13.7 to 21.0 mg m-3, were commonly observed in the study area. These high chl a values at the pycnocline depth, together with the nutrient depletion at surface are indicative of a phytoplankton bloom in surface waters taking place prior to our study period and prior to the ice break up. The results of this study indicate a dominant influence of icebergs on mixing and upwelling processes rather than on nutrient dynamics in the Canadian Arctic Archipelago.

**ANALYSIS OF ZOOPLANKTON DATA WITH FISHER INFORMATION AS AN INDICATOR OF MARINE REGIME SHIFTS**

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Given the rapid pace of climate driven ecological change, there is a compelling need for ecological indicators that can be practically applied to detect ongoing changes and potentially forecast regime shifts. One such potential indicator, Fisher information, holds promise as a regime shift indicator that may be able to forecast change. Fisher Information is an information theory approach that captures patterns in system dynamics and collapses the behavior of multiple variables into an index that is used to track changes in dynamic order (i.e. patterns). Here we explore the use of Fisher Information for marine regime shift detection by taking a “space for time” approach utilizing zooplankton data from the Canada’s Three Oceans project collected around Northern North America in 2008. Cluster analysis of Bray-Curtis similarity across the entire sample set shows five high level clusters consisting of the North Pacific, Bering Sea Shelf-North Bering Sea-Southern Chukchi Sea (some sub-division within this large group), Beaufort Sea,
Canadian Arctic Archipelago, and the Atlantic influenced waters of Lancaster Sound-Baffin Bay-Labrador Sea. This structuring along with the salient geophysical and oceanographic structure was used as a basis from which to interpret the performance of Fisher Information for spatial structure detection as compared to traditionally used indicators including lag-1 autocorrelation, variance, kurtosis, skewness, and the variance index. Plotting of Fisher information along the spatial array captures four of the five major transition points in zooplankton structure: namely the Gulf of Alaska-Bering Sea transition, the Bering Sea-Chukchi Sea transition, the Chukchi Sea-Beaufort Sea transition, the Beaufort Sea-CAA transition, and the transition between the Canadian Arctic Archipelago and the Atlantic waters of Lancaster Sound and Baffin Bay and the Labrador Sea. Out of all of the other traditional regime shift indicators only increasing variance showed promise by detecting 2 of the five spatial community changes. Because Fisher Information reflects the trend in the changing dynamic, it may indicate subtle shift in the dynamic order leading to a warning of a critical transition. Our results suggest that Fisher Information analysis of mixed zooplankton data may be useful for reconstructing the timing of past regime changes, as well as potentially foreshadowing imminent change.

**“ONE VOICE” TO MONITOR NORTHERN CANADA’S FRESHWATER AQUATIC ENVIRONMENT - METHOD DEVELOPMENT TO USE INUIT TRADITIONAL KNOWLEDGE AND WESTERN SCIENCE IN CONJUNCTION**

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Climate change, developing industry and growing communities have a strong potential to influence the aquatic environment throughout Nunavut. At present, no dedicated regional monitoring program is in place nor is the data collected by various groups standardized or routinely aggregated. This presents a monitoring gap in freshwater baseline information, limiting the ability of industry, regulators and communities to track, attribute, and therefore manage future impacts effectively. A Secretariat of Key Stakeholders, including the Kivalliq Inuit Association (KIA) and the Nunavut General Monitoring Program (NGMP) are leading a program to address this gap through the development of an Aquatic Cumulative Effects Monitoring Pilot Program in Nunavut’s Baker Lake Basin. This region is culturally significant to Nunavummiut, features current and potential industrial development, has a potential for population growth, and a history tracking environmental changes using both western science and Inuit Qaujimajatuqangit (IQ). Western scientific methods to assess environmental changes in the Arctic are in development but vast, inaccessible expanses with a harsh climate present logistic and financial challenges few other places in Canada experience. Community based monitoring and IQ therefore represent a potential to improve our ability to track changes in Canada’s north. While proponents have historically collected traditional knowledge as part of the Nunavut’s environmental assessment process, there is no established methodology to link observations made by Inuit while on the land with scientific indicators such as water chemistry. The KIA, Hutchinson Environmental Sciences Ltd. and the University of Alberta are currently developing a methodology to monitor the northern aquatic environment using traditional knowledge in conjunction with scientific observations, under the sponsorship of the Canadian High Arctic Research Station and the NGMP. Once refined, it will also be used to track cumulative impacts through community based monitoring initiatives. We are working throughout the fall of 2015 to develop this methodology by conducting a series of interviews with traditional knowledge holders and to link their land use patterns to areas in the Baker Lake Basin that are intended for western science monitoring initiatives. While the first set of interviews are led by social scientists, the questions are developed with input from western science. Scientists then review the results and develop more detailed follow up questions for subsequent interviews which will be attended by “curious scientists”, to develop a rapport with IQ holders and work with IQ observations to refine details. This allows, for the first time, targeted follow up of IQ based observations that should identify key variables and interpretations that could link western science with traditional knowledge. Outcomes could include, for example, correlation of the taste and visual aesthetics of water experienced while on the land with chemical analysis, changes in the ability of Inuit to travel
on ice with records from the local climate stations, and observations of river vegetation with specific species, water temperature and nutrient status. We will present our preliminary findings and discuss means to ensure our final methodology relies on reproducible observations that can be relied on by industry, governments and communities to monitor changes in Canada’s north.

THE PORTAL AS A TOOL TO ENABLE COMMUNITY AND UNIVERSITY COLLABORATION IN RESEARCH

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Polar research depends on effective strategies for sharing information and mobilizing knowledge, not just within institutional research circles but also increasingly with user communities, knowledge holders and communities of practice. Polar data faces unique challenges and increasingly, in remote regions as broadband access grows, web-based solutions are seen as practical. However, institution based systems are not always able to be inclusive where community and non-academic partnerships are involved. The Portal is a web-based tool that is being created to support communication between community and university based members to support research collaboration. At McMaster University there is a gap when it comes to including community members in current platforms for collaboration. In response to this need, The Portal was created as a way to allow community members to connect for free with each other and the network of researchers at the university to allow for truly community engaged research to be conducted. This platform links to GoogleDrive and Dropbox which supports document development and sharing, as well as communication throughout the process; Google Calendar is linked to allow members to schedule meetings and events; and finally, Trello is linked which allows for collaboration through task sharing and project management. In developing this platform, the McMarsh community group has contributed to the determining the key aspects that are needed to support collaboration at this level and are involved in piloting the platform to populate the site with information and determine any practical problems. The Portal as a collaboration platform has many potential applications and will be important in empowering community members to be fully engaged and become equal partners in community based research projects going forward. Here, we give examples of the potential of the Portal’s relevance, extended to creating, accessing and visioning polar data.

INUIT QAUJISARVINGAT: LINKING DATA, MAPPING AND VISUALIZATIONS OF INUIT KNOWLEDGE ACROSS CULTURES AND CONTEXTS

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Inuit Tapiriit Kanatami (ITK) is the National Inuit organization mandated by the four Inuit Land Claim Organizations (Nunatsiavut Government, Makivik Corporation, Nunavut Tunngavik Incorporated, and the Inuvialuit Regional Corporation) to work on behalf of the needs and aspirations of Canada’s Inuit at the national level. ITK is committed to addressing Arctic and Inuit research issues through its research Centre called Inuit Qaujisarvingat: The Inuit Knowledge Centre (IQ). IQ strengthens the voice of Inuit in Canada, by producing, collecting, analysing, and sharing Inuit-specific data, information, and knowledge for improved research, policy and decision-making. Through advice and direction from the Inuit Qaujisarvingat National Committee (IQNC), IQ focuses efforts to ensure an increasingly active role for Inuit in research that leads to the generation of innovative knowledge for improved research, science and policy decision making within a Canadian, circumpolar and global context. The IQNC provides technical guidance and recommendations on Inuit research priorities, research practices, and research policy development at the international, national, regional and community levels. The IQNC membership follows the structure of the ITK Board of Directors (BOD) where
INTEGRATED STUDY OF SEDIMENTARY PROCESSES IN HIGH ARCTIC LAKES (CAPE BOUNTY, MELVILLE ISLAND)

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Lacustrine sedimentary sequences can hold a substantial amount of information regarding paleoenvironments, hydroclimate variability and extreme events, and these records provide critical insights where observational records are limited. In the High Arctic, the broad field of limnogeology is often limited to the analysis of sediment cores from which past changes are inferred. However, studies have provided evidence that the accumulation of sediments in lacustrine basins and their distribution can be affected by a wide range of internal and external forcing mechanisms. It is therefore important to have a good knowledge of the controls on the transport and distribution of sediments in lakes prior to investigating paleoenvironmental archives. To address this knowledge gap, the Cape Bounty Arctic Watershed Observatory (CBAW) was initiated in 2003 to develop a long-term site with the aim of understanding the controls over sediment transport within similar paired watersheds and lakes. The East and West lakes, located on southern Melville Island in the Canadian High Arctic, have been monitored each year since 2003 to document the role of hydro-climate variability on water-column processes and sediment deposition. Moorings recording water electrical conductivity, temperature, density, dissolved oxygen and turbidity, as well as sediment traps were deployed during the active hydrological period (generally May–July). These data were analyzed in combination with hydrological and climatic data from the watersheds. Additionally, a high-resolution bathymetric and sub-bottom survey was completed in 2015 and allowed imaging the lake floor and sub-surface in great detail. This combination of process and lake morphometric data are unique in the Arctic. The swath bathymetry data and sub-bottom profiles reveal two highly disturbed lake floors, being widely affected by subaqueous mass movements. A minimum of two events have triggered more than 20 slope failures along the shores of the lakes in the last 2000 years, some of which were triggered subaerially on the surrounding slopes. Backscatter intensity maps reveal that underflows (turbidity currents) generated at the river mouths are frequent and deliver coarse-grained sediments to the deeper waters. Small-scale bedforms were also observed on each delta foresets, suggesting episodic high-energy turbidity currents. According to the 2003–2014 mooring data, no single hydroclimatic process can explain this underflow activity. Spring snowmelt is often responsible for delivering a substantial amount of sediment to the lakes in the form of underflows. However, summer...
rainfalls have also contributed in some years. Interestingly, one of the largest rainfall recorded (100 mm over four days) in August 2013 did not trigger a corresponding underflow event in West Lake, confirming that antecedent soil conditions can significantly reduce runoff and suspended sediment concentrations in the rivers. Hence, reconciling the range of processes responsible for sediment deposition and that generate both bedform and subaqueous mass movements are important to developing consistent records and interpretations of sediment deposition in High Arctic lakes.

**TERRAIN INFLUENCE ON SOIL ORGANIC CARBON AND TOTAL NITROGEN STOCKS IN SOILS OF HERSCHEL ISLAND, WESTERN CANADIAN ARCTIC**

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The Arctic-wide increase of permafrost temperatures and subsequent thaw is mobilising large amounts of organic matter that is stored in permafrost environments. Organic matter decomposition results in the release of carbon dioxide and methane, which will amplify the warming and will cause so called permafrost carbon feedback. Increasing air temperatures due to greenhouse gas emissions from permafrost is not yet incorporated into Earth System Models. The lack of high-resolution carbon storage data and factors influencing it are two important uncertainties hindering modelling efforts. In this study we estimate soil organic carbon (SOC) and total nitrogen (TN) storage on Herschel Island and we identify the effect of terrain properties on SOC and TN storage. Herschel Island is characterised by diverse terrain and the occurrence of mass movements. We analysed 128 active layer and permafrost samples from 11 cores and pits for SOC and TN contents and extrapolated them to ecological units. These ecological units were generated from multispectral remote sensed imagery on the basis of soil and vegetation ground surveys. The average estimated SOC and TN storage for Herschel Island is 34.8 kg C m-2 and 3.4 kg N m-2. This high SOC and TN storage is in the range of other studies conducted in the western Canadian Arctic and Alaska. SOC storage showed high positive correlation with topographic wetness index which is an indicator of catenary position and slope characteristics. Comparison of SOC storage between the study sites showed statistically significant different storage between three groups: 1) undisturbed uplands, 2) mass wasting sites (occurrence of solifluction and past active-layer detachment), and 3) accumulation sites (peatlands and alluvial fans). The same groups showed also different down-core SOC, TN and dry bulk density trends. Undisturbed uplands stored the majority of SOC in the upper part of the profile, which was decreasing with depth together with higher ground-ice contents. Mass wasting sites showed depleted storage in the upper 50 cm and slightly increased storage with depth due to material compaction. Accumulation sites showed high storage throughout whole profile. In conclusion, our results indicate that terrain has an important influence on SOC storage. SOC and TN stocks are highest in accumulation environments and lowest on sites where mass wasting occurs.

**THE IMPACT OF THE TROPICAL/NORTHERN HEMISPHERE TELECONNECTION PATTERN ON AN ABNORMALLY COLD WINTER OVER NORTH AMERICA**

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The weather over central North America was abnormally cold during the winter of 2013/2014. Central Canada and the eastern United States also experienced abnormally persistent cold temperatures in the winter of 2013/2014. During 2013/2014, Winnipeg, Canada, experienced its coldest 3 months since 1978-1979. The average mean temperature was -20°C from December 2013 to February 2014. It is important to understand the mechanisms of climate variability/change associated with extreme weather events over North America due to their impacts on society, health, ecosystems and the economy. Furthermore, it is critical to understand whether future climate events will become more extreme and more frequent to inform decision makers. In this study,
we address the following questions: 1) Is there evidence of a dominant teleconnection pattern associated with the anomalous cold temperatures over North America? 2) What is the physical mechanism that helped maintain the anomalous cold winter? We have shown that the large-scale atmospheric circulation pattern over North America during winter 2013/2014 was dominated by the Tropical/Northern Hemisphere (TNH) teleconnection pattern, and warm North Pacific SSTs were associated with the TNH pattern. Rossby wave trains associated with the TNH pattern propagated from the North Pacific Ocean toward North America and maintained the negative Z500 anomalies over North America related to the TNH pattern. Maintaining these cyclonic circulation anomalies led to the persistence of the cold weather conditions over North America. Furthermore, year-to-year variations between the TNH pattern, North Pacific SSTs and air temperature over North America show good correlation from 1951 to 2014. This provides evidence for a connection between the TNH pattern, warm North Pacific SSTs and cold temperature over North America, which is not only observed in the last decade but also over longer time scales. The TNH pattern may hold a key to predicting anomalous weather changes for the following winter, as in the case studied here (winter 2013/2014).

What will happen to the relationships and milestones that we have achieved to date between Inuit communities and researchers? This session will give others an opportunity to brainstorm and devise a framework for the development of an Inuit legacy. Our goal is to invite Inuit present at the ASM as well as many of our regional and academic partners to contribute to the dialogue. The format of this session will include a combination of presentations, breakout sessions and open dialogue and will focus the discussion around the following main themes: Sustaining and continuing to build upon Inuit capacity, Consolidating partnerships and network links, Securing research Infrastructure and support for Inuit, Locating and securing funding for Inuit Research Advisors and other Inuit specific research objectives, Determining what the role of Inuit will be in this new vision of the Pan-Arctic Research Network (planned by ArcticNet). After the topical session, the IAC plans to analyze any comments and information collected from session attendees around our identified themes and attempt to translate these goals into actionable items/activities for the future of Inuit and research.

**INUIT RESEARCH LEGACY: PLANNING FOR THE FUTURE OF RESEARCH FOR INUIT NUNANGAT**


(1) Nunavut Tunngavik Incorporated
(2) Inuvialuit Regional Corporation
(3) Kativik Regional Government
(4) Nunatsiavut Government
(5) Inuit Circumpolar Council Canada
(6) Inuit Tapiriit Kanatami

The ArcticNet Inuit advisory committee is comprised of all four regions, which includes the Inuit members of the Research Management Committee, and the four regional Inuit Research Advisors. As advisors of the ArcticNet program, it is important to begin thinking about Inuit and research beyond ArcticNet.

**TALIK FORMATION AT A SNOW FENCE IN CONTINUOUS PERMAFROST, WESTERN ARCTIC, CANADA**

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The long-term ground thermal effects of a snow fence were examined in continuous permafrost on Peel Plateau, NWT. The fence was erected in the early 1980s, so present conditions include the response to over 30 years of snow pack modification. Snow cover, ground temperatures, late-summer thaw depth, and moisture content are higher at the fence than in ground nearby. The terrain surface around the fence has subsided about 0.5 m due to the disturbance. Field measurements indicate that a talik has developed below the fence. The measured late-summer thaw depth under the fence is greater than 1.75 m. Numerical simulation of the disturbance suggests that the talik began to form 24 years after the fence was constructed, and that thaw depth in late summer is now over 3 m.
CO-PRODUCTION OF KNOWLEDGE IN THE INUVIALUIT SETTLEMENT REGION: BRIDGING KNOWLEDGE IN BELUGA (DELPHINAPTERUS LEUCAS) MONITORING AND RESEARCH

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Beluga whale (Delphinapterus leucas) harvests have been documented in the western Canadian Arctic since 1981 in Kugmallit Bay, Shallow Bay and Kendall Island and since 1989 in the Paulatuk area. Standardized beluga monitoring documented the size, composition and timing of the subsistence harvest in addition to hunter-collected data on the landed whales. In recent years, sampling has broadened to include all or a subset of the following studies: diet markers, diving physiology and lung function, viruses and parasites, eco-toxicological endpoints and overall health. Additional studies were conducted on the habitat characteristics and beluga hotspots in the Mackenzie Delta Estuary. In 2013, a project was developed to support the inclusion of local observations and community perspectives in beluga monitoring. This project enhanced community participation in beluga research through community meetings, harvester questionnaires, beluga surveys, semi-structured interviews and focus groups. Local observations and traditional ecological knowledge contributed unique and valuable information about potential indicators of beluga whale health and the quality of beluga muktuk and meat. Specific and general observations about beluga habitat use provided critical information about how beluga whales utilize specific areas of the Mackenzie Delta Estuary and Darnley Bay. The results from this project will support the monitoring of existing and proposed Marine Protected Areas in the ISR based on knowledge from multiple knowledge sources. The different knowledge-holders, including scientists and community experts will come together in February 2016 to further our understanding of beluga whales during a beluga communication summit in Inuvik, NT, CA. This project provided a case study to highlight the unique opportunities and challenges associated with bridging diverse knowledge systems to enhance beluga monitoring and research.

GOVERNANCE OF RISKS IN THE PERMITTING OF NEWLY PROPOSED LARGE-SCALE MINES IN ALASKA

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This project explores the key science, policy, legal and ethical debates raised during the large mine permitting process in the State of Alaska. Obtaining the permits and approvals needed to build an industrial-scale mine is a process that is highly scientific, economic, political, legal and social. It is a crucial stage in any technological development project, where fundamental and long-reaching decisions are made on controversial issues. It is where various competing interests are mediated: between the fishing industry and the resource extraction industry, the Native people of Alaska and the state, and the State of Alaska and the Federal government; over objective assessment of risk and benefits, over the rights of nature, preservation of food sustainability, legal authority, and environmental justice. Based on a close analysis of current mines under exploration and permitting such as Pebble, Donlin, Chuitna, Wishbone Hill, Teller and Ambler and in-depth interviews with the key industrial, state, federal, civil, and the scientific community involved in these permitting debates, this research examines how risks vs. benefits are interpreted, discussed, debated, disputed and mediated amongst the social, scientific, economic, political and the legal community. This project promises to provide important new information on the permitting processes of mining resource-rich habitats.

IMPORTANCE OF STORAGE FOR FOOD SECURITY IN ULUKHATOK, NWT

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Research examined the vulnerability of an Inuit food system to climate change in the context of multiple socio-economic stressors through a case study of Ulukhaktok, Northwest Territories, Canada. A vulnerability science lens, described by Ford (2009), guided the research approach in order to identify and characterize the human and non-human processes that shape food system vulnerability to climate-related conditions and identifies the presence of vulnerable groups. Notably, the research extends current understanding of food security in the Arctic beyond the direct effects of climate change on access and availability of country foods, to also include insights on food storage and entry points for policy to strengthen food systems in light of expected future climate change. Data collection took place in Ulukhaktok from July to October 2014. Semi-structured interviews with open-ended questions were conducted with a cross-section of community members (n=35) and key informants (n=6); and participant observation, with a particular focus on the attributes of the dual food system including access, availability, quality, preparation, and storage of both store and country foods. Findings indicate that the ability to store preferred country foods impacts household food security. This is demonstrated in households with active hunters where larger amounts of freezer space than the community average enable them to store their harvest (e.g. musk-ox, fish, caribou, ducks, muktuk), however their summer harvest may at times be limited by the absence of a functional community freezer or ice house. These households in turn play a role in providing country foods for households with less freezer space by sharing what they are able to store. The importance of storage in Inuit food security is expected to contribute to the growing body of knowledge examining the relationships between food security and climate change while providing new insights into the socio-economic dimensions of Inuit food security. The research is part of ArcticNet Project 1.1 Community Adaptation and IK-ADAPT (Inuit Traditional Knowledge for Adaptation to the Health Effects of Climate Change) supported by CIHR).

FORMAL SAFETY ASSESSMENT IN NORTHERN MARINE TRANSPORTATION

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Climate change presages increasingly less sea ice and longer shipping seasons in the Arctic regions. This in light of an increasing global demand for the Arctic’s natural resources, cruise and adventure tourism, exponential population growth in northern regions, and the insatiable quest for more efficient shipping routes among Europe, Asia, and USA East Coast has resulted in unprecedented global interest in Arctic waters. While scientific proof indicates that Arctic ice is decreasing in overall coverage and thickness, there is considerable uncertainty among the scientific community as to exactly when Arctic waters will experience ice-free summers. Regardless, retreating sea ice will provide the opportunity to increase the annual re-supply of goods to northern communities, expedite the development of natural resource projects, increase cruise ship and adventure tourism activity, expand the fishing industry, and contribute to more efficient shipping routes. Although vessel traffic in Arctic waters is increasing, significant challenges and risks to shipping and the environment are ever present. With less ice and more shipping comes new hazards and compounded risk to maritime shipping operations. Therefore, future growth in safe, efficient, and environmentally responsible shipping in the Arctic will require further research, maritime education and training, supporting infrastructure, as well as services and resources which are currently scarce or non-existent in places. In recognition of the immense global interest and significant risks to shipping and the environment in Polar waters, the IMO is working toward implementation of its mandatory Polar Code, an international code which will provide guidance and a level playing field for those operating ships in Polar waters. Given the interconnectivity of human factors, emergency procedures and ship routeing in Polar waters, it seems practicable to be able to combine and analyze all three concepts under the Formal Safety Assessment (FSA) process when addressing Northern transportation. The FSA will be based on the review of existing literature and consultation with stakeholders from Northern communities, academics, NEXTAW, Transport Canada, the Arctic Council and others as deemed appropriate. The review and consultations will focus on the analysis of Northern shipping accidents to ascertain the cause(s) of such accidents and on IMO and Canadian education...
and training requirements for Polar water operators. Risk management focused interviews will be conducted with Canadian shipping companies operating in Northern waters. The study will also undertake an analysis of the FSA process used in maritime applications and subsequent development of a FSA for Northern marine transportation.

CURRENT DIRECTIONS FOR CLIMATE CHANGE VULNERABILITY AND ADAPTATION RESEARCH

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The last decade has witnessed a proliferation of research into the human dimensions of climate change in the Arctic. Much of this research has been supported by ArcticNet and has examined impacts on subsistence hunting, fishing, and trapping among Inuit communities. This scholarship has developed a baseline understanding of vulnerability and adaptation, drawing upon interviews with community members and stakeholders to identify and characterize climatic risks and adaptive strategies. To further advance this baseline understanding, new methodologies are needed to complement existing research if we are to capture the dynamic nature of how climate change is experienced and responded to. Longitudinal studies, community-based monitoring, and targeted adaptation research offer significant promise to advance understanding. These methodologies provide a strong basis for developing meaningful partnerships with communities, the co-production of knowledge, and empowerment for adaptation. The research is part of the ArcticNet Project Knowledge Co-Production for the Identification and Selection of Ecological, Social, and Economic Indicators for the Beaufort Sea

COSTING ADAPTATION FOR COMMUNITY HOUSING AND INFRASTRUCTURE IN TWO NORTHERN COMMUNITIES

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Permafrost thaw threatens community infrastructure and is already affecting buildings and houses across the north. The Northern Climate ExChange, Memorial University and International Institute for Sustainable Development are studying the impacts of permafrost thaw on housing and community infrastructure in Arviat, Nunavut and Old Crow, Yukon. We are conducting an economic analysis to reveal the financial costs and benefits of infrastructure adaptation choices in communities. This work builds on the hazard mapping that has been extensively undertaken for communities across the North. Hazard maps portray the
relative risk to infrastructure of individual (e.g. coastal erosion, slope movement, permafrost thaw) or composite landscape processes that affect terrain stability. These maps are challenging, however, for community decision makers to use, primarily because they tend to portray the bulk of community lands as vulnerable to some degree (red/orange or “stop/caution” in the traffic light classification scheme) and only minor areas as safe for development (mapped as green or “go” areas). The premise of our research project is that hazard maps can more fully enable community planning by conveying that most community lands are available for development if adaptation actions are taken. The key challenge is to identify the adaptation costs related to addressing those vulnerabilities. Our overall goal therefore is to provide maps that help community decision-makers in Old Crow and Arviat, and ultimately across the Arctic and sub-Arctic, in making effective and sustainable infrastructure choices in the face of climate change. We are using existing hazard maps, vulnerability assessments, permafrost studies, climate projections and other information to understand current and potential terrain instability in the study communities. With community infrastructure managers, we are identifying the repair, maintenance and replacement costs of infrastructure under baseline climate conditions. This provides the current economic value at risk without adaptation. With the support of a geotechnical engineer, we are identifying and costing potential adaptations based on projected permafrost changes in the communities. Comparing the adaptation scenarios with the baseline scenario will generate financial information that shows the benefits and costs of various adaptation options. With this information, we will generate Cost-of-Adaptation maps and related products that can be used by community planners and decision makers to guide future infrastructure decisions. The maps and products that are generated will be tested and validated with community members and decision makers to ensure that they are accessible and user-friendly.

MULTI-TEMPORAL FACTORS INFLUENCE PREDATION FOR POLAR BEARS IN A CHANGING CLIMATE

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Predation is an ecological interaction influenced by abiotic and biotic factors acting on multiple temporal scales, yet multi-temporal comparisons are rare in empirical studies. For polar bears (Ursus maritimus), the physical configuration of the habitat and conditions in which seals are hunted may change on intra- and inter-seasonal scales. Additionally, while the effects of climate change on polar bears have focused on linking reductions in sea ice to body condition and survival, the potential changes to on-ice hunting conditions have not been examined. Employing observational counts of seals killed by polar bears between early-April and late-May, 1985-2011 (n = 650), we modelled the likelihood of predation events in the Beaufort Sea, Canada at multi-temporal scales. We used the top model to estimate the expected kill rate of seals in the springs of 1985-86 and 2005-06 and integrated the result with fasting rates derived from physiological markers in blood samples. Predation events were influenced by ringed seal (Pusa hispida) reproduction and haul-out behaviour, regional sea ice concentration and the phase of climatic indices. The expected kill rate from the top predation model and the estimated mean biomass of seal kills were significant predictors of polar bear fasting rates. Documented changes in polar bear fasting rates between 1985-86 and 2005-06 are likely due to a complex set of abiotic and biotic factors including underlying prey dynamics, rather than a single-scale environmental correlation. Results also indicate a potential influential mechanism for the recently documented declines in polar bear abundance in the southern Beaufort Sea.

THE COMPLEX BALANCE BETWEEN MERCURY EXPOSURE AND COUNTRY FOODS BENEFITS: COMPREHENSIVE GUIDELINES FOR HEALTH PRACTITIONERS IN NUNAVIK

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Mercury (Hg) is a heavy metal found at high concentrations in some marine mammals and predatory fish species. While Hg exposure can have detrimental health effects at any life stage, the foetus is especially sensitive. Most Canadians are exposed to Hg through diet, specifically fish consumption. In Canada, a number of clinical guidance recommendations have been published to assist health practitioners in adopting appropriate responses to mercury exposure in patients. These recommendations are poorly adapted to the circumstances of Arctic communities, which are geographically remote and for whom local, country foods are significant sources of food, medicine, livelihood and identity. Reducing Hg exposure in the Arctic is a public health priority. Based on data from the most recent representative survey available from Nunavik, Quebec, more than half of women of childbearing-age (18-40 years) had at-risk blood Hg concentrations (above 8 µg/L). The negative health consequences of Hg exposure, especially in utero, are well documented. However, significant additional health challenges present in the Arctic, such as substantial food insecurity, the nutrition transition, and iron deficiency anaemia, complexify the recommendations and actions that doctors, nurses, midwives, nutritionists and public health professionals can make to reduce individual and population-level exposure to Hg. For example, while country foods are replete with nutrients essential for healthy pregnancies and optimal child’s health, some may also be particularly elevated in Hg. In this presentation, we will discuss the interdisciplinary, collaborative process we employed to develop region-specific guidelines for the medical management of mercury exposure in Nunavik, as well as the outcome of these efforts. After an exhaustive literature review conducted by researchers from Laval University, an iterative feedback process with members of the Nunavik Board of Health and Social Services, and one-month of community consultation with health staff from five Nunavik communities, we developed guidelines that responded to the following questions: 1) What are the global trends in Hg exposure; 2) Why is exposure to Hg a public health priority in the Arctic; 3) What are the primary dietary sources of Hg in Nunavik; 4) What are the manifestations of acute Hg exposure; 5) What are the effects of chronic, low-level Hg exposure through diet; 6) How can Hg be measured in blood, hair, and urine samples; 7) What are the guidelines for Hg concentrations of concern in select populations; 8) What should I recommend to reduce Hg exposure in women of reproductive age; 9) Why is it ill-advised to ask women to stop eating country foods; 10) Are there other considerations important to informing my clinical decisions about Hg exposure? Overall, we worked to balance concerns about Hg exposure in the Arctic with the benefits of country foods and to provide comprehensive guidelines for health practitioners that consider other health priorities also related to the environment and diet. These guidelines should help health professionals answer patient questions and provide health and nutritional counselling adapted to local needs.

CARIBOU CO-OCCURRENCE WITH HUNTERS DOES NOT INFLUENCE ITS VULNERABILITY TO SPORT HUNTING

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Human disturbances have been suggested as one of the main factor for caribou and reindeer (Rangifer tarandus) declines across boreal and arctic regions. Hunting is a human disturbance that is rarely considered in impact studies, despite the fact that it has known effects on survival and habitat use of animals. With the increasing threat of human disturbances in northern ecosystems and their potentially cumulative effects on wildlife, it is crucial to understand all sources of disturbances, including sport hunting. Our study aimed at identifying factors of vulnerability of an Arctic ungulate to sport hunting. We used a multi-species approach to assess the effect of both caribou and hunters’ behaviors on caribou vulnerability. We used a long-term data base of caribou relocations and harvest sites (1997-2015) on the Rivière-aux-Feuilles herd in northern Québec. We also collected hunters’ relocations in the hunting seasons of 2013 and 2014 at two outfitter camps. Using resource selection functions (RSFs), we first described habitat selection by caribou and hunters using habitat characteristics such as vegetation cover, elevation and distance to human infrastructures. We then used these habitat selection patterns to predict the probability of occurrence of hunters and the probability of co-occurrence of caribou and hunters.
on the hunting territory. We finally tested the effect of hunters’ occurrence, hunters-caribou co-occurrence and habitat characteristics on the spatial distribution of caribou mortality from sport hunting. Caribou vulnerability was higher near hunting infrastructures, such as roads and outfitter camps. Roads were strongly selected by hunters while they were strongly avoided by caribou, suggesting that higher harvest probability near roads may be attributable to hunters’ behavior. Camps, however, were neither selected by caribou nor hunters and, still, harvest was more probable near camps. Most hunters used camps as starting points. The density of hunters in a relatively small radius around camps may be periodically higher than elsewhere, leading to higher caribou vulnerability near these infrastructures. We also found that caribou vulnerability was higher on lakes than in any other vegetation cover types, even though caribou avoided lakes and that hunters did not select for them. We believe that this is the result of opportunistic encounters and easier detection and harvest due to high visibility. In conclusion, we show that habitat characteristics, such as vegetation cover and proximity to human infrastructures, are more important in describing game vulnerability to sport hunting than the global habitat selection behaviors of hunters and game.

**TRENDS IN THE AMERICAN, CANADIAN AND EUROPEAN FUNDING AGENCIES FOR ARCTIC RESEARCH AND THEIR ALIGNMENT WITH RESEARCH PRIORITIES AND POLICY NEEDS**

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Over the past twenty years, increasing awareness and understanding of changes in the Arctic system, the stated desires of Arctic Peoples to be engaged in the research process, and a growing international interest in the region’s resources have informed various stakeholders to undertake many Arctic science planning activities. Some of the examples of science planning include priority-setting for research, knowledge translation, stakeholder engagement, coordination and international collaboration. The International Study of Arctic Change recently initiated an analysis of the extent to which alignment exists among stated science priorities, recognized societal needs, and funding patterns of the major North American and European agencies. Here we present a decade of data on international funding patterns and data on two decades of science planning. We discuss whether funding patterns reflect the priority research questions and identified needs for information that are articulated in a myriad of Arctic research planning documents. Five funding agencies were selected (Canada: NSERC, SSHRC and CIHR; USA: NSF; Europe: EU Framework). Abstracts for the entire project proposals in the last decades were collected from these agencies and were analyzed for their funding contributions in Arctic research projects. These abstracts of Arctic projects were then screened for research priorities on the relationship between environmental change and human health. The needs for a solution-oriented science for the Arctic region were then analyzed. Our results indicate that the alignment between funded research and priority areas remains poor in some cases, and only a fraction of the total funding from these particular agencies was allocated for Arctic research projects (ranges from <1% to 3%). Most of the research projects focused on current issues and were not solution-oriented research directed towards solving societal relevant problems stemming from Arctic environment change. The results raise the question of the purpose of large-scale science planning if it does not lead to funding of at least a majority of those priorities identified by Arctic stakeholder communities (scientists, Arctic Peoples, planners and policy makers, etc.).

**A BAFFIN BAY ACOUSTIC COMMUNICATION AND NAVIGATION SYSTEM**

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In open water, autonomous floats and gliders can periodically surface and use GPS to determine their position. Iridium satellite communication can be used to send data back to land-based ocean data centers for analysis, research and operational decision-making. However, autonomous operation in the Arctic is not currently possible because ice cover prevents floats and gliders from positioning (geolocating) their measurements as well as relaying data to shore for long periods; neither GPS nor satellite data communications are possible under the water. As a result, our current set of scientific observations of the Canadian Arctic is biased towards
spring and summer when it is navigable by ships and when autonomous platforms can safely surface. To truly comprehend winter Arctic waters in the manner that has been achieved in world’s more temperate oceans, floats and gliders require additional capability for underwater geolocation and periodic communication. We propose a Baffin Bay Acoustic Navigation and Communication System (BBANC), which will use broadband low-frequency sources to provide basin-wide coverage of RAFOS-style signals for acoustic positioning of underwater assets. Low-frequency acoustic receivers would be collocated with the sources to enable ocean acoustic tomography for long-term study of heat content and currents. Finally, passive acoustic listening systems would enable the study of marine mammal communication and ambient noise from ships, sonar, ocean-based resource exploitation and ice dynamics, as well as gating acoustic source operation in the presence of marine mammals. The BBANC Project currently consists of a collaborative feasibility study to describe the basic challenges and design parameters of such a system, as well as define additional acoustic measurements required to complete a system design. Drawing from a database of over 10,000 historical temperature-salinity profiles in Baffin Bay, we will present, simulations of under-ice sound speed conditions, ice properties derived from satellite remote sensing and upward looking sonar data, and modelled acoustic propagation paths in an ice-covered Baffin Bay. Impacts of such a system on marine mammal populations will be discussed via a comparison of proposed sound levels with existing natural and anthropogenic soundscape.

INTERACTIONS BETWEEN POLAR BEARS, RINGED SEALS, AND THEIR DYNAMIC SEA ICE HABITATS

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Polar bear (Ursus maritimus) populations are sensitive to changes in sea ice extent and phenology because of their reliance on sea ice for mating, travel, and hunting their primary prey, the ringed seal (Pusa hispida). Ringed seals also depend on sea ice for mating, parturition, nursing, and moult, and several studies have shown that changes in sea ice conditions can significantly influence reproductive success. Sea ice cover can be divided into two main types of ice; landfast ice and the more dynamic pack ice farther offshore. Ringed seals and polar bears are known to use these two types of sea ice for different purposes and at different times in their life histories, but it is unknown how these species may respond to changing landfast and pack ice conditions. Additionally, to date, predictive studies on the impacts of climate change on ice-obligate species have been focused on single species’ responses. It is unknown whether the interactions between ringed seals, polar bears and sea ice will buffer or accelerate population change. We introduce a dynamic programming approach to studying polar bear habitat selection based on optimal foraging theory. This approach will allow us to consider the responses of polar bears to variable ringed seal population dynamics as well as to changing sea ice conditions. In this talk, I will outline how the dynamic programming approach can combine empirical data and ecological theory to provide a framework for understanding the effects of climate change on polar bears and ringed seals in the Beaufort Sea ecosystem.

A SPECIES DRIVEN APPROACH EXAMINING FIRE IMPACTS AND HABITAT RECOVERY FOR BARREN GROUND CARIBOU (RANGIFER TARANDUS GROENLANDICUS)

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Fire regimes in Canada’s northern boreal forest are changing, affecting available habitat for barren ground caribou across their southern range. Multiple recent studies have employed successional vegetation modelling to estimate available habitat in the future given different fire regimes. Here, we present an alternative method for assessing caribou habitat recovery post-fire by examining caribou behaviour pre-fire and post-fire across five decades. We expect complete avoidance by caribou immediately post-fire, followed by recovery of travel focused behaviour then foraging behaviour. Fire disturbances were mapped using best available pixel Landsat data from 1985 to 2011, after which fire disturbances were detected using break point analysis and
extended to 1955 using historical fire databases. Caribou behaviour was examined using step length and turning angle from 274 animals across five herds. Behaviour post-fire was assessed using generalized additive mixed models. Pre/post fire analysis demonstrated strong avoidance of burned locations, confirming our first hypothesis. Behavioural recovery, however, occurred much earlier and in a more complex fashion than hypothesized. Burned locations were used in spring, fall, and winter as early as three years post fire. In spring and fall, travel did recover prior to foraging; however, behaviour in winter showed little response to time since fire. Our approach allows for a more direct estimation of caribou habitat recovery post fire while considering different behaviours and seasons. Importantly, our results indicate that use occurs earlier than predicted in successional modelling, suggesting an overestimation of habitat loss when using successional models to project future caribou habitat.

CANADA'S ARCTIC SUBMISSION TO THE UN COMMISSION ON THE LIMITS OF THE CONTINENTAL SHELF

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Up until December 2013, Canada was expected to make a full and comprehensive submission to the United Nations Commission on the Limits of the Continental Shelf pertaining to the extended continental shelves off its Atlantic and Arctic coasts. Then on December 4th 2013, just two days before the submission was due, Prime Minister Harper announced that Canada’s submission would only pertain to its Atlantic extended continental shelf. At the same time, he publicly criticized Canadian public servants for not having included the North Pole in the Arctic submission, and announced that they were being sent “back to the drawing board” to craft a more expansive Arctic claim that included the North Pole. The paper examines the consequences of the Prime Minister’s announcement. In particular, it addresses two questions. First, did the partial submission - pertaining to the Atlantic but not the Arctic extended continental shelf - fulfil Canada’s legal requirements to make a submission within 10 years of its ratification of the UN Convention on the Law of the Sea? The answer to the first question is a qualified yes. Secondly, was the Prime Minister’s announcement problematic on other scores? The answer to this second question is a resounding yes in at least four respects. The implications of the announcements apropo these two questions is the focus of the presentation.

FINE-SCALE VARIABILITY IN PERMAFROST TERRAIN AND ITS CONTROL ON GROUND TEMPERATURE

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Surface and subsurface conditions in permafrost terrain control ground temperature. These conditions vary both spatially and temporally. As means to measure permafrost temperature at depth, boreholes are drilled and instrumented. Due to heterogeneity of terrain in permafrost regions, it can be difficult to determine exactly how a given condition influences the temperature in the ground. Spatial variation occurs at different length scales, and when one temperature series represents a large area with undetermined variability, it becomes hard to pinpoint the relation between surface conditions and their control on ground temperature. Subsequently, when one data series is applied to a large area it introduces a random component of whether that one sample truly represents the population mean. This becomes problematic when that data is used describe and predict temperature change over time. This research aims to understand the local variability at a fine scale in order to better quantify that random component. Here, “fine scale” is defined by a 15 m by 15 m area. The method is to select four points within a site that are representative of the variation found there and one data logger is installed 10 cm below the surface at each point. By doing so, regional variables such as latitude, incoming solar radiation, wind, and precipitation are being applied to all four loggers at the site. Any difference in temperature between the four loggers at a site can be attributed more specifically to the conditions at the surface and subsurface above them. That difference will inform on how representative one temperature measurement can be for a heterogeneous site. This method was applied to 43 sites in the Lac de Gras region of the Northwest Territories. The sites are divided into three terrain types: organic, boulder, and bedrock. Sites are located on hilltops, hill slopes, eskers, and valleys. The range in terrain type allows for the local variability to be analyzed within a site and then compared to a site of the same or another terrain type to determine regional variability. The surface conditions measured and
documented were local topography, vegetation (type, height, and leaf area index), along with surface permafrost landforms. The subsurface conditions measured and documented were soil properties, moisture content, and organic layer thickness. An initial analysis based on one month of ground temperature data is presented. This will demonstrate the methodology to be used once a full year of data becomes available.

**DECISION-TREE MAPPING TO IMPROVE KNOWLEDGE MOBILIZATION FOR COMMUNITY PLANNING AND HOUSING DEVELOPMENT IN ARCTIC COMMUNITIES**

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Communities in Arctic Canada continue to face housing crises, manifested in a shortage of culturally appropriate and affordable dwellings. Negative outcomes include, but are not limited to, homelessness, physical and mental illness, domestic violence, and detrimental effects on food security (Tester 2009, Minich et al 2011). Environmental change, coupled with demographic shifts, exacerbates these challenges. For example, the Hamlet of Arviat, Nunavut, expects an increase in population of over 40% by the year 2030, placing enormous pressure on the region to provide sufficient housing units. In addition, adapting to permafrost thaw and degradation represents additional housing costs through modified building plot development, upgraded foundation design and potentially increased maintenance needs. The occurrence of sensitive permafrost terrain may also constrain where housing can be built, potentially resulting in higher service costs. Geoscientific information in the form of terrain hazard assessment or permafrost mapping and characterization can help to alleviate housing challenges through identification of suitable building land and informing adaptation choices. For example, a recent initiative in Arviat, NU, and Old Crow, YK, will reveal the economic costs of adapting future community infrastructure to climate change, in particular the projected shifts in local permafrost conditions. This knowledge will provide the two communities with additional options on where to build, including the projected economic costs and benefits or a range of adaptation measures in building design under several climate scenarios. For such geoscientific and economic information to be useful, however, uptake by local and regional decision makers is key. This presupposes an understanding by researchers of the needs and resources of a wide range of decision-makers at various levels of government and the private sector. A review of vulnerability assessments and hazard mapping initiatives from across the Canadian Arctic suggested a disconnect between project outcomes and their uptake and implementation by intended users. Review recommendations included the need to map out and make explicit the processes of decision-making around housing and building land to improve knowledge mobilization (Champalle et al 2012, Ford et al 2014). Our presentation therefore explores the questions of where and when geoscientific information can best be used to inform community planning and housing development, using the specific example of Arviat, although results are relevant to Nunavut communities in general. Some, including former Inuit Tapiriit Kanatami president Mary Simon, have suggested that closing the gap in living conditions in the Arctic is not only a matter of health and well-being, but also of Inuit sovereignty and autonomy. Understanding decision-making processes therefore is not only of interest to researchers and those immediately involved in planning sustainable northern communities; it may also have implications for those interested in unravelling colonial legacies and balancing uneven power structures.

**STRUCTURAL, PSYCHOSOCIAL, AND SPATIAL DIMENSIONS OF HOUSING IN THE ARCTIC**

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Background: Housing conditions in the Canadian Arctic are an important determinant of individual and community health and well-being. In 2014-2015, about 150 social housing units were constructed in six communities in Nunavik and 200 in 12 communities in Nunavut. In collaboration with Inuit organizations in both regions, a study was designed to assess the impacts of moving to a newly built social housing unit on the health
and well-being of Inuit. This paper presents housing conditions of participants at “baseline”, i.e. before they moved to a new house. Housing conditions are explored along three dimensions identified for their plausible direct and indirect effects on health and well-being: structural, psychosocial and spatial. Methods: A total of 238 households on the waitlist for social housing were recruited by local housing managers (response rate of about 70%). Within households, all adults aged 18 years and older were invited to participate. A total of 291 adults participated to the study. Data collection took place in a neutral environment (e.g. rented rooms at municipality building). Two questionnaires were used to collect data. A Household Questionnaire collected information regarding structural housing conditions; it was administered to the main household respondent, defined as the person whose name was on the waitlist. This questionnaire provided information on the number of occupants within the household and on the number of bedrooms, from which different indicators of crowding and overcrowding were computed. Other questions addressed the need for repairs, house rules against smoking, and hidden homelessness. All participants answered an Individual Questionnaire, which collected information on psychosocial factors associated with the house environment, e.g. perceived crowding, control, safety, and privacy. It also collected information on the spatiality of housing, e.g. perceived social cohesion and safety in the community. Results: Results are reported for the 135 participants from Nunavik only (data for Nunavut were not available for analysis at the time of abstract submission). About 50% of the participants lived in overcrowded dwellings, that is in dwellings with more than one person per room, whereas 60% perceived living in overcrowded dwellings. About 30% reported living in house requiring major repairs. House rules against smoking were reported by most participants. About a third of participants reported that people stayed in their house in the previous years because they had nowhere else to live. With regards to psychosocial factors, about 40% of respondents reported low control or privacy in their homes, and about 15% reported not feeling safe. Over 60% of participants reported a good quality of life in their community, although concerns for safety were raised by some. Conclusions: These results provide novel evidence pertaining to housing conditions important for health, beyond structural information. Future work will assess whether changes in these conditions following the move to a new house is associated with changes in health and well-being.

**TAKING IT “GLOCAL”: BRINGING NORTHERN COMMUNITY VOICES TO GLOBAL CIVIL SOCIETY CAMPAIGNS ON ENERGY AND CLIMATE CHANGE**

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On August 20th, 2015, conservation photographer and guide Kerstin Langenberger posted a photograph to her Facebook page of an emaciated polar bear, along with a commentary that the bear was starving due to a changing climate. In less than 20 days, the photo garnered 7 million views, over 50,000 ‘shares’, and thousands of comments on Facebook alone, and was featured around the world on national and international news and popular science websites (Langenberger). Just two years after Inuit organizations successfully prevented a Convention on the International Trade of Endangered Species (CITES) ban on polar bear hunting, the circulation of this image to southern publics – one in a long line of ‘starving polar bear’ photographs – had ugly echoes of past conservation campaigns against whaling and seal hunting. Done with little consultation with northern peoples, these campaigns deeply affected livelihoods in Inuit, Inupiat, and Yup’ik communities (Hess; Lynge). With a melting Arctic increasingly cast as a ‘poster child’ for a changing climate, it is inevitable that civil society individuals and organizations will continue to circulate powerful narratives and images of the Arctic. Such narratives have the potential to either support or undermine the policy goals of northern indigenous communities. Drawing both on my dissertation research into twenty-five years of collaboration between Gwich’in communities and the Alaska Coalition to protect the Arctic National Wildlife Refuge, and on more recent public engagement campaigns on energy led by northern indigenous peoples (such as the Yinka Dene Alliance Freedom Train against tar sands expansion), this paper will reflect on the possibilities and limits for public storytelling as a form of engagement and even collaboration between indigenous communities and global civil society actors concerned about climate change. I will highlight roles academic researchers can play in bringing indigenous and civil society actors together. These include bringing to light a long history of colonial encounters that inform civil society-indigenous interactions (Cameron; Cruikshank; Kulchyski and Tester); bridging between science communications discourses on “communicating climate change” and northern traditional knowledge and knowledge holders (Kunuk and

WHY DID THE CARIBOU CROSS THE ROAD? - MEASURING PERMEABILITY OF A MINE ROAD FOR BARRENLAND CARIBOU

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In order to examine how the presence and use of roads may be affecting caribou movement we have conducted a four year monitoring program at the Ekati Diamond Mine using motion triggered cameras to assess caribou behaviour along project roads (2011-2015). Caribou numbers, movements, and behaviours were assessed to determine what, if any, effects the project roads have on caribou behaviour: (1) This study determined temporal and seasonal trends in caribou abundance, which were consistent with data from GPS collaring studies and Traditional Knowledge, with a maximum abundance during late summer (August) and fall. (2) The most common behaviours at the group level at roads were foraging (135 observations), crossing or crossed the road running (15 observations), walking across/along roads (169 observations), and alert (88 observations). (3) The frequencies of behaviours of caribou groups was compared adjacent to and at control sites away from the road - behaviour did not vary consistently between these groups (more stressed versus less stressed). (4) The frequencies of behaviours differed close to the road compared to control sites at the group level; investigating camera, walking, standing, foraging, bedded, and calm behaviours. (5) Deflections occurred infrequently at project roads, representing <1% of observations. Most deflections were in response to a passing vehicle. (6) No effect of group size on susceptibility to heavy or light vehicle was detected (i.e., both large and small groups behaved similar to potential vehicles disturbances). (7) Traffic on the road was relatively consistent in 2011 and 2012 and increased substantially during 2013. The camera effort adjusted number of caribou road crossings did not change with changes in yearly traffic volumes. (8) Daily differences in traffic were substantial, but differences in traffic between days was not correlated with the number of caribou observations or the behaviour of caribou, suggesting that the road itself with vehicle traffic deters caribou from crossing the road at a very low rate (less than 1%).

RESOURCE REVENUE DISTRIBUTION AND COMMUNITY DEVELOPMENT AND WELL-BEING: EVIDENCE FROM NUNAVIK

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Resource development is often portrayed as a means to improving the well-being and quality of life in Northern Aboriginal communities. This narrative makes the assumption that the benefits from employment and resource revenue distribution will improve the social circumstances in these communities. In this presentation, we will look at the evidence provided by the impact of the Raglan Mine on the two neighbouring Inuit communities of Salluit and Kangiqsujuaq. The Raglan Mine has been in operation since 1998 and has signed an agreement (IBA) with Makivik Corporation with a goal for Inuit employment at the mine. It also provides a 4.5% share of profits to Makivik, which are mostly redistributed in Salluit (35%) and Kangiqsujuaq (25%). Using data from Qanuippitaa? Nunavik Health Survey (2004), Statistics Canada and interviews conducted in both communities, we will assess the impacts and benefits stemming from the mining development.
LAKE ICE GROWTH AND DECAY IN NORTHERN SCANDINAVIA OBSERVED WITH SENTINEL-1 SAR DATA

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The high-latitude regions of the earth are characterized by a vast number of water bodies, mostly lakes. Water in general and lakes in particular have the ability to store heat. The monitoring of the ice-cover variability of lakes in high latitudes is therefore a good indicator for changes related to global warming and its effects on the Polar Regions. Furthermore the knowledge of ice growth and decay is important for environmental protection, resource development and safety of operations. E.g. frozen lakes and rivers are often used as transportation routes during the winter period and flow releases from hydroelectric generation facilities can better be managed to reduce the risk of ice jam related flooding. Remote Sensing has the capacity to provide accurate high resolution information of the sea and land surface in an automated and standardized way. In particular satellites equipped with Synthetic Aperture Radars (SAR) enable regular mapping and monitoring. Their all-weather and day and night observation capability are important advantages in the Arctic due to high cloud coverage rates and low illumination during the winter period. On April 3rd, 2014 ESA launched the first of two Sentinel-1 satellites. The main purpose of this mission is to acquire and deliver SAR data for global monitoring and observation. It ensures continuity of SAR systems operating in C-band frequency. ESA offers free and open access to the Sentinel data. Objective of the presented work is to assess the applicability of Sentinel-1 SAR data for the monitoring of lake and river ice growth and decay. Data acquired in Interferometric Wide Swath mode with VV/VH polarization were processed and analyzed for the whole winter period 2014/2015. The test site is located in Northern Finland and ranges from the Swedish border in the West to Russian border in the East. It covers three rivers, numerous small lakes, but also wide-stretched lakes like Porttipatha Lake and Lokan Tekorjavi. The latter is one of the biggest reservoirs in Europe with an extension of approximately 400 square kilometers. Four meteorological stations provide weather data that are used for verification together with optical and high resolution SAR data of the TerraSAR-X mission.

PERMAFROST DISTURBANCE IMPACTS ON WATER QUALITY ACROSS A RANGE OF WATERSHED SCALES, EASTERN BANKS ISLAND, NT

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Intensification of thermokarst disturbances have been observed across the Arctic. These are considered to reflect changes in landscape stability brought about by changes in climate, including warming and/or intensification of summer precipitation that have resulted in increased active layer thaw depths. Retrogressive thaw slumps (RTS) are a form of thermokarst that develops on permafrost terrain underlain by massive ground ice. An extensive number of thaw slumps have been mapped at our study area situated in the Jesse moraine belt on eastern Banks Island, NT. Field research has found this region to be extensively underlain by buried glacial ice. A comparison of 2008/9 satellite images with current satellite imagery demonstrates that there have been substantial increases in the number and size of RTS in addition to the appearance of a large sediment plume entering the ocean from the main study area river in 2012. While suspended sediment and solute concentrations in runoff from thaw slumps would be expected to have an immediate localized effect on water quality, how this impact is manifest at different watershed scales remains poorly understood. Hence, the objectives of this work are to investigate the local and downstream impact of RTS on water quality by examining varying sizes of watersheds with different numbers and magnitudes of disturbance. Prior to the 2015 field season, watersheds were delineated using 2nd and 3rd order streams to guide a field water sampling strategy. Water samples were then collected over a six-hour period on July 8, 2015 and were analyzed for dissolved chemical constituents including major ions and metals, suspended sediment and stable isotopes. Results clearly illustrate the relationship between RTS density, watershed order, suspended sediment concentration (SSC), and total dissolved solids (TDS). Impacted watersheds have mean SSC values that are four magnitudes greater than unimpacted watersheds.
(90,000 mg/L vs 10 mg/L) and TDS values that are more than twice as high (500 mg/L vs 250 mg/L). While the impact of thaw slumps on SSC and TDS diminishes with increasing watershed order, the influence of thaw slumps is still clearly evident at the marine outlet of the watershed (6th order, 230 km² watershed) with SSC and TDS values of 3030 mg/L and 320 mg/L respectively. The broad scale impact of extensive buried glacial ice and widespread thermokarst disturbances includes drastic changes to the hydrogeomorphic system as watersheds receive large quantities of new sediment inputs that may geochemically differ from weathered surface materials that characterize the active layer. Ice-cored permafrost landscapes are highly sensitive to climate change and thermokarst disturbances. A better understanding of the sedimentological and geochemical effects of thaw slumps on water quality at both local and broader scales is necessary for understanding the present state of the hydrological system, and predicting the potential impacts of future change.

FROM SPRUCE TO SHORE: SUBARCTIC AND LOW ARCTIC VASCULAR PLANT BIODIVERSITY OF THE LOWER COPPERMINE RIVER VALLEY AND VICINITY (NUNAVUT, CANADA)

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Exploration of the vascular plant flora of the Canadian Arctic has been ongoing for almost two hundred years, yet substantial gaps remain in our floristic understanding of this large, rapidly changing and difficult-to-access ecoregion. Detailed baseline information on the diversity and distribution of Arctic plants is urgently needed to understand the potential impacts of climate change on the region's flora. In July 2014 we explored the rich flora along a Subarctic to Arctic gradient along the Coppermine River valley in western Nunavut, including Bloody Falls/Kugluk Territorial Park and Kugluktuk and vicinity. In this botanically underexplored area the treeline reaches its northern limit in Nunavut, just 40 km south of the Arctic coast. Study of our >1000 new and all previous collections of vascular plants document some 304 species in the area, comprising a mixture of boreal taxa (most at their northern limit), Arctic taxa (some at their southern limit), and amphi-Beringian taxa (some at their eastern limit). Among our collections are many first records for Nunavut (Allium schoenoprasum, Botrychium tunux, Draba lonchocarpa, Eleocharis quinqueflora, Eremogone capillaris subsp. capillaris, Festuca altaica, Polygonum aviculare, Salix ovalifolia var. arctolitoralis, S. ovalifolia var. ovalifolia, Stuckenia pectinata), mainland Nunavut (Carex gynocrates, C. livida, Cryptogramma stelleri, Juncus alpinoarticulatus subsp. americanus, Salix pseudomyrsinites), numerous northern and southern range extensions for boreal and Arctic species (Anthraxanthum arcticum, Arctostaphylos uva-ursi, Betula occidentalis, Carex adelostoma, C. capitata, C. lachenallii, C. norvegica, C. petriocosa subsp. petriocosa, Castilleja raupii, Draba simmonsii, Epilobium arcticum, E. davuricum, Festuca viviparoidaea subsp. viviparoidaea, Hordeum jubatum subsp. intermedium, Juniperus communis subsp. depressa, Linnaea borealis subsp. americana, Potamogeton gramineus, Rubus arcticus subsp. acaulis, Sagina nodosa subsp. borealis, Stellaria borealis subsp. borealis, Shepherdia canadensis, Taraxacum phymatocarpum, Utricularia intermedia, U. vulgaris) and many first records for the study area, which fill in gaps in the known distributions of Arctic species. Several species in the area reach their known northern limits in Nunavut in Kugluk/Bloody Falls Territorial Park, a protected site. The many floristic novelties identified for the study area underscore the fact that there remains much to learn about vascular plant biodiversity in Canada’s Low Arctic.

PARTICIPATORY METHODS IN RIGOLET: EVALUATION OF INUIT HEALTH PROGRAMS AND COLLABORATIVE DEVELOPMENT OF A WHITEBOARD VIDEO FOR HEALTH PROMOTION

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Indigenous populations face the greatest health disparities globally; even within developed countries
such as Canada. For example, incidence of acute gastrointestinal illness (AGI) is greater for the Inuit community of Rigolet, Nunatsiavut, Labrador as compared to rates within southern Canadian communities. Public health interventions and programs are set up to help alleviate the burden of various illnesses and use a variety of communication means such as posters, brochures, pamphlets, and videos. However, in recent years there has been a strong focus on the contextual relevance of these approaches to the communities in which they are hoping to generate change. Broadly created public health programs may not be as effective when applied to specific culturally distinct communities. Inuit culture is very oral and visual, and storytelling is an important cultural tradition. These significant parts of Inuit culture can, and should be used to inform and shape public health programs in order to garner more interest and community relevance. Additionally, public health programs require an evaluation to determine whether they are achieving the desired objectives of the specific program/intervention and to inform future initiatives for improved impact. The objectives of this project are to (1) co-develop with Inuit youth a whiteboard video, (2) co-develop an evaluation framework for Inuit health programs, using participatory methods within one community in the Canadian North and (3) assess the development and use of the video using the framework. In-depth interviews were conducted with 34 Rigolet community members and Nunatsiavut Government employees to discuss the evaluation framework's needs and perspectives on participation in the evaluation of public health programs. Additionally, 6 youth from Rigolet aged 11-13 years old were involved in a three-day workshop to develop ideas for the whiteboard video. Further community feedback on the video and the youth’s ideas was obtained through a community open house. Surveys were also completed at the community open house and were used to collect information on the participants’ health information seeking behaviour, their experience with whiteboard videos and their ideas for the whiteboard video content. Approximately, 10% of the community attended the open house and everyone that attended, participated in the survey. Preliminary results suggest evaluation of public health programs should engage individuals in providing feedback on the program. Additionally, preliminary results show interest and acceptance from the community for the whiteboard video as a novel and innovative tool to share information. We will develop an evaluation framework that can be used across many public health interventions. We will test this framework by developing a whiteboard communication tool regarding AGI and assess both the evaluation's generalizability and the development and use of this communication tool in this community.

INVESTIGATING THE IMPACT OF SUMMER MELT ON THE EFFECTIVENESS OF POLARIMETRIC MICROWAVE REMOTE SENSING FOR SEA ICE TYPE DISCRIMINATION IN THE CANADIAN ARCTIC ARCHIPELAGO

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Satellite synthetic aperture radar (SAR) data are used by agencies tasked with discriminating sea ice types and defining ice conditions in support of safe voyages in ice-prone waters. SAR based sea ice information is also used to support of scientific research and the activities of people in northern communities. During summer the reliability of SAR data is severely compromised by melt water impacts on SAR measured microwave backscatter. Challenges include developing a better understanding of summer sea ice physical properties and microwave backscatter at critical scales, and developing new SAR technologies which overcome melt related ambiguities and offer observational stability. The goal of this research is to advance the utility of polarimetric and compact polarimetric (CP) backscatter parameters, from the C-band (5.5 GHz) RADARSAT-2 SAR, for discriminating sea ice types and geophysical information during the summer melt period. New results from a 2015 field and image acquisition campaign in the Victoria Strait section of the Canadian Arctic Archipelago are highlighted. During this campaign a suite of RADARSAT-2 images comprising a mixture of landfast sea ice types were acquired during pre-melt (winter) and summer periods. Coincident sea ice thickness and ice surface roughness data were acquired using a suite of helicopter-borne sensors flown over the study site during winter. Ice thickness and roughness data were used to identify contiguous zones of first-year ice (FYI) and multiyear ice (MYI) types, from which baseline (winter) polarimetric and CP backscatter information was characterized. After the onset of summer melt, when the sea ice was flooded by melt water, a set of coincident high-resolution (50 cm pixel) visible-near infrared images of FYI and MYI were acquired from the World-View 2 satellite. Optical scenes were partitioned into relative fractions of ice, open water, and melt pond.
The winter to summer change in polarimetric and CP backscatter parameters according to ice type, as well as the contribution of sea ice melt ponds to variations in summer backscatter parameters, are here detailed.

LAKE HAZEN WATERSHED: A SURROGATE FOR ASSESSING CHANGES IN TERRESTRIAL INPUTS TO THE NEARSHORE MARINE COASTAL ZONE IN THE HIGH ARCTIC

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Effects of global warming on the nearshore marine environment in the arctic is currently a topic of intensive research. Nutrient loading from the terrestrial system and the coupling between land and nearshore environment is changing but few terrestrial systems are amenable for study, especially in the high arctic. Lake Hazen is a large, inland lake in Quttinirpaaq National Park, Nunavut at the northern end of Ellesmere Island with terrestrial inputs from both glacial fed rivers and streams fed by active layer and permafrost thawing. The lake maximum depth is 265 m and the whole lake water residence time is nominally 89 years. Recent work has shown that Lake Hazen and its watershed have undergone rapid change within the past 5 years and spurred a new intensive research effort on the lake and watershed. Lake Hazen is now consistently ice-free for part of the summer and both glacier ablation and lake sedimentation rates have increased dramatically. In 2015, we sampled lakes, ponds, seeps, streams, subsurface water and rivers in the Lake Hazen watershed to assess nitrogen (N) inputs and both the quantity and quality of dissolved organic carbon (DOC) inputs. We also performed microbial decomposition and photolysis experiments to explore the downstream fate of DOC and release of N. Carbon (C) and water isotopes are used to follow flowpaths and sources of C. DOC concentrations are very low in glacial rivers but are elevated in ponds and surface streams or rivulets where microbial mats can develop. This DOC is low in visible colour and fairly resistant to both short term photochemical and microbial loss suggesting that nutrients associated with DOC are amenable for export to coastal areas. Transport is limited however to snowmelt periods and the short summer when water released from the deepening active layer connects the terrestrial and aquatic systems. The complex interplay of processes controlling production and loss of dissolved organic matter will govern the terrestrial response to changes in temperature and precipitation and thus the export of nutrients to the nearshore coastal zone.

MINING ECONOMIES AND LOCAL BUSINESS DEVELOPMENT

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Our paper discusses how to evaluate the economic impacts of major extractive industries on local businesses in Nunatsiavut and Nunavik. We assess mining activities and the economic links and revenue flows between the Voisey’s Bay and Raglan mines and local businesses. We first present a comprehensive literature review that documents the impacts of mining on local businesses and communities in Canada. We then discuss findings from focus groups meetings with 4 select communities (2 from Nunavik (Kuujjuaq and Salluit) and 2 from Nunatsiavut and surrounding area (Goose Bay and Nain)) and their implications for the construction of a comprehensive business survey for the two regions. The focus group questions are designed to allow local business leaders to share their experiences regarding the aforementioned mining projects and allow researchers to identify gaps in the existing literature. The results of the focus group sessions will be used to design a survey to be distributed to all businesses in Nunatsiavut and Goose Bay, Kuujjuaq, Kangiqsujuaq and Salluit (Nunavik). These business surveys will be used to document, compare, examine and interpret the experience of Inuit entrepreneurs in Quebec and Labrador in relation to mining sectors in their respective regions. In addition this research will complement and augment the existing literature on the impacts of mining on local businesses and serve to construct an up-to-date, rigorous baseline for assessing,
managing and promoting local Inuit business development in future mining activities.

**COUPLING OF PHOTOSYNTHETIC ELECTRON TRANSPORT AND CARBON FIXATION RATES IN ARCTIC MARINE PHYTOPLANKTON ASSEMBLAGES**

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Fast repetition rate fluorometry (FRRF) has the potential to provide estimates of primary productivity at unprecedented spatial and temporal resolution. FRRF-derived productivity rates are based on estimates of charge separation in photosystem II (ETR_RCI), which must be converted into ecologically relevant units of carbon fixation. Understanding sources of variability in the coupling of ETR_RCI and carbon fixation (Φ_e:C/nPSII) provides important physiological insight into phytoplankton photosynthesis, and is critical for the application of FRRF as a primary productivity measurement tool. Whereas a number of studies have examined the coupling between ETR_RCI and carbon fixation in various oceanic regions, almost no data are available from the Arctic Ocean. Instantaneous, high resolution data is of particular importance in this polar region, where scarcity of primary productivity measurements makes it impossible to establish robust baselines, against which changes future changes can be detected in the face of significant environmental perturbations. We present preliminary results from data collected during Leg 2 of the 2015 GEOTRACES expedition, during which we simultaneously measured phytoplankton carbon fixation rates and ETR_RCI, both as a function of short-term light availability (PvsE curves). Samples were collected at 8 stations, and during a light/pCO2 manipulation experiment. Our approach allows us to assess changes in realized rates (ETR_RCI and carbon assimilation) and the derived conversion factor (Φ_e:C/nPSII), as well as their capacity (Pmax) and efficiency (α). We discuss our results in terms of the metabolic responses to varying light and CO2 conditions, and the potential environmental controls on marine productivity in a rapidly changing Arctic Ocean.

**POST-CALVING AND SUMMER HABITAT SELECTION BY A DECLINING CARIBOU HERD IN THE CENTRAL CANADIAN ARCTIC: APPLICATIONS FOR CUMULATIVE EFFECTS MANAGEMENT AND CONSERVATION**

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Barren-ground caribou (Rangifer tarandus groenlandicus) are a biologically and culturally important species in the Arctic. Caribou not only sustain wild predator populations such as wolves, grizzly bear and wolverine, but also provide a critical resource for human populations living in the North, particularly Aboriginal communities. Hunting, disease, and environmental variability can all affect caribou numbers, and the effects from industrial activities occurring within the species range are monitored for management of caribou. The Bathurst caribou herd winters below the treeline and migrate to calving grounds currently to the west of Bathurst Inlet, the herd’s namesake. The Bathurst caribou herd has experienced significant declines since the mid 1980’s, to around 16,000 animals currently. These population trends have been attributed to declining calf survival, and concomitant declines in adult female fecundity, and low over-winter survival. While the decline in caribou numbers may be a consequence of natural population cycles, current low numbers make the populations vulnerable to human harvest, disturbance, disease, and weather events. Caribou vary in their response to disturbances based on the time of year and age of calves. Caribou may sensitive to population-level effects during calving and post-calving when calves are most susceptible to predation and disturbance. Recent evidence suggests that over-winter survival of calves may be related to conditions on the summer range. Inadequate leaf biomass, late start date and early end date of green leaf biomass, and poor quality of leaf biomass in the summer range are generally believed to be detrimental to caribou growth and pregnancy rate during the summer-fall period and calf:cow ratio in the next year. Understanding the relative contributions of
natural and anthropogenic factors to population level changes is the goal of cumulative effects assessment, and fundamental to developing sound management practices to promote the long-term sustainability of the Bathurst herd. Resource Selection Functions are increasingly being used to provide information on essential resources needed to manage and conserve rare, threatened, and endangered species in complex socio-environmental landscapes. RSFs provide an objective and explanatory framework to assess habitat selection and relative habitat quality at multiple scales and across individuals and populations. We present results from RSF modeling for the Bathurst herd using GPS collar data collected between 2004 and 2011. The modeling effort focused on the post-calving and summer ranges as these periods are when caribou calves may be most vulnerable, and conditions on these ranges may determine over-wintering success and recruitment. We discuss these results in the context of cumulative effects management, and explore paths forward to understanding potential mechanisms that underlie the declining population trend.

21ST CENTURY GLACIER CHANGE IN THE CANADIAN HIGH ARCTIC: RATES, MECHANISMS, AND FEEDBACKS

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In the 21st Century, the ice caps and glaciers of the Canadian High Arctic have become the 3rd most important regional contributor to the eustatic component of global sea level rise after the ice sheets of Greenland and Antarctica (Gardner et al., 2013). Changing rates of glacier mass loss are documented by in situ measurements of glacier surface mass balance, satellite-derived measurements of glacier surface velocity and iceberg calving fluxes, and GRACE satellite gravimetry. Most of the recent increase in rates of mass loss arises from increased surface melting and meltwater runoff in summer. The meteorological context for this is an unprecedented increase in the frequency of anticyclonic circulation over the region in summer, and an increased incidence of warm core lows passing over the region in the fall. The energy sources driving increased melting differ between the two synoptic settings (increased net solar radiation under anticyclonic conditions, and increased long wave radiation during the passage of warm core lows). Iceberg calving and other forms of marine mass loss are temporally variable, but generally minor, contributors to the overall mass loss rate. The factors responsible for variability in the marine mass loss rate are as yet unclear, due largely to a lack of oceanographic data from locations proximal to tidewater glaciers and floating ice tongues. At least two significant feedbacks likely contribute to the recent increase in summer melt: (i) the snow/ice albedo feedback, whereby decreasing surface albedo results in greater absorption of solar radiation and higher melt rates per unit incident solar radiation, and (ii) a feedback involving increases in the ice content of the near surface section of the firn layer on the ice caps. The latter feedback may contribute to the albedo decrease, and increase the fraction of surface melt that runs off by warming the firn with the latent heat of freezing, and by impeding the deep percolation of meltwater into the firn. The precise mechanisms involved in the surface albedo feedback in this region have yet to be determined.

SPATIO-TEMPORAL OCCURRENCE OF RABIES EPIZOOTICS ACROSS CANADIAN ARCTIC, 1953-2014: FROM DISEASE SURVEILLANCE TO ECOLOGICAL MECHANISMS

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Rabies is endemic throughout the Arctic, and domestic dogs that have come in contact with rabid wild carnivores are the main source of rabies exposure for humans. Rabies is an ongoing public health concern for
residents of northern communities, but little is known about the epidemiology of Arctic rabies. The aim of this study is to provide a descriptive overview of the spatio-temporal distribution of animal rabies cases across the Canadian Arctic and to explore the mechanisms underlying the onset of rabies outbreaks in the fox populations. In Canada, the Canadian Food Inspection Agency (CFIA) is responsible for rabies diagnostic testing of all wild and domestic animals suspected to be rabid and where there was a potential human or domestic animal exposure. The data collected through this surveillance system represent the largest and most comprehensive database of rabid animals across Canada, and provides unique information about spatio-temporal distribution of rabies cases in the Canadian Arctic. Here, we present an analysis of rabies cases collected in Yukon, Northwest Territories, Nunavut, Nunavik and Labrador from 1953 to 2014. Preliminary results show that rabies cases were found in all Arctic regions of Canada except Yukon, and were relatively synchronous among species. Nunavut seems to be an endemic region for Arctic rabies with an apparent 9-year cycle. This study provides the first portrait of rabies across the Canadian Arctic, and for the first time explores density and dispersal of fox populations as drivers in rabies transmission dynamics. Further analysis of these data in an epidemiological modelling context may allow us to better understand and predict the spatio-temporal dynamics of rabies occurrence in both wild and domestic carnivores, leading to better estimates of the varying risk of human exposure.

OPPORTUNITIES TO REDUCE ENVIRONMENTAL IMPACT OF RESEARCH ACTIVITIES IN ARCTIC WATERS

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Marine Operations in the Offshore Arctic impact the environment across several, distinctly different, facets. Air Emissions, Acoustic Noise, Incidental Water Pollution, and Allowable Discharges constitute environmental impacts that cannot be avoided while conducting research in Arctic waters. All of these issues require pragmatic consideration when undertaking the selection process for a vessel to conduct the research program. With the research expedition’s natural focus on collecting as much data as possible within budget limitations, opportunities exist to minimize the environmental footprint while retaining the optimal utilization of research funds. This paper provides a basis for making such decisions, both for the selection of existing vessels, as well as design considerations for new vessels.

OURANOS’ NEW PROGRAM 2014-2019 TO ADDRESS CLIMATE CHANGE IMPACTS AND ADAPTATION ISSUES IN NORTHERN QUEBEC

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The objective of this presentation is to inform conference participants on Ouranos’ Northern Environment Program and its new research framework, objectives and priorities for 2014-19. It will also emphasize on research projects under-way, including two ArcticNet co-funded projects started this year. Ouranos (www.ouranos.ca) -a scientific consortium on regional climatology and adaptation to climate change- provides stakeholders and decision-makers with up-to-date data and information to help society adapt to climate change. Bringing together researchers from many disciplines and different institutions it conducts integrated research projects that combine climate science (e.g. climate change scenarios) and R&D (on vulnerabilities, impacts and adaptation) to meet the needs of end-users, policy-makers and decision-makers, mainly in Quebec. Given the significant challenges posed by climate change and the presence of active research networks in arctic and subarctic regions, this program targets complementarity to existing initiatives and support to territorial development governing bodies at all levels of government. With the aim to support integration of climate risks in decision-making and sustainable northern development, program’s goal is to improve knowledge on adaptation, enhance outreach and increase knowledge transfer to institutional bodies who manage the territory in Northern Quebec. To achieve this goal, four objectives were identified by the Program Committee: i) Make sure that created new knowledge is efficiently transferred to stakeholders; ii) Favor the issues which are not well covered by other research networks; iii) Support and help institutional bodies in the decision-making process; and iv) Improve the understanding of the issues linked to the identification, analysis, implementation and assessment of the adaptation. Moreover, the program will explore two priority issues, using an integrated approach: 1) The food security and management of harvested resources; and 2) The authorization process
and how climate risks are taken into account. One of the continuing projects deals with permafrost instability and preservation of Canada’s northern transportation infrastructures: its goal is to develop expertise to improve adaptive capacities and mitigate impacts of climate change. A second project addresses the impacts of climate change and related storms and surges in the Hudson Bay and James Bay, by improving the modelling of storminess on present and future extreme water levels along the coast. In addition, two new projects were elaborated within the ArcticNet 2014-Call for Proposals, with additional support from Ouranos. A first project will assess the exposure, sensitivity and vulnerability of the tundra ecosystem to climate change to provide the basis information for supporting biodiversity conservation plans and territory planning. A second project is to expand and ensure the continuity of a community-based environmental monitoring (Avativut Program), using climate change indicators, for stimulating science education in the schools of Nunavik. The Northern Environment program and supported projects are developed in collaboration with partners in this area: research networks such as ArcticNet and the Centre for Northern Studies (CEN), the Federal & Provincial Governments, universities, as well as Nunavik authorities, stakeholders and communities.

ARCTIC BIODIVERSITY ASSESSMENT: AN OVERVIEW OF STATUS AND TRENDS OF BIODIVERSITY AND ITS THREATS IN THE CIRCUMPOLAR ARCTIC

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The Arctic Biodiversity Assessment was released in 2013-14 by the Conservation of Arctic Flora and Fauna (CAFF), a working group of the Arctic Council. Its purpose is to synthesize and assess the status and trends of biodiversity in the circumpolar Arctic, providing a sound scientific basis for decision making that affects Arctic biodiversity. The ABA was produced as a series of 5 reports: •Arctic Biodiversity Trends 2010, which is an indicators report reflecting CAFF’s contribution to the global biodiversity target to reduce the rate of biodiversity loss •2013 Full Scientific Assessment, with contributions from 253 scientists, which details status and trends of Arctic Biodiversity and descriptions of species, ecosystems and threats. The chief scientist was Hans Meltofte •2013 Synthesis Report , which summarizes the results of the full report in a shorter, more digestible format for the non-scientist •2013 Summary for Policy Makers, which provides key findings and recommendations, adopted for implementation by the Arctic Council Ministers; and •2013 Life Linked to Ice : A guide to sea-ice-associated biodiversity in this time of change The Arctic Biodiversity Congress, in Trondheim Norway, Dec. 2014, was a follow-up to the report, in which over 400 participants provided advice on the most critical policies and actions needed to address issues raised in the ABA. At the 2013 Arctic Council Ministerial the Arctic Council Ministers agreed to implement the 17 recommendations articulated in the Arctic Biodiversity Assessment: Report for Policy Makers. Subsequently at the 2015 Arctic Council Ministerial in Iqaluit the Ministers approved the Actions for Biodiversity 2013-2021: implementing the recommendations of the Arctic Biodiversity Assessment. This is a living document that will be reviewed and updated every two years. This presentation will provide an overview of status and trends for Arctic species and ecosystems and both current and anticipated threats, as well as approaches to address threats. Topics will include status and trends in a diverse subset of species (e.g. marine mammals, migratory birds, seabirds, invertebrates, microbes and plants) and ecosystems (e.g. freshwater, tundra, and marine). Threats to Arctic biodiversity from both within the Arctic and outside the Arctic will also be presented, including climate change, pollution, invasive species, range expansion of southern species, and habitat destruction in staging and wintering areas, will also be presented.

MAXIMIZING THE VALUE OF SOCIAL SCIENCES RESEARCH THROUGH REPURPOSING AND THE PROMOTION OF STEWARDSHIP AND EDUCATION TO RESOURCE USERS

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The Torngat Joint Fisheries Board (TJFB) and the Torngat Wildlife and Plants Co-management Board (TWPCB) are Institutions of Public Government created from Chapters 12 and 13 of the 2005 Labrador Inuit Land
Claims Agreement (LILCA). The Torngat Secretariat (Secretariat) is a small work team of professionals who support both Boards. The organization’s vision is healthy ecosystems and communities with shared stewardship of wildlife, plants, and fisheries. This vision will be achieved through a mission to enhance the sustainable utilization and management of wildlife, plants, fisheries, and their habitat. Through the development of a strategic plan, the organization subsequently started to further implement a stewardship and education campaign. Atlantic Salmon and Arctic Char are two species covered under this plan and proposed to be the subject of a 30-minute talk at the Arctic Marine Resource Governance Conference. Atlantic Salmon are subject to governance through the North Atlantic Salmon Conservation Organization (NASCO) and a shared resource with users in the United States, Canada, and Greenland. From a Labrador Inuit perspective, Atlantic Salmon are an important food source. Labrador Inuit have also proven to be true stewards of this resource, and this will be presented through the presentation of various stewardship and education products ranging from documentary films, placemats, community posters, and social media approaches, with further discussion about the outcomes from the 2015 NASCO annual meeting. This talk would focus on the human dimension of inter-jurisdictional co-management and encourage an increased level of dialogue across geo-political boundaries. Dialogue that aim to solve critical questions such as: How do we deal with different jurisdictional definitions of subsistence? How do we deal with different jurisdictional management objectives? How do we deal with allocation inequities for shared resources? The talk will further increase stewardship promotion, using the analogy of preventative healthcare. It is important we protect our shared resources when they are healthy and keep them as such, as apposed to reacting when resources levels are critically low.

BUILDING CAPACITY TO MONITOR THE RISK OF CLIMATE CHANGE ON WATER QUALITY AND HUMAN HEALTH: A TWO YEARS JOURNEY EXPANDING COMMUNITY-BASED LEADERSHIP IN POND INLET

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Building local capacity in the field of Arctic Research becomes a priority for many stakeholders: community, educational institutions, academia and leaders. Building capacity is an essential first step towards the development of community-based research endeavors; culturally relevant and grounded in community priorities. Building capacity means opportunity and empowerment for community and, for the academia; it is a gateway towards gaining new perspectives and developing trust relationship. Our community of Mittimatalik is experiencing accelerated environmental changes under global warming and industrial development. Our people are getting more concerned with regards to the quality of our food and water. Many of us have experienced stomach illness recently and we fear that it might relate to the degradation of our environment. Our local leaders and elders have encourages us, the young generation, to take action and gain more knowledge to become the next stewards of the environment. We wished to conduct our own research project to study the pressing issue of stomach illness. With the help of researchers from ARCTIConnexion, Dalhousie University, Université du Québec à Rimouski and University of Guelph and with the support of the Nunavut Research Institute and local partners, and funding from Health Canada, we have initiated in 2014 a two years pilot where us, the local youth, would lead a research project while receiving an ongoing training in advanced research, and where scientific procedures would harmoniously merged with Inuit knowledge and principles. Our core research question was to understand the state of our fresh water and see whether or not it poses a risk to people's health in order to better inform our community and develop best practices. A related question was to study the impact of climate change on our water. During 2014, our research activities consisted of addressing Mittimatirmiut’s water use habits through surveys, quantifying indicators of possible fecal contamination (coliforms, E.coli and Enterococci), monitoring water parameters, sampling benthic invertebrates and documenting historical knowledge of fresh water among our elders. We have
found a significant number of water samples that tested positive for fecal coliforms, E.coli and Enterococci within four streams located in the vicinity of the community and from our water reservoir. Surveys from 53 different households indicated that these sources were actually used by Mittimatalirmiut and 30% of the respondents reported stomach illness. We found the highest density of bacteria during the episodes of heavy rain which reflect observations from our elders that our summers have become “wetter” in recent years. Elders unanimously recommended a new site as municipal water reservoir, one that would have deeper and flowing water. At summer 2015, we expanded our research to study harmful pathogens in our fresh water through DNA qPCR procedure, weather patterns with two HOBO units and stream flow with pigmy meter. We also conducted health survey with >100 households and ran an Elders Camp that brought local students to learn more about historical changes in water quality. We are now running data analyses. Within this two years journey, five of us have developed capacity and leadership skills as young researchers of the North. We wish that this model would inspire youth from other community and researchers to team-up and build more research capacity in the North.

COUNTRY FOOD GUIDELINES PROJECT: INCREASING ACCESS TO TRADITIONAL FOOD IN FACILITIES AND PROGRAMS IN NUNAVUT

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Food insecurity is a significant concern in Nunavut, and access to country food (traditional food) is central to achieving food security. The Government of Nunavut encourages government operated facilities and community-based programs to serve country foods whenever possible. These settings, which include long-term care facilities, boarding homes, hospitals, and schools, provide an opportunity to support country food access to some of the most vulnerable Nunavummiut, including pregnant women, elders, and children. However, a lack of clear guidelines for serving country food in facilities and programs has been identified as a barrier. The purpose of the Country Food Guidelines project is to help facilities and programs serve more country food by providing guidance for acquiring, storing, preparing, and serving country food. The project considers Inuit harvesting practices, traditional food preferences, wildlife health and sustainability, food safety practices, and nutritional needs. We completed a literature review to examine the prevalence and risks of zoonotic diseases in Arctic wildlife. We conducted key informant interviews (n = >30) with hunters, facility staff, program workers, environmental health and nutrition specialists, food safety experts, Inuit organizations, wildlife regulators, food processing plants, and facilities in Canada in Greenland serving traditional food. We consulted with Inuit hunters as well as visited facilities and programs in four Nunavut communities. We found that there are a number of zoonotic diseases of concern in Nunavut, but measures can be taken to reduce the risk of transmission from animals to humans. Hunters, program workers, and facility managers are receptive to knowing more about zoonoses and reducing risks wherever possible. Both Inuit Qaujimajatuqangit and policies in other jurisdictions can help inform this. Hunters in Nunavut are supportive of country foods being served in facilities and programs, and are interested in working towards this, both to provide vulnerable populations with access to country food and to provide hunters with access to income. During fall 2015, we will present research results and draft guidelines to hunters, facility staff, program workers, and other key informants for feedback and input on implementation. A pilot project to implement the guidelines is planned for early 2016. There is interest from all groups to develop a knowledge exchange session to facilitate the exchange of Inuit traditional knowledge and research-based knowledge around zoonotic disease and food safety in country food in Nunavut.

FOOD POLICY IN CANADIAN INUIT COMMUNITIES: IS THERE A ROLE FOR COUNTRY FOOD MARKETS?

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The Nunavut Food Security Coalition is a collaborative group of government departments, Inuit organizations, non-governmental organizations, and the private sector working together to improve food security in Nunavut. One of the Coalition's objectives is to help ensure that Nunavummiut who are most vulnerable to food insecurity are able to access country food. While the Coalition encourages the sharing of country food, it also respects the decisions and rights of Inuit to buy and sell country food. In Nunavut, several options exist for buying and selling country food, including informal markets, retail stores, commercial plants, and online sales. However, these options are relatively new to the territory and are not available to everyone at all times. Other Arctic regions, on the other hand, have had a much longer history of buying and selling country food, and the Coalition wanted to learn from their experiences. We examined if country food markets (CFMs) offer a feasible, sustainable, and effective model for strengthening food systems in Nunavut, drawing upon the model of Greenland. We conducted semi-structured interviews (n=45) with key informants to examine the Greenlandic CFM model and evaluate its potential development in Nunavut as part of territorial food policy. We found that the Greenland experience indicates that CFMs can provide access to sufficient, safe, and nutritious food on a regular basis, and can diversify locally available foods. These benefits are transferable to Nunavut, although knowledge gaps, regulatory and institutional conditions, and concerns over how CFMs might affect the cultural basis of Nunavut food systems, underlies apprehension over their development in the territory. We conclude that Nunavut is not currently in the position to develop CFMs, but their role in food policy should not be discounted. Future development would need to first solicit community input on CFMs, resolve regulatory issues around wildlife management and harvesting, and study how future risks would affect sustainability and effectiveness.

THE FUTURE OF THE SUBSURFACE CHLOROPHYLL-A MAXIMUM IN THE CANADA BASIN - A MODEL INTERCOMPARISON

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Six Earth system models and three ocean-ice-ecosystem models are analyzed to evaluate magnitude and depth of the subsurface Chl-a maximum (SCM) in the Canada Basin and ratio of surface to subsurface Chl-a in a future climate scenario. Differences in simulated Chl-a are caused by large intermodel differences in available nitrate in the Arctic Ocean and to some extent by ecosystem complexity. Most models reproduce the observed SCM and nitracline deepening and indicate a continued suppression in the future until the models reach a new state with seasonal ice free waters. Models not representing a SCM show either too much nitrate and hence no surface limitation or too little nitrate with limited surface growth only. The models suggest that suppression of the nitracline and deepening of the SCM are caused by enhanced stratification, likely driven by enhanced Ekman convergence and freshwater contributions with primarily large scale atmospheric driving mechanisms. The simulated ratio of near surface Chl-a to depth integrated Chl-a is slightly decreasing in most areas of the Arctic ocean due to enhanced contributions of subsurface Chl-a. Exceptions are some shelf areas and regions where the continued ice thinning leaves winter ice too thin to provide a barrier to momentum fluxes, allowing winter mixing to break up the strong stratification. Results confirm that algorithms determining vertically integrated Chl-a from surface Chl-a need to be tuned to Arctic conditions, but likely require little or no adjustments in the future.

A NATIONAL WILDLIFE HEALTH STRATEGY FOR NORTHERN ONE HEALTH NEEDS

Stephen, Craig

Canadian Wildlife Health Cooperative

Healthy fish and wildlife define the very essence of our country. Fish and wildlife are essential to cultural, economic and ecological well-being. Yet, wild animal health remains defined either as the absence of species pathogens or by the viability of the harvest. Most One Health literature and projects have been preoccupied with protecting people from disease threats from animals. But the triad of people, animals and their shared environment
lacks directionality. Just as animals and environments influence human health, people and environments affect animal health, and animals and people impact their environments. New models are needed to ensure we cooperatively manage to promote the capacity of communities and ecosystems to cope with the rapid changes being caused by industrial development, climate change and other forces. The purpose of a National Fish and Wildlife Health Strategy should be to ensure strong, shared leadership to protect and sustain wild animal health and the values they bring Canadians by promoting, sustaining, coordinating and integrating infrastructure and expertise in Canada. This presentation will be a call for action for a National Strategy that better prepares Canada for an uncertain future and ensures sustainable wild animal health programs required by national and international obligations and the needs of local communities.

NET EXCHANGE OF CARBON DIOXIDE AND METHANE FROM FRESHWATER SYSTEMS IN THE CANADIAN HIGH ARCTIC

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Freshwater systems in the rapidly changing high Arctic ecoregion are crucial sites for biological production and the accumulation of watershed materials, yet little is known of their role as sources or sinks of carbon dioxide (CO2) and methane (CH4) compared to surrounding landscapes. During the summers of 2005-2015, we have been quantifying dissolved CO2 and CH4 concentrations in, and net fluxes from, common freshwater systems in the Lake Hazen watershed (81.8°N, 71.4°W). Gas concentrations in oligotrophic Lake Hazen, the world’s largest high Arctic lake by volume, were below or near atmospheric equilibrium and associated closely with carbonate concentrations and turbulence, resulting in near-zero exchange of each gas with the atmosphere (CO2: -12.1±4.1 mg/m2/d; CH4: 0.19±0.05 mg/m2/d). Lakes higher up in the watershed emitted CO2 (+58.1±14.5 mg/m2/d) in relation with heterotrophy signatures, while CH4 emissions (+1.31±0.23 mg/m2/d) were low and related to catchment delivery of sulfate due to competition between sulfate reduction and methanogenesis. Shoreline ponds bordering Lake Hazen transitioned from CO2 sinks (-155 to -45 mg/m2/d) during drier conditions, to strong sources of CH4 (3.8-35.8 mg/m2/d) when flooded by Lake Hazen. Glacial melt river waters were always undersaturated in both CO2 and CH4 concentrations. Despite local hot-spots of CO2 and CH4 exchange, the unglaciated portions of the Lake Hazen watershed, dominated in area by semidesert soils and Lake Hazen itself, effectively transferred net-zero amounts of the carbon gases (CO2: 153±650 mg/m2/d, CH4: -0.7±1.2 mg/m2/d) with the atmosphere.

ENVIRONMENTAL TRANSFER PARAMETERS FOR CESIUM IN THE LICHEN-CARIBOU-HUMAN FOOD CHAIN

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Following the Fukushima-Daiichi nuclear accident in March 2011, northern Canadians expressed concerns about the levels of radioactive contaminants in important traditional foods. The main radionuclide of concern is cesium-137, which has a half-life of 30 years and is chemically similar to potassium, thereby easily accumulating in plants and animals. Historic sources of cesium-137 in the environment include nuclear weapons tests and nuclear accidents, such as Chernobyl and Fukushima. Since the atmospheric weapons tests of the 1960s, radiocesium has been periodically measured in the lichen-caribou(or reindeer)-human food chain. Three different types of environmental transfer parameters between lichens and caribou have been reported throughout the entire Arctic. The most recent study to this end examined cesium-137 levels in environmental samples from the Porcupine caribou herd collected before and after the Fukushima nuclear accident, and the health risks were determined to be negligible as reported at previous Arctic Net conferences.(1) In this present work, a more in-depth analysis of these three types of transfer parameters for multiple Canadian herds has been undertaken, in order to better understand how contaminants like cesium move through this food chain.

(1) See T.J. Stocki et al., in Arctic Change 2014 and ArcticNet 2013
MELTWATER AND PERMAFROST THAW IMPACTS ON MERCURY DYNAMICS IN THE RAPIDLY CHANGING LAKE HAZEN WATERSHED (QUTTINIRPAQ NATIONAL PARK, NUNAVUT, CANADA)

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Methylmercury (MeHg) is a globally relevant neurotoxin that bioaccumulates in organisms and biomagnifies up the food chain. In the Arctic, higher trophic level freshwater fish (e.g., Arctic char) are an important part of the local diet, making MeHg of concern for human health. While we recognize many of the factors that control MeHg production and degradation in Arctic freshwater systems, we have yet little understanding of how watershed processes like snow and glacial melt influence MeHg loadings into high Arctic lakes. Given temperature and precipitation increases predicted for the Arctic due to climate change, understanding meltwater MeHg inputs to freshwater systems is critical for predicting the quality of future Arctic freshwater resources. We examined snowmelt, glacial melt and permafrost thaw impacts on watercolumn MeHg and total mercury (THg) concentrations of the world’s largest high Arctic lake by volume, Lake Hazen (81.8°N, 71.4°W). In spring 2014 and 2015, we sampled snow on the lake surface and adjacent landscape, three snowmelt-fed streams/rivers and the watercolumn before and after snowmelt for Hg and general chemistry. In summer 2015, six glacier-fed rivers flowing into Lake Hazen, the outflow of Lake Hazen (Ruggles River), a permafrost thaw continuum and the watercolumn of Lake Hazen in the absence of ice cover were sampled for Hg and general chemistry. In summer 2015, six glacier-fed rivers flowing into Lake Hazen, the outflow of Lake Hazen (Ruggles River), a permafrost thaw continuum and the watercolumn of Lake Hazen in the absence of ice cover were sampled for Hg and general chemistry. Snowmelt inputs to the lake increased watercolumn THg and MeHg concentrations right below the ice from 0.02 ng L-1 to 0.08 ng L-1 and from 0.42 to 1.28 ng L-1 respectively, but Hg remained low throughout the remainder of the spring watercolumn (0.008 ± 0.004 ng L-1 and 0.29 ± 0.49 ng L-1 for MeHg and THg respectively below 5 m). Preliminary data from summer 2015 suggest that glacier-fed rivers may be an important source of MeHg to Lake Hazen. Most of the MeHg in glacial rivers was particle-bound, with significant variability in MeHg concentrations possibly reflecting differences in particle loads. When ice-free, Lake Hazen watercolumn MeHg concentrations were very low (0.004 ± 0.002 ng L-1); however, Ruggles River MeHg concentrations were high (0.143 ± 0.001 ng L-1), leading to speculation about possible sources of MeHg to the Ruggles River, the only outflow of Lake Hazen. Permafrost seep waters contained very little MeHg (0.006 ± 0.001 ng L-1); however, MeHg was produced downstream of the seeps in small lakes and wetlands, suggesting that these environments are amenable to the microorganisms that methylate inorganic Hg. Our results thus far suggest that increasing inputs of both THg and MeHg from snow and glacial meltwaters and permafrost thaw to high Arctic freshwater systems could increase watercolumn Hg concentrations and make more MeHg available for uptake into the foodweb.

TOWARDS AN ELECTRONIC INVENTORY OF CULTURAL RESOURCES IN THREE PILOT NUNAVUT COMMUNITIES

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Nunavut Tunngavik Inc (NTI) and the three Regional Inuit Associations (RIAs) of Nunavut reached agreement with the Government of Canada to establish an Inuit Impact and Benefit Agreement (IIBA) for National Wildlife Areas and Migratory Bird Sanctuaries in the Nunavut Settlement Area. This IIBA details mutual rights and obligations for the use and administration of the lands delineated in the IIBA, collectively known as Conservation Areas. Article 6 of the IIBA describes commitments under the general heading of “Cultural Resource Inventories”, and provisions for developing ‘Interpretive Materials’ based on the Cultural Resource Inventories, to be used by Inuit Tourism Providers from communities adjacent to the Conservations Areas. Three communities (Arviat, Cape Dorset and Gjoa Haven) were identified as pilot communities in which to gather “Cultural Resource Inventories” and develop related ‘Interpretive Materials’. To improve community access to cultural resources and interpretive materials, an online electronic system was developed. Through the creation of the “Cultural Resources and Interpretive Materials
(CRIIM)’ online inventory, it is hoped that Nunavut communities will be able to approach cultural challenges through: - Accessing a variety of archaeological, ethnographic, and oral history records of National Wildlife Areas and Migratory Bird Sanctuaries; - Finding resources associated with cultural and wildlife sites of importance to Inuit; - Accessing Interpretative Materials in support of tourism that is appropriate to National Wildlife Areas and Migratory Bird Sanctuaries; - Educating Nunavut residents and visitors about National Wildlife Areas and Migratory Bird Sanctuaries resources including, in particular, Inuit cultural and heritage resources; and - Promoting the understanding of Inuit Qaujimajatuqangit, and other aspects of Inuit culture and heritage. The remainder of the presentation will briefly discuss the status of the CRIIM electronic inventory, and will present future opportunities to utilize this inventory as a resource owned and managed by Nunavut communities.

RAPID PERMAFROST CARBON DEGRADATION AT THE LAND-OCEAN INTERFACE

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Climate change has a strong impact on permafrost coasts in the Arctic. With increasing air and water temperatures, the ice-rich un lithified permafrost coasts will thaw and erode at a greater pace. Organic carbon that has been stored for thousands of years is mobilized and degrades on its way to the ocean. The objective of this study is to investigate to what extent permafrost carbon degrades after thawing before it enters the ocean in a retrogressive thaw slump. A slump located on Herschel Island (Yukon Territory, Canada) was sampled systematically along transects from the permafrost headwall to the coastline. Concentrations of particulate and dissolved organic carbon (POC and DOC) as well as its stable carbon isotopes (δ13C-POC and δ13C-DOC) were measured and compared in frozen deposits and in thawed sediments. Ammonium, nitrite and nitrate were also analyzed in order to identify and understand the carbon metabolization mechanisms taking place during slump activity. Our results show that major portions of permafrost carbon are metabolized right after thawing. Ammonium concentrations are highest in areas where thawed permafrost material directly accumulates. We suggest that before entering the nearshore zone permafrost organic carbon and nitrogen is subject to major degradation and metabolization. This makes permafrost coasts and retrogressive thaw slumps degradation hotspots at the land-ocean-interface.

HIGH RESOLUTION AUTONOMOUS MEASUREMENTS OF PHYTOPLANKTON PRODUCTIVITY AND PHOTO-PHYSIOLOGY IN ARCTIC AND SUBARCTIC OCEAN WATERS

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Understanding the spatial and temporal distribution of primary production in the Arctic Ocean is key to understanding climate-dependent biological responses in this region. Discrete measurements of primary productivity from standard 14C incubation experiments provide poor spatial and temporal resolution data, and suffer potential caveats associated with sample containment artifacts. Satellite-based remote sensing of phytoplankton biomass and inferred primary productivity is limited by cloud cover, and uncertainty in the functional relationships between surface temperature, irradiance and primary productivity. Primary productivity can be estimated by examining surface water gas distributions, including biological O2 saturation (O2/Ar) and pCO2. We recently measured surface water gases along a ~ 10,000 km transect between Quebec City and Kugluktuk through the Labrador Sea, Baffin Bay and the eastern Arctic Archipelago, as part of the 2015 Arctic GEOTRACES expedition. We found strong gradients in surface water pCO2 and O2/Ar, related to underlying patterns of phytoplankton biomass (chlorophyll a) and hydography (salinity, temperature and mixed layer stratification).
Particularly high biological activity and oceanic CO2 uptake was found in regions of recent sea ice melt in Baffin Bay, and in hydrographic frontal zones in Hudson Strait and the Arctic archipelago. We derived high resolution estimates of net community production (NCP; gross photosynthesis minus autotrophic and heterotrophic respiration) using our O2/Ar data, and a simple mixed layer O2 mass balance calculation. The results yield NCP estimates ranging from ~ - 20 to 100 mmol O2 m-2 d-1, and provide unprecedented new insight into the spatial distribution of biological productivity across a range of Arctic Ocean waters. The results also provide a bench mark for comparison against future years in a rapidly changing system. We also present results derived from underway analysis of surface waters using Fast Repetition Rate Fluorometry (FRRF) to characterize changes in phytoplankton photo-physiology based on light-dependent chlorophyll a fluorescence transients. Results from this analysis show strong diurnal (day-night) cycles in phytoplankton photo-chemical capacity, reflecting light-dependent regulation of photosynthetic electron transport. These results provide new insight into the physiological adaptations of Arctic phytoplankton assemblages to rapidly changing light regimes in surface waters.

THE MARINE ECOSYSTEM OF HUDSON BAY IN A CHANGING CLIMATE

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In preparation for the first Integrated Regional Impact Study of the Hudson Bay system, this presentation reviews existing, fragmentary knowledge on marine ecological processes obtained from expeditions covering mostly the late summer and fall periods. In Hudson Bay, river runoff, sea ice dynamics and ocean physics influence the growth conditions of marine organisms. The relative importance of the different factors and their interactions vary in space (locally, regionally) and time (seasonally, inter-annually). Under climate warming, increased river flow, reduced ice formation and decreased winter convection is expected to reinforce vertical stratification, decrease upward nutrient supply and lower overall biological productivity at the bay-wide scale. Horizontal nutrient deliveries by rivers will probably make a greater contribution to coastal productivity in such a setting, unless storms became sufficiently frequent or powerful to erode the strong vertical stratification. These changes are also likely to shift the seasonal peak of primary production forward, thereby affecting the coupling between primary producers and consumers as well as the vertical export of organic matter to the benthos. In the near-shore zone, the timing of biological production will be impacted by the quantity and quality of runoff. Resolving seasonality and focusing on the critical spring-summer transition are necessary steps toward evaluating the ecological consequences of climate change and flow regulation on the Bay.

USING STANDARDS TO ADAPT TO CHANGING CONDITIONS IN CANADA’S NORTH

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Adapting infrastructure to climate change impacts, including changes in temperature and precipitation patterns will result in significant expenses to Northern communities. Adaptable mechanisms that decrease the North’s vulnerability are therefore needed. One tool available to assist northerners in addressing climate-related risks to infrastructure is the application of standards. The Northern Infrastructure Standardization Initiative (NISI) is a five year (2011-16) program funded under the Government of Canada’s Clean Air Agenda. Standards Council of Canada (SCC) leads the NISI, in partnership with Aboriginal Affairs and Northern Development Canada (AANDC) under the advisement of the Northern Advisory Committee (NAC). Northern Advisory Committee is comprised of senior government representatives (ADM) from Yukon, Northwest Territories, Nunavut, and Kativik (Nunavik). The main deliverables of the NISI include the development of new standards intended to strengthen infrastructure in the face of a changing climate, as well as building
capacity to ensure these standards are implemented. NAC has prioritized the standard development focus areas as follows: 1) Community Drainage System Planning, Design and Maintenance in Northern Communities, 2) Managing Changing Snow Load Risks for Buildings in Canada’s North, 3) Thermosyphon Foundations for Buildings in Permafrost, 4) Moderating the Effects of Permafrost Degradation on Building Foundations, and 5) Geotechnical Site Investigations for Building Foundations in Permafrost.

ALLUVIAL FANS STRUCTURE THE DISTRIBUTION OF THE ERECT SHRUB SALIX RICHARDSONII AT ITS NORTHERN LIMIT OF DISTRIBUTION IN THE HIGH-ARCTIC

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Shrubs are increasing in dominance in response to climate warming in the tundra biome. Although the phenomenon has been reported in the Low Arctic, it remains poorly documented in the High Arctic. Our work focuses on the distribution of the erect shrub Salix richardsonii at the northern limit of its range in Qarlikturvik valley on Bylot Island, Nunavut (73°N). The largest populations were observed in association with alluvial fans. These cone shaped structures built by deposit accumulation from the streams coming from the surrounding hills are frequent in the study area. We quantified the shrub abundance using transects perpendicular to three fans from the apex to their outskirt (0, 100, 200, 400, 1000 and 2000 meters). Shrubs increased in height and density from the apex to the base of the fan (0 to 400 m) and decreased outside the alluvial zones of active sediment deposition (1000-2000 m). The density and size of the populations were highest on gentle slopes (1.5o to 2.5o - 400 m) where water was widely redistributed in tributary sub-channels. The soil surface of these high density populations was characterized by a high cover of bare ground and cryptogrammic crust (> 50%) and a limited cover of mosses and lichens (< 15%) corresponding to zones with active sediment deposition.

In contrast, deeper channels and higher water velocity correlated to steeper slopes closer to the apex (0 to 200 m) limited access to water and were correlated to low shrub density populations restricted to the margin of the streams. The highest densities outside the zones of active deposition by the fans (1000 and 2000 m) were localized on river banks affected by spring overflow. Punctual measurements of active layer depth, soil moisture and soil temperature associated to shrub populations showed positive correlations with shrub density, height and patch area. We conclude that alluvial fans promote environmental conditions associated to taller and denser populations of Salix richardsonii and that they structure the spatial distribution of the species in the study area. These results give the first insights on the conditions that promote the growth of the erect shrub Salix richardsonii at this latitude. In the context of climate change, these results will help to understand how the species is going to react to a change in the environmental conditions that shape its distribution.

FACTORS IMPACTING BILINGUAL EDUCATION IN INUIT NUNANGAT

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In his Conciliator’s Report, submitted to Nunavut Tunngavik Incorporated, the Government of Nunavut, and the Government of Canada, Thomas Berger (2006) concluded that the top priority in reaching the goals of Article 23 of the Nunavut Land Claims Agreement involved strengthening Inuktitut-English bilingual education. Although the 2008 Nunavut Education Act addresses this gap, the Auditor General’s 2013 report found that the Act is not being effectively implemented. Through critical discourse analysis of narratives relevant to bilingual education in Nunavut (1993-2015), evidence of efforts to improve educational experiences and outcomes in bilingual education in Inuit Nunangat is presented. Sources include language legislation and policy; Inuit educational leaders’ accounts of their own experiences and efforts in bilingual education; and academic studies documenting bilingual schooling in Inuit Nunangat. Analysis reveals perspectives and beliefs about
bilingual education interacting with societal factors and impacting community and government commitment and capacity for implementation of bilingual education.

**NORTHERN INDIGENOUS MEN’S ENGAGEMENT IN LEARNING AND WORK**

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The Northern Men’s Research Project was an exploratory, community-based investigation of factors that block or support northern Indigenous men’s engagement in education and employment. The project was initiated in response to community concerns and national statistics showing northern Indigenous men as under-represented in some educational and employment opportunities. The purpose of the project was to make visible northern Indigenous men’s experiences, create space for dialogue about men’s specific needs and desires for meaningful learning, and establish an evidence base from which to enhance programming or create new initiatives to more effectively engage and support northern Indigenous men in learning and work. Community-based researchers (primarily Indigenous men) worked in their home communities and regions to document men’s experiences through interviews and closed questionnaires. The men’s stories and responses were then systematically analyzed to identify underlying trends. Results showed that many men experience education and employment as oppressive contexts. The trauma of assimilationist schooling and the rapid shift from nomadic subsistence to sedentary cash economies continues to impact even young northern Indigenous men. Interpersonal and systemic racism are entrenched in the colonizing institutions, possibly with a particular impact on men. Educational and employment practices are sometimes at odds with men’s needs, priorities, and visions of themselves as Indigenous men. As they struggle to reconcile changing and conflicting societal and personal ideals of what makes a man ‘successful’, many do so while facing limited opportunities and insufficient support. The futility and frustration men feel faced with these multiple layers of overt and covert oppression lead some, at different points in their lives, to disengage. Men’s stories of engagement with learning and work, in contrast, reflected a sense of freedom from, or in spite of, the oppressive context. A strong sense of identity, pursuit of physical and mental health, and connectedness to the land, spirituality, family, and community, emerged as both causes and effects of the personal well-being that supported engagement in learning and work. Men who were well supported and had a positive vision of themselves seemed freer to choose roles and live in ways that aligned with their values, and better able to reconcile their vision of themselves to what they were doing in school and at work. While they faced the same challenge of conflicting expectations and goals, and limited resources to reach them, they felt that they were making good choices within their options, and were more resilient to persevere. The results emphasize the need for effective implementation of policies and programming that address men’s self-defined identities and build connectedness. Retention in schools and jobs can be enhanced by including and acknowledging men’s specific Indigenous cultural practices and expertise; enhancing counseling options; equipping parents in their support roles; and supporting non-Indigenous staff to adopt decolonizing mindsets and practices. Community-based programs led by Indigenous men, for Indigenous men-including support groups, land camps, sports, traditional activities, and non-formal learning programs-are promising venues for reengaging and supporting men to be more willing and able to participate in other learning and work.

**THE ROUGH GUIDE TO POLAR DATA STEWARDSHIP IN CANADA**

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Data stewardship is the management and governance of an organization’s data assets (both content and metadata) to assist in providing users with high-quality data that is easily accessible and readily available. Data stewardship helps to ensure that data can be found and understood, that unnecessary duplication is avoided,
that results can be validated, that research is visible and has impact, that data can be cited and credited, and that researchers can comply with funder mandates. In Canada, there are a number of organizations that manage polar data and information through all stages of the data life cycle. From raw data to metadata to publications, learn which organizations are responsible for polar data stewardship in Canada; policies and best practices for data stewardship including ethical considerations; submission information; and how both new and established researchers can contribute to the preservation and long-term management of our polar data to ensure its legacy.

EXAMINATION OF SOIL COMMUNITIES AFTER PERMAFROST THAW SUBSEQUENT TO AN ACTIVE LAYER DETACHMENT IN THE HIGH ARCTIC

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Active layer detachments (ALDs) are permafrost slope disturbances associated with climate change and increased seasonal warming. Such perturbations result in the exposure of buried soil and the thaw of the upper permafrost as a new seasonal active layer develops in subsequent years. The soil in this newly-developed active layer is exposed to a more extreme range of seasonal temperatures compared to the prior permafrost state, as well as changes in water content, and presumably increased rates of biogeochemical cycling, all of which may affect soil microbial community composition and function in Arctic soil ecosystems. Here we report an initial investigation of the impact of an ALD located at Cape Bounty on Melville Island, NU in the Canadian High Arctic on soil nutrient content and microbial community structure. Active layer soil cores obtained six years after the ALD disturbance were aseptically sampled with coring at 5 cm intervals and subjected to nutrient analysis and community assessment using denaturing gradient gel electrophoresis. Selected DNA samples were then sequenced. Statistical analyses revealed that the ALD core had significantly altered bacterial and fungal community compositions compared to a core taken from an adjacent non-disturbed site. The ALD community changes were correlated with different levels of dissolved organic carbon and microbial carbon as well as total dissolved nitrogen and microbial nitrogen, presumably associated with the exposure of previously-frozen soil. In addition, Nitrososphaerales, an ammonia-oxidizing archaean Order was more abundant in the ALD core suggesting altered nitrogen cycling after permafrost disturbance. Intriguingly, Ascomycota, a phylum of filamentous fungi with hyphae was more abundant in the undisturbed soil compared to the ALD samples, suggesting that further investigation of the relationship between of hyphal networks and permafrost disturbance would be warranted.

MERCURY IN THE MARINE WATER OF THE CANADIAN ARCTIC

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Mercury (Hg) is a contaminant of major concern in the Arctic marine ecosystem for its high toxicity and biomagnification in the food web. In upper trophic level species, Hg concentrations are sufficiently high to pose health risks to both animals and the Northern people who consume them as part of traditional diet. The dominant form of Hg that is transferred within the food web is monomethylmercury (MMHg), which is built up from MMHg in their prey and ultimately from seawater. Although sedimentary production and release of MMHg can occur, recent studies indicate that the primary source of MMHg to seawater is in situ conversion of inorganic Hg(II) to MMHg in the water column. We have reported enhanced methylmercury (MeHg, sum of MMHg and dimethylmercury) production in a subsurface layer of the Beaufort Sea and linked this MeHg production to local and recent organic matter remineralization. Here we report depth profiles of total Hg and MeHg concentrations from the ArcticNet/GEOTRACES 2015 cruise. The vertical distribution of total Hg in Canadian Arctic is “C”-shaped, with higher concentrations in the surface and deep water. Concentrations of MeHg in seawater show similar distribution patterns to those observed in the Beaufort Sea, with low surface concentrations and a sub-surface peak.
POLAR BEAR, POLAR SECURITY LINKING POLAR BEARS AND ENVIRONMENTAL SECURITY: A CALL FOR A COLLABORATIVE, COOPERATIVE AND INTEGRATED APPROACH TO POLAR BEAR RESEARCH

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Signed November 15th, 1973 in Oslo, Norway, the Agreement on the Conservation of Polar Bears served both to protect polar bear populations from the threat of hunting, and as a show of cooperation between the Soviet Union and NATO within the context of the Cold War. Today, the Agreement serves as the foundation of a renewed polar bear conservation effort largely triggered by climate change. With the dependence of polar bear populations on Arctic sea ice for feeding, breeding, and migratory movement, the forecasted decline of sea ice coverage as a result of climate change, poses a serious threat to polar bear populations. This concern is amplified in large part due to the importance of polar bear populations to the Arctic peoples who rely on them for cultural identity, income and as a vital part of the subsistence economy. As such, a decline in polar bear populations will likely be paralleled by a decline in environmental security-that is, a negative impact on the economic, cultural and political facets of Arctic societies. Given this, conservation and management efforts in the species’ Arctic range have been supported by two research methods-western science and Traditional Knowledge (TK). While both methods have been widely acknowledged for their contributions to the conservation and management of Arctic environment and populations, attempts to incorporate both methods into the research and conservation have been strained. This is largely the result of conflicting data brought forward by both research communities-rooted in different epistemologies and historical relationships and interactions-and the effects of this data on hunting quotas and conservation methods. While both research methods provide valuable insight, data and information, incomplete data recorded through observation, scientific method, first-hand experience, and computer modeling have led to conflicting conclusions as to the status of particular subpopulations. Neither method adequately addresses the threat that polar bear population decline places on environmental security in the Arctic. As such, a collaborative, cooperative and integrated approach to research, observation, and data collection is recommended.

HARVEST DATA AND THEIR RELEVANCE TO THE FOOD SECURITY DISCUSSION IN NUNAVUT

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The role of wildlife in Inuit Culture has been a major, if not dominant, theme in the popular and academic literatures on Inuit. This is no less the case today in regard to discussions about Inuit food security, with traditional foods seen as critical to cultural, psychological and physical wellbeing. While this is repeatedly asserted, quantitative information on harvesting has little presence. This paper examines harvest data from the Qikiqtaaluk/ Baffin Region of Nunavut from two critical periods, 1980-1984 and 1996-2001. Analysis of these data indicate a downward trend in traditional resource availability and relates this decline to: 1) insufficient growth in the regional harvester cadre relative to growth in the overall population; 2) structural weakness in the monetized sector of the regional mixed economy.

CHANGING CLIMATE, CHANGING COASTS, CHANGING PERSPECTIVES IN TUKTOYAKTUK AND THE INUVIALUIT SETTLEMENT REGION

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The Arctic climate is changing; the coastal region is experiencing warmer temperatures, longer ice-free seasons (more open water) leading to an increased potential for thermal abrasion and storm-wave impacts on the coast. The coastline of the Inuvialuit Settlement Region in the Mackenzie -Beaufort region of the western Canadian Arctic is characterised by rapid erosion of ice-bonded
sustainability of coastal communities and the cost of adaptation to climate change will ensure developing appropriate adaptation strategies. Reducing to making accurate projections of the future change and dynamics in this rapidly changing environment is critical. For this reason, a better understanding of nearshore coastal possible adaptation measures are being considered. For action taken to stabilize Tuktoyaktuk Island and several in inexorable erosion, community residents would like to see As a result of the island’s importance, in the face of this rapid coastal retreat is the result of large waves and surges generated by storms that can cause up to 10-15 m of erosion in a single event. If Tuktoyaktuk Island were to erode away, this valuable natural harbour would be more exposed to wave action, with varied severity depending on the morphology of any resulting shoal in the harbour mouth. Widening of the harbour entrance will also lead to accelerated siltation and shoaling. The stability of the harbour entrance channel(s) under these conditions is difficult to predict, but the utility of the harbour for subsistence, barge, and offshore supply activities could be significantly compromised over the next 20-25 years. As a result of the island’s importance, in the face of this inexorable erosion, community residents would like to see action taken to stabilize Tuktoyaktuk Island and several possible adaptation measures are being considered. For this reason, a better understanding of nearshore coastal dynamics in this rapidly changing environment is critical to making accurate projections of the future change and developing appropriate adaptation strategies. Reducing the cost of adaptation to climate change will ensure sustainable development of coastal communities and infrastructure in the region.

CHARACTERIZING THE HYDROLOGY AND LIMNOLOGY OF SHALLOW SUBARCTIC LAKES IN WAPUSK NATIONAL PARK, WESTERN HUDSON BAY LOWLANDS, MANITOBA IN RESPONSE TO MULTIPLE STRESSORS

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Wapusk National Park (WNP), located within the western Hudson Bay Lowlands, contains over 10,000 shallow, mainly thermokarst lakes and ponds that provide important wildlife habitat. Over the past ~50 years, this area has experienced some of the greatest warming in the circumpolar North and is considered one of the most sensitive regions in northern Canada to permafrost thaw. This pond-rich landscape has the potential to be greatly influenced by increased evaporation due to longer ice-free seasons, alteration in seasonal precipitation, and more frequent lake drainage events. Additionally, coastal regions of WNP have witnessed rapid increases in the population density and nesting area range of Lesser Snow Geese (LSG). This has raised concerns and uncertainty about environmental effects of their activities on the abundant shallow ponds. In this study, we use a combination of contemporary hydrological and limnological measurements to determine the effects of climate change and LSG population growth on the hydrological, limnological, and biogeochemical conditions of WNP ponds. Surface water samples from ~40 lakes spanning three ecotypes (coastal tundra fen, interior peat plateau-palsa bog, boreal spruce forest) within WNP were collected three times a year (June, July, September) over a three-year period (2010-2012). These samples were analyzed for water isotope composition (18O, 2H) to assess seasonal and inter-annual hydrological variability as well as basic water chemistry (TP, TKN, DIC, DOC, pH) and carbon isotopic composition of dissolved inorganic carbon and particulate organic matter to provide information on pond nutrient and carbon behaviour. Strong seasonal and spatial variability in lake hydrology related to variable meteorological conditions and ecosystem characteristics have been identified. Lake
water balances within the boreal spruce forest ecotype appear to be resilient to variability in meteorological conditions, whereas lake water balances in the interior peat plateau-palsa bog and coastal fen ecotypes display strong seasonal responses to variations in snowmelt and rainfall. In addition, nutrient concentrations also display seasonal variability with a general increase in nutrient concentrations during the productive summer months, followed by a decrease by September as productivity declines. Carbon behaviour shows strong variability between low LSG disturbance and actively LSG disturbed ponds. In June, all ponds were under-saturated in CO2 but by July most low LSG disturbance ponds became over-saturated or sources of carbon. However, the active disturbance of LSG seems to change the carbon cycling behaviour of the pond, changing them from a net source to a net sinks throughout the thaw season. By using a combination of both hydrological and limnological indicators, we have been able to fully characterize the effects of multiple stressors on the ponds in WNP.

SNOW COVER REDUCTION CONTRIBUTES MARGINALLY TO TERRESTRIAL TEMPERATURE CHANGE IN THE SOUTH WEST YUKON
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The contribution by the snow albedo feedback to Arctic amplification is currently a matter of debate. In the Arctic, surface air temperature anomalies have become consistently warmer than the global average since 2000, and rate of Arctic temperature increase is greater than two times the global average. The differential warming is considered Arctic amplification, a phenomenon which is occurring simultaneously with precipitous spring snow cover decline. However, there is no consensus in either models responses to different forcings or between models and surface observation of the strength of the snow albedo feedback. The local contribution to warming from the snow cover albedo feedback is difficult to quantify with re-analysis data because local feedbacks and external forcing are inherently related and occur simultaneously. We show, for the month of May between 2000 and 2008, that differential snow melt rates found on a 5,000 m gradient in the south-west Yukon causes little surface heating related to snow cover decline. During this period Tundra snow cover decreased by 35 - 50%, Conifer snow cover was largely absent and the Icefield showed unchanging and near complete snow cover. The unexplained amount of variation between the linear correlation of surface temperature for tundra versus icefield and tundra versus conifer forest indicate the snow cover feedback is < 6% of tundra temperature change in May (or <0.091 W m-2 per decade over the study period). We conclude that snow cover and temperature change in south-west Yukon tundra largely results from external forcing and the value of the snow albedo feedback measured at surface is significantly less than previously thought.

EVALUATING LEVELS OF PERSONAL, SOCIAL AND CULTURAL FOOD NEEDS, AND THE ROLE OF A COMMUNITY FREEZER, AMONG COMMUNITIES IN NUNATSIAVUT
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Rooted in Inuit culture is a connection to wild foods that come from the local environment. This relationship with the land provides Inuit with nutritious food, and the connection with their environment supports their health and cultural identity. However, changes in social and natural environments currently taking place in the North are challenging the availability, access to and use of these foods by Inuit communities, and are contributing to higher rates of food insecurity in regions such as Nunatsiavut (Labrador). Social and cultural elements of food are recognized needs in many conceptualizations of food security. In regards to wild food species, the ‘need’ for food is also a protected concept in some Land Claims agreements, such as the Labrador Inuit Land Claims Agreement. Objective measures of universal physiological needs (nutrient and caloric intake) for food are commonly recognized and understood. However, there is limited information regarding the concepts of and measurements for social and cultural food needs. These food needs
also may vary among individuals and communities as they are contextually defined and individually perceived. Additionally, measures traditionally used to estimate the level of wild food need in Arctic communities, such as harvest studies, likely provide an underestimate of the true level of food needed at the household scale. This project followed a mixed methods design to explore the relationship between a diversity of food needs, and the use of food support programs among communities in the Inuit region of Nunatsiaput. Questions regarding personal, social and cultural food needs and food program use were included in community wide surveys in 4 coastal communities. The results provide an evaluation of the perceived level of food needs and the role of community freezers in supporting food needs. Results from 2 communities demonstrate a series of community or culturally specific (e.g. access to a harvester and food sharing networks) household (e.g. household income) and individual (e.g. marital status) characteristics that have a significant impact on individual's perceived ability to support their needs. Overall, findings from this research will contribute to our understanding of the concept of food 'needs', demonstrate potential differences in levels of perceived needs across different communities, potentially influence estimates of levels of different forms of 'need' that are protected in some Inuit land claim agreements, and inform the development or improvement of community level solutions for food insecurity.

LONG TERM ECOSYSTEM MONITORING IN NUNAVUT: QAMANIRJUAQ CARIBOU CALVING GROUND

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Climate is a major driver influencing caribou populations in Canada. Changes to not only climate but the socio-economics of Nunavut will have wide-ranging implications for wildlife, ecosystems and the Inuit communities that depend on them. The Qamanirjuaq Caribou herd is the largest in Nunavut and supports a large proportion of Nunavut's subsistence harvesters yet little is known about their range. This study is aimed to assess the long term habitat use on caribou calving grounds by using plots that can be relocated exactly and re-measured annually. By collecting data repetitively every year (such as pellet counts, camera trapping, acoustic monitoring and vegetation abundance, structure / diversity), we are able to capture changes to critical habitat used by caribou over time with the aim of developing indicators to monitor ecosystem health. In 2015 we deployed 16 acoustic monitors and cameras across the Qamanirjuaq caribou calving ground to record spring migration and calving activities. This first year of camera trapping successfully captured over 40,000 unique images including those of caribou and their predators. These images will help to develop habitat use indicators when coupled with vegetation and scat plots for monitoring changes over time. Future applications of this method could be used to link site specific habitat indicators with large scale monitoring efforts such as remote sensing and caribou population trends, better enabling us to detect and forecast effects of climate change on caribou movements and important habitat use. This information will facilitate informed decision making for resource use to ensure access to a high yielding subsistence resource in Nunavut.

A BURIED FULLY PRESERVED LATE QUATERNARY ICE KEEL TURBATE, UPPER CONTINENTAL SLOPE, CANADIAN BEAUFORT SEA

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A period of intense scouring by icebergs on the upper continental slope of the Canadian Beaufort Sea resulted in the development of an ice keel turbate during the mid-Holocene. The area covered by the now buried turbate ranges in width from 3 to 15 km and is at least 175 km long parallel to the continental shelf margin. The turbate formed in paleo-water depths of between 70 m and ~380 m between ~16000 and 12000 calendar years before present (CYBP). The turbate preserves a poorly defined hummocky basal surface which represents the onset of ice keel scouring with indications of initial ice scour depths of 2 - 7 m. A well-defined, topographically rugged, upper paleo-surface marks the top of the turbate.
which preserves all of the last ice keel scour marks that formed. Between the basal and upper surfaces acoustic stratigraphy within the turbate unit has been obliterated, although hints of heavily disturbed strata are seen in places. The turbate was probably formed by SW-drifting icebergs calved from a disintegrating mélange between the Laurentide ice sheet and Arctic Shelf Ice and an ablating ice stream in the Amundsen Gulf. As sea level rose iceberg scouring ceased and sea ice scour on the outer shelf began after ~12000 CYBP in a zone that migrated shoreward to modern water depths of <60 m. Regional pelagic sedimentation in the form of acoustically well-stratified muds dominated prior to, during and after the period of iceberg scouring. Well-stratified post-scouring sediments cover and bury/fill the upper surface of the turbate, now up to 45 m below the modern seafloor. However, buried scour mark paleo-morphology has been propagated to the seafloor through the draped pelagic sediments. The youngest buried scour marks thus preserved are clearly seen on multibeam seafloor imagery as linear and curvilinear troughs up to 100 m wide and 8 km long. The seafloor morphology of the scour marks exhibit a strong northeast-southwest orientation, parallel, or slightly oblique to regional isobaths and to a putative Holocene shoreline at the edge of the continental shelf. The turbate is lens-shaped in cross-section ranging in thickness from a maximum of 40 m to where it pinches out at its lower margin in deep water. The pinch out region defining the upper margin close to the putative Holocene shoreline is poorly defined and partially obscured by a zone of fluid escape features (FEFs). Spatial and temporal characteristics of the iceberg turbate clearly distinguish it from underlying mega scale glacial lineations and overlying sea-ice keel marks.

DRINKING WATER CONSUMPTION PATTERNS AND CHANGES OVER TIME IN RIGOLET, NUNATSIAVUT

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Safe drinking water is essential for health, yet a large proportion of Inuit adults in Canada state concern over the quality of water at their home, and feel that it is contaminated at various times during the year. Perceptions of water safety and aesthetic appeal may influence a person’s choice of drinking water source, such as tap water, untreated brook water, purchased bottled water, or other sources. This research aims to understand drinking water consumption in the Inuit community of Rigolet. Specifically, the objectives are to investigate current patterns of drinking water consumption (including volume of water consumed daily and sources used), associations with various household and demographic factors, and changes in water consumption since the installation of a decentralized “advanced drinking water system” (ADWS) in Rigolet in January of 2014. This study uses data from a series of seven retrospective cross-sectional census surveys: six conducted before the arrival of the ADWS and one conducted post-installation. Descriptive statistics and logistic regression modeling were used to identify trends and factors contributing to the use of various water sources. In June 2014, the median amount of water consumed per day was two-500mL servings (1.0L), and women had higher odds of drinking bottled water than men (OR=1.81, 95% CI 1.06-3.08). After the installation of the ADWS, 74.8% of residents reported using it as a source of drinking water, with a concomitant decline in consumption of bottled, tap, and brook water as main water sources by 37.3%, 21.3%, and 5.2%, respectively. The knowledge generated from this study will serve to increase the community’s capacity to understand factors that affect water consumption. Results are intended to inform sustainable drinking water interventions, risk assessments, and public health messaging in Nunatsiavut, as well as other Indigenous communities in Canada.

THE RESPONSE OF MINERAL SOIL CARBON RESERVES WHEN EXPOSED TO NUTRIENT ADDITION AND SUMMER WARMING TREATMENTS IN THE LOW ARCTIC TUNDRA

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Warmer air temperatures in the Arctic over the next 100 years will result in a rise in soil temperature, enhanced microbial activity and increased mineralization of nutrients from soil organic matter. Greater availability of soil nutrients could enhance overall productivity resulting in different plant community compositions and changes in patterns of plant productivity. To simulate future nutrient conditions and assess trends in vegetation, chronic high levels of nitrogen (N) and phosphorus (P) have been topically added to experimental plots at several low Arctic sites. An Alaskan study that used nutrient addition observed enhanced vegetation carbon uptake, but more surprisingly, the study also showed a significant overall net loss of carbon from the ecosystem because the organic matter in the underlying mineral soil was significantly depleted, presumably as a result of downward leaching and increased microbial activity. This result was of great scientific importance because organic matter reserves in arctic tundra mineral soil are large enough that their decomposition would result in a globally significant CO2 release that could provide a positive feedback to climate warming. We used a similar experimental manipulation at our research site (Daring Lake, NWT) except we compared responses to chronic high level nutrient additions with manipulations that may be more realistic in terms of the magnitude of the soil nutrient release expected with climate warming (i.e. low level N and P chronic additions, and greenhouse summer warming). We characterized the soil and microbial nutrient pools and microbial community structure (PCR-DGGE analysis) throughout the soil profile (i.e. organic and mineral horizons) to investigate the mechanisms that might lead to significant mineral soil carbon depletion.

Soil samples were collected at multiple depths from treatment plots (n=5) that have been maintained for the past 10 years in mesic birch hummock tundra vegetation. In this talk, I will investigate the following questions: (1) Are excess soil nutrients leaching downwards to deeper horizons of treatment plots and, if so, is leaching matched with an increase in microbial nutrient uptake and/or changes in the microbial community structure? (2) Are increases in microbial nutrient uptake and/or changes in the microbial community structure also matched with decreases in carbon storage of that horizon? (3) What can we conclude about the potential for soil carbon losses in the low Arctic under future climatic conditions? While high nutrient addition plots had enhanced soil nutrient pools throughout the soil profile, the microbial pools were not larger at deeper soil depths and there was no evidence of significant mineral soil carbon loss. Interestingly, the responses of the low nutrient addition plots did not differ from the greenhouse or control plots in any respect except that warming plots had greater bacterial richness and abundance, possibly because the increased temperatures stimulated dormant species and promoted bacterial population growth. Ultimately, none of the manipulations resulted in a reduction of mineral soil organic matter, suggesting that the effects of high nutrient availability on low arctic soil carbon stocks may vary substantially between regions and that there is a low risk of mineral soil carbon depletion across the low Arctic due to climate change.

**CALIBRATION AND VALIDATION OF THE COSMIC-RAY SOIL MOISTURE OBSERVING SYSTEM (COSMOS) SOIL MOISTURE PRODUCT IN AN ARCTIC PEATLAND ENVIRONMENT**

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Permafrost is an integral component of environmental processes occurring in the Arctic and is sensitive to changing climatic conditions. Warming of near surface ground temperatures has been observed over much of the Arctic and it is anticipated that this region will experience further changes to temperature and precipitation regimes in the near future. Soil moisture is a key variable in understanding Arctic terrestrial hydrology due to the implications of these changes for Canada’s climate. Consequently, establishing reliable monitoring of active layer soil moisture is increasingly important. The Cosmic-ray Soil Moisture Observing System (COSMOS) is an emerging in-situ technology which operates by measuring cosmic-ray neutron intensity to estimate soil moisture over an aerial footprint of intermediate scale (100s of metres). These sensors have shown promise in agricultural mineral soils; however, investigation into the efficacy of cosmic-ray probes in a mixed porous organic peat and mineral soil environment as found in the Arctic tundra has been limited. Research is needed to establish the effective influence of other sources of water (surficial vegetation, root biomass, and lattice water) on the cosmic-ray probe’s estimate of soil moisture, and correct for this bias. The objective of this study is to evaluate the efficacy of cosmic-ray probes in mixed peat and mineral soil...
environments by conducting a calibration and validation study. Research was conducted at Trail Valley Creek, NWT over two field seasons spanning July through August, 2014, and June through August, 2015. The cosmic-ray probe was calibrated in 2015 using 72 soil cores collected in a single day at three radial distances from the probe (25, 75, and 175 m) and in six radial directions (every 60°), from 0 to 20 cm in 5 cm increments to capture the profiles of soil moisture. Samples of root biomass and lattice water were collected at six randomly selected sites from 0 to 20 cm in 5 cm increments, with 20x20 cm vegetation water content samples also collected in the same six locations. Calibration of this cosmic-ray probe was validated using five in-situ stations positioned 25, 50, 150, 175, and 200 m from the cosmic-ray probe, which were instrumented with Stevens Hydra Probes measuring soil moisture, temperature, and dielectric permittivity horizontally at 5, 10, and 20 cm depths for the duration of both field campaigns. Laboratory based dielectric to soil water content calibrations were developed for each Hydra Probe, resulting in an accuracy of <0.05 cm³ cm⁻³ RMSE. A preliminary calibration of the cosmic-ray probe was tested using the 2014 Hydra Probe soil moisture time series data in lieu of soil cores, which resulted in a RMSE of 0.019 cm³ cm⁻³. Results of the 2015 calibration have improved the accuracy of the cosmic-ray probe’s soil moisture product beyond the 2014 preliminary calibration by removing the bias introduced by other water sources on the sensor’s estimate of soil moisture.

UNDERSTANDING THE EPIDEMIOLOGY, MICROBIOLOGY AND GROWTH TRAJECTORIES OF CHILDREN WITH ENTERIC INFECTIONS IN NUNAVIK AND NUNAVUT: A PROSPECTIVE COHORT STUDY

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Globally, enteric infections (causing diarrhea and/or vomiting) are a leading cause of childhood mortality under age 5. Repeated exposure to enteric pathogens has been strongly associated with decreased growth and cognitive outcomes in high-burden countries. It is therefore surprising that, even though the highest self-reported incidence of acute enteric illness in the world is in Northern Canada, very little is known about the spectrum of causative agents or whether this enteric disease burden has a negative impact on the developmental trajectory of affected Indigenous children. Conventional diagnostic approaches for enteric infections are poorly integrated with the geographic realities of the most affected communities in the North, perpetuating under-recognition and continued transmission. This session will review the current state of knowledge about enteric infections in Northern communities, and outline an ArcticNet-funded programme that aims to fill urgent knowledge gaps, overcome the barriers that currently prevent diagnosis and linkage to appropriate treatment, and ultimately help designing community-adapted interventions that will prevent enteric infections and ensure that children reach their full potential.

ATMOSPHERIC DEPOSITION OF PERFLUOROALKYL ACIDS TO THE DEVON ICE CAP FROM 1977 TO 2015

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Perfluoroalkyl acids (PFAAs) are present ubiquitously in the environment, including in remote regions such as the Arctic, where local contamination is insignificant. Previous work demonstrated the presence of PFAAs on the remote Devon Ice Cap, which could only have been deposited through atmospheric transport. In that study, samples dating from 1995 to 2007 were collected. In spring of 2015, a 15 m ice core was collected that contained deposition from 1977 to 2015. These samples were analyzed for a full suite of PFAAs, including C4 - C14, C16, C18 perfluorocarboxylic acid (PFCAs), C4, C6 - 8, C10 perfluorosulfonic acids (PFSAs), perfluoroethanecyclohexane sulfonic acid, and
perfluorooctanesulfonamide. Time trends for PFAAs will be presented, along with correlations between congeners, along with comparisons to reported emission data and other aqueous samples. Implications for long-range transport mechanisms will be discussed.

REVIEW OF CANADIAN INDIGENOUS MINING POLICY FRAMEWORKS

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The goal of this report is to review and evaluate elements of existing Canadian Indigenous Mining Policy frameworks to determine commonalities and unique principles. This report begins by providing some context to the political frameworks in Canada and recent changes that have had an effect on the political environment in Canada. This report serves as an evaluation and comparison of the policies listed below. The goal of this report is to understand the themes present within Canadian Indigenous Mining Policy and to formulate recommendations to other First Nations looking to develop their own Mining Policy. The Mining Policies considered were launched and developed under different contexts. All policies focus, at least in part, on mineral exploration and development. The Canadian Indigenous Mining Policies reviewed as part of this research include:


THE INFLUENCE OF PERMAFROST THAW SLUMPS ON CARBON DYNAMICS IN STREAMS OF THE PEEL PLATEAU (NT)

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Permafrost thaw contributes significantly to the transport of sediments, organic carbon, and other constituents previously ‘locked up’ in frozen soils to inland waters. In the context of the carbon cycle, exposure of these constituents to biological activity has significant implications for CO2 production (by microbial respiration of organic carbon) and release from streams to the atmosphere. However, weathering of minerals released by thawing permafrost can fix CO2 as bicarbonate, removing it from the active carbon cycle. Moreover, the release of nutrients and ions by thawing permafrost might spur methane reduction in streams. While largely unknown, the degree to which thawing permafrost enhances or tempers the release of CO2 and CH4 (collectively, carbon gas) from streams has critical implications for feedbacks to climate change. The Peel Plateau (NT) is characterized by intense degradation of ice- and inorganic-rich permafrost, and is thus an ideal site to investigate the influence of mineral weathering on carbon gas emissions from streams. We investigated summertime trends in geochemistry, carbon source, and gas dynamics in nine streams across the Peel Plateau. The conductivity of thaw slump-impacted streams was significantly elevated compared with their pristine counterpart. This corresponded with an isotopically-enriched dissolved inorganic carbon (DIC) pool in impacted streams (mean δ13C-DIC = -9.80‰), likely indicating the dissolution of carbonate minerals following exposure by thaw slump activity. Streams were supersaturated with CO2 (mean
excess CO2 = 845 µatm), with the highest concentrations 
(2σ > mean pCO2) in thaw slump runoff. These high 
pCO2 levels in runoff were likely driven by a combination 
of microbial respiration of aliphatic permafrost carbon 
(mean SUVA254 = 2.14 L mg-1 m-1) and dissolution of 
exposed carbonates (range δ13C-DIC = -5.70 - -19.41‰). 
Ongoing research will characterize CH4 dynamics and the 
role of mineral weathering in CO2 fixation in thaw slump 
impacted streams on the Peel Plateau. By elucidating 
the influence of mineral weathering and nutrients on 
carbon gas emissions in an inorganic-rich permafrost 
environment, this work will improve our understanding of 
aquatic carbon cycling and permafrost-climate feedbacks.