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Poster Abstracts

2015

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POSTER ABSTRACTS

AIR-SEA CO2 EXCHANGE IN THE CANADIAN ARCTIC ARCHIPELAGO

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In recent years, studies have indicated that understanding the carbon cycle and variations of air-sea CO2 exchange in the Arctic seas is a crucial and important issue to properly forecast the effect of climate change since the Arctic Ocean contributes approximately 5-14% to the global balance of CO2 sinks and sources. However, the spatiotemporal variability of CO2 uptake and fluxes are not consistent across all the Arctic Ocean, and accurately estimating CO2 uptake can be difficult due to a lack of field data. Fortunately, remote sensing provides a rigorous avenue for extrapolating seawater carbon system observations, since dissolved CO2 in seawater (pCO2sw) tends to covary with parameters (e.g. sea surface temperature (SST), ocean colour) that are readily observable from space. Gas exchange rates for water surfaces can also be estimated remotely, either from wind-velocity estimates derived from scatterometers, or by altimeter or scatterometer measurements of wave slope. In this study, we will aim to estimate the interannual variations of air-sea CO2 fluxes in the Canadian Arctic Archipelago. Field datasets of surface salinity, temperature, ocean colour, and dissolved CO2 concentration have been collected for the study area for five years. Work is ongoing to correlate the dissolved CO2 with parameters that are easily retrieved from remote sensing products (e.g. ocean colour and surface temperature) to extrapolate pCO2sw over the entire study area. Once this extrapolation of pCO2sw is complete, we will attempt to apply a gas transfer value to the open water sections, likely utilizing scatterometer data. By combining gas transfer velocity with pCO2sw, we will be able to estimate CO2 fluxes over a large spatial scale. By calculating CO2 fluxes over the open water period, we will be able to test an existing hypothesis that this season plays an important role in the annual cycle of air-sea CO2 exchange in Arctic seas. This will be a novel result, as no other studies have produced a detailed assessment of CO2 exchange in the Canadian Arctic Archipelago. The techniques that we develop will be useful in other regions, and will hopefully contribute to a wider understanding of CO2 exchange on Arctic shelf seas.

CURRENT STATE OF THE KOLYMA AND CHUKOTKA GLACIERS AND PROJECTION OF GLACIAL SYSTEMS OF THE CHUKCHI HIGHLANDS' EVOLUTION

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The aim of this work is to assess the current state of the highlands' glaciation by the high resolution satellite images, to compare with the Glacier inventory data at the background of climatic parameters, such as temperature and precipitation trends over the last 50 years, as well as assessment of the evolution of glacier systems in the near future. A recent study, done by a group of authors presents a generalization and systematization of the information on glaciers of the Chukotka and Kolyma highlands, which was given by the Magadan researcher R.V. Sedov. Glaciers of the Kolyma highlands consist of two groups: five are located on the eastern slope of the Kolyma highlands near the western shore of the Sea of Okhotsk, the equilibrium line altitude (HELA) is from 700 to 1500 m a. s. l., and 14 cirque glaciers are located in the northern part of the Taigonos Peninsula, the equilibrium line altitude (HELA) from 700 to 1000 m. Glaciers of the Chukchi Highlands, according to R.V. Sedov, are represented by five groups: in the Teniany Range in the Lavrentiya Bay, the mean HELA is 500 m a.s.l. in the Providenskiy Mountain Massif, the HELA is from 400 to 550 m, in Iskaten Ridge, HELA from 500 to 1000 m, on the Pekulney Ridge, the mean HELA was 740 m, in the Amguema River basin with an average HELA 1400 m. (Kotlyakov et al, 2011). To determine the parameters of glaciers the high-resolution satellite images have been used dated by August 2012, which cover the glaciers of these regions, courtesy of program AMAP, as well as LandSat-7 for the same period. We were able to detect and decipher 27 glaciers in the area of the Iskaten Range,

Cross Bay , 16 glaciers in the Providenskiy Massif, 6 in the Lawrence Bay, 5 - on the Pekulnei Range and 19 - in the Kolyma Highlands (the same number as was the specified of R.V. Sedov). In general, the trend is clear: the glaciers have decreased in size as compared to the estimates of late 1980s. Particularly small glaciers of Pekulnei Range "suffered" most, there are not more than 7% of the area remained from that of indicated by R.V. Sedov. The rest of the glacial systems reduced much less, the proportion of the remaining area is of 66% (Kolyma Highlands) to ~ 40% (Iskaten Range). Method for estimating glacier systems evolution was described in our papers (Ananicheva and Krenke, 2007, Ananicheva et al, 2010); in this work we had to make some changes, caused by the climate scenario features. In order to project future changes in the morphology and regime of the Chukchi Highlands glacier systems the output data (temperature and precipitation), calculated by the ensemble models A-31 (Kattsov, Govorkova 2013) were used. The glaciers of the Chukchi Highlands in 2030, based on chosen climatic scenario (A-31) will reduce in size in different way. Small glaciers will completely disappear from Pekulnei Range, so far HELA has shifted upward maximum (410 m) among other studied systems, and a glacier area remained is just 0.1 km2. Glaciers of Iskaten Ridge (the Cross Bay) and Providence Bay Massif by 2012 have saved more than 40% of their area, and by 2030 they will lose a large part of it which will remain only 6.1%, and 13, 6%, respectively, offset by the time HELA reach 350 m. The best preservation of glaciers belongs to Amguema River basin, located in the northeastern Chukotka (~ 60%), but there are small glaciers there, and up to 2030 only ~ 0.7 km2 covered by ice will "survive".

WINTER WEATHER IN JAPAN CONTROLLED BY LARGE-SCALE ATMOSPHERIC AND SMALL-SCALE OCEANIC PHENOMENA

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The important components of atmospheric circulation in the winter over the Northern Hemisphere are the Arctic Oscillation (AO) and Western Pacific (WP) pattern. Although in general positive (negative) AO and WP phases cause Siberia, East Asia, and Japan to be abnormally warm (cold). The low (high) temperature of the Sea of Japan, which cooling (heating) by these cool (warm) waters, despite the small size of the Sea of Japan, overwhelmed the warming (cooling) effect of the positive (negative) AO and WP. Linear regression analyses show that Japan tends to be warm (cool) in years when the Sea of Japan is warm (cool). Consequently, the temperature over Japan is controlled by interannual variations of small-scale oceanic phenomena as well as by large-scale atmospheric patterns (Ando et al. 2015). However, we cannot obtain the conclusion that surrounding ocean temperature generally influence on the temperature over Japan because Ando et al. (2015) is case study of the winter of 2012/13. To obtain the general conclusion, we should use statistical analysis, i.e., correlation between the temperature over Japan and surrounding ocean temperature. However, large-scale atmospheric circulations affect both the temperature over Japan and the surrounding ocean temperature. This is the usual result that the temperature over Japan is significantly positively correlated with the surrounding ocean temperature. Thus, to know the "real" influence of the surrounding ocean temperature on the temperature over Japan, we must remove the influence of large-scale atmospheric circulation from the temperature variation over Japan. We considered the "new" method of removing influence of large-scale atmospheric circulations. In this study, we examined whether the surrounding ocean temperature generally influence on the temperature over Japan in winter using new statistically analysis method. The surrounding ocean temperature around Japan is significantly positively correlated with the temperature over Japan removing large-scale atmospheric circulations. This result is consistent with the finding of Ando et al. (2015). Influence of large-scale atmospheric circulations is strong. However, the surrounding ocean also influence on the temperature over Japan, statistically. Reference Ando, Y., M. Ogi, and Y. Tachibana, 2015: Abnormal winter weather in Japan during 2012 controlled by large-scale atmospheric and small-scale oceanic phenomena, Monthly Weather Review, 143, 54-63.

CONDUCT OF TRADITION KNOWLEDGE RESEARCH - A REFERENCE GUIDE

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Recently published by the Wildlife Management Advisory Council (North Slope), the Reference Guide provides background information and practical guidance for principal investigators and research team members planning to conduct Traditional Knowledge (TK) research. In reviewing past TK research in the Inuvialuit Settlement Region and other parts of Canada, the authors observed that: (1) current research standards across northern Canada vary greatly from one project to the next; (2) a significant amount of the TK research does not meet minimal data quality standards; and, (3) TK research and studies are falling under increasing critical scrutiny, especially where documented TK is at odds with science-based knowledge. Well-documented and defensible TK research is important when preparing data/evidence in support of environmental assessment, land and water management, wildlife management, conservation planning, aboriginal self-government decision making, land claims negotiations, and other applied purposes. The Reference Guide is an attempt to summarize a wide variety of considerations when conducting TK research and suggest best practices. Researchers should strive for the best possible design and conduct within the constraints imposed by budgets, time, and logistics. Topics included in the Reference Guide include: (1) the need for systematic research designs and practices; (2) the benefits of multi-disciplinary research teams; (3) commitment to data quality standards; (4) choosing appropriate research methods; (5) assumptions concerning spatial knowledge; (6) why careful consideration of language and worldview is important; (7) informant sampling; (8) methodological details concerning interviewing; (9) spatial knowledge documentation; (10) creating geospatial data using the map biography method; (11) direct-to-digital methods of documenting spatial TK; and, (12) post-study data management.

BRIDGING THE GAP - GROUND-TRUTHING REMOTELY-SENSED GREENING OF QIKIQTARUK WITH LONG-TERM ECOLOGICAL MONITORING AND EMERGING UAV TECHNOLOGIES

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Rising summer temperatures and expanding growing seasons are expected to lead to an increase in primary productivity (greening) in tundra ecosystems. Satellite observations indicate that this greening is already occurring, showing a strong positive trend in the Normalized Difference Vegetation Index (NDVI) at sites around the Arctic, including our focal research site, Qikiqtaruk - Herschel Island on the North Coast of the Yukon Territory. In addition, ground-based ecological monitoring at the site shows an increase in biomass, as well as shrub and graminoid cover over the last 15 years. This change in community composition is accompanied by changes in plant phenology, observed in the timing of flowering and leaf development for three focal plant species: Dryas integrifolia, Eriophorum vaginatum and Salix arctica. Despite this evidence of concurrent vegetation changes, we do not yet know if the on-the-ground changes are responsible for the remotely-sensed greening. Establishing a link between low resolution satellite data and ground-level ecological monitoring will be key to answering this question. Here we test the correspondence between inter-annual variability in plant phenology and remotely-sensed NDVI on Qikiqtaruk. By combining conventional methods of data collection with emerging technologies (UAVs - Unmanned Aerial Vehicles), we bridge the spatial gap between coarse-scale satellite datasets and ground based ecological monitoring. We document: 1) a strong NDVI greening pattern, 2) evidence of vegetation composition change and 3) shifting plant phenology on Qikiqtaruk. Greening corresponds

with leaf emergence for our focal plant species, indicating that part of the greening signal on Qikiqtaruk can be attributed to changes in plant phenology over time. Following the successful collection of multispectral imagery with UAVs during summer 2015, we are now continuing the development of these emerging analytical and surveying methods to ground-truth satellite data in remote Arctic tundra ecosystems. Linking on-the-ground ecological monitoring with high resolution UAV data and remotely-sensed satellite imagery is essential for improving biome-wide predictions of vegetation change in high latitude ecosystems. Only with the integration of data across scales can we begin to understand the extent and rate of current vegetation change and make meaningful predictions about the future of the tundra biome as a whole.

CHANGES TO THE QUANTITY AND QUALITY OF HIGH ARCTIC DISSOLVED ORGANIC MATTER FROM PHOTOLYTIC AND MICROBIAL DEGRADATION EXPERIMENTS

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Northern environments are some of the most sensitive to a warming climate, with much of Canada's high-arctic freshwater environments rapidly undergoing change. There is much uncertainty associated with the magnitude and impact on these systems, and one in particular is the result of a warming climate on dissolved organic matter (DOM) dynamics in high-arctic environments. 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. With a changing climate, it is uncertain how DOM source, quantity, or quality may be affected in Canada's high arctic. Our research was conducted at the Lake Hazen watershed, Quttinirpaaq National Park, Nunavut, and already has been responding to a warming climate. Here we conducted a 30-day photolytic and microbial degradation experiment to better understand how DOM quality varied among different hydrological environments within the watershed. Samples were taken from a permafrost seep, subsurface water, and lake within a productive subcatchment, as well as from a creek draining a glacier. Over the 30-day experiment, changes were measured in DOM quantity (though overall carbon concentration) and quality (using DOC:DON ratios, size-exclusion chromatography, and UV-visible absorbance). Degradation rates were compared to similar experiments conducted in the sub-arctic. The results from this study illustrate DOM quality with respect to two major degradation pathways, as well as quantify the potential fate of DOM in high-arctic environments.

CLIMATE CHANGE IN THE HUDSON BAY COMPLEX: IMPLICATIONS FOR THE PORT OF CHURCHILL'S SHIPPING OPERATIONS

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As part of Transport Canada's NEXTAW (Network of Experts on Transportation in Arctic Waters) this project was designed to assess the impact of climate change in the Hudson Bay Complex (Hudson Bay, Hudson Strait, and Foxe Basin) and to examine the resultant vulnerabilities and opportunities for the Port of Churchill's shipping operations extending to 2030 and 2050. Changes in sea ice and their consequences for shipping routes and the shipping season were of particular interest. Literature review and novel data analysis indicate that significant climate change has occurred throughout the Complex and in the Churchill area in recent decades. For example: warming trends of 0.5 to 1.8°C per decade in surface air temperature between 1979 and 2013, extension of the open water season by 3.1 to 4.9 weeks between 1996 and 2010, and a tendency towards higher average wind speeds and more days with high winds between 1970 and 2011. Looking to the future, projections for 2030 and 2050 from climate models indicate that the recent rate of change will continue and may even accelerate. These climate changes could have a significant impact on the Port of Churchill's operations. Open water (ice-free) access to the Port may grow from an average window of 16.3 weeks between 1980-2010 to 20.7 weeks by 2030 and 25.2 weeks by 2050. Moreover, current projections do not suggest that a growth in shipping at the Port will be significantly hampered by changes in weather. However, the ecological consequences of increased shipping and the shipment of new types of freight (e.g. oil) must be considered.

PHYSICAL PROCESSES CONTRIBUTING TO AN ICE FREE BEAUFORT SEA DURING SEPTEMBER 2012

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During the record September 2012 sea ice minimum the Beaufort Sea became ice free for the first time during the observational record. Increased dynamic activity during late winter enabled increased open water and seasonal ice coverage that contributed to negative sea ice anomalies and positive solar absorption anomalies which drove rapid bottom melt and sea ice loss. As had happened in the Beaufort Sea during previous years of exceptionally low September sea ice extent, anomalous solar absorption developed during May, increased during June, peaked during July and persisted into October. However in situ observations from a single floe reveal that only 78% of the energy required for bottom melt during 2012 was available from solar absorption. We show that the 2012 sea ice minimum in the Beaufort was the result of anomalously large solar absorption that was compounded by an arctic cyclone and other sources of heat such as solar transmission, oceanic upwelling and riverine inputs, but was ultimately made possible through years of preconditioning towards a younger, thinner ice pack. Significant negative trends in sea ice concentration between 1979 and 2012 from June to October, coupled with a tendency towards earlier sea ice reductions have fostered a significant trend of +12.9 MJ m-2 year-1 in cumulative solar absorption, sufficient to melt an additional 4.3 cm m-2 year-1. Overall through preconditioning towards a younger, thinner ice pack the Beaufort Sea has become increasingly susceptible to increased sea ice loss that may render it ice free more frequently in coming years.

TOXOPLASMA IN WILDLIFE TRADITIONALLY CONSUMED IN NUNAVIK

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In Nunavik, Canada, congenital toxoplasmosis and high levels of human exposure to Toxoplasma represent public health concerns. One possible route of human exposure includes handling or consuming infected wildlife. Foodborne exposure to Toxoplasma through infected wildlife therefore warrants further research since felid hosts that shed oocysts in the environment are rare above the treeline and Toxoplasma can lead to the formation of infective tissues cysts in exposed and infected animals. Because the consumption of raw wildlife tissues is commonly practiced by Inuit people, and because foodborne parasites including Toxoplasma can infect wildlife tissues, it is important to better understand local knowledge and risk perception of wildlife parasites in the North. Few Toxoplasma studies in wildlife exist in Nunavik and all are based on serological exposure rather than tissue infection. We aim to assess the seroprevalence and risk factors for Toxoplasma in seals (Phoca hispida), geese (Chen caerulescens, Branta canadensis), ptarmigan (Lagopus lagopus, Lagopus muta) and foxes (Vulpes lagopus, Vulpes vulpes) harvested in Nunavik. Detection of Toxoplasma DNA using a novel diagnostic technique which uses larger quantities of tissue will also be done. Finally, a survey will be conducted to assess local knowledge and risk perception of wildlife parasites. This information should help improve prevention and communication around wildlife parasites and the safety of country foods with respect to Toxoplasma in Nunavik. Determining whether or not Toxoplasma represents a potential health concern for subarctic and arctic wildlife populations could also be valuable for Inuit communities of Nunavik.

FROZEN CARBONATES: CARBON DIOXIDE SPECIATION IN SUB-ZERO BRINES

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The polar regions are experiencing the most visible and significant impact from climate change due to an increase in atmospheric CO2. In the Arctic, temperature has increased at twice the rate of the rest of the globe, and ocean acidification proceeds more swiftly than in other regions. However, several key aspects of CO2 chemistry remain experimentally undetermined, forcing reliance on extrapolation and estimation. In particular, the Henry's law constant of CO2, which governs the partitioning of gases between the atmosphere and aqueous phases, has never been experimentally determined at cold temperatures and high salinities resembling the conditions of sea ice brine. This study aimed to determine the Henry's law constant of CO2 in brines with various salinities at temperatures down to -10 °C. This was done in a closed system under a narrow range of pH, where the Henry's law constant was determined by simultaneous measurements of pCO2, total dissolved carbon, and alkalinity. Preliminary results showed a trend of increasing aqueous phase CO2 concentration with decreasing temperature, and a more complex relationship with salinity. Additionally, the experimentally determined Henry's Law constants were considerably different from the literature values estimated from simple extrapolation. Our results caution the use of extrapolated thermodynamic constants of CO2 in climate modeling, and call for experimental determination of these constants under conditions resembling those of the polar marine cryosphere.

ASSESSING SHORT TO LONG TERM IMPACTS OF AN EXPERIENTIAL SCIENTIFIC OUTREACH PROGRAM ON HIGH SCHOOL STUDENT AND TEACHER PARTICIPANTS.

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Schools on Board' is a national outreach program of ArcticNet, initiated with an Arctic field program that brings high school students and teachers from across Canada 'on board' the Arctic research vessel, CCGS Amundsen to participate in an active scientific expedition. Since 2004, this unique program has provided 85 students and 24 teachers with an experiential learning opportunity focused on Arctic research in Canada's north. Developed in 2003 and based out of the Clayton H. Riddell Faculty of Environment, Earth and Resources at the University of Manitoba (Winnipeg, Canada), the program aims to promote science, increase awareness of climate change issues, and inspire young Canadians to explore future studies and career opportunities of Arctic research. In 2014, Schools on Board contracted Health in Common to conduct a comprehensive evaluation of last 10 years of this program. The aim of the study was to assess short to long-term impacts of the field program on participants (high school students and teachers). Program information from 2004-2014 was gathered through: an online survey sent to 92 past student and teacher participants; in-depth telephone interviews with a randomly selected group of past student and teacher participants representing each program year and region; a focus group conducted with participants during the 2014 excursion; and student evaluation surveys on knowledge and interest in environmental science and research completed at the end of the 2009, 2010 and 2011 excursions. Findings were analyzed for themes relating to: connections made to science and the environment; improved attitudes and behaviours about science and the environment; personal and career impacts; and school engagement. This presentation will describe the process and results of this assessment including actionable recommendations for program improvement.

BIOTIC INTERACTIONS MEDIATE PATTERNS OF HERBIVORE DIVERSITY IN THE ARCTIC

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Understanding what shapes biodiversity patterns, particularly for groups of organisms with key functional roles in the ecosystem, will help predict ecosystem responses to environmental changes. Vertebrate herbivores exert a strong trophic influence in terrestrial Arctic ecosystems and the diversity of herbivores is expected to influence the outcomes of plant-herbivore interactions. Several hypotheses have been put forward to explain patterns of species diversity at the global scale, but drivers seem to be region- and guild-specific. Despite recent efforts to document biodiversity in the Arctic, no study has systematically evaluated the relative role of different drivers in shaping broad diversity patterns of herbivores. The aim of this study was to identify patterns of species richness of vertebrate herbivores and their drivers in the Arctic. This biome, traditionally perceived as homogeneous and low in biodiversity, includes wide variation in biotic and physical conditions and is currently undergoing major environmental change. We compiled available information on vertebrate (bird and mammal) herbivore distribution at a pan-Arctic scale, and used eight variables that represent the most relevant hypotheses to explain patterns of species richness. We used range maps rasterized on a 100 x 100 km equal-area grid to analyse richness patterns of all vertebrate herbivore species combined, and birds and mammalian herbivores separately. Overall, patterns of herbivore species richness in the Arctic were positively related to plant productivity (measured with Normalized Difference Vegetation Index) and secondarily to the species richness of predators. Species richness of herbivores was also, but to a lesser degree, affected by mean annual temperature and distance to coast (bird richness peaking near the cost and mammal richness inland). Our results suggest that biotic interactions, with either higher or lower trophic levels or both, can drive patterns of species richness at a biome-wide scale. Rapid ongoing environmental changes in the Arctic are likely to affect the distribution of herbivore diversity through impacts on primary productivity and changes in predator communities via range expansion of predators from lower latitudes.

NUNAVIMMIUT KNOWLEDGE OF POLAR BEARS: AN IMPORTANT CONTRIBUTION TO THE MANAGEMENT PROCESS

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Under the Nunavik Inuit Land Claims Agreement (NILCA) the Nunavik Marine Region Wildlife Board (NMRWB) has the responsibility for wildlife management in the marine region surrounding Nunavik. The NMRWB was requested to establish a total-allowable take (TAT) for each of the three polar bear sub-populations occurring in Nunavik. To achieve this the board is required to consider the best available information, including the knowledge of Nunavik Inuit. To date very little of the wealth of knowledge held by hunters and Elders in Nunavik has been systematically gathered and documented in a format accessible to decision makers. The NMRWB, together with Trent University, is conducting a project to document Nunavik Inuit Knowledge (NIK) of polar bear ecology, biology and traditional management practices, so that this information can be formally considered during the NMRWB's decision-making process. Semi-directive individual or small-group interviews and participant

mapping sessions have been held with 101 participants from the ten communities within the range of the Southern Hudson Bay and Davis Strait sub-populations thus far. Verification and validation of results and findings have been completed in each community. Results provide in-depth information about Nunavik Inuit hunting traditions, as well as Inuit perspectives on increasing interactions and conflict with polar bears, research and monitoring methods, and stewardship/traditional management. The study demonstrates the rich knowledge of Nunavimmiut (Inuit of Nunavik) about the biology and ecology of polar bears, including their abundance, behaviour (e.g. mating, denning, feeding, etc.) and health/body condition. Participant mapping activities are providing significant data on the distribution/movements of polar bears, as well as denning and foraging areas. As expected, the results to date confirm the high level of importance afforded to polar bears by Nunavimmiut as an economic and cultural resource. Respondents indicated that traditional management practices included seasonal hunting closures, and general avoidance of harvesting cubs. Ongoing Inuit stewardship practices are generally governed by need and appropriate use of polar bears. Participants also reported significant concerns regarding the implementation of modern management systems that may not align with Inuit values and traditions. The depth and breadth of the knowledge gathered makes critical contributions to the overall understanding of polar bears in this region. This demonstrates the importance of including documented NIK, in addition to expert knowledge holders themselves, in the development of management practices. Doing so is necessary to maintain vital and healthy polar bear populations which remain an important component of the regions' ecological systems and which are available for use by current and future generations of Inuit in a way that respects and embodies their rights, culture and traditions.

RELATING VEGETATION PIGMENTS, SPECTRA, AND RGB DATA IN A LOW ARCTIC TUNDRA ECOSYSTEM

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We evaluated how chlorophyll, spectral reflectance, and RGB data of tundra vegetation are related. Biomass samples, spectral data and digital photographs were collected from 1 x 1m plots at the Toolik Field Station in the summer of 2015. We determined the chlorophyll concentrations of dominant species using a spectrophotometer and related these values to plot-based spectra derived from a hand held spectroradiometer and vegetation indices derived from digital images. We expect that spectral and RGB indices will be highly correlated to chlorophyll content. We also expect that the resolution (pixel vs. plot) will be a large determinant in the strength of the relationships. These results will help characterize and validate the photosynthetic capacity of tundra communities from air and space-borne imagery.

SEASONAL RESOURCE SELECTION BY TORNGAT MOUNTAINS CARIBOU IN NORTH-EASTERN QUÉBEC AND LABRADOR

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Several caribou and reindeer (Rangifer tarandus) herds are presently declining throughout their range. This global decline is believed to be partly caused by anthropogenic factors, such as climate change, habitat alteration, and industrial development. The Torngat Mountains caribou herd, inhabiting the Torngat Mountains in north-eastern Quebec and Labrador, is one of the many herds experiencing decline. Very few studies have examined the potential causes of this decline, and little is known about the space use and resource selection of this population. Furthermore, this mountain caribou herd is of great economic and sociocultural importance to local Inuit communities. An improved understanding of the resource selection, space use and survival of Torngat caribou will help to ensure the successful management of this herd, allowing for its sustainable use and long term protection. Using caribou location data from 35 Argos and GPS-collared Torngat caribou, we evaluated the resource selection of Torngat caribou within their seasonal home-ranges. We determined the probability of use of areas with different vegetation classes and topographic features (e.g. aspect, slope, elevation, ruggedness) based on the characteristics of 1 km buffer areas surrounding each caribou location. We found that seasonal selection was mostly driven by a) resource availability and topographic features in winter, b) topographic features in the pre-calving season, c) topographic features, snow avoidance

and possible insect avoidance in summer, d) topographic features and snow in fall, and e) resource availability and topographic features in the breeding season. Moving forward, we will evaluate the factors responsible for Torngat caribou seasonal home-range selection within the annual home-range of the herd. Our results should help defining a potential protected area to favour the recovery of Torngat caribou. It will also help guide the harvest management of Torngat caribou, as well as the planning of new industrial development in the Torngat region.

THE VIEWS OF SHIPPING COMPANIES WORLDWIDE ON THE ARCTIC MARKET

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The media speaks of a pending boom in the Arctic shipping industry throughout the circumpolar North, using routes along the coast of Norway and Russia, through the Canadian Archipelago, and across the North Pole. Wanting to know the reality behind the headlines, we surveyed over 150 shipping companies from around the globe, asking about the risks, costs, their interest in operating in the Arctic, and their perception on the potential of an Arctic shipping industry as a whole. Based on the responses, we can conduct comparisons among shipping companies between continents, countries, and sectors, allowing us to assess the reality of current shipping activities in the circumpolar North, and the likely future development of Arctic maritime traffic.

THE NEW DATABASE OF THE GLOBAL TERRESTRIAL NETWORK FOR PERMAFROST (GTN-P)

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The Global Terrestrial Network for Permafrost (GTN-P) provides the first dynamic database which extensively collects permafrost temperature (TSP) and active layer thickness (ALT) data from Arctic, Antarctic and mountain permafrost regions. The goal of GTN-P is to establish an early warning system for the consequences of climate change in permafrost regions and to provide standardized thermal permafrost data to global models. This presentation will introduce the GTN-P database and describe the concept and structure of the data management system in regard to user operability, data transfer and data policy.

MUD VOLCANOS ON THE BEAUFORT SHELF AND UPPER SLOPE: A REGIONAL DISTRIBUTION OF A SEABED GEOHAZARD

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Regional seabed mapping has led to the identification of 2100 conical and elongate shaped mounds on the Canadian Beaufort seabed that range in size from 1 to 50 m high with basal diameters of 20 to 1200 m, or lengths of 2100 for elongated features. The distribution of these instability features is not random. Concentrations of events occur on the east and west sides of the Mackenzie Trough, the central Beaufort outer shelf and upper slope and on the shelf north of the Tuktoyaktuk Peninsula. Approximately 50 features have been observed actively venting fluids (of which 2 are associated with oil seeps). Gas plumes in the water column above the crests of active features are associated with the upward migration of biogenic and/or thermogenic fluids. Venting gases have a high methane content and may include higher octane gases. Most appear to be relict but well preserved and as such, probably occurred post shelf transgression. Margin loading by glacial sediments, sea level rise, margin subsidence, overpressures at depth

and permafrost taliks created the dynamic conditions needed to generate the observed distribution of mud volcanoes. The sub-seabed directly underlying a few of these features is disrupted to depths of several hundred to several thousand metres, forming an acoustic 'chimney' of disturbed strata. One of the largest active mud volcanoes occurs on the upper slope and is characterized by: • Circular morphology, truncated cone shape, height of 30 m, broad flat top over 1100 m in diameter, a basal diameter of 1200 m, and surrounding moat approximately 1 km wide. Water depth 450 m. • Venting gas and other extrusive material, which create buried mud flows in the near- and sub-surface, indicating recent activity • Underlying seismic 'chimney' reaching several hundred metres below seabed indicating the presence of migrating fluids • Chemosynthetic biological processes are active on the crest of the feature indicating bacterial mats From a seabed geohazard perspective, regional mapping has resulted in a knowledge of formation processes and instability feature distribution. Mapping in local areas of prospective hydrocarbon drilling activity would reveal their presence and allow for avoidance during exploration.

COASTAL CLASSIFICATION OF NUNAVIK (QUÉBEC)

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Nunavik is surrounded by Hudson Bay to the West and by Hudson Strait and Ungava Bay to the North. Its coastal geomorphology is not well documented in comparison with the Canadian Beaufort Sea or the Gulf of Saint Lawrence. Being approximately 8,000 kilometers long in total, its coastline is composed of numerous bays, pocket beaches, estuaries, low-lying tundra and emerging glacial landforms (fjords, eskers, De Geer moraines, drumlins, etc.). The three seaboards of Nunavik are very contrasted in terms of tidal conditions, wind and sea ice climate, morphology and coastal permafrost conditions, inducing a large complexity for the elaboration of a coastal classification. This research project is linked to the expected development of marine transportation infrastructure in Nunavik, both in the Inuit communities and elsewhere along the coastline. Moreover, the western coast of Nunavik is situated in the centre of the Hudson Bay glacio-isostatic land uplift region, with an uplift rate of 13 mm per year. In the scientific literature, many coastal classifications have been defined and applied to characterize the main features of a coastline in terms of physical and ecological properties. To date, several scientific programs have been carried out to map and classify Canadian Arctic shorelines: CanCoast, ACD (Arctic Coastal Dynamics), ShoreZone and eSPACE (Emergency Spatial Pre-SCAT for Arctic Coastal Ecosystems). Consequently, acquiring sound knowledge on coastal systems and processes of Nunavik is essential to assess the sensibility of these environments in a context of climate change and economic development. A meticulous geomorphological analysis is necessary for coastal management. Current coastal dynamics and expected transformative changes due to climate and geophysical changes need to be better appraised. A shoreline videography by helicopter was conducted in summer 2015 between Kuujjuarapik and Deception Bay. In total, 20 hours of videography and 12,000 photos were collected while flying more than 3,000 km along the coastline. The mapping procedure is based on shoreline segmentation. We use a high resolution shoreline classification scheme at a 1:50,000 scale, which was developed by CanVec (a product of NRCan). Descriptive attributes (e.g. substrate, slope, shore type [SCAT class], anthropogenic features) are entered into a data entry form for each shore segment to describe both the alongshore segment and the across-shore morphology (intertidal, supratidal and backshore zones). Preliminarily, the main shoreline types along the Hudson Bay and Ungava Bay coasts are: bedrock, inundated low-lying tundra, mixed/coarse sediment tidal flat and sand beach. Sections along the coastline sensitive to erosion due to marine (waves, tides, ice, surges) and geophysical factors (relative sea level changes, coastal permafrost) are already generally identified. Mapping from Deception Bay to Killiniq Island, around Ungava Bay, is in planning for summer 2016.

USE OF PASSIVE ACOUSTIC MONITORING (PAM) TO DETERMINE SPATIOTEMPORAL HABITAT USE OF CUMBERLAND SOUND BELUGA

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Commercially exploited during the early to mid-1900's, the Cumberland Sound beluga whale (Delphinapterus leucas) population was significantly depleted, with stocks estimated to have declined to the low hundreds in the latter half of the century. Through regulation of local subsistence hunts and bans on commercial exploitation, the resident beluga population has since recovered to approximately 1000 individuals. However, this population remains listed as a threatened species under COSWEIC since 2004. Traditionally, population counts of Cumberland Sound beluga have been conducted using time-costly and expensive aerial surveys. In this proposed study, we intend to use sound, rather than sight, to detect the presence of belugas. Using a non-invasive and relatively inexpensive technique, passive acoustic monitoring (PAM) allows for continuous detection of submerged and otherwise non-visible animals, aiding in determining spatiotemporal habitat use. Using data gathered from three hydrophones placed in Clearwater Fjord of Cumberland Sound, an area in which belugas aggregate during the ice-free summer months, the presence of beluga will be determined based on detected vocalizations. Data collected in 2010 and 2011 over a three week period will be used from each hydrophone. Findings from this project will expand upon previous knowledge of Cumberland Sound beluga population, and when coupled with recent aerial surveys, may give a more accurate estimate of beluga population size and distribution. Continual monitoring and assessment on the presence of beluga in Cumberland Sound can provide insight into beluga population size, health, and dynamics, which can aid in determining future management plans and conservation efforts.

GROWTH AND STABLE WATER ISOTOPES OF ICE FORMED BY VAPOUR DEPOSITION IN COLD ENVIRONMENTS

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In regions with mean daily soil surface temperatures less than 0°C, such as in the upper McMurdo Dry Valleys of Antarctic, the hydrological cycle is largely restricted to water vapour exchanges between the atmosphere and ice-bearing permafrost. Although the rates of vapour exchanges have been examined, both experimentally and numerically, the water isotope composition and evolution of ground ice formed by vapour deposition into the permafrost is mainly unknown. This research focuses on the dynamics of deposition and sublimation of atmospheric water vapour into permafrost and the isotopic signature (D/H and 18O/16O) of the emplaced ground ice under different experimental conditions. The objectives of the study are to: 1) Measure the ground ice content emplaced via vapour deposition in soils; 2) Measure the D-18O composition of ground ice formed by deposition of atmospheric vapour in the soils; and 3) Investigate the effect of magnesium perchlorate, a highly deliquescent salt, on vapour-diffusion rates between the atmosphere and the soils, including potential effect on D-18O. These objectives were attained using an experimental chamber in which ground ice was produced in two different types of soils with different porosity's (33% vs. 73%). The samples were placed on top of cooling plates which created a sharp vertical thermal gradient of -3.2°C/cm in the soils. After a 2 month growth period, the ground ice contents in the high porosity soil is >10x more important compared to the less porous soil and ground ice formed by vapour-diffusion has a distinct δD-δ18O composition that plots along the global meteoric water line, but is slightly shifted below it.

UNDERSTANDING PERMAFROST TEMPERATURE TIME SERIES IN THE CONTEXT OF SUBSURFACE HEAT GAIN AND ICE LOSS

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Permafrost is a thermal phenomenon and is defined strictly on the criterion of temperature. Consequently, most permafrost measurement and monitoring data comprise temperature time series. Despite its relevance with respect to geomorphic change or infrastructure stability, data on subsurface ice loss, however, is usually not available. As warming permafrost approaches the melting point of water, temperature response to the continued addition of heat decreases as more and more of the added energy is used to melt ice. This takes place according to subsurface characteristics, which are usually

not known a priori. It is therefore difficult to meaningfully compare rates of temperature increase for sites with differing ground temperatures. This research will look at how a series of increasingly strict assumptions about ground characteristics can yield approximations to the amount of heat that has been added to a soil sample or a soil column. An attempt will be made to estimate plausible ranges of heat gain and ice loss for each set of assumptions. By reframing an increase in temperature as an estimate of heat gain or ice loss, a more appropriate comparison of permafrost change can be made between sites whose temperature trends would otherwise partially suggest that very little change was taking place.

MERCURY AND CADMIUM IN RINGED SEALS IN THE CANADIAN ARCTIC: INFLUENCE OF LOCATION AND DIET

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Concentrations of total mercury (THg) and cadmium Cd were determined in muscle and liver of ringed seals (Pusa hispida) from up to 14 locations across the Canadian Arctic. Location, trophic position (TP) and relative carbon source best predicted the THg and Cd concentrations in ringed seals. THg concentrations in ringed seals were highest in the western Canadian Arctic (Beaufort Sea), whereas Cd was highest in the eastern Canadian Arctic (Hudson Bay and Labrador). A positive relationship between THg and TP and a negative relationship between THg and relative carbon source contributed to the geographical patterns observed and elevated THg levels at certain sites. In contrast, a negative relationship between Cd and TP was found, indicating that high Cd concentrations are related to seals feeding more on invertebrates than fish. Feeding ecology appears to play an important role in THg and Cd levels in ringed seals, with biomagnification driving elevated THg levels and a dependence on low-trophic position prey resulting in high Cd concentrations. The present study shows that both natural geological differences and diet variability among regions explain the spatial patterns for Hg and Cd concentrations in ringed seals.

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.

VULNERABILITY AND ADAPTIVE CAPACITY OF INUIT WOMEN TO CLIMATE CHANGE: A CASE STUDY FROM IQALUIT, NUNAVUT

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Climate change impacts in the Arctic will be differentiated by gender, yet few empirical studies have investigated how. We use a case study from the Inuit community of Iqaluit, Nunavut, to identify and characterize vulnerability and adaptive capacity of Inuit women to changing climatic conditions. Interviews were conducted with 42 Inuit women, and were complemented with focus group discussions and participant observation to examine how women have experienced and responded to changes in climate already observed. Three key traditional activities were identified as being exposed and sensitive to changing conditions: berry picking, sewing, and the amount of time spent on the land. Several coping mechanisms were described to help women manage these exposure-sensitivities, including altering the timing and location of berry picking, and importing seal skins for sewing. The adaptive capacity to employ these mechanisms differed among participants, however, a function of mental health, physical health, traditional/western education, access to country food and store bought foods, access to financial resources, social networks, and connection to Inuit identity. The study finds that gender roles result in different pathways through which changing climatic conditions affect people locally, although the broad determinants of vulnerability and adaptive capacity for women are consistent with those identified for men in the scholarship more broadly.

IMPLICATIONS OF A CHANGING ARCTIC ON SUMMERTIME SURFACE SEAWATER PCO2 VARIATIONS IN THE EASTERN CANADIAN ARCTIC

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Arctic marine carbonate chemistry and rates of air-sea CO2 exchange are anticipated to be affected by current changes in sea-ice structure and extent, freshwater inputs, ocean circulation patterns, and the seasonality of phytoplankton blooms. This study examines how such changes will impact rates of air-sea CO2 exchange in northern Baffin Bay, Nares Strait, and the eastern Canadian Arctic Archipelago. This complex oceanographic region includes the North Water polynya; one of the most biologically productive areas in the Arctic Ocean, and the convergence site of the warm West Greenland Current with cold exported Arctic waters. Continuous measurements of atmospheric and surface seawater CO2 (pCO2) were collected onboard the Canadian Coast Guard Ship Amundsen during its 2013 and 2014 summer cruises. Surface seawater pCO2 displayed considerable variability (145 - 389 ppm), but never exceeded atmospheric concentrations. Calculated CO2 fluxes ranged from 0 to -45 mmol m-2 day-1 (oceanic uptake), and were estimated using the Sweeney et al. (2007) parameterization with in-situ wind speed measurements. Ancillary measurements of chlorophyll a reveal low productivity in surface waters during mid-summer with isolated sub-surface blooms. This is likely the result of nutrient limitation within the highly stratified polar mixed layer (PML). Measurements of stable oxygen isotope ratios (δ18O) and total alkalinity were used to estimate freshwater inputs (sea-ice melt vs. meteoric water) to the PML. These and in-situ observations of sea ice cover were used to interpret seawater pCO2 variations. Surface waters influenced by sea-ice melt exhibited lower pCO2 than those influenced by meteoric water. The

results of this investigation shed light on the future role of this region as a summertime sink of atmospheric CO2.

OPTIMIZATION AND USE OF A NOVEL DIFFUSIVE SAMPLER FOR DETERMINING ATMOSPHERIC POLYCYCLIC AROMATIC HYDROCARBONS AND HEXACHLOROBENZENE IN THE ARCTIC

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Ambient air quality has become an important issue over the last years, especially for Arctic communities. Hexachlorobenzene (HCB) and polycyclic aromatic hydrocarbons (PAHs) are organic chemicals distributed globally and ubiquitously found in the atmosphere. HCB is toxic to humans and animals in long-term exposure and it was included as a priority compound in the Stockolm Convention. Due to their toxicity and carcinogenic effects, PAHs are regulated internationally by the United Nations Economic Commission for Europe's (UNECE's) Convention on Long-Range Transboundary Air Pollution (CLRTAP) and by national legislation in most circumpolar countries. Although several methods exist for analysis of HCB and PAHs, mainly based on Soxhlet and ultrasonication extractions using larger amounts of solvent, there is a need to develop new eco-friendly and sustainable analytical methods without compromising performance. Therefore, the main objectives of this work are: i) To test a novel diffusive sampler for determining volatile PAHs and HCB, minimizing the use of solvents, ii) To minimize the require exposure time for monitoring in remote places such as the Arctic. In order to achieve that, a new diffuse passive sampler (Patent Number Wo 2014/076153 A1 22.05.2014) developed in the Joint Research Centre was tested for sampling in the Arctic. Three sampling campaigns were carried out during April and June 2014 in the European Arctic (Svalbard) and one in the Canadian High Arctic (Melville Island and Resolute) in July 2015. Background sites and sites close to main research facilities were selected for the deployment of the passive samplers. Samplers were exposed for 6 to 15 consecutive days depending on the time available. Three to six replicated samplers were deployed at each sampling site. Coefficients of variation between replicates were <6 % for HCB and between 5-20% for PAHs, where the higher molecular weight PAHs showed the higher variability. PAHs profiles in air were dominated by low MW compounds: those having 2, 3 rings: naphthalene and phenanthrene, with naphthalene accounting for more than 60-85% of the total amount of PAHs. Concentrations of PAHs and HCB were calculated using the sampling rates determined in laboratory conditions. Concentration of naphthalene, phenanthrene and fluoranthene in Svalbard were in the range 0.77-15 ng m-3, 0.86-3.92 ng m-3, 0.17-0.48 ng m-3 respectively. Concentrations of PAHs in the High Canadian Arctic (Resolute and Melville Island) were 1.30-4.47 ng m-3, 0.72-1.24 ng m-3, 0.28-0.49 ng m-3 for naphthalene, phenanthrene and fluoranthene respectively. The highest concentrations were found close to main research facilities in comparison to background areas, suggesting that beside long-range transport of PAHs in the Arctic, local sources (research stations, diesel generators, municipal waste burning, vehicles, etc) would also account for the total budget of PAHs in the Arctic. HCB in Svalbard, Resolute and Melville Islands were in the range 15-121 pg m-3, 82-107 pg m-3 and 80 pg m-3. For HCB, no differences between areas were observed, suggesting that the main mechanism for the introduction of HCB in the Arctic was long range atmospheric transport.

A COMPARISON OF IN-SITU, FORECAST AND RE-ANALYSIS WINDS OVER SEA ICE IN THE BEAUFORT SEA

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Near surface winds in the Arctic are used to predict sea ice motion and to study ocean-sea ice-atmosphere processes and general large-scale circulation patterns. In order to study these processes generally data sets from ECMWF and NCEP/NCAR are widely used. This study compared the NCEP/NCAR re-analysis data sets and CMC forecasts with near surface on-ice towers deployed during 2014 and 2015. Re-analysis data sets use all available data to produce wind fields over the high Arctic. Unfortunately the lack of in-situ wind data over

sea ice means re-analysis data sets have generally stronger winds speeds and large biases akin to those in coastal stations. Five on-ice towers were deployed during August and September 2014 and three during September 2015. Each tower collected surface winds, speed and direction, surface pressure, air temperature, and humidity data. All data was transmitted remotely via an Iridium modem. All data is a ten minute average leading up to the hour. Position only ice beacons were placed next to every on-ice tower to transmit the latitude and longitude at hourly intervals. As winds can vary tremendously over a short region it is intrinsically difficult to compare two different measurements unless they are in the same location. The data sparse Arctic needs more in-situ data, as input into the re-analysis data sets as the Arctic Ocean is currently a data void.

THE IMPACTS OF HIGH ARCTIC PERMAFROST DISTURBANCES ON TUNDRA ECOSYSTEMS

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Permafrost disturbances (in the form of retrogressive thaw slumps) are widespread across the Fosheim Peninsula, Ellesmere Island, Canada. This project analyzes the impacts of these disturbances on tundra ecosystems through measurement of vegetation composition, environmental variables, and carbon-dioxide fluxes during the 2013 growing season. Vegetation composition and environmental variables (including soil moisture, temperature, and nutrient availability) were determined at multiple retrogressive thaw slumps located in areas with different vegetation types. This was complemented by measurements of net ecosystem exchange (NEE) and ecosystem respiration (ER) determined using eddy covariance and a static chamber system. Two eddy covariance towers were established at the beginning of the 2013 growing season and ran continuously throughout the season. Flux partitioning based on wind direction allowed separation of NEE fluxes into fluxes from disturbed tundra and surrounding undisturbed tundra. A static chamber system was utilized throughout the season to measure ER from corresponding disturbed and undisturbed tundra. Analysis of vegetation indicates a decrease in overall vegetation cover within two active disturbances of differing dominant vegetation types when compared with undisturbed surrounding areas. Different soil conditions (moisture and temperature) and nutrient availabilities are also evident in disturbances. Eddy covariance measurements indicate decreases in NEE in disturbed areas. At one site, this decrease shifted the system from a net sink to a net source of carbon over the growing season. Vegetation community composition determines the overall impact of disturbance on carbon dioxide fluxes. Chamber measurements indicate disturbances increased ER in sedge tundra and decreased ER in dwarf shrub communities. We determined the impacts of permafrost disturbances on ecosystem structure and function by quantitatively measuring vegetation composition, environmental variables, and carbon dioxide fluxes in disturbed and undisturbed tundra.

SPATIAL AND TEMPORAL VARIABILITY OF SMALL-SCALE ENERGY AND INFERRED INTERNAL-WAVE DRIVEN MIXING IN THE CANADIAN ARCTIC

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Mixing in the Arctic Ocean is integral to understanding a variety of physical processes such as the transport of mass, heat, salt and biogeochemical tracers, sea ice melt, and the large-scale circulation. In particular, there has recently been great interest in quantifying the energy available in mesoscale, submesoscale and wave-scale motions that may ultimately drive small-scale mixing. While a comprehensive survey of the spatial and temporal variability of the energy spectra across the Canadian Archipelago has not yet been done, there exists a wealth of 1 m resolved density and velocity vertical profiles collected from Arctic expeditions over the last two decades that makes this endeavour possible. We aim to use this data to map the kinetic and potential energies of the circulation as a function of vertical scale throughout this extensive region. Furthermore, we will examine the observed shear and strain profiles to specifically investigate the energy in the internal wave field and, using fine scale parameterization methods, consider the implications for internal-wave driven turbulent kinetic energy dissipation and diapycnal diffusivity rates. Our

work is still in its very preliminary stages, and as such we invite feedback on our project plans and early results. We believe the large scope of this analysis will lead to an improved understanding of mixing patterns in the Canadian Arctic, and further will provide an opportunity to gain insight into the roles of topography, atmospheric forcing, tidal energy and other driving forces on the variability that exists in both time and space.

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.

IDENTIFICATION AND CHARACTERIZATION OF PHYSICAL CONTROLS ON SUBSURFACE FLOWS DURING BASEFLOW RECESSION IN A SMALL ARCTIC RIVER

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Recent research suggests that climate warming may be impacting the hydrology of Arctic river systems. Long term discharge records in some Arctic systems indicate a significant reduction in the ratio of maximum to minimum annual discharge, suggesting an increased importance of subsurface flows and groundwater discharge. Altered subsurface flows are likely to have important consequences on the ecology of freshwater environments and on the management of water resources in northern communities. The goal of this study is to advance our understanding of subsurface flows in a catchment potentially subject to permafrost degradation. Our study site is the Apex River, a third-order watershed (drainage area = 58km^2) located north of the city of Iqaluit, Baffin Island, NU (63°35'N, 68°28'W). The river and its tributaries flow through a landscape characterised by a mosaic of surficial deposits indicative of warm-base glacial processes. Continuous tundra vegetation covers these deposits, while wetlands and floodplain features are also present. Typical of a small Arctic river the annual peakflow is associated with the nival melt which here typical occurs in June (~5m^3/s); with rapid recession to base flow conditions (< 1m^3/s) during the Arctic summer. Subsurface contributions to baseflow are likely to be strongly influenced by active-layer development (max depth ~1.5m). Currently, we lack an understanding the spatial distribution, temporal evolution and relative importance of subsurface flows in Arctic river systems. Addressing this gap in knowledge is particularly relevant for the Apex River, which has been identified as a potential potable water source for the city of Iqaluit. During the summer of 2015 (July

8th - August 28th) we employed various techniques to characterized subsurface flows to the river at sites within the Apex watershed. We conducted fine scale mapping (1-m resolution) of surface water temperature and conductivity along four river segments (lengths ranging from 1 to 2 km), on each of the three main tributaries and one downstream of their confluence. Local variations in temperature and conductivity were used to infer the location of subsurface inputs to the river. Additionally, at each of our study sites we undertook detailed mapping of surface deposits and vegetation types adjacent to the river. At a selection of sites representative of the various types of surface deposits, we installed mini-piezometer networks to characterize subsurface flows between hillslope and stream. Our specific objective is to define the spatio-temporal patterns in subsurface lateral inflows and examine how these patterns relate to local landscape features. There is a pressing need to understand how climate change and permafrost influence the hydrology of Arctic watersheds. Here we aim to advance our understanding of the: (i) spatio-temporal variability; and (ii) physical controls, on subsurface flows to rivers in permafrost environments. This knowledge is necessary to assess the relative importance of subsurface flows in arctic river systems, and to determine how anticipated climate related changes are likely to impact these systems. As part of an ongoing collaborative research project investigating the environmental controls on runoff in the Apex River, this research should also contribute to improved decision making regarding the use of the Apex River as a potential source of potable water for the city of Iqaluit.

CARIBOU IN A CHANGING ARCTIC: A CASE STUDY USING STRUCTURED DECISION MAKING TO SUPPORT LONG-TERM SUBSISTENCE IN WAINWRIGHT, ALASKA

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The community of Wainwright, located in northern Alaska on the Chukchi Sea coast, is facing unprecedented changes to their environment and way of life. Caribou are an important species for the community and constitute approximately half of their subsistence diet. Two herds of caribou, the Western Arctic herd and the Teshekpuk herd, are accessible to the community, and both have been declining in recent years. Possible reasons for this decline include icing events leading to starvation, high predation rates by brown bears and wolves, and long-term changes in winter range condition. An additional factor that may influence caribou populations in the future is development related to shipping and oil and gas activities. Although no large-scale development projects are planned for the vicinity of Wainwright in the immediate future, global energy demand combined with increased shipping activities may result in significant long-term changes to the regional landscape and economy. The community of Wainwright is concerned about how caribou declines are impacting subsistence, and are interested in possible management actions to perpetuate their subsistence way of life in the long-term. We are using a structured-decision making (SDM) approach to help the community achieve their objectives of maintaining a subsistence lifestyle in the face of change, and have held two successful workshops with broad representation from the community. These workshops allowed us to identify how SDM can assist the community as they consider how best to meet their needs and interests for a sustainable future. We are in the process of evaluating a suite of solutions including a) mapping current distributions of caribou so that future changes can be detected and key habitats can be protected; b) exploring ways in which hunters can adapt to changing caribou numbers and conditions influencing accessibility; and c) engaging youth in considerations about long-term sustainability through our SDM process. We hope that this process will help the community of Wainwright maintain a long-term subsistence lifestyle in the face of changing economic and ecological processes in the Arctic.

COLLABORATIVE RANGE MANAGEMENT PLANNING FOR THE BATHURST CARIBOU HERD: A STRUCTURED DECISION MAKING APPROACH

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In the Northwest Territories (NWT) the Bathurst caribou herd has been identified as a priority for cumulative effects assessment and management (CEAM) in recent environmental assessments and regional

workshops. CEAM is also identified as a key objective in Government of the NWT's 2011-2015 NWT Barren-ground Caribou Management Strategy. A Range Plan for the Bathurst caribou herd will make recommendations on how cumulative land disturbances will be monitored, evaluated and managed within the herd's historical range. It will set species specific landscape management objectives and outline how the objectives will be achieved to ensure the herd persists into the future. The Plan will also provide certainty and clarity to the regulatory process. The process for undertaking the development of a Range Plan is unique in the NWT and will utilize a Structured Decision Making approach to building consensus among diverse interests. It is guided and influenced by a Steering Committee comprised of first nations, co-management partners, government, industry and ENGOs with representatives from Nunavut, Northwest Territories and Northern Saskatchewan. If successful, this approach may be applied to other regions and herds. Results from the first year and a halfof the process are presented as well as lessons learned and next steps.

URBAN PLANNING IN THE COMMUNITY OF INUKJUAK, NUNAVIK

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A rising population, overcrowded housings, the pressure of urban and economic development and the warming climate are all factors that create the necessity for a better planning of the territory in the communities of Nunavik. The traditional ad hoc-developed Inuit communities are now undergoing modern urbanization. In this context, permafrost knowledge by community decision makers and the population in general is essential for siting construction, selecting building foundation types, planning the rejuvenated villages and designing their municipal infrastructure. Well informed decision making about permafrost conditions and climate change is an essential component of a better adaptation to climate change. The main objective of this project is to evaluate how an improved understanding of permafrost conditions can be used in the process of urban planning in Inukjuak, a large Inuit community. More precisely, this study analyses how to take advantage of the information recently made available by CEN on innovative permafrost condition maps, in order to select the best building foundations, determine the most secure zones for future expansion and orient the planning in a general way. The objectives of this project are: 1) to improve the knowledge of permafrost on the terrain of the community of Inukjuak; 2) to evaluate the actual condition of the buildings on different types of ground; 3) to consult with the community and take into consideration the needs to improve the actual urban environment and the needs for new developments and 4) to elaborate the base of a plan for potential improvement and urban growth taking into account permafrost conditions and climate warming. In order to reach those different objectives the methodology includes several important methodological steps which are: the inventory of current permafrost stability problems in town, the inventory of all the actual buildings and their current performance on recently warmed permafrost, the mapping and characterization of untouched, available terrains within the community area, the mapping of suitable terrain for expansion in the surroundings and discussion with the community and with land planners as to how best take advantage of the maps and the new knowledge.

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 HTO's and communities in the Hudson Strait region, and the Canadian Museum of Nature.

THE DYNAMICS OF POLAR BEAR HIDE AUCTION PRICES AND IMPACT ON POLAR BEAR HUNTING

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In recent years numerous media sources reported on the increasing demand and escalating prices paid for polar bear hides sold at Canadian auctions. Some authors suggested that the high prices were stimulating increased numbers of bears being killed. At least one mainstream publication suggested that the increased prices resulted from anticipation that commercial trade in polar bear products would be prohibited because the species would be transferred to CITES Appendix I. Therefore, it was suggested, buyers were trying to acquire these products while they still could, driving prices up. However, the concern about polar bear hide prices and the link to increased hunting pressure was based primarily on anecdotal reporting and conjecture. And if high auction prices were not stimulating unsustainable levels of hunting, then increased prices could be interpreted as having a positive impact on Inuit livelihoods. The goal of this study was to conduct a systematic analysis of annual polar bear hide auction prices compared and contrasted to the numbers of bears hunted, and established hunting quotas. Specifically, this study sought to determine whether auction prices for polar bear hides increased significantly since 2008. And if the prices increased, to determine whether this influenced a corresponding increase in the number of bears hunted. In addition, this study explored whether the auction prices for polar bear hides fluctuated significantly in response to the possibility of a CITES Appendix I listing. Review of polar bear auction results for the years 2008 - 2014 found that the top price paid for hides at fur auctions fell after May 2008 and the average price paid slowly dropped in subsequent years to a low in January 2010. Suggestions that price increases were related to a possible CITES Appendix I listing were not supported by the available data. The increased prices paid for polar bear hides at auction beginning in the spring of 2010 correlated with an increased number of polar bears reported killed in Canada starting in the 2010/11 hunting season. However, hunting still did not exceed established quotas. The number of bears killed in Canada dropped significantly in 2014, correlated with a drop in the total Canadian hunting quota-despite prices for hides remaining high.

PATTERNS OF GLACIER DISINTEGRATION AND ICEBERG PRODUCTION IN YELVERTON BAY AND INLET, NORTHERN ELLESMERE ISLAND

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Over the past decade, there have been dramatic breakups of the floating termini of several tidewater glaciers on northern Ellesmere Island in Arctic Canada. For example, almost the entire 10 km floating terminus of Yelverton Glacier has disintegrated since 2007 in conjunction with the loss of large regions of nearby multi-year landfast sea ice. In combination with ice shelves, these glaciers provide the main source of icebergs that are found in the Beaufort and Chukchi Seas. Knowledge of the spatial and temporal variability in production of these icebergs, and their size distribution, is therefore of critical importance to properly evaluate hazards to shipping and offshore oil exploration activities. This study reports on the current location and size distribution of more than

2000 icebergs across Yelverton Bay and Inlet, including direct measurements of their thickness made with a ground-penetrating radar system in July 2015. Glacier thicknesses and bed topography measured by NASA's Operation IceBridge in spring 2014, and surface velocities derived from speckle-tracking of Radarsat-2 data, are also used to quantify current rates of iceberg production from these glaciers and to provide predictions of how they may evolve in the future.

ENVIRONMENTAL CONTROL OF PRIMARY PRODUCTION IN THE LABRADOR SEA - A KEY PROCESS FOR CLIMATE REGULATION

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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 physical and biological ecosystem processes. Under the auspices of the pan-Canadian research network VITALS (Ventilation, Interactions and Transports Across the Labrador Sea) the present project aims to characterize the main biogeochemical components of primary production (i.e., net, total, new and regenerated) 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.

IMAGING AIR VOLUME FRACTION IN SEA ICE USING NON-DESTRUCTIVE X-RAY TOMOGRAPHY

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Although the presence of a gas phase in sea ice creates the potential for gas exchange with the atmosphere, the distribution of gas bubbles and transport of gases within the sea ice are still poorly understood. Currently no straightforward technique exists to measure the vertical distribution of air volume fraction in sea ice. Here, we present a new fast and non-destructive X-ray computed tomography technique to quantify the air volume fraction and produce separate 3D images of air-volume inclusions in sea ice. The technique was performed on relatively thin (4 -22 cm) sea ice collected from an experimental ice tank. While most of the internal layers showed air-volume fractions <2%, the ice-air interface (top 2 cm) systematically showed values up to 5%. We suggest that the air volume fraction is a function of both the bulk ice gas saturation factor and the size of the brine channel. We differentiate micro bubbles (∅< 1 mm), large bubbles (1<∅<5 mm) and macro bubbles (∅> 5mm). While micro bubbles were the most abundant type of air inclusions, most of the air porosity observed resulted from the presence of large and macro bubbles. The ice microstructure (granular and columnar) as well as the permeability state of ice are important factors controlling the air volume fraction. The technique developed is suited for studies related to gas transport and bubble migration and can help considerably improving parameterization of these processes in sea ice biogeochemical models.

SEASONAL METHANE DYNAMICS IN MACKENZIE RIVER DELTA LAKES, NORTHWEST TERRITORIES

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Methane is an important component of carbon cycling in the lakes of the Mackenzie River Delta, but our understanding of its role in lake food webs and as a greenhouse gas source to the atmosphere remains limited in this Arctic ecosystem. Research 20 years ago has shown that a significant amount of methane accumulates in these delta lakes under-ice during the winter, but the relative roles of methane production, oxidation, and emission processes through the annual cycle have thus far been unknown. Mackenzie Delta lakes are characterized hydrologically by a strong gradient of connectivity with the river as a function of the delta topography. This ranges from continual connection in the lowest elevation lakes, to connection for part of the year in higher elevation lakes, to connection with the river only in intermittent years in the highest elevation lakes. Previous studies indicate strong correlation between degree of lake connectivity and under-ice methane accumulation, as well as between lake connectivity and pCO2 levels. Following this hydrologic underpinning, the objectives of our research were to: (1) compare current levels of under-ice methane accumulation to that of 20 years ago; (2) investigate differences in methane emissions between lakes of differing river connectivity; and (3) track spring/summer methane production in lakes based on ambient methane levels, in combination with methane oxidation and emission measurements. Our hypotheses were: (1) current under-ice levels of methane accumulation in Delta lakes will be higher than what was observed 20 years ago; (2) lakes with greater river connectivity will be lower emitters of methane; and (3) methane production in all lakes will decrease throughout the open water period. Under-ice methane accumulation was measured at the end of winter during May 2014 in a suite of 30 delta lakes with river connectivities and limnological characteristics known from prior work. Every 1-2 weeks during open-water conditions in 2014 (June through August), methane oxidation rates were measured using in situ incubations in a subset of 6 lakes, and methane emission rates were tracked with floating chambers in a subset of 2 lakes. In June 2015 methane oxidation and emission rates were measured in a subset of 6 lakes. Preliminary results suggest strong linkages between methane dynamics and lake-river connectivity. Lakes that were most isolated from the Mackenzie River had the highest rates of methane accumulation (under-ice), oxidation, and emission. Conversely, as lake-river connectivity increases, rates of methane accumulation, oxidation, and emission decreased.

BUILDING LOCAL & INDIGENOUS KNOWLEDGE SYSTEMS (BUILDING LINKS): COMMUNITY-LED ENVIRONMENT & HEALTH SURVEILLANCE FOR ADAPTATION

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The Canadian Arctic is experiencing intense socio-cultural stresses as a result of climate change, resource extraction, contaminants, and associated shifts in environment. These changes present major challenges to health, with the most acute impacts experienced among Inuit populations reliant on the environment for sustenance and livelihoods. Indeed, Inuit across the Canadian North are indicating that observed changes in weather, climate, and environment not only directly impact numerous facets of health and wellbeing, but also interact with other social determinants of health. It is anticipated that these environmental stressors will likely lead to increased negative impacts on physical and mental health issues across the North. Research has uncovered many associations between environment and health outcomes; however, detecting cumulative environment-health outcomes and responding to them is an enormous challenge. The need for comprehensive, integrated, sustainable, and locally-appropriate surveillance systems is, then, a major priority across the North. Considering these gaps in the academic literature and in public health practice, government stakeholders, industry, health practitioners, and academics alike have called for approaches to surveillance strategies that are responsive and integrate environmental and socio-economic factors, and provide management tools for decision-makers and communities. Responding to these needs, this program will develop, implement, and pilot an active community-based surveillance system in Nunatsiavut, Labrador to track and respond to cumulative health impacts from multiple environmental stressors, while developing a scalable survey strategy that collects systematic, standardized environment-health data to support communities and decision-makers in adapting to environmental change. In collaboration with Northern partners, Indigenous leaders, and health professionals, this program aims to integrate data from existing community-based monitoring systems with data from newly-created environment and health Inuit-led participatory surveillance systems to contribute to the advancement of Canada's knowledge of the Arctic, with the aim of strengthening surveillance in Northern Canada to track, attribute, and respond to environmental health impacts. This poster will introduce the overall goals of the Building LINKS, provide background research and context for participatory monitoring systems, and discuss strategies for development and implementation over the next three years.

MICROBES FROM THE DEEP: COMMUNITY COMPOSITION AND ASSOCIATED BIOGEOCHEMISTRY UNDERLYING THREE DISTINCT VEGETATION TYPES IN THE LOW ARCTIC

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The continental climate at the Daring Lake Tundra Ecological Research Station, located three hundred kilometers north of Yellowknife NWT, has not changed substantively over the last few decades, even though more coastal arctic tundra locations have been warming at almost twice the global average. It is thus relatively urgent that we document this site now, so that the impact of future temperature change can be properly assessed. This region of the arctic tundra, locally referred to as 'the barrens', is actually a complex landscape typified by several distinctive vegetation types found within a few decimeters from each other and often all contained within a single valley. Directly under the plant cover, the summer-thawed soil active layer (0.3-1.2 m) overlies continuous permafrost. As part of the Arctic Development and Adaptation to Permafrost in Transition (ADAPT) initiative, we collected cores from beneath three of these vegetation types: wet sedge, mesic birch hummock and dry heath. Duplicate 2-3 m cores from each vegetation type were sampled to include the active layer and the uppermost permafrost soil horizon, and then subjected to biogeochemical and microbiological analysis. Soluble

and total carbon, nitrogen, phosphorous concentrations, water/ice content and pH at successive depth intervals were correlated with bacterial, archaeal and fungal communities. Assemblage composition was consistently more diverse in the surface organic soil layer than in the deeper layers, and there were also distinct consortia beneath the different plant covers, demonstrating that the vegetative heterogeneity across this tundra landscape was also mirrored in its soil microbial communities. Although there was generally high variation across depths and vegetation types, biogeochemical analysis frequently showed a striking nutrient peak in the permafrost, just below the presumptive transition zone from the overlying active layer, which is not normally seen at other tundra sites. The soils at these nutrient peaks had relatively high fatty acid methyl ester content, indicating increased microbial community abundance. Furthermore, the magnitude of these peaks appeared to be correlated with primary production from the vegetation-types, suggesting that downward leaching of organic matter could explain their presence. Alternatively, these peaks may have be associated with a deeper active layer during the hypsithermal mid-Holocene warm phase, which is no longer apparent at locations that have warmed substantially in the last few decades.

CHARACTERIZING THE DISTRIBUTION OF SPERM WHALES (PHYSETERIDAE MACROCEPHALUS) AND NORTHERN BOTTLENOSE WHALES (HYPEROODON AMPULLATUS) IN BAFFIN BAY AND DAVIS STRAIT

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Climate change is having a significant impact on the Arctic marine environment and as a result it becomes increasingly important to understand basic information such as the distribution, population dynamics and behaviour of vulnerable species in order to deliver effective conservation. In this study, the distribution of two species of deep-diving cetaceans, the sperm whale (Physeteridae macrocephalus) and the northern bottlenose whale (Hyperoodon ampullatus) in Baffin Bay and Davis Strait is examined. Sperm whales have a global distribution. Studies based in the North West Atlantic, Norwegian Sea and the Gulf of Mexico, have shown that they are typically sighted in regions with deep waters and in areas of high primary productivity. However, their distribution characteristics in the Canadian Arctic are poorly understood. Similarly, a subpopulation of Labrador-Davis Strait northern bottlenose whales has been recognized but investigation into its distribution is lacking. Observations of sperm whales and bottlenose whales were obtained from annual fisheries surveys by the Greenlandic vessel M/V Paamiut for 1999, 2004 and 2006-2014. Additional sightings for the defined area and time period were gathered from the Global Biodiversity Index Facility Database. All sightings were imported into the spatial information program QGIS. The physical parameters included were sea surface temperature, chlorophyll-a, salinity, depth and slope. These parameters were obtained from NASA AQUA-MODIS QGIS plug-in, and the NASA Aquarius database. The bathymetric data was obtained from the International Bathymetric Chart of the Arctic Ocean. Ice cover data may also be included, however most sightings obtained were recorded during months with very little or no sea ice cover. After interpolation between all parameters and sightings in QGIS, the statistical program R will be used to apply General Additive Models (GAMS) in order to determine relationships among the parameters and the presence of the cetaceans. Our expectation is that these cetaceans will be associated with deep waters and show some seasonal movements. This research will provide the beginnings of a baseline for the distribution of these two species in Baffin Bay and Davis Strait. It is the hope that it will provide an insight into their habitat use, based on the relationship of locations with physical parameters. In the future, with more research, this information could be used to be able to better predict where the cetaceans might go as our climate continues to change.

MONITORING RINGED SEALS (PUSA HISPIDA) IN HUDSON BAY, CANADA

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Arctic marine mammals are subject to a variety of environmental and anthropogenic stressors that affect their health and survival. Ringed seals (Pusa hispida) are the most abundant pinniped in the Arctic, and are dependent on the sea ice for breeding, birth lairs, and survival. Considered an indicator species for environmental change in the Arctic, it is predicted that ringed seals will show altered distribution, diet, reproduction, and survival as sea ice dynamics continue to change. Previous research suggests potential change in population structure, and overall decline in Hudson Bay. Ringed seal recruitment has been linked to snow and ice conditions that are expected to deteriorate under most climate models. Multiple factors such as increased stress, reduced body condition, increased competition with harbour seals (Phoca vitulina), and increased predation pressure by polar bears (Ursus maritimus) and possibly killer whales (Orcinus orca) contribute to the negative trend suspected in ringed seal populations. By monitoring individual and population health, it is possible to gain insights into ringed seal population dynamics, predator-prey interactions, and increasing inter-specific competition between other seals. In addition to drastic environmental changes, alternate explanations for the observed trends are related to biases in survey methods and timing, which can lead to a decrease in visible seals, therefore using a combination of laboratory and field methods we aim to assess the population dynamics of ringed seals in Hudson Bay. Biological samples collected from harvested seals by hunters in the Nunavut communities of Arviat, Coral Harbour, and Sanikiluaq will be used to answer specific questions related to ringed seal health and population status. To understand the effects of environmental change on Arctic marine food webs it will be imperative to collect blubber samples from ringed seals in Hudson Bay throughout the year to accurately reflect the spatiotemporal changes in seal diet. Understanding factors affecting ringed seal populations will be essential for the development of co-management strategies and to provide accurate predictions of the status of the Arctic ecosystem throughout this period of environmental change. This project will expand on previous work conducted in the Hudson Bay marine ecosystem to better understand current ringed seal population dynamics.

MORPHOLOGY AND SETTING OF TWO SUBMARINE SLOPE FAILURES, INNER FROBISHER BAY, BAFFIN ISLAND, NUNAVUT

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Of the more than 250 submarine slope failures mapped from multibeam echosounder (mbes) records in inner Frobisher Bay, so far only two have been studied in detail. They are located off the coast of Hill Island, about 12 km from Iqaluit, and by the end of the 2015 sampling season will have been acoustically profiled, piston and box-cored, grab sampled, and video-imaged. Our initial focus on these two slope failures was prompted by differences in morphology, potential preconditioning factors, and possible triggering mechanisms, despite their close proximity to one another. One failure occurred on a steep slope (60°) immediately off Hill Island. The mbes coverage missed the upper reach of the failure scar, which given the local slope projection may extend onshore onto Hill Island. The imaged failure consists of a single lobe 750 m long and 350 m wide, tapering downslope to a narrow front. The other failure occurs nearby in a similar water depth range (65-140 m) on the flank of a submarine ridge within the same basin. It appears to be composed of two separate mass movement events that shared a common source area, marked by head and sidewall scarps below the ridge crest. The larger (750 m long by 250 m wide) of the two events extends directly downslope (20-30°) and appears to be the oldest, whereas the smaller event (550 m long by 200 m wide) is oriented more tangentially across the slope. A piston core taken from the toe of the larger lobe displays about 3 m of structureless mud with occasional sand beds above an erosional contact, interpreted as a décollement plane. This upper unit therefore is considered to be the sediment transported during the slope failure. A radiocarbon date of 5600 cal BP from roughly 10 cm below the décollement plane provides a maximum age on the failure event. The study of these failures off Hill Island provides the first insights into the origin, age and stratigraphic setting of the larger population of slope failures in inner Frobisher Bay.

ASSESSING UAS TECHNOLOGY TO MAP SNOW DEPTHS AT A BASIN-WIDE SCALE IN THE WESTERN ARCTIC

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The variability of snow depths within a small surface area (sub m^3 scale) has created many challenges for scientists trying to assess the total Snow Water Equivalent (SWE) at the end of winter in a given watershed. In the Western Arctic, snow is the main contributor to stream runoff, therefore it is essential to try to quantify SWE in a given watershed and assess its year to year variability. Using new Unmanned Aerial System (UAS) technology it is now possible to obtain centimeter level resolution imagery (~3cm^2) to create Digital Surface Models (DSM) based on the Structure from Motion method. In this study, we used a small UAS equipped with an True Colour (RGB) camera to create DSMs of a small (1 km^2) watershed in the Western Arctic during snow (end of winter) and snow-free periods. To improve the image georeferencing, 15 Ground Control Points were marked across the watershed and incorporated into the DSM processing. LiDAR data was also used to correct for vegetation heights in the summer imagery. The summer DSM was then subtracted from the winter DSM to deliver snow depth measurements across the entire watershed. These snow depth measurements were then validated by over 2000 snow depth measurements and over 100 SWE measurements across the watershed. This technique has the potential to improve larger scale snow depth mapping across watersheds by providing snow depth measurements at a ~3cm^2 spacing.

PERFLUOROALKYL ACIDS (PFAAS) IN THE LAKE HAZEN WATERSHED (QUTTINIRPAAQ NATIONAL PARK, NUNAVUT, CANADA)

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Perfluoroalkyl acids (PFAAs) are anthropogenic surfactants found in fabric cleaners, lubricants, paper products, and hair care products, among others, with extraordinary environmental persistence. Their long-range transport potential has resulted in global dissemination of these unique compounds. Furthermore, their bioaccumulation potential has resulted in high concentrations in top predators. PFAAs have been measured in Arctic Lakes on Cornwallis Island, and in ice caps on Devon Island, and their precursors remain in commerce. There has been a shift in industrial manufacture to smaller molecule PFAAs and less is known about their disposition and fate. The objective of this research was to illuminate how watershed processes impact PFAA loadings into high Arctic lakes, such as Lake Hazen (81.8°N, 71.4°W), located on northern Ellesmere Island, Nunavut. Specifically, we are interested in how climate induced changes in Arctic watersheds might impact contaminant delivery. For example, warming surface temperatures of glaciers in the Lake Hazen watershed have accelerated glacier melt in recent years, increasing the potential for delivery of emerging and legacy contaminants to the lake. We conducted multi-year (2012-2015) sampling of snow packs, glacier-fed riverine inflows, permafrost seeps and the water column of Lake Hazen itself (before and after snowmelt) to the importance of these various inputs as sources of PFAAs to the lake. Preliminary data suggests that total perfluorocarboxylates (PFCAs) in the water column in 2013 were very low: 0.120-0.240 ng/L ∑PFCAs and perfluorooctane sulfonate (PFOS) was 0.0080- 0.027 ng/L. In 2014, the tributaries had PFAA levels that were higher than in the lake, corresponding to 0.098-2.9 ng/L perfluorooctanoate (PFOA), 0.11-1.9 ng/L perfluorohexanoate (PFHxA), and 0.0029-0.13 ng/L PFOS. Snow surveys indicated even higher concentration than in tributaries with 0.16-1.6 ng/L PFHxA, 0.46-4.9 ng/L PFOA, and 0.0093-0.44 ng/L PFOS for 19 sites. The importance of snowmelt sources to the lake water column is demonstrated by the fact that PFAA concentrations in surface waters of Lake Hazen increase during the spring melt period. However, depth profiles demonstrated that post-melt enrichment of PFAAs in surface waters relative to deeper waters was limited to the upper few meters of the water column. This study demonstrates the importance of watershed processes and sources to loadings of certain organic contaminants such as PFAAs in High Arctic lakes.

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 (ᐃᖃᓗᐊᕐᓚᖅ) and Resolute, NU (ᕐᒃᑐᓴᐃᓪᓕᕐᒃ). 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.

"SWIMMERS" IN SEDIMENT TRAPS: CHANGES (OR LACK THEREOF) IN ZOOPLANKTON COMMUNITY AT A SINGLE STATION FROM 2003 TO 2015 (BEAUFORT SEA SHELF BREAK, CANADIAN ARCTIC)

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As part of ArcticNet's Long-Term Oceanic Observatories (LTOO) project, moored sediment traps were deployed at the Beaufort Sea shelf break over 6 years between 2003 and 2015 to monitor the downward flux of organic and inorganic matter. Because they are not regarded as passively sinking particles, zooplankters actively swimming into the trap (aka "swimmers") are routinely removed prior to biogeochemical analyses of the trap samples. Here, we use swimmers as indices of seasonal and interannual fluctuations in zooplankton community. Copepods dominated the swimmers assemblage, in particular the herbivorous calanoïds Calanus hyperboreus and Calanus glacialis, the omnivorous Metridia longa, and the carnivorous Paraeuchaeta glacialis. Variations in the absolute flux (number m-2 d-1) and relative abundance of key species will be correlated to water temperature and salinity obtained from current meters deployed on the same moorings as well as satellite-derived sea ice concentration. To investigate interannual differences in the match or mismatch between primary production cycles and the seasonal vertical migration of key species, the vernal arrival and fall disappearance of dominant herbivore copepods such as Calanus glacialis and C. hyperboreus will be correlated to ice-algal and phytoplankton cell abundance and composition in the trap. The 6-year study will enable us to assess potential changes in this match/mismatch linked to climate change. Preliminary results revealed the occurrence of Neocalanus cristatus, a species endemic to sub-arctic Pacific waters and rarely observed as far north as the Beaufort Sea, during the record ice minimum extent of 2012.

TOWARDS SEA ICE THICKNESS RETRIEVAL FROM POLARIMETRIC SAR

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Sea ice in the Arctic region is behaving in an increasingly unpredictable and treacherous way due to climate change. Monitoring of sea ice is essential in order to document its response to these changes, as well as to provide operational information to arctic communities and industries. Radar technology already enables us to evaluate the sea ice extent, but we remain blind to ice thickness. Due to the dramatic changes the ice is undergoing, Inuit traditional knowledge is sometimes insufficient to evaluate the security of the ice cover for travel. Marine operators in the mining industries installed in Nunavik require detailed ice forecasts when making decisions regarding navigation. Furthermore, the ability to estimate sea ice thickness from remote sensing data would be important to northern communities, mining operators and naval industries alike. Synthetic Aperture Radar (SAR) is the best tool for this task as it can image in the dark, through clouds and, most importantly, penetrate the ice cover and theoretically bring back information about its thickness. Canada's renewed commitment to this technology guaranties access to polarimetric data through Radarsat-2 and the upcoming Constellation mission. The Safe Passage CHARS project will give us a privileged access to Arctic study sites in the northern Nunavik coast including Deception Bay. Through collaboration with the Kativik Regional overnment and Raglan Mine, we aim to monitor ice extent and thickness at these sites through in situ measurements and fully polarimetric SAR images. An important part of this project will be to develop an algorithm enabling us to estimate sea ice thickness from fully polarimetric radar images. Sea ice thickness will be monitored as a function of time at specific stations installed by the researchers and operated by local community collaborators. Cameras have been installed at Deception Bay and will provide season-long observations. A Shallow-Water Ice Profiler (SWIP) will be anchored in the bay, providing a continuous observation of ice draft. Field measurements through ice cores and georadar will be made in January 2016. Radar quad-pol images will be acquired over the same time frame as the field measurements. Analysis of these images and their decomposition will then begin in the hopes of finding a proxy for ice thickness.

THE 2015 ICE COVER BREAK-UP IN ECLIPSE SOUND, NUNAVUT

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Eclipse Sound is a narrow strait located between Bilot and Baffin Islands, Nunavut, and is covered with landfast ice two thirds of the year. An extension of the Mary River iron ore mine's shipping season has recently been propose, which would require intensive, unprecedented icebreaking in the Sound. Local residents want the mine to succeed, but they also want to ensure that it doesn't jeopardize the bountiful ecosystem or their cultural and economic connection to it. With the goal of answering key questions about the potential impact of year-long icebreaking, two autonomous camera systems have been installed in May 2015 on nearshore mountain tops of northern Baffin Island, looking at the Sound's mouth, between Guy's Bight and Cape Graham Moore, Bilot Island. Cameras were retrieved as part of the Students On Ice expedition in the Arctic. Pictures allow us to witness in great details (and beauty) the evolution of the ice cover throughout the melt season until its sudden break-up on July 18th. Based on high-resolution georectified images, taken every 30 minutes, and complementary environmental data, we present an autopsy of the conditions leading to the break-up and interpret findings in terms of the stability of the landfast ice cover and predictability of the break-up date.

DOGS ON THE EDGE OF THE ARCTIC: A LOOK AT SOCIAL PERSPECTIVES OF DOGS IN CHURCHILL, MB.

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Within northern Canada dogs have a diverse and import role in communities and ecosystems, in Churchill, MB dogs play an important cultural and ecological role. Social surveys were used to determine trends for perspectives of locals on the dogs within their community. The surveys were administered vocally to 52 residents of Churchill, MB in August 2015. We found that there are two main populations of dogs in the community, companion dogs and working dogs. The working dog population is mainly comprised of sled dogs, which add to to the strong tourism industry in this remote community. Survey results showed dogs have a strong cultural importance within the community, but that work would need to be done to improve welfare and veterinary access within the community. The most popular activities that dogs participated in were swimming and walk in and out of town, all activities that offer significant potential for dog-wildlife interaction, showcasing the potential for disease transfer particularly with other carnivores of the area. Churchill is a remote community, but with regular access to rail and air travel veterinary care is more accessible than in other more northern communities. Northern communities in Canada offer unique environments and cultures to examine how social perspectives influence the lives of dogs. Churchill showcases a remote community within a strong ecosystem, the dogs within this community have an important role, and evaluation of their social role is key context for the establishment of sustainable devlopment and mitigation strategies.

OCEANOGRAPHIC CONDITIONS UNDER LANDFAST SEA-ICE DURING THE 2015 WINTER IN THE BELCHER ISLANDS AREA, SOUTHEAST HUDSON BAY

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Hudson Bay (HB) mimics a closed ocean system, in which seawater properties are dependent on atmospheric-oceanographic coupling processes and inputs of freshwater from the extensive drainage basin. Several of the major inflowing rivers, including the La Grande River that discharges into James Bay, are now regulated as a result of hydroelectric development, with the consequence that wintertime freshwater discharge has increased. Fresher waters circulating in southeast Hudson Bay as a result of this increased winter river discharge could affect several physical processes, including exchange between the surface layer and lower depths of the water column, and the rate or properties of the ice forming on the surface. To investigate the oceanographic conditions, including freshwater distribution, in winter in southeast Hudson Bay and possible relationships to river discharge, oceanographic data were collected in the Belcher Islands area in southeast Hudson Bay in January-March 2015. The data collection was conducted in collaboration with the Arctic Eider Society and the community of Sanikiluaq. A mooring containing several temperature and salinity (CT) sensors and two current profilers was installed from the landfast ice southeast of the Belcher Islands and additional CT sensors were deployed beneath the ice at various other locations around the islands. CTD casts and water and ice-core sampling were conducted at various sites. The water and melted ice samples were analyzed for salinity and oxygen isotope ratios (δ18O) to quantify the amount and components of the freshwater present (river runoff vs. sea ice formation/melt). Ice core records of δ18O were used to derive a record of freshwater distribution throughout the period of ice cover. The results are discussed in the context of the processes affecting winter oceanographic conditions and the freshwater budget in southeast Hudson Bay.

LOOKING TO THE PAST: MUSEUM COLLECTIONS CAST NEW LIGHT ON THE SPATIAL ECOLOGY OF DIET FOR ARCTIC SPECIES

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What do differential foraging strategies of barren-ground grizzly bears (Ursus arctos), polar bear

(U. maritimus) designatable units, and health-related fluctuating asymmetry in Arctic wolves (Canis lupus) have in common? These are just some of the research topics being examined with the aid of specimens housed in either museum or government collections, and with the use of technological advances in biochemical analyses and spatial ecology. Through three case studies I will discuss how museum collections are being used to answer spatially explicit questions related to species-landscape relationships through stable isotope and fatty acid signature analyses coupled with spatial ecology. Tissue sampling has been a common fish and wildlife management practice across Canada, yet with dwindling resources for sample collection and storage the practice is no longer the norm. Nevertheless, specimen collections still persist in certain jurisdictions and in museums and these specimens hold signatures of an individual's dietary profile, which can in turn tell us about their foraging patterns. Stable isotope analysis (SIA) and fatty acid analysis (FAA) are two biochemical approaches that can aid in differentiating foraging strategies that reflect regionally-specific characteristics, such as prey availability. SIA uses tissues such as hair, blood or bone and identifies the active elements that occur in different isotopic forms (e.g., 12C and 13C or, 14N and 15N, etc.), which have been assimilated into these tissues and reflect an individual's diet and trophic position. Similarly, to determine what an animal has eaten, FAA uses fatty acid signatures derived from lipids extracted from dietary fat, which have been incorporated from ingested food items. Museum collections normally include hair, skin, and scales from study skins, bone from cranial and post-cranial material, and shell, and some more contemporary museums may even have samples of liver, heart and blood stored in freezers at -80°C. For example, the Mammalogy program at the Royal Alberta Museum is using wolf skulls collected in the Northwest Territories and accessioned into the collection, to determine regionally specific diets using SIA of bone collagen and individual health through skull morphometrics. When SIA and FAA results are coupled with geo-referenced data from the samples in a Geographic Information System such ArcGIS, scientists and managers have a powerful tool for determining inter-regional differences in the role individuals or within-population groups play within an ecosystem. Such knowledge is fundamental for effective conservation and management because it provides a means of improving our ability to refine protocols to meet the needs of focal groups within a species and for the population as a whole.

REMOTE SENSING OF VEGETATION CHANGE: 30 YEAR LANDSAT NDVI TRENDS, IQALUIT, BAFFIN ISLAND, NU

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Tundra environments account for a large portion of the earth's surface and are important to consider in reference to global climate change. Vegetation productivity in some arctic ecosystems has already begun to increase, resulting in trends of greening driven by changes in vegetation type and abundance. Remote sensing derivatives, such as the Normalized Difference Vegetation Index (NDVI) and time series analyses allow researchers to detect, map, and monitor ecosystem changes, especially in remote regions of the Canadian High Arctic where the effects of climate change will be most notable. In previous literature, coarse spatial resolution time series data (e.g., AVHRR) have been widely used to observe synoptic vegetative patterns and processes due to their vast coverage and high temporal resolution. Although allowing for repetitive coverage, AVHRR data is limited in providing detailed information on vegetation community type, structure and function. To solve this issue, intermediate resolution satellite imagery (e.g., Landsat TM) can be used for more detailed vegetation analysis with a sufficient historical record to allow for time-series analysis. Finally, using fine resolution data (e.g., WorldView-3) in conjunction with ground measurements allows researchers to develop and link relationships between NDVI and above-ground biophysical variables for arctic vegetation communities. Therefore, the primary goal of this research is to determine whether or not there has been an increase in percent vegetation cover (PVC) over the past 30 years in the Apex River Watershed (ARW), Iqaluit, NU. To address this goal, extensive field measurements of PVC were collected to create a high resolution vegetation community classification of the ARW. In addition, a Landsat NDVI time series was examined to quantify the overall trend in 'greenness' that has occurred from 1984-2015 in the ARW. The vegetation classification in conjunction with the NDVI time series allows for analyses of specific community change over time. To achieve these objectives, the International Tundra Experiment (ITEX) method was adopted to determine the PVC of each community type in a series of 14 x 100m transects established throughout the watershed. In addition, the PVC measurements taken at each transect

location and other areas of interest were georeferenced and utilized as calibration and validation data for the vegetation classification map. For the NDVI time series analysis, cloud-free Landsat TM/ETM+/OLI time-series data, collected at peak growing season (i.e., anniversary dates between mid July and early August) were examined to determine any NDVI trends for the ARW. These images were atmospherically corrected and radiometrically normalized to compensate for atmospheric path radiance and errors associated with the use of multiple sensors and different dates. Statistics will be extracted from each vegetation functional group determined by the vegetation classification and linear regression will be performed to determine rates of change. Finally, the NDVI trends and rates of change will be analysed for their relationships to other climate variables.

HIGH RESOLUTION MAPPING OF SOIL ORGANIC CARBON AND NITROGEN IN TWO SMALL ADJACENT ARCTIC WATERSHEDS ON HERSCHEL ISLAND, YUKON TERRITORY

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Permafrost soils are especially vulnerable to global climate change and warming temperatures can turn them from carbon sinks into carbon sources. Estimates of Arctic carbon stocks are still highly uncertain, despite their importance to predict the magnitude of CO2 and CH4 release to the atmosphere. Because most of the Arctic is difficult to access, remote sensing techniques are particularly important to monitor the changing landscape. Recent studies have attempted to use spectral images, like Landsat, to estimate soil organic carbon (SOC) and nitrogen (TN). Most studies worked on a regional to global scale and use relatively coarse landscape classes. However, good, high resolution estimates of SOC and TN are crucial to estimates for permafrost related uncertainties in storage and spatial heterogeneity needed for Earth System Models. Furthermore, they are an invaluable step from data collection toward a process oriented understanding of the landscape. This project is one of the first to use high resolution images (1.65m GeoEye (4 spectral bands: blue-infrared), 2m DEM) to predict SOC and TN within different Tundra vegetation classes in a small twin watershed (4 km²) on Herschel Island, Yukon, Canada. Vegetation classes were based on indicator species and geomorphic disturbance levels. Remote sensing detection accuracy varied strongly between classes. Field based moisture measurements were most strongly correlated with the carbon to nitrogen (CN) ratio (r^2=0.80, $p<0.05$). However, slope and the normalized difference vegetation index (NDVI) which were extracted from remote sensing images have a statistically significant relationship to CN (r^2=-0.56, $p<0.05$, r^2=0.48, $p<0.05$). This suggests that fine scale estimates of carbon and nitrogen stocks are possible using few spectral bands from high resolution images. Given the high correlation of soil moisture with CN ratios we encourage further research to improve validation of satellite radar moisture information with field data.

TEMPORAL AND SPATIAL PATTERNS IN SNOW DEPTH, SNOW MELT, TEMPERATURE, AND SOLAR INSOLATION AT A HIGH ARCTIC SITE

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Understanding snowmelt patterns across Arctic landscapes is a basic requirement for forecasting and modelling plant responses to climate changes, such as phenology, growth and reproduction. The lack of data from High Arctic sites hampers the ability to determine spatial and temporal patterns, or to verify the patterns found through remote sensing analyses. Climate observations have been made at Alexandra Fiord on Ellesmere Island since 1980, and were used to investigate the relationship between snow depth, snow melt dates and various other data including temperature and solar insolation. Yearly snow melt and snow depth data, from nine sensors at three sites on the lowland were analyzed. A technique was developed to determine accurate baseline values from curves with significant noise. Both the technique and the sensor data were validated by comparing manual snow melt observations to those derived from these baseline calculations. Snow depth patterns since 1993 are presented along with an approximate map of the snow melt date across the lowland. The map was based on a series of aerial photos taken in 2000 and the rate of snow melt from the snow

depth sensors. A relationship between air, surface and soil temperatures with snow depth during snow melt in the spring, is described. Temporal patterns in temperature show a lengthening of summers over the last thirty years, mainly through a delay in freezing temperatures (and snow fall) in September. It was found that the temperature data over the lowland through time T(x,t) can be expressed through a separation of variables as f(x)*g(t). The spatial function f(x) describes how temperatures vary across the Alexandra Fiord lowland. Spatial maps of the accumulated incoming solar insolation (both diffuse and direct in WH/m2) over the snow melt time period (day 150-170) and over the summer (day 170-220) are compared with the spatial maps of temperature and snow melt date. The incoming solar insolation was calculated in ARCGIS based on an elevation model of the lowland and surrounding hills. Relationships shown to exist between these abiotic parameters will be discussed in the context of their implications for the tundra plant communities at the site. There is evidence of an increase in the depth of snow in control plots at Alexandra Fiord. Independent of snow depth, the date of snowmelt has not changed significantly over the past twenty years, which is because once temperatures reach a certain value all of the snow melts reasonably quickly regardless of the original snow depth. Snowmelt dates have not shifted in any clear trend over time and thus snowmelt date is not likely the factor causing changes in long term observed phenology. Understanding how snow depth is related to snow melt dates (the date when 90% of the snow has disappeared from a field site) and meteorological observations at a single well monitored site such as Alexandra Fiord will enable researchers to better interpret phenology results from local plant studies.

MERGING INUIT QAUJIMAJATUQANGIT AND SCIENCE: PERSPECTIVES OF YOUTH IN FOUR NUNAVUT COMMUNITIES

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Youth in Nunavut are encouraged to become the next generation of leaders in a world of rapid environmental and social change. This growing demographic is actively seeking ways to get involved in Arctic research while keeping their traditions alive. Western science has the potential to be a tool for young Inuit to become engaged in environmental research while supporting Inuit values and knowledge. The Ikaarvik: Barriers to Bridges program has focused on a North-to-North Mentorship, directed by Youth Mentors from Nunavut. Workshops, offered by Ikaarvik in Gjoa Haven, Cambridge Bay, Pond Inlet and Kugluktuk, were developed with the Mentors to demystify science and create an opportunity for discussion and understanding of the strengths of both Inuit Qaujimajatuqangit (IQ) and science in addressing environmental concerns. The exploration of the strengths of IQ and science enabled the participants to clearly identify ways that the two, when working effectively together, can achieve more than either one alone. Fifteen key strengths of IQ and 9 strengths of science were identified during the workshops by the youth participants. A further goal of the Ikaarvik workshops was to enable the youth participants to identify and prioritize local environmental concerns, and to work with their communities to create a consensus on these priority issues. This offered the youth a chance to both represent their generations' opinions of environmental issues, and to learn from the life experience and knowledge of Elders, hunters and other community members. In this way, the workshop followed the Inuit traditions of working together for a common purpose, respect for the knowledge of Elders, and building consensus. Inuit Qaujimajatuqangit is more than simply knowledge of the land and wildlife; it also encompasses Inuit societal values for maintaining healthy communities and strong interpersonal relationships. Incorporation of IQ into scientific research through respectful community-scientist partnerships can result in more engaged communities and stronger science. The Ikaarvik workshops challenged the youth participants to carefully consider their role, and the role of their communities, in developing such partnerships. Participants were enthusiastic about finding ways to create and support science that is more responsive to communities' needs, and several were identified. The workshops identified priority environmental issues, the strengths of IQ and science for addressing them, and ways for communities and scientists to work more effectively together. Ikaarvik will continue to facilitate building bridges between scientists and Arctic communities, between generations within communities and across the Canadian Arctic.

A LONGITUDINAL APPROACH TO ASSESSING VULNERABILITY TO CLIMATE CHANGE IN ULUKHAKTOK, NWT, CANADA.

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Climate change is occurring rapidly in Arctic regions, already affecting ecosystems and the human communities that rely on them. These changes are expected to continue in the future, and in some instances accelerate, requiring communities to undertake some level of adaptation. Adaptation research conducted in Ulukhaktok in 2004 identified particular vulnerabilities in the Inuit subsistence hunting sector including increased risks, altered trails and travel routes on the land and ice, and changes in the health and availability of some species of wildlife important for subsistence. Inuit were responding to these risks by taking extra precautions before traveling, adjusting travel routes and timing of hunts, and in some cases switching species hunted. These findings are based on informant recall at a particular time of the year, and provide a static understanding of vulnerability ten years ago. Less is known about how vulnerabilities manifest over time. The proposed research will employ a longitudinal study design, using fieldwork data from both 2004/05 and 2015 alongside historical data to examine the processes and dynamism of climate change vulnerability in Ulukhaktok. Specific objectives are: (1) document current exposure-sensitivities affecting Inuit subsistence hunting and the adaptive strategies employed to manage them; (2) compare current exposure-sensitivities and responses with those documented in 2004/05 (Pearce et al. 2010); and (3) describe the processes and conditions which have aided or constrained adaptation over time. This research is part of ArcticNet Project "Community Vulnerability, Adaptation and Resilience to Climate Change in the Arctic".

BEHAVIOUR AND ABUNDANCE ESTIMATES OF HARBOUR SEALS (PHOCA VITULINA) IN THE CHURCHILL RIVER ESTUARY

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Harbour seals have a broad distribution throughout coastal waters in the northern hemisphere. The majority of harbour seals occur in temperate waters; however, harbour seals also occur at lower density in Arctic waters. Little is known about these harbour seals including details of their natural history, distribution, population structure, and population size. This research focuses on a putative population of harbour seals that inhabit the Churchill River Estuary and western Hudson Bay. Harbour seals haul out on land between foraging bouts, to rest, for thermoregulation, and for breeding and pupping. When they are hauled out they are available to be easily counted for population estimates. However, the proportion of the local population that hauls out at any one time is unknown and this information is needed to estimate local abundance. Observations were conducted that provide the first recent estimate of harbour seal abundance in the Churchill River Estuary. The haul-out site was observed directly or remotely (via GigaPanTM photos) for the duration of the open water seasons in 2014 and 2015. The highest number of harbour seals hauled out each year was in June (minimum known alive = 110 and 80 harbour seals in 2014 and 2015, respectively). For both years, peak harbour seal haul out was not related to tide height or environmental variables such as temperature or wind speed. However, haul out was positively correlated with time of day and negatively correlated with Julian date. Several mom and pup pairs were observed, providing the first records of pupping in the Churchill River Estuary. Pups were first observed on June 10 in 2014 and June 7 in 2015 . Harbour seal abundance in the Churchill River Estuary has increased over the last 10 years which may be a response to warmer conditions in Hudson Bay. Continued monitoring will be important to document climate related shifts in species abundance and distribution.

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.

THE INTEGRATED BEAUFORT OBSERVATORY (IBO)

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The integrated Beaufort Observatory (iBO) is a new mooring-based program (2015-2018) targeting the shelf and slope environment of the Canadian Beaufort Sea and co-led by ArcticNet, the Institute of Ocean Sciences (Department of Fisheries and Oceans Canada, DFO), Université Laval, and Golder Associates Ltd. The program is supported by the Environmental Studies Research Funds (ESRF) and Imperial Oil Limited and aims to extend existing time-series and regional coverage and contribute key information required for decisions on development and regulations in the offshore Beaufort Sea. iBO builds upon extensive time-series acquired by DFO since the 1970's and through ArcticNet and related projects (e.g. Canadian Arctic Shelf Exchange Study, ArcticNet-Industry partnership, Beaufort Regional Environmental Assessment) from 2002 to 2015. Through the collection of multi-year observations and the integration of existing time series, the iBO program will contribute to the further development of regional syntheses of ocean circulation, sea ice observations and biogeochemical fluxes that will include: (1) information on the magnitude, duration and return period of extreme ice features and ocean currents, comprising those associated with mesoscale eddies and storm surges; (2) ice and ocean datasets to assess seawater trajectories and particulate matter fluxes across key areas over the shelf and slope in relation to various transport mechanisms, such as upwelling and downwelling; and (3) data to support accurate predictive capability and the validation/verification of regional circulation, ice drift models, and oil spill trajectories. The main iBO sampling platform is composed of 7 tautline moorings located in waters ranging from 20 to 750 m depth at key locations from the Mackenzie Canyon, to the mid- and outer central shelf and slope, up to the remote northwestern area off Banks Island. The moorings are equipped with state-of-the-art instrumentation, including acoustic Doppler current profilers from 75 to 2000 MHz to measure current velocity, current direction, ice drift and plankton/particulates backscattering; ice-profiling sonar for the measurement of sea ice thickness, under-ice topography and for assessing waves and storm surges; water quality sensors for salinity, temperature, turbidity, chlorophyll and dissolved oxygen; and automated sediment traps that collect sinking particles for the measurement of biogeochemical fluxes. Data from the iBO program will be available to all stakeholders, including industry, regulators, northern communities, federal departments and the public through the Polar Data Catalogue.

SHARING ARCTICNET AND NCP DATA WITH THE WORLD: THE POLAR DATA CATALOGUE

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The Polar Data Catalogue (PDC, https://www.polardata.ca) is the data repository for ArcticNet, the Northern Contaminants Program (NCP), Polar Knowledge Canada (POLAR), and a variety of other Canadian and international programs. Through support to researchers and other data and information creators, PDC archives, manages, and serves online the data and metadata resulting from their Arctic and Antarctic research and monitoring activities. The PDC's multidisciplinary repository currently hosts over 2,250 metadata descriptions of datasets and relevant polar programs; more than 605,000 data files from 267 datasets in natural, social, and health sciences and policy, including over 10 years of data from the CCGS Amundsen; and more than 27,700 RADARSAT images of northern Canada and Antarctica. To enhance discoverability and use of these data, OAI-PMH, CSW, and WMS web services have been configured to share the PDC metadata (https://ccin.ca/home/webservices) in both the ISO 19115 (North American Profile) and FGDC-STD-001-1998 standard formats. As of late 2015, metadata interoperability has been established or is being tested with nearly 20 partner programs in 10 countries. Additional sharing partners are sought to strengthen this globally-distributed polar metadata interoperability network. To further increase the visibility and availability of the rapidly growing PDC collections, several major improvements have been made to the PDC system during the past year. Data visualizations have been added and improved, particularly a new Map Viewer displaying CTD data from the Amundsen along with sea ice thickness, floating buoy, and other map-based datasets. Based on feedback from partners at Inuit Tapiriit Kanatami and individual users, we have updated the PDC Lite search application and have dramatically increased the use of our Twitter, Facebook, and LinkedIn social media accounts to expand interaction with the online community. To protect the PDC system components against loss or corruption, we have archived the data files, database, and all supporting software assets at an off-site Compute Canada storage installation. PDC staff have also been active in collaboration activities within Canada and internationally to develop and implement best practices and sustainability in data stewardship, including coordinating Canadian polar data management activities as well as leading a project to unify metadata standard formats for the International Arctic Science Committee/Sustaining Arctic Observing Networks' Arctic Data Committee. With guidance from the Polar Data Management Committee and other partners in Canada, we have developed data policies and data deposit agreements for POLAR, NCP, and the Nunavut General Monitoring Plan, with the goal of coordinating policies across programs to simplify the process for researchers, data managers, and users alike. Next steps include registering new datasets with DOIs (digital object identifiers, similar to a published journal article), finalizing memberships in the World Data System and the Antarctic Data Centre network, and establishing data sharing functions to facilitate and enhance access to and use of the actual data files.

QUANTIFYING ORGANIC CARBON AND SEDIMENT FLUXES TO THE ARCTIC OCEAN DURING THE HOLOCENE: THE CONTRIBUTION OF COASTAL EROSION

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Arctic coastal zones are sensitive ecosystems for terrigenous matter inputs via coastal erosion. During the Holocene, the delivery of sediment, particulate organic carbon (POC) and dissolved organic carbon (DOC) varied in response to temperature and relative sea level changes. Changing inputs of sediments, carbon, and nutrients may alter the biogeochemical setting on the upper arctic shelves and may impact the global carbon cycle. Recent flux estimates of sediment and POC from coastal erosion into the Arctic Ocean are ~430 Tg y-1 sediment and 4.9-14 Tg y-1 POC, which is comparable to if not higher than riverine fluxes. However, the fate of sediments and organic carbon once eroded from the cliff remains largely unknown and the release of DOC from melting ground ice in permafrost cliffs has not been considered

yet. Material supply over the Holocene is difficult to quantify as it depends on erosion of a coastline whose original configuration is not known. For example, large parts of the circum-arctic shelves were subaerially exposed during the last glacial maximum (LGM) and became flooded rapidly. Thus, early Holocene erosion of coastal permafrost deposits was probably stronger than today and released more terrestrial material. With the retreat of the coastline, the depocenters moved further southward and thereby successively reducing accumulation rates in the distal shelf areas. In other parts of the Arctic, however, glacioisostatic rebound was significant so that global transgression was outpaced and therefore reduced shore line retreat. Even after the modern sea-level highstand was approached around 5,000 cal BP, there is evidence that the depositional system on the shelves took time to stabilize. Quantitative estimates of erosion rates along Arctic coasts throughout the Holocene are still sparse and need substantial improvement to clarify the fate of terrigenous material in the Arctic Ocean.

FOOD FOR THOUGHT: A SYSTEMATIC REVIEW OF THE CIRCUMPOLAR FOOD (IN) SECURITY LITERATURE

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Food insecurity in the circumpolar region has been identified as a critical issue threatening Indigenous health. The Committee on World Food Security defines food and nutrition security as "when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life". Despite the increased attention given to this issue and the proliferation of research on the topic, relatively little is known of where the emphasis has been placed in this work to date. Therefore, the objective of this project was to identify the trends in the study of food security in peer-reviewed and grey literature in the circumpolar north through the conduct of a systematic literature review. The peer-reviewed literature was searched using three electronic library databases. The grey literature (non-peer reviewed) was searched using three online search engines and three agency websites. Search terms used included "food security", "Arctic" and "Aboriginal" and selected synonyms for each. A total of 740 publications were collected that discussed food security and/or components of food security (i.e. food availability, food accessibility and food quality). Articles spanned the time period from 1953 to 2015. As one might expect, over this period, both literatures show an exceptional growth in the number of publications annually on focused on aspects of food security in the circumpolar region. A substantially larger proportion of publications have focused on this issue in the Inuit population (72%) and in Canada. In Canada, the largest proportion of publications (45%) speak to aspects of the issue in the Territories as compared to Nunavik or Nunatsiavut. Alaska and Greenland are the most represented geographic areas in the circumpolar literature outside of Canada; however, they only account for just fewer than 10% of all publications on the topic. In terms of the focus of publications, 17% discussed food availability, 40% food accessibility and 90% focused on elements of food quality. Among all sources, nutrient and chemical aspects of quality were most common (65%). Sources mentioning or focused on cultural or biological quality of foods represented 45% and <10% of all sources, respectively. In terms of access, most publications discussed elements of economic (34%), followed by social (24%) and then political (10%) and physical (<10%) accessibility to food. The issues of abundance (17%) and diversity of food (<5%) were represented in a much smaller proportion of the literature.

ISFJORDEN IN WEST SPITSBERGEN; A HIGH-ARCTIC MODEL SYSTEM FOR STUDYING HYDROGRAPHICAL AND ECOLOGICAL CHANGES

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Isfjorden at 78 °N represents a unique model system for studying the influence of hydrographic processes on biological systems throughout the year. In this high-Arctic fjord, sympagic communities develop

in its innermost, seasonally ice-covered parts while the outer parts have largely been ice-free the last decade. The fjord, on the western coast of Spitsbergen, is influenced by the warm and saline West Spitsbergen Current which periodically enters the system. Two time series stations in the fjord are frequently sampled; the winter sea ice covered BAB station (Billefjorden, since 2008) and the usually ice free IsA station (Adventfjorden, since 2009). Standard biological parameters including chlorophyll a biomass, nutrients, phytoplankton and zooplankton community composition along with CTD profiles are collected regularly at these two stations. Moored observatories with sensors measuring temperature, salinity, fluorescence, light and currents have been available periodically at several stations in the fjord. Based on available data from our time series stations, we will discuss ecological trends along the continuum from seasonal ice-cover to year-round open water in warm vs cold sea water temperature scenarios to identify the range of variability on weekly, seasonal and annual scales. To predict potential impacts of climate change on Arctic marine systems, short term physical and biological interactions and variability in these strongly seasonal systems must be better identified.

A LOOK BACK ON A HALF-CENTURY OF RESEARCH; THE 50TH ANNIVERSARY OF THE INUVIK RESEARCH LAB

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In 2014, the Western Arctic Research Centre and the Aurora Research Institute celebrated 50 years of operations in Inuvik. The history of Inuvik's research centre dates to the founding of the town in 1955, when space was set aside in the town plans for a research centre that would support northern exploration and discovery. The original facility opened in January 1964, and became known in the community as the Inuvik Research Laboratory (or "the Lab" for short). It was Canada's first permanent scientific research station north of the Arctic Circle, and was initially operated by the federal government before being transferred to the Government of the Northwest Territories in 1984. A merger with Aurora College occurred in 1995, when the building became known as the Inuvik Research Centre, or the IRC. This was one of three regional centres that comprised the Aurora Research Institute, the research division of the college. After 46 years of continual operation and heavy use by the research community, the original facility closed in 2010. Research centre staff, long-term facility users, and community members collaborated to design a new building, the Western Arctic Research Centre (WARC), which was built in 2011 using funding received from the Government of Canada's Arctic Research Infrastructure Fund. The many infrastructure improvements over the original facility have kept WARC on the front line of Arctic research, and have provided continued support for many projects in the Inuvik region. Our 50th anniversary allowed us to reflect on both our institutional history, as well as the history of all research taking place in and around Inuvik. The town serves as a regional hub for government, health and industry in the western Arctic, and straddles the treeline on the eastern edge of the Mackenzie River Delta. The rich social, biological and ecological diversity of the region has supported a wealth of research based out of the Inuvik Lab over the past half-century. This work has contributed greatly to our understanding of climate change, traditional knowledge, oil and gas deposits, archaeology, health, and contaminants in Canada's north. This poster presentation will provide a retrospective on the Inuvik Lab and 50 years of research in the region, as well as a description of how we celebrated our 50th anniversary with the research and local communities.

RINGED SEAL FEEDING ECOLOGY DETERMINED FROM STOMACH CONTENT ANALYSIS AND INUIT QAUJIMAJATUQANGIT

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Ringed seal are an ice-dependent species with a circumpolar distribution. They are a main prey species for polar bears and are important to Inuit culture and the subsistence economy. This study aims to understand ringed seal feeding ecology in Nunavut. Studies evaluating ringed seal diet in the past have found that Arctic cod, pelagic amphipods, and mysids mainly dominate the diet of ringed seal in the high Arctic but a shift to capelin and

sand lance has been observed in the Hudson Bay region. The volume of work on this subject in the Canadian Arctic is limited and heavily weighted towards stable isotope analysis and fatty acid composition. Our approach will be to use both Inuit Qaujimajatuqangit (IQ) and stomach content analysis to determine diet and expand our knowledge of ringed seal feeding ecology in the Territory. IQ represents a knowledge system that is orally transmitted both intergenerationally and horizontally across groups where ecosystem-wide observations are accumulated over long periods of time and large spatial scales. In contrast, research in the natural sciences typically focuses on a few variables that can be measured quantitatively over shorter temporal scales. Although IQ has traditionally been under utilized within wildlife management, it is argued that the use of both IQ and western scientific knowledge could be complementary and help enhance overall understanding of species ecology. The proposed study will engage qualitative data represented by narratives gathered through semi-directed interviews with Elders and hunters on their knowledge of ringed seal biology and habitat use, and quantitative data represented by analysis of ringed seal digestive track contents from seal collected by hunters in Nunavut communities. We will investigate spatial and temporal differences in the prey preferences of ringed seal, and evaluate potential niche overlap between ringed and harp seal in areas where the distribution of their population overlaps. Results will be used to inform the Government of Nunavut on the potential complementary use of both science and IQ in ringed seal management, research, and education. Understanding the feeding ecology of ringed seal as well as tracking changes over time will help wildlife managers better understand the evolving dynamics of the Arctic food web and determine potential impacts on species at higher trophic levels. Finally, this study will start to help address Inuit concerns regarding the use of IQ as a valuable component in scientific research.

AN EXAMINATION OF THE IMPACTS OF ARCTIC CLIMATIC FLUCTUATIONS ON MERCURY CONCENTRATIONS IN RINGED SEALS (PHOCA HISPIDA) USING MERCURY STABLE ISOTOPES.

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Recent studies have shown that climate change is already having significant impacts on many aspects of transport pathways, speciation, cycling and exposure of contaminants within Arctic ecosystems. For example, recent work by our group has shown that mercury concentrations in ringed seals vary depending on the extent of sea-ice cover in the preceding winter. More recent work (Point et al. 2011 Nature Geosci doi: 10.1038/NGEO1049) showed that mercury stable isotopic signatures in Arctic seabirds were also affected by sea-ice cover, which they attributed to changes in methylmercury photodegradation rates in the ecosystem. Building on these studies, we will test the hypothesis that changes in ice-related light regime will affect the net pool of MeHg at the base of the food web by changing photo-demethylation rates which may be tracked by characteristic mass-independent fractionation of mercury stable isotopes in ringed seal tissues. For this, we will use archived tissue samples of ringed seals collected over the last three decades by Fisheries and Oceans Canada (Freshwater Institute). Mercury isotope ratios and fractionation of mercury isotopes in tissue samples will be determined using the state-of-the-art multi-collector ICP/MS (NU Plasma II).

EVALUATION OF INFRARED THERMOGRAPHY TO NON-INVASIVELY ASSESS THERMOREGULATION IN POLAR BEARS (URSUS MARITIMUS).

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Polar bears in western Hudson Bay experience a range of temperatures throughout the year from 50°C in the winter to 40°C in the summer. As a result, polar bears have adapted to these thermal extremes both behaviourally and physiologically. Increases in air and sea temperatures have led to significant sea ice loss and lengthening of the snow-free and ice-free season. These factors may augment the challenges that polar bears face while trying to maintain their body temperature whilst

minimizing energetic costs. Unfortunately, the energetic costs related to thermoregulation in polar bears (staying warm in the winter and cooling off in the summer) are not well understood nor are the related behaviours they employ to thermoregulate. Polar bears are a challenging species to study as they are large, dangerous marine mammals that live in difficult to access habitat. The purpose of this study is to develop non-invasive methods of accurately measuring changes in body temperature using infrared thermography and relating those internal changes to hypothesized thermoregulatory behaviours. We explored these techniques in a controlled zoo setting, where behaviours such as shaking, rolling, and swimming were recorded in conjunction with thermal imagery. Eye temperature was found to be the most consistent measure of body temperature being approximately 3 degrees Celsius cooler than internal temperature. Internal body temperature positively correlates with activity level, so if eye temperature fluctuates with core temperature, then using observed eye temperature might be a good proxy for internal temperature. One limitation of using this method in the field is that the observer needs to relatively close to the animal, a situation that is only rarely possible in the field. Exploring new technology and non-invasive methodology to study to the costs of thermoregulation in polar bears will allow us to better predict future behaviours and the ecological impacts of current climatic trends on polar bears in the wild and in captivity.

ARTIC MELT PONDS: AN OVERLOOKED SOURCE OF DMS?

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The Arctic Ocean is a hotspot for Dimethyl sulfide (DMS) research: 1) First, the low atmospheric particle content in summer increases DMS-derived aerosol formation. 2) Second, frozen ocean offers multiple niches for DMS producers below-, within-, and even above- sea ice, in melt ponds (MPs). MPs are dynamic and transient environments forming on top of sea ice as a result of seasonal snow melt. Marine bacteria and algae introduced in MPs can lead to in situ DMS production. The significance of MPs as sources of DMS in the Arctic has not been thoroughly investigated yet. Meanwhile, the extent of ponded ice is increasing with the warming of the Arctic. Here, we present data obtained during three campaigns conducted in the Canadian Arctic Archipelago between 2012 and 2015. DMS measured in 23 Arctic MPs ranged from n.d. to 14 nmol l-1. Back-of-the-envelop calculation shows that close to 1.10-4 Tg of DMS could potentially lie in Arctic MPs. Our data suggest that only brackish MPs were sources of DMS. We also found that in situ degradation of algal DMS precursor, DMSP, was the main source of DMS while photo-oxidation was its main sink. Finally, time series data show that DMS accumulated in MPs.

ADVANCING PHENOLOGY OF THREE TUNDRA PLANT SPECIES IN NORTHERN YUKON.

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With a warming climate, arctic ecosystems are experiencing shifts in plant phenology. Long-term monitoring is necessary for observing the gradual but marked changes in plant phenology, but few programs have the resilience and support to fulfill this need. Herschel Island-Qikiqtaruk Territorial Park located in the Beaufort Sea off the Yukon Territory coast is a remarkable example of ecological monitoring with collaboration between the Yukon Government (Yukon Parks) and local people (Inuvialuit from Aklavik and Inuvik). For 15 years, the Herschel Island-Qikiqtaruk Territorial Park Rangers have been recording and observing the phonological stages of three tundra plant species (Eriophorum vaginatum, Dryas integrifolia, and Salix arctica). The 10 cm2 plots are visited every two to three days over the growing season, from snow-off in the spring to senescence in the fall. Additional measurements are taken at peak growing season, such as leaf length and number of flowers, depending on the species. Using

this 15-year dataset, we compared plant phenology measurements including leaf emergence, flower emergence and senescence through time and found that plant phenology has advanced for all three species, though the magnitude of advance varied. Plant phenology was correlated with growing season temperatures and lengths. This evidence demonstrates the shifts in timing of tundra ecosystems associated with climate changes and suggests that certain plants can adapt to these seasonal alterations more readily than others. This monitoring program also demonstrates the feasibility and necessity of working with local people to attain a mix of observational recording, as well as length (15 years or more) and detail (phenology measurements every 2-3 days for the entire growing season) in long-term monitoring.

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 (Rri), the horizontal length scale at which rotational effects become as important as pressure effects, was estimated to be ~ 160 m and the Rossby number (Ro), the ratio of the centripetal acceleration to the Coriolis acceleration, ~ 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 Rri ~ 240 m, with Ro ~ 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.

WHEN NUMERICAL MODELING TALE US THE STORY OF THE ACTUAL AND FUTURE NATURE OF THE ANNUAL SEAFLOOR FEAST IN THE NORTH WATER POLYNYA

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Pelago-benthic coupling refers to a series of processes that are key to marine ecosystems. Among them, sedimentation of organic matter from the upper water column to the seafloor, hereafter referred as food transfer (FT), is of great importance, as it influences the abundance and composition of the benthic community. In polar regions, FT is conditioned by the hydrographic regime and sea ice dynamics. Polynyas such as the North Water Polynya (NOW), northern Baffin Bay, are areas of unfrozen sea surrounded by ice. They support high primary production (PP) and are, consequently, hotspots

of benthic communities. Polynyas can be particularly sensitive to sea ice variability induced by climate change. A recent study in the central Arctic found that fresh algal biomass can reach the seafloor (~4000m) in two months, attracting opportunistic benthic megafauna (Boetius et al. 2013). Gaillard (2015) have found a signal of fresh ingestion of diatoms (less than a month) by Astarte sp. at a 568-m depth in the NOW. Common values of sedimentation rates used in models, for example, underestimates what's observed in the field, and has to be reconsidered. This project will study how PP and FT will respond to climate change in the NOW, by answering three questions: 1) Which obstacles do microalgae have to overcome to win the sedimentation race? A 1-D Lagrangian model will be developed and used to study how vertical processes such as particle size, aggregation processes, critical level of turbulence, buoyancy and stratification control the sedimentation rate. 2) Where does the fresh food of the benthic feast come from? This previous model will be then coupled to a 3-D model general circulation model with which horizontal transport, affected by currents at various scales, sea ice dynamics, turbulence will be taken into consideration to represent, as realistically as possible, where the surface PP reach the seabed. 3) How will the FT evolve in a changing climate in the NOW? Whilst PP tends to increase in Arctic Ocean, in the NOW it is rapidly decreasing (2 decades) thanks to changes in ice dynamics and leads to rapid short-term change in FT (Hargrave 2002). In this final part we aim at understanding and predicting how PP and FT will both contribute to transform the benthic ecosystem by carrying simulations of various future climate scenarios. 1.Boetius, a. et al., Science (2013). 2.Gaillard, b.,Thesis presentation, UQAR-ISMER (2015). 3.Hargrave, b.t. et al., Deep-Sea Research Part II (2002).

SEASONAL PATTERNS OF GROWTH AND APPETITE REGULATION IN ARCTIC CHARR (SALVELINUS ALPINUS L.): DIFFERENCES BETWEEN MORPHS IN WILD AND FARMED POPULATIONS

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Arctic Charr, Salvelinus alpinus (L.), is arguably the most diverse vertebrate species due to the great range of existing morphs and life-histories (e.g. anadromy, residency) both within and among populations. Within a single population, anadromous individuals are significantly larger at age relative to their resident conspecifics. Preliminary work has demonstrated that growth patterns in early life are important when differentiating between anadromous and resident individuals. The proposed study's goals are to: (1) determine whether seasonal growth patterns in Arctic Charr differ between life-histories (i.e. anadromous and resident) in wild populations and between growth morphs (i.e. slow- and fast-growing) within a farmed population and (2) determine if seasonal patterns of appetite regulation differ between growth morphs of farmed Arctic Charr. It is hypothesized that seasonal growth patterns in Arctic Charr are dependent on (1) life-history (wild) or growth-morphs (farmed) and (2) year in wild individuals due to annual variability in climate. Finally, it is hypothesized that seasonal appetite regulation will be dependent on (3) growth-morph in farmed Arctic Charr. It is predicted that (1) anadromous and fast-growing individuals will have significantly greater proportion of summer growth within a year relative to the resident and slow-growing morphs and that (2) there will be an increase in the amount of summer growth in wild populations following the increasing trend in temperature. Lastly, it is predicted that in farmed Arctic Charr (3) fast-growing individuals will show a greater seasonal up-regulation of appetite in the summer and down-regulation in the winter relative to slow-growing individuals. Growth will be estimated using otoliths in both wild and farmed individuals. Seasonal appetite regulation will be monitored over the period of a year in farmed Arctic Charr by measuring circulating levels of leptin, ghrelin, and free fatty acids. Greater knowledge of Arctic Charr biology and ecology is essential for monitoring and management purposes. Results from this study will provide insights into Arctic Charr growth and life-history characteristics which are crucial to understanding the effects of climate change in the Canadian Arctic marine system and to ensure sustainability of the fisheries industry.

PAST AND PRESENT LINKS BETWEEN MYA TRUNCATA ECOLOGY AND WALRUS FORAGING IN CHANGING ARCTIC FJORDS

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Ecological principles commonly invoked in environmental impact assessment cannot predict the fate of arctic ecosystems because they are based on single state dynamics. The purpose of our study is to characterize the long term impact of climate change on a coastal meta-ecosystem, defined by a simple but emblematic trophic chain (Phytoplankton - Clam - Walrus), alternating between two states according to the presence or the absence of sea ice. Changes of states (Ice-No Ice) are considered to be discrete at the spatio-temporal scale of the dynamics of the system. Focusing on the mathematical properties of the dynamics of this particular hybrid system, our goal is to define sets of testable hypotheses to identify trends of changes, that can be observable in biological archives (such as chronobiological signal recorded in Walrus teeth or bivalve shells).

SEAWATER STRONTIUM ISOTOPIC COMPOSITION IN HUDSON BAY: A NOVEL TOOL FOR TRACING WATER MIXING

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We present Sr concentrations and high resolution 87Sr/86Sr measurements in Hudson Bay, together with salinity and colored dissolved organic matter (CDOM), to evaluate water mixing and the influence of freshwater input in coastal Hudson Bay. Dissolved Sr generally mixed conservatively in the Nelson and Great Whale estuaries, suggesting dynamic mixing affected by river runoff. Variations in the 87Sr/86Sr ratios were apparent in estuarine and coastal waters (salinity < 20), consistent with CDOM distribution. Together these results indicate that Sr concentrations and isotopic composition can provide insight into mixing processes in coastal Hudson Bay.

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.

TRENDS AND FRAMING TECHNIQUES USED BY CANADIAN NEWSPAPERS REGARDING CLIMATE CHANGE IMPACTS ON HEALTH.

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The climate is changing, and the impacts of these changes have already begun to affect human health. Newspapers are a prominent source through which many individuals are informed about climate change and other topics. This review aimed to characterize how newspapers report on climate change impacts on health that may inform the perceptions of the North American population. A 2-reviewer, 3-stage screening process was used to identify and select articles, which were analyzed via quantitative descriptive statistics and qualitative thematic analyses. Articles were identified using ProQuest ©, and limited to six major newspapers from across Canada. Population subsets, defined by any demographic feature, were identified in 12% of the articles, of which 47% of the articles focused on Inuit populations. The most noticeable difference in reporting between regions, groups, or demographics was the increased reporting of Arctic regions, compared to other regions in North America. A positive correlation was identified between the frequencies of reporting of climate change impacts on health and the occurrence of climate change related political events, such as the Conference of the Parties. Characterization of the framing of climate change impacts on health revealed that climate change impacts on health are generally reported with a negative valence. Overall, reports of climate change impacts on health were generally consistent with scientific literature published on the subject, which is beneficial to informing perceptions of the North American population.

PRE-BREEDING PHYSIOLOGICAL MECHANISMS DRIVING REPRODUCTION IN A MIXED-STRATEGY BREEDER

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Variation in individual state is one of the key factors driving the reproductive decisions of mixed-strategy breeding species reproducing in seasonal environments. Although proxies of state such as body mass can significantly predict an individual's reproductive decisions (e.g., lay date, clutch size), a substantial amount of variation in reproductive investment decisions remains unexplained. Physiological traits are highly valuable integrated measures of individual state since physiology directly mediates the relationship of an individual to its environment. As such, physiological traits may be useful in enhancing our predictive capacity to explain the existence of individual variation in reproductive decisions. Baseline corticosterone (CORT) is the primary avian glucocorticoid and is critical in modulating energetic balance and has been shown to influence foraging behaviour. As such, variation in baseline CORT may act as a driver of resource acquisition and energetic demand, thereby influencing reproductive investment decisions. We used a combination of long-term correlative data and inter-annual manipulative experiments to determine how variation in baseline CORT in pre-breeding Arctic common eiders influences individual energetic management and downstream effects on reproductive investment. We demonstrate that CORT plays an important causal role in supporting the energetic demands of reproduction in this capital-income strategy species. Further, determining how individual physiological phenotypes impact fitness in Arctic-breeding species will provide researchers with the predictive capacity to determine whether an individual's phenotype will better enable it to succeed when faced with the expected constraints of a rapidly-changing Arctic.

THE EFFECT OF SEASONAL LIPID DYNAMICS ON PERSISTENT ORGANIC POLLUTANT ACCUMULATION IN ARCTIC COD (BOREOGADUS SAIDA).

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Arctic cod are a keystone species in Arctic marine food webs and, hence, are a critical link in the transfer of energy and persistent organic pollutants (POPs) to higher trophic levels in the food web including larger fish, marine mammals and sea birds. In a large sample of cod (n=70, 5-140mm in length) collected over a year, concentrations of legacy POPs showed significant changes with size/age, season and lipid content, with concentrations of most POPs peaking in the fall when lipid content was highest. Comparisons of wet weight versus lipid normalized concentrations show that the uptake/elimination processes for many contaminants lag behind the nearly four-fold fluctuation in lipid content over the year. These results have implications for understanding the importance of seasonal lipid dynamics on contaminant levels and the importance of seasonal variability on contaminant exposure for top predators, especially those that may have peak feeding periods in the late summer and fall. We have applied this information to estimate the annual range of other POPs and current use pesticides in more recent samples of cod collected at a single point in time in 2012.

HYDROSECURITY OF THE YUKON RIVER WATERSHED - A COLLABORATIVE RESEARCH PROJECT WITH YUKON ENERGY CORPORATION

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Limited observational data and a complex river basin that includes mountainous topography, glaciers, large lakes and permafrost present numerous challenges for Yukon Energy Corporation (YEC) when anticipating and planning for the impacts of climate change on its ability to generate hydroelectricity at its Whitehorse Dam. To help overcome these challenges, YEC has partnered with the Northern Climate ExChange (NCE). Together, YEC and the NCE have designed a research program that aims to 1) improve the observational network in the Yukon River headwaters, 2) model the current form, flow dynamics and mass balance characteristics of the Llewellyn Glacier, and 3) to develop a predictive regional hydrologic model that will operate at various timescales relevant to climate change adaptation planning. During the first two years of their three-year research collaboration, the NCE and YEC have installed five automated weather stations in the Yukon River headwaters, conducted ice penetrating radar surveys from the Llewellyn Glacier and surrounding sites, collected and 14C-dated wood samples from moraines surrounding the glacier, and monitored ice mass balance at five sites. Results from these activities show that ice thickness currently exceeds 450 m, but radiocarbon dates indicate that there has been substantial ice wastage in recent centuries. Mass balance monitoring indicates that this trend is continuing. Initial model results show that while glacier wastage contributes to flow, particularly in fall, this contribution will decrease in decades to come, potentially impacting YEC's ability to store water in the fall, in preparation for high winter power demands. On-going research in this final year of the project will see NCE complete hydrologic modelling of the basin, and translate knowledge and on-going monitoring operations to YEC though user manuals, practical training and a series of workshops. The outcomes of this project will allow YEC to anticipate and plan for variability and change in the timing and volume of flow in the upper Yukon River. Ultimately, this research program will improve our understanding of, and preparedness for, the impacts of climate change in a part of northern Canada, which is of vital importance for continued economic prosperity in Yukon and in Canada's North.

ANALYSIS OF MICROBIAL SOIL COMMUNITIES OF THE BOGS AND FENS IN THE HUDSON BAY LOWLANDS

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The Hudson Bay Lowlands in northern Canada is the second largest wetland in the world, storing approximately 30 petagrams (i.e. ~5 million kg) of carbon. The microbial communities in these peatland fen and bog ecosystems are important factors impacting the turn over of the carbon reservoir, influencing the release of greenhouse gases as permafrost melts. However, few studies have investigated the relationship between the microbial communities in the permafrost active layer, the layer of soil that seasonally thaws, and the thickness of the active layer. Here we use high throughput 16s ribosomal RNA sequencing to characterize the microbial communities in the soil of bogs in the Hudson Bay Lowlands in the Greater Wapusk Ecosystem. The sequenced data revealed the types of organisms that comprise the community and was used to predict the functional attributes of the organisms in the environment, and their potential as indicators and effectors of climate change. The aim of this study was to use soil microbial diversity, permafrost active layer thickness, and the type and % cover of the vegetation as indicators of climate change in the Arctic. Studying microbial communities is a powerful tool that allows us to investigate the effects of impending climate change in a critical habitat of the world.

BEYOND CITIZEN SCIENCE: MONITORING PERMAFROST ACTIVE LAYER AND ASSOCIATED VEGETATION COVER IN PEATLANDS OF THE HUDSON BAY COASTAL REGION

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Canada contains one quarter of all of the wetlands on earth, and the Hudson Plains Ecozone along the Hudson Bay Coast in Canada represents the largest continuous wetland in the world. Most of this landscape is underlain by continuous and discontinuous permafrost, which is at great risk due to global climate change. The permafrost active layer thickness (ALT) is expected to increase in arctic regions as the climate warms and permafrost decays. Local factors such as vegetative cover and soil moisture may mediate the effects of rising temperature on ALT. Developing a model that relates ALT to surficial indicators could greatly contribute to the feasibility of monitoring permafrost changes across the subarctic. Our student led research goes beyond citizen science by having students develop the objectives and procedures and add new approaches as the program expands. In this ongoing study, a selection of subarctic sites representing the seven most common fen and bog habitat types on the Hudson Bay coast of Manitoba were studied from 2006-2015. At each site, two parallel 50-m transects, 10-m apart, were sampled at 2-m intervals along each transect. ALT was measured twice at each survey point. At each 2-m interval, percent cover of eight vegetative types (tree, shrub, herb, lichen, moss, dead vegetation, water, and unvegetated) was estimated within 1m^2 plots. Results of ALT (2008-2015) suggest that ALT was significantly greater ($\beta = 64.8$, $t = 19.8$, $P < 0.001$) in fen (mean + SE: 98.3 + 2.83 cm) than bog habitats (38.2 + 4.67; n = 144 transects). Among fen habitats, ALT was significantly greater ($\beta = 123.4$, $t = 3.97$, $P < 0.001$) in Sedge Larch Fens (119.0 + 7.90 cm) than in Sedge Bullrush Poor Fen (91.7 + 2.20 cm). The ALT also significantly increased during 2008-2015 in Sedge Larch Fens ($\beta = 0.08$, $\chi2 = 40.3$, $P < 0.001$) but not in Sedge Bullrush Poor Fens ($\beta = 0.01$, $\chi2 = 2.30$, $P = 0.13$). Among bog habitats, ALT was significantly greater ($\beta = 0.15$, $t = 7.34$, $P < 0.001$) in Burned Lichen Heath Bog (41.4 + 1.18 cm) than in Lichen Heath Bog (37.2 + 0.60 cm). However, the ALT significantly increased during 2008-2015 in both bog habitats similarly ($\beta = 0.02 \pm 0.01$, $t = 3.05$, $P = 0.003$). In fen habitats, a model including lichen cover ($\beta = -0.05$, $t = 11.4$, $P < 0.001$), water cover ($\beta = 0.05$, $t = 10.2$, $P < 0.001$), bare ground ($\beta = 0.04$, $t = 7.62$, $P < 0.001$), and habitat type ($\beta = 0.25$, $t = 4.90$, $P = 0.003$) effectively predicted ALT. Cover types and habitat type alone explained $R2 = 0.17$ of the variation in ALT, while a model also including year and location explained $R2 = 0.72$. In bog habitats, a model including lichen cover ($\beta = -0.09$, $t = 12.8$, $P < 0.001$), moss cover ($\beta = -0.01$, $t = 4.17$, $P < 0.001$), shrub cover ($\beta = -0.03$, $t = 5.55$, $P < 0.001$), tree cover ($\beta = -0.02$, $t = 6.28$, $P < 0.001$), water cover ($\beta = 0.01$, $t = 1.88$, $P = 0.06$), and bare ground ($\beta = 0.02$, $t = 2.97$, $P = 0.003$), effectively predicted ALT. Cover types and habitat type alone explained $R2 = 0.25$ of the variation in ALT, while a model also including year and location explained $R2 = 0.66$. These results could inform an algorithm that would predict ALT from measures

of year, vegetative, and water cover. This student-led approach has effectively engaged over 250 students in ecological research design and data analysis, while raising awareness about arctic ecosystems, and effectively training future scientists.

GENETIC VARIATION IN RINGED SEALS (PUSA HISPIDA): POPULATION STRUCTURE AND GEOGRAPHICAL ISOLATION IN THE CANADIAN ARCTIC

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Climate warming is rapidly changing ecosystems around the world but some of the most rapid changes are occurring in the Arctic. These changes include reduced ice cover, extension of the open water season, and precipitation changes among others. Most changes are shifting the habitat from an ice dominated habitat to one with more open water and temperate conditions. These changes have the potential to affect species that are adapted to Arctic conditions. Ringed seals (Pusa hispida) rely on ice and snow for survival and reproduction as it provides a platform for resting and pupping as well as cover from polar bears and hunters. Ringed seals are important species in Arctic food webs yet relatively few studies have examined the landscape genetics of this species in the Canadian Arctic. We examine the population structure and genetic variability of samples across the Canadian Arctic in relation to geography and historic ice cover. Samples of ringed seal were contributed by Inuit hunters located across the Canadian Arctic and from collaborators in Greenland. In order to assess population structure and genetic variability; we will look at 420 ringed seals. We will analyze 20 microsatellite loci from 20 individuals from 21 distinct locations across the Canadian Arctic. We will be specifically looking to detect population structure, if it occurs, and comparing various isolation by distance models using a great circle distance, distance by sea with no ice cover, distance by sea with summer minimum ice cover, and distance by sea with median ice cover. This analysis will provide insight into historic barriers to gene flow and may predict future conditions.

THE EVOLUTION OF SUBSISTENCE AND COMMERCIAL FISHERIES IN THE EASTERN CANADIAN ARCTIC

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Eastern Canadian Arctic Inuit have hunted marine mammals for subsistence for over 4000 years. Historical landing estimates remain incomplete but archaeological sites suggest hunting pressure for each species varied in intensity over time depending on culture and climatic conditions. Today, marine mammals are still hunted as well as several fish and invertebrates species. Gear type has greatly changed over time as metal tools, wood, motors and explosives appeared in northern communities. This research aims to investigate the evolution of Nunavut fisheries, both subsistence and commercial, by assessing gear type, landings and quotas, species abundance, use, and conservation status. Gear type was found to be greatly influenced by climatic variations, and exchanging goods with fur traders and whalers. Landings increased over time for most species, which could be the result of Inuit population growth or gear technology development. Restrictions such as harvest quotas or seasonal and area closures were introduced in the late 20th century to comply with species conservation goals. Commercial fisheries continue to grow since the 1960s, targeting Greenland halibut and northern shrimp, and employing more Inuit each year in its fishing plants. The Inuit are interested in developing future commercial fisheries in Nunavut such as invertebrate fisheries. They further wish to increase whale harvesting quotas in order to continue traditional practices and maintain cultural identity.
One challenge faced in managing Nunavut fisheries is combining the very different knowledge systems of Western science and Inuit Qaujimajatuqangit. However, collaboration is necessary in further developing Arctic fisheries knowledge and respecting the Nunavut Land Claims Agreement signed in 1993. This research is part of the SSHRC-funded partnership research grant aimed at improving fisheries governance and management in Canada.

THE DISTRIBUTION OF DIMETHYLSULFIDE (DMS), DMSP AND DMSO IN CANADIAN ARCTIC WATERS

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Dimethylsulfide (DMS), dimethylsulfoxide (DMSO), and dimethylsulfoniopropionate (DMSP) are interrelated biogenic components of the marine sulphur cycle, with multiple roles in the ocean ecosystem. The metabolite DMSP is a critical osmolyte utilized by multiple species of phytoplankton, while its cleavage product DMS is the largest natural source of atmospheric sulfur aerosols. These aerosols impact regional and global climate patterns, exerting a direct influence on climate by scattering solar radiation and exerting indirect influence by forming cloud condensation nuclei that increase the albedo of low-altitude clouds. The ocean-atmosphere dynamics of DMS may be particularly important in the Arctic environment, where climate change effects are amplified by lower albedo resulting from reduction in summer ice cover. Changes in Arctic phytoplankton assemblages in response to climate change will alter the distribution of DMS, and consequently the strength of DMS-induced climactic effects, in the future, but the nature of this change is unclear. For these reasons, understanding the spatial and temporal distribution of these inter-related sulphur compounds is a key step in predicting climate feedbacks in the rapidly changing Arctic system. Because traditional, non-automated methods of analysis of DMS, DMSO, and DMSP are labour intensive, measurements of these compounds across the Canadian Arctic remain relatively sparse. Our group utilized membrane inlet mass spectrometry, and an automated organic sulphur sequential chemical analysis robot (OSSCAR) to perform rapid underway measurements of DMS and DMSP during Leg 2 of the 2015 GEOTRACES expedition through the Canadian Arctic Archipelago. Additional samples for discrete DMSO measurements were also collected. In this presentation we will describe the spatial distribution of DMS, DMSP and DMSO concentrations through northern Baffin Bay and the Arctic Archipelago. We will explore relationships between our observations and other measured parameters, such as primary productivity and sea ice across our observed transect. Our results show that DMS concentrations ranged from ~ 1 nM to 20 nM for DMS and from 1 nM to 150 nM for DMSP, Our findings represent a significant addition to the existing body of knowledge of the distribution of DMS, DMSO, and DMSP in Arctic waters, and will aid in understanding the role of these compounds in the changing Arctic ecosystem of the future.

INUIT WOMEN'S CONCEPTUALIZATIONS OF AND APPROACHES TO HEALTH IN ADAPTATION TO CLIMATE CHANGE

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Climate change has been identified as the biggest human health threat of the 21st century and Inuit as one of the most at-risk populations. In response northern communities and health systems will have to adapt. Inuit are active players in adaptation and Inuit knowledge of health needs to be central to research to focus on health risks relevant and important to people and capture the complex and culturally specific interactions of climate and non-climate factors influencing vulnerability. However, Inuit perceptions of health are underrepresented in current northern healthcare services and given little consideration in the context of adapting to climate change. Previous research documents health trends, behaviours and vulnerabilities to be differentiated by gender. To date, most research either does not account for gender differentials or focuses on the exposure of Inuit male hunters to dangers of engaging on land-ice-based activities and preserving men's traditional knowledge for adapting to climate change. Less is known about the knowledge influencing Inuit women's experience of health and climate change. This research responded to this knowledge gap and examined Inuit women's conceptualizations of and approaches to health in adaptation to climate change through a case study of Ulukahktok, NWT, Canada. Results suggest that Inuit women's conceptualizations of health are largely holistic, characteristic of Inuit traditional knowledge. While analysis identified distinct themes to include family, the land, healthy eating, active lifestyles, happiness/positivity,

community involvement and cultural connectedness the significant overlap across them emphasized the interconnectedness of all these elements and holistic perspectives of health and wellbeing. In contrast, the results of this research portray Inuit women's approaches to treating the different parts of one's health as being highly compartmentalized. For example, mental and emotional support is sought from family and friends, with little reliance on or success in counseling and westernized practices. While nearly all traditional remedies or care for physical ailments have been lost and treatment is sourced primarily via the formalized healthcare system. Moreover, this research found little to no evidence of any health promotion behaviours that would address the patterns of ill-health present or predicted among Inuit as a result of climate change. Importantly, while only one participant explicitly identified climate change as an imposing health risk, many women identified health concerns or determinants of health that have in other research been connected to climate change. The results of this project may inform the identification of entry points to enhance adaptive capacity and health among Inuit women in Ulukhaktok as well as a responsive health system. The project is part of ArcticNet Project 1.1 Community Adaptation and supported by the CIHR project IK-ADAPT (Inuit Traditional Knowledge for Adaptation to the Health Effects of Climate Change) and Nasivvik Centre for Inuit Health and Changing Environments.

3D ICEBERG MAPPING: EXPERIENCES AND CHALLENGES

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Icebergs, ice islands, and the fragments produced during their deterioration, are hazards to shipping and the offshore resource extraction industry in eastern Canada. In-situ iceberg keel (underwater) and sail (above-water) morphology data can be utilized to calibrate drift models or for scouring assessment to mitigate iceberg imposed risks. Concurrent multibeam sonar and LiDAR/photogrammetry data collection has the potential to produce complete 3D iceberg models and a recent field campaign was conducted on the CCGS Amundsen to develop and test these surveying methods. These models will aid in the above risk reduction efforts, and furthermore can be utilized to detect deterioration when conducted repeatedly over an elongated time period. Here, we present the methodological approach, the 3D models constructed as well as recommendations for future surveys. Five icebergs and one ice island were surveyed in April 2015 using various combinations of the aforementioned sensors. Three sonars were used to determine keel depths and underwater morphology: (1) a Simrad SX 90 sonar (20-30 kHz) and (2) an EM302 multibeam sonar (30 kHz) which were both mounted on the CCGS Amundsen as well as (3) a 30° tilted high frequency (250 kHz) Reson 8101 multibeam sonar mounted on the CCGS Amundsen's barge. The two low frequency sonars were capable of determining keel depths but with very poor 3D modelling capability, whereas the high frequency sonar proved to be the most adequate for modeling iceberg keels. Iceberg sails were surveyed with a barge mounted Optech Ilris LiDAR scanner and a nadir-angled Nikon DX7100, externally mounted to the Bo 105 helicopter. The LiDAR and photogrammetry methods allow for rapid collection of dense 3D data points. However, the main challenge for 3D sail and keel modelling remains to be the correction for iceberg translation and rotation. Iceberg models produced thus far highlight the need for further tests and the use of alternate or complementary methods: (1) deploying differential GPS arrays or motion sensors pre-survey to account for a target's 3D displacement; (2) increasing the range detection for iceberg keels by using high frequency sonar with narrower beams; (3) monitoring sound velocity in the water column around the iceberg; and (4) using different perspectives to obtain a complete 3D image of an iceberg's sail with the laser scanner.

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 Nunavut 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.

BAFFIN BAY NARWHAL SEA ICE SELECTION AND MOVEMENT

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Narwhals (Monodon monoceros) are an endemic Arctic whale species that are best known for their spiraled tusk. They are an important component of the eastern Canadian Inuit culture and subsistence hunt. With the changing environment and increased industrial developments, it is important to fully understand their habitat requirements in order to both predict how narwhals will adapt, as well as determine sound management practices to protect this species' future. Previous studies of north Baffin Bay narwhals have shown their consistent migration pattern, wintering grounds within dense sea ice in southern Baffin Bay, and summering grounds philopatry (tendency of an organism to return to an area). The goal of this study is to further understand the habitat usage of Baffin Bay narwhals. My objectives are to (a) determine narwhal preference of sea ice concentration, thickness, and floe size, and (b) compare migration routes and movement to previous studies. Since narwhals are often below the ocean surface and winter in remote areas in dense ice packs, satellite tags are used to learn the details of their migration patterns and habitat usage. A total of 19 narwhals were attached with Wildlife Computer SPLASH tags in Admiralty Inlet in 2009 and in Eclipse Sound in 2010 and 2011. Location data was collected via the ARGOS system. Sea ice data on ice concentration, thickness, and floe size were collected from the Canadian Ice Service weekly ice charts. Daily average positions, daily distance traveled, and rate of travel were calculated for each whale. Available habitats were calculated using a 95th percentile daily distance buffer around average daily positions. Used ice habitats versus available ice habitats were analysed in ArcGIS 10.2. Multivariate Analysis of Variance was used to test the difference in movement and habitat selection of the different sexes. Analysis of sea ice selection is ongoing with preliminary results presented at this poster session. The tagged whales' home ranges and migrations resembled previous studies with three notable exceptions. Six out of seven narwhals tagged in Admiralty Inlet traveled to Prince Regent Inlet in late September before their fall migration. Three of these narwhals traveled deep into the inlet with one continuing through and overwintering in Northern Foxe Basin. This is the first tagged Baffin Bay narwhal to not overwinter in southern Baffin Bay. The second finding is that one narwhal tagged in Eclipse Sound went to Disko Bay, Greenland in January 2010 during the winter narwhal hunt. This overlap has not been documented before. The third finding is an increase in summer range overlap between Admiralty Inlet and Eclipse Sound stocks. In 2011, three narwhals tagged in Eclipse Sound spent September throughout Admiralty Inlet, with two of these venturing into Prince Regent Inlet before their winter migration. Three different narwhals tagged in 2011 spent early October in the mouth of Admiralty Inlet before starting their migration. One whale, whose tag lasted over a year, was tagged in Eclipse Sound August 2010, spent July 2011 in Navy Board Inlet (mouth of Eclipse Sound), and spent August and September 2011 throughout Admiralty Inlet. Only a small fraction of the Baffin Bay population has been tracked with satellite tags. Narwhals in this study have demonstrated more flexibility in movement than previously recorded, which might indicate that they are more adaptable to change than previously thought.

MOORING-BASED MONITORING AT THE MOUTH OF BARROW CANYON AND HOPE VALLEY IN THE PACIFIC SECTOR OF THE ARCTIC OCEAN

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Changes of the Arctic Ocean environment are well known as one of the most remarkable evidences of global warming, attracting social and public attentions as well as scientists'. However, to illustrate on-going changes and predict future condition of the Arctic marine environment, we still do not have enough knowledge of Arctic sea ice and marine environment. In particular, lack of observation data in winter, e.g., under sea ice, still remains a key issue for precise understanding of seasonal cycle on oceanographic condition in the Arctic Ocean. Mooring-based observation is one of the most useful methods to collect year-long data in the Arctic Ocean. We have been conducting long-term monitoring using mooring system in the Pacific sector of the Arctic Ocean. Volume, heat, and freshwater fluxes through Barrow Canyon where is a major conduit of Pacific-origin water-masses into the Canada Basin have been observed since 2000. We show from an analysis of the mooring results that volume flux through Barrow Canyon was about 60 % of Bering Strait volume flux. Averaged heat flux ranges from 0.9 to 3.07 TW, which could melt 88,000 to 300,000 km2 of 1m thick ice in the Canada Basin, which likely contributed to sea ice retreat in the Pacific sector of the Arctic Ocean. In winter, we found inter-annual variability in salinity related to coastal polynya activity in the Chukchi Sea and strong upwelling events due to easterly winds. We also initiated year-long mooring observation in the Hope Valley of the southern Chukchi Sea since 2012. Interestingly, winter oceanographic conditions in the Hope Valley are greatly different between in 2012-2013 and in 2013-2014. We speculate that differences of sea ice freeze-up and coastal polynya activity in the southern Chukchi Sea cause significant difference of winter oceanographic condition. It suggests that recent sea ice reduction in the Pacific sector of the Arctic Ocean presumably influences marine environment not only in summer but also in winter.

LEARN INUINNAQTUN ON YOUTUBE!

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The TUMIVUT: tracks of our ancestors program focused on the transfer of traditional knowledge, skill sets and values among generations, based on Inuit knowledge and guiding principles. Language has an integral role in knowledge transmission and was a focus of TUMIVUT. Language is the means for communication between Elders and younger Inuit, it is the key to the meaning of place names, and holds the richness of detail and description that characterizes Inuit knowledge. Inuit in Ulukhaktok are passionate about their culture and recognize the need to learn their language but also acknowledge the barriers in doing so. An innovative youth-led language initiative is the "Learn Inuinnaqtun" YouTube videos. The videos provide instructions for writing and pronouncing commonly used Inuinnaqtun words and phrases. Please watch our videos by searching "learn Inuinnqtun" on YouTube. The project was funded by Health Canada's Climate Change Adaptation Program for Northern First Nations and Inuit Communities. TUMIVIT ingillgatjuta aulaniqaqtok ima eningneqhatni taimanga pitkuhungit inunniaqutaittu taimaningatniet. Elihimayutingangit inuniagiitiminet taman aulalinga ublumi atomayoq. Naonaitkutaoyok inuhiptingnun okaohiqput hivinmoniqangman eningnihanin Inuhanun atomanman. Maakoa nunapta atita tainingit angiyomik taigohogit titigakhogiit. Inuit ilihimatiakmatta, pitkohimiknik. Ulukhaktomiuit Inuniakgohikteklo okaohekteklu pimatiaqtangat ublumi. Huli malgok inuniagotek atokhugiit nutaklo pitkohekputlu. Hamna Inuhat aolapqaqtat okaohekuut elehaahimaqtut pisasuliuqtatigut Inuinnaqtun okaohiptigut. Nakoyomek aolayok. Titigaqnekun taigogutagutlu. Kongiakpaqluhi Elihaqlugulu Inuinnaqtun okaohekput. Youtubemi. Kinaoyat tuniyaoyut Health Canadamin.

ADAPTATION TO CLIMATE CHANGE IN NUNAVUT: WHERE ARE WE AT AND WHERE DO WE GO FROM HERE?

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For several decades the Arctic has been undergoing transformative change in climatic conditions, including temperature rise, changes to sea-ice, permafrost thaw, and weather unpredictability, among others, which are affecting both natural and human systems. Adaptation is essential in-light of this already occurring rapid climate change and expected future impacts. We know that adaptation is taking place in the Arctic, yet our understanding on who is adapting, to what stresses, where, and in what way is limited. These gaps in understanding are increasingly of interest to decision makers, practitioners, researchers, and communities in the North and more information on the northern adaptation landscape is needed in order to move forward. To address this knowledge gap we assess and characterize the current state of adaptation to climate change at the community, territorial, and federal level in the Canadian northern territory of Nunavut. To do so we systematically reviewed government-driven adaptation programs and policies at multiple levels to create an adaptation baseline for monitoring and evaluating change over time. The high number of discrete adaptation initiatives found (n=762) show that adaptation is on Nunavut's radar. However, a high percentage of adaptation is in the planned or recommended stage, suggesting that adaptation action may still be in the initial stages. Key trends highlight that extreme weather events and weather uncertainty, permafrost and vegetation change, and sea-ice change are the most common climate change impacts driving adaptation. When looking at jurisdictional patterning of adaptation type, the federal level emerges as a leader for funding and resources provision, territorial level shows high percentage of infrastructure and innovation adaptations, and capacity building initiatives are most common at the community level. Evaluation of adaptation is low across all jurisdictions. Based on publically available information, reported adaptation also varies greatly across communities, with communities that have adaptation plans, such as Arviat and Iqaluit, emerging as leaders.

SEASONAL HYDROLOGY AND PERMAFROST DISTURBANCE AS CONTROLS ON THE LABILITY OF DISSOLVED ORGANIC MATTER IN RUNOFF FROM HEADWATER HIGH ARCTIC CATCHMENTS

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The composition of DOM in High Arctic rivers is an important control on the fate of terrestrially derived carbon (C) that enters aquatic systems. The Arctic is one of the environments most strongly affected by climate warming, experiencing significant changes to permafrost, hydrology, and ecosystem dynamics, which all in turn affect watershed biogeochemical cycling. Arctic regions contain approximately 50% of the global belowground organic matter and the degradation of permafrost will accelerate its release. Furthermore, climate change will alter water sources and hydrological pathways and therefore the sources, fluxes and composition of DOM that enters arctic rivers. DOM is a complex mixture of soluble organic compounds from both terrestrial and aquatic sources. The abundance and composition of DOM in runoff is determined by the combination of the sources of DOM (plant litter, soil organic matter, and microbial biomass) and the processes that retain or alter DOM (e.g. sorption, photoxidation, microbial degradation) along the hydrological flowpath. In permafrost watersheds, seasonal changes in the sources of water contributing to runoff (i.e. snowmelt, rainfall, subsurface waters), seasonal development of the active layer, and permafrost disturbance can exert important controls on the potential sources of DOM, as well as on the nature and intensity of the processes that may retain or alter DOM in transit through the catchment. This study investigates the control of seasonal hydrology and permafrost disturbances (active layer detachments) on the composition of DOM in runoff from four headwater catchments that were subject to varying degrees of permafrost disturbance at the end of July 2007, at the Cape Bounty Arctic Watershed Observatory, Melville Island, NU. We use the fluorescence characteristics (including PARAFAC analysis of Emission Excitation Matrices (EEMs)) of DOM to investigate the variability in loads and lability of DOM in runoff from these catchments over the course of the 2012 melt season. In all cases the highest concentrations and mass flux of dissolved organic carbon (DOC) occur at the onset of

snowmelt, with significant (near equal) secondary peaks following late summer rainfall events. In all catchments, the DOM in runoff from late season rainfall events is fresher, has lower aromaticity, and is increasingly more microbial, and is therefore more labile, than it is during the peak snowmelt period. There was significant overlap in the fluorescence properties of DOM in all streams, regardless of disturbance, during the first five days of snowmelt runoff. However, watersheds subject to permafrost disturbance subsequently released the freshest and typically the most aromatic DOM later in the season. These results support that through increasing summer rainfall and permafrost disturbance, regional climate warming stands to enhance the release of more biologically labile DOM from arctic watersheds. These findings are consistent with other work from Cape Bounty and elsewhere that indicate permafrost degradation and climate warming is resulting in the addition of new fresh carbon to the active C pool in these environments, which may have the potential to act as a positive feedback on climate.

NEW EVIDENCE FOR PAST RELATIVE SEA-LEVEL OSCILLATIONS ON THE BANKS ISLAND SHELF

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The innermost part of the Banks Island Shelf constitutes a broad terrace that is traceable on existing bathymetric datasets for several hundred kilometres. It dips northwestward and extends up to approximately 40 km west of the present Banks Island coast. The terrace is widest at its southern and northern margins but narrows to a width of only ~15 to 20 km in its central area. At its seaward edge, the terrace is characterized by a break in slope that occurs at present depths of approximately 30 to 40 m. Examination of available 3.5 kHz subbottom profiler data reveals the presence of dipping reflectors immediately below the terrace surface. Southward dipping reflectors were also surveyed along the southernmost margin of the terrace, which indicates local variability in the geometry of the strata comprising the terrace. The terrace morphology and the available seismic stratigraphy suggest that the terrace constitutes a succession of progradational delta foresets, with the terrace surface constituting a former delta plain. As such, the terrace is inferred to approximate the relative sea-level that was contemporaneous with the final stages of progradation. The stratigraphic position of the newly identified terrace and its proximity to western Banks Island indicate that it is likely a product of deglacial sedimentation associated with the eastward withdrawal of the northwest Laurentide Ice Sheet from western Banks Island and related relative sea-level oscillations. As the terrace is a progradational deposit, and because it is not overlain by a subglacial diamicton or ice-proximal facies, it must postdate withdrawal of the northwest Laurentide Ice Sheet from the inner shelf. Similarly, the terrace is inferred to postdate the marine limit on western Banks Island, because some of the marine sediments marking marine limit are clearly ice-contact or glacier-fed deposits that imply synchronicity with ice sheet retreat from the adjacent shelf onto Banks Island. Therefore, the terrace is interpreted to record a postglacial relative sea-level lowstand. Preliminary correlations to the deglacial chronology and geomorphology from Banks Island, suggest that the terrace and its associated relative sea-level may date to approximately 13 cal ka BP.

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).

THE DISTRIBUTION OF DISSOLVED METHANE IN THE BEAUFORT SEA

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Concentrations of dissolved methane were determined in coastal and offshore waters of the Beaufort Sea in the Augusts and Septembers of 2014 and 2015. The vertical distributions of methane at many sampling stations were characterized by pronounced subsurface peaks that resembled those of chlorophyll a, suggesting an in situ biological methane production. High concentrations of methane (up to 30.78 nmol L-1) were observed in the bottom water of Barrow Canyon. This methane enrichment corresponded to a water mass with a temperature of ~ -1.6°C and a salinity of ~ 32.6 which are characteristic of the Pacific Winter Water. Methane concentrations were very low (< 1 nmol L-1) in the deep waters of the Canada Basin but were mostly supersaturated relative to the atmosphere in the surface waters of the study area.

HUDSON BAY AND BAFFIN BAY SEA-SURFACE TEMPERATURE CLIMATOLOGIES AND RECENT TRENDS

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New high-resolution sea surface temperature (SST) monthly climatologies and recent (1985-2013) trends are computed for Baffin Bay and Hudson Bay. Results show the imprint of major circulation features and mixing process on the spatial distribution of SST. Hudson Bay is characterized by a mean seasonal amplitude of about 8-10°C while the western side of Baffin Bay is characterized by the quasi absence of a seasonal cycle. A trend analysis showed that these two regions are not warming uniformly. The most important warming was detected in the central portion of Baffin Bay and appears to result from decreasing ice cover. Small to medium warming trends are observed in Hudson Bay with the higher values located in the central part of the Bay. Climate change scenarios have shown that the largest atmospheric warming is predicted to occur over the Arctic. Higher air temperatures will lead to higher SST, with direct or indirect effects on many species. For example, higher surface layer temperature can influence the marine food web by strengthening the vertical stratification, having a direct impact on primary production. It could also move the spatial and temporal window of optimum temperatures for fishes that are sensitive to surface temperature during part of their life cycle. Regions with small SST seasonal cycles and weak warming trends may become future cool water oases for some species. SST is also an important parameter concerning ocean acidification. Results shown here thus have important implications for ecosystem management of Canadian arctic waters.

INFLUENCE OF SEA-ICE REGIME ON DISTRIBUTION AND BIOMASS OF PELAGIC FISH IN BAFFIN BAY

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In Baffin Bay, the ice-free season is lengthening, while fishing activities are increasing. However, fish communities of the region are poorly documented, even though they are part of the intermediate trophic levels and thus play a central role in the ecosystem equilibrium. The objectives of this study are to (1) document the pelagic fish assemblage, abundance and biomass in Baffin Bay; and (2) compare the annual recruitment of the main species to the date of the ice break-up and to vernal sea-surface temperatures. These objectives will allow testing two hypothesis: (1) that Arctic cod (Boreogadus saida) is the dominant pelagic fish species in this region; and (2) that an earlier ice break-up and warmer sea-surface temperatures enhance the recruitment of this key species. To achieve these objectives, a scientific multi-frequency (38 and 120 kHz) echosounder hull-mounted aboard the research icebreaker CCGS Amundsen will be operated in Baffin Bay to detect fish aggregation. Post-analysis of the acoustic backscatter will allow estimating length, abundance and biomass of pelagic fish along the track of the ship. Ichthyoplankton nets, midwater and benthic trawls will be deployed to document the fish assemblage and to validate the acoustic echoes. This study will contribute to anticipate the impacts of the on-going changes on the Baffin Bay marine ecosystem in a context of climate change and fisheries development.

DYNAMIC VULNERABILITY, CLIMATE CHANGE, AND INUIT SUBSISTENCE HUNTING

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Global climate change is accelerating and expected to continue in the future. These changes are already affecting the environment on which Inuit lives and livelihoods are reliant. A number of studies have looked at current vulnerability and adaptation of Inuit to these environmental changes by documenting and describing how Inuit are sensitive to current changes and the adaptive strategies being employed. These assessments reduce vulnerability to a static indicator, which fails to capture the richness and complexity of the processes that create and maintain vulnerability over time. The need for dynamic vulnerability assessments in an Inuit context have been acknowledged, but have yet to be undertaken. The proposed research aims to develop a dynamic understanding of environmental risks and decision-making in the Inuit subsistence hunting sector. Objectives are to: (1) document land and ice use activities in an Inuit community; (2) identify and characterize environmental risks and changes that Inuit hunters are having to deal with and the adaptive strategies employed to deal with these risks; and (3) identify the processes and conditions which facilitate or constrain adaptation. Data collection will involve community-based monitoring, semi-structured interviews, participant observation and analysis of secondary sources. A monitoring team will be identified consisting of hunters who will be equipped with GPS units. They will take these units on every trip throughout the field season to record land use data, downloading trip data and answering a series of fixed questions on their activities bi-weekly. Questions will focus on decisions made, hazards faced, coping mechanisms used, unusual conditions encountered, challenges experienced, and changes in climatic and non-climatic factors observed. This data will be compared and cross-checked with data from instrumental datasets on sea-ice (satellite data) and weather conditions (met. station data). This will contribute a dynamic understanding of how environmental risks interact with human sensitivities and how decisions are made in real time from an Inuit knowledge perspective and from instrumental observations. This research is part of ArcticNet Project "Community Vulnerability, Adaptation and Resilience to Climate Change in the Arctic."

ECOSYSTEM METABOLISM IN HIGH ARCTIC PONDS IN THE LAKE HAZEN WATERSHED, QUTTINIRPAAQ NATIONAL PARK (NUNAVUT)

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Freshwater lakes, ponds and wetlands can be very productive systems on the Arctic landscape compared

to terrestrial tundra ecosystems and provide valuable resources to many organisms, including waterfowl, fish and humans. Rates of ecosystem productivity dictate how much energy flows through food webs, impacting the abundance of higher-level organisms (e.g., fish), as well as the net carbon balance, which determines whether a particular ecosystem is a source or sink of carbon. Climate change is predicted to result in warmer temperatures, increased precipitation and permafrost melting in the Arctic and is already altering northern ecosystems at unprecedented rates; however, it is not known how freshwater systems are responding to these changes. To predict how freshwater systems will respond to complex environmental changes, it is necessary to understand the key processes, such as primary production and ecosystem respiration, that are driving these systems. We sampled wetland ponds during the open water season, and lakes during both open water and ice-covered seasons on northern Ellesmere Island (81° N, Nunavut, Canada) for a suite of biogeochemical parameters, including concentrations of nutrients and dissolved gases (O2, CO2, CH4, N2O) as well as stable-isotope ratios of dissolved oxygen (δ18O-DO). Data were collected using both depth profiles and continuous deployment of automated sondes. We will present rates of primary production and ecosystem respiration, modeled from the concentration and stable isotope ratios of DO. Preliminary demonstrate that ecosystem metabolism in these ponds is high enough to result in significant deviations in the isotope ratio of DO (and dissolved inorganic carbon) from atmospheric equilibrium conditions. In other words, ecosystem rates of primary production and respiration are faster than gas exchange even in these small, shallow, well-mixed ponds. Most, but not all, sites appear to be net heterotrophic systems. Finally, most ponds were sources of both CO2 and CH4 to the atmosphere, but were surprisingly under-saturated with respect to N2O, demonstrating that they are sinks for atmospheric N2O. Rates of N2O consumption (denitrification) will also be modeled from concentration-time data.

OCCUPY NAHANNI: THE ARCTIC GRAYLING QUEST FOR A SOCIETY WITH LESS VERTICAL HIERARCHY AND FLATLY DISTRIBUTED SPAWNING HABITAT

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An improved understanding of the distribution and habitat requirements for mountain stream populations of Arctic Grayling (Thymallus arcticus) is necessary to assess their vulnerability to environmental stressors, establish thresholds for development activities, and evaluate population abundance trends over time. As developmental activities reach deeper into remote mountain environments in Canada's north, it is beneficial to use Arctic Grayling as an indicator for fresh water health and to establish life stage-specific baseline data, including critical spawning habitat. Occupancy-based fish survey methods were used in the Little Nahanni River watershed in 2014 and 2015 to quantify Arctic Grayling occupancy. Data on a suite of associated habitat variables were also collected. Pilot results from 2014 suggest that Arctic Grayling select spawning areas with water temperatures >10oC, elevation <1100 masl and an average slope of ≤0.02. Further analysis of occupancy data will allow us to refine our understanding of spawning habitat use. Other preliminary observations suggest a hierarchal distribution of Arctic Grayling throughout the watershed that depends on life stage (adult vs. juvenile) and correlated habitat characteristics; Arctic Grayling of larger size classes have the ability to reach higher altitude streams with increased water velocities. These habitats are presumably used for highly productive foraging. Further analysis of habitat variables will reveal critical habitat components that contribute to successful spawning and rearing of Arctic Grayling in mountain stream environments.

A SEMI-SUPERVISED APPROACH FOR ICE-WATER CLASSIFICATION USING DUAL-POLARIZATION SAR SATELLITE IMAGERY

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The daily interpretation of SAR sea ice imagery is very important for ship navigation and climate monitoring. Currently, the interpretation is still performed manually by ice analysts due to the complexity of data and the difficulty of creating fine-level ground truth. To overcome these problems, a semi-supervised approach for ice-water classification based on self-training is presented. The proposed algorithm integrates the spatial context model, region merging, and the self-training technique into a single framework. The backscatter intensity, texture, and edge strength features are incorporated in a CRF model using multi-modality Gaussian model as its unary classifier. Region merging is used to build a hierarchical data-adaptive structure to make the inference more efficient. Self-training is concatenated with region merging, so that the spatial location information of the original training samples can be used. Our algorithm has been tested on a large-scale RADARSAT-2 dual-polarization dataset over the Beaufort and Chukchi sea, and the classification results are significantly better than the supervised methods without self-training.

REGIONAL COMPARISON OF THG, MEHG, AND PAH CONCENTRATIONS IN DECAPODS IN THE BEAUFORT SEA FROM 2012-2014

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The primary objective of this comparative study was to gain perspective on select Arctic shrimp species living along the coast and in offshore waters in the Beaufort Sea. With attention to oceanographic and geographic influences, total mercury (THg), methyl mercury (MeHg), polycyclic aromatic hydrocarbon (PAH) concentrations, and food web structure amongst the decapod species was investigated. Eualus gaimardii belcheri (Egb), E. gaimardii gaimardii (Egg), Sclerocrangon boreas (Sb), and S. ferox (Sf) were the crustacean species chosen for analysis as part of this comparison. All samples were from the Arctic Net 2014 Amundsen expedition and the BREA 2012 and 2013 Frosty expeditions in the Beaufort Sea. Tail muscle samples were analyzed for δ13C and δ15N stable isotopes, while tail muscle, exoskeleton, egg, and whole body bulk samples were analyzed for THg and MeHg concentrations. Two whole body bulk samples were analyzed for PAHs although high levels of PAHs were not expected in these epi-benthic species. A preliminary investigation of the data revealed that mean δ15N values ranged from on average 14.7 +/- 0.4 in Egb to 17.2 +/- 0.4 ‰ in Sf. While little is known of the feeding ecology of these shrimp species, all are thought to feed on copepods and pelagic amphipods. Because of their relatively large size, however, it is not surprising that the δ15N is the highest in Sf. Higher tropic level feeding is also reflected in Sf THg concentrations, where levels as high as 3.01 ug g-1 (wet weight) were measured. We will continue this work by looking at bioaccumulation and biomagnification of mercury in these species as more results become available.

SPATIAL PATTERNS AND ENVIRONMENTAL CONTROLS OF CO2 AND TRACE GAS FLUX IN A HIGH ARCTIC WET SEDGE MEADOW ON MELVILLE ISLAND, NUNAVUT

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Until recently Arctic wetlands have been an important carbon sink, but with climate change affecting the Arctic's environment the fluxes of carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) may change. This could create positive feedback systems if the emissions of these greenhouse gases (GHGs) exceed their uptakes, ultimately accelerating the rate of climate change. In order to predict this, the environmental influences on the flux of CO2 and the trace gases CH4 and N2O need to be determined. Thus far studies focused on this research have high temporal resolution but typically have only a few replicates of spatial data, which has not allowed for the spatial patterns and variability within individual vegetated communities to be analysed. This can cause significant error when trying to predict the GHG flux from whole vegetated communities by upscaling the data. The aim of this study is to gather high spatial and temporal resolution data on CO2 and trace gas flux in a

high Arctic wet sedge meadow and examine correlations with measured abiotic factors. The goal of this is to achieve a greater understanding of the responses of Arctic wetlands to seasonal and multi-year environmental change. For example, the wet sedge in focus for this study receives its water from a perennial snowpack that has been shrinking over the last decade. The data for this study was collected at Cape Bounty on Melville Island, Nunavut from the beginning of July to mid August on a weekly basis. Both the ecosystem respiration (ER) and net ecosystem exchange (NEE) of CO2 as well as the emissions of CH4 and N2O were measured at 24 sites within a 200m by 200m study area. Abiotic parameters of the sites were measured with these samples, including soil temperature, soil moisture, and active layer depth. Preliminary results will be presented.

SHRUBIFICATION IMPACTS ON BERRY PRODUCTIVITY AT UMIUJAQ, NUNAVIK

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In the context of current global warming, the tundra vegetation near treeline is changing. In places, the erect shrub layer has increased markedly transforming open habitats into shrublands. Such changes alter the composition, structure and dynamic of plant communities. Competition for light and nutrients can become stronger and reduce the growth and reproduction of less competitive plant species such as berry-producing shrubs. A recent study demonstrated the significant increase in shrub cover (> 20%) between 1994 and 2010 near the community of Umiujaq, Nunavik. Residents of the community are also noticing changes in vegetation and these sometimes affect their berry picking habits. A decrease in productivity of berries could have significant impacts on northern people for whom berry picking is an important activity. It could also impact animal species, such as black bear (Ursus americanus), that feed on them. We predict that erect shrub cover and height will reduce berry productivity. We quantified the abundance of the three main berry producing species present near this sub-arctic community: Vaccinium vitis-idaea L., Vaccinium uliginosum L. and Empetrum nigrum L. The cover and productivity of berry shrubs were assessed at 402 points throughout the landscape near Umiujaq. At each point, four quadrats (70cm x 70cm) were sampled within 4 m to contrast four conditions: open areas, under erect shrub cover and at the margin of shrub patches (inside and outside). Erect shrub species cover density and height, soil types, slope and aspect were also assessed at each point. Overall, berry plant species had contrasting responses. The cover of V. vitis-idea was comparable between open and closed habitats whereas V. uliginosum cover was markedly reduced under erect shrub cover. However, E. nigrum cover was greater under erect shrubs. We also highlighted a marked reduction in fruit production (relative to cover) under erect shrubs for V. uliginosum L. and E. nigrum whereas V. vitis-idea L. only showed a small decrease. On the other hand, we observed a sharp decrease in fruit numbers and plant cover for the three berry species with increasing erect shrub height whereas no relation was noticed with shrub cover density. Surprisingly our results demonstrated that in contrast to V. uliginosum and E. nigrum, cranberry (V. vitis-idea) performed well in closed habitats and could be promoted by shrub cover increase, as long as there was no marked increase in height. These findings underline the heterogenous response of berry plants to current vegetation structural changes and will contribute to modelling efforts predicting shrub cover and berry availability for this community.

THE LOCATION AND MAGNITUDE OF DEEP SNOW DRIFTS ACROSS PATCHY TUNDRA, FOREST AND SHRUB LANDSCAPE

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In high-latitude regions, where snow is the primary type of precipitation and there is a lack of vegetation, blowing snow is a key player in the water budget as it controls sublimation rates over the winter and is the dominant process controlling end of winter snow cover distribution. At a watershed scale, deep snow drifts contribute a large percentage of total snow retained on the arctic tundra for the small percentage of area it occupies. With drifts storing a great amount of snow per area throughout the winter and spring, the impacts on

streamflow and ground temperature are significant and their magnitudes are hard to measure. The purpose of this study is to use a combination of field observations of snow accumulation using traditional snow surveys, cosmic ray snow sensors and other instruments to calculate the percentage of total snow water equivalent stored in drifts on lee slopes, along stream valleys and lake edges and in shrub and tree patches. Knowledge of shrub properties, patch size, slope and aspect are critical in order to understand the quantity of end of winter snow water equivalent that can accumulate in these drifts and the impact on the timing and volume of streamflow.

THE BURDEN OF INFECTIOUS PATHOGENS IN RETAIL AND COUNTRY MEATS IN IQALUIT, NUNAVUT

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BACKGROUND: The highest incidence of self-reported enteric illness in the global literature is in the Canadian North, compared to studies in other regions using the same study design and case definition. Risk factors for enteric illness in the North that might differ from those in southern communities include differences in retail and country food consumption. The specific foodborne pathogens causing enteric illness and their source attribution have not been thoroughly studied in some of these Northern communities. GOALS: To close this gap in knowledge, the proposed research aims to better understand the pathogens present in retail and country meat in Iqaluit, Nunavut. The objectives are to estimate the prevalence, identify risk factors, and examine molecular source attribution for various foodborne pathogens. METHODS: An EcoHealth approach will be used to guide the research process, and will include principles of community participation, transdisciplinarity, systems thinking, social equity, sustainability, and knowledge-to-action. Food samples will be obtained from retail stores and country foods sourced from local hunters and trappers over a 2-year period. Sample collection from retail meats will be adapted from the FoodNet Canada surveillance method used in sentinel communities in Southern Canada. Samples will be tested for foodborne pathogens such as Giardia, Cryptosporidium, Salmonella, Campylobacter, C. difficile, and E. coli (generic). On-site presence/absence testing will be followed by microbial subtyping analyses of positive samples for microbial source attribution. Prevalence of pathogens will be estimated from these data, and multivariable logistic regression will be used to identify potential risk factors for positive test results. OUTCOMES: This project contributes to a larger, ArcticNet-funded study which is working closely with Northern organizations to create a participatory, community-based surveillance system to understand, respond to, and reduce the burden of foodborne, waterborne, and zoonotic enteric pathogens in Northern locales. This study will use this generated knowledge to create tangible and sustainable interventions, while developing the community's capacity to understand and identify potential factors increasing the risk of foodborne disease. Results from this study are intended to inform public health messaging in Nunavut, as well as other Indigenous communities in Northern Canada.

ASSESSING GROWTH AND PHYTOCHEMISTRY OF RHODIOLA ROSEA IN COASTAL LABRADOR FOR SMALL-SCALE ENTERPRISE

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Rhodiola (Rhodiola rosea L.) (Crassulaceae) is an amphi-Atlantic plant with considerable value in both traditional pharmacopeias as well as the commercial natural products industry. Despite its broad ecological amplitude, little is known about the effects of environmental conditions or habitat upon its phenotypic plasticity and phytochemistry. In particular, while only a few studies have investigated the biology of North American populations of rhodiola, none have examined the abundant coastal populations native to Labrador, an

area that is being significantly affected by climate change. Interviews with Nunatsiavut Inuit elders in Labrador have documented traditional knowledge and use of rhodiola, locally known as "tulligunak", as well as enthusiasm for the development of a community-based enterprise to market value-added, locally cultivated rhodiola as a natural health product. However, the geographical variability in growth and phytochemistry of local rhodiola populations must first be addressed, in order to inform cultivar selection and cultivation conditions. We investigated the effects of latitude, substrate, and sex (female vs male) on the growth and phytochemistry of coastal Labrador populations of rhodiola. Wild plant specimens were sampled from northern (Nain) and southern (Rigolet) populations, and from sand, organic, or rock substrates to compare growth, morphology, and phytochemistry. Latitude and substrate were found to have a significant effect upon overall growth and biomass, while the differences between males and females were not significant. Greatest biomass was found in specimens gathered from southern populations and those growing in sandy and organic substrates. Substrate had a significant effect on salidroside, rosavin, and tyrosol, with less tyrosol and salidroside in rocky substrates, and less rosavin and rosarin in sandy soil. Sex did not have a significant effect upon phytochemistry. These results will inform development of a community-based enterprise with tangible and intangible benefits for a remote aboriginal community. Importantly, by cultivating local strains of rhodiola for commercialization, this will help mitigate pressure on wild populations of rhodiola due to commercial harvest activities and ensure uniformity of the phytochemcial components.

PATTERNS OF HOST GENETIC STRUCTURE IN RELATION TO VIRUS VARIANT IN A RECENT FOX RABIES EPIZOOTIC OF THE EASTERN SUBARCTIC

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We present the rationale and background results for a sub-component of a new ArcticNet-funded project regarding wildlife diseases and public health in the Eastern Subarctic. Specifically, we aimed to analyze the origin and spread of a recent fox rabies epizootic in Labrador. We report the population genetic structure of red and Arctic foxes across various regions of northern Canada, assessed with mitochondrial control region sequences and microsatellite profiles, and compare it with rabies virus variant distribution, to better understand the movement of the vector and virus across the landscape. Patterns of mitochondrial control region genetic diversity and structure for both red and Arctic foxes indicate lower haplotypic diversity, higher nucleotide diversity, and greater population structure for red foxes than Arctic foxes, reflecting the different pattern and timescale of evolutionary history of the two species. Very little genetic structure exists in Labrador with respect to either host haplotype or virus variant. Across Canada, genetic structure among red foxes exists on a broad scale with respect to host haplotype but little variation exists with respect to viral type. By way of contrast, greater viral variant structure occurs among Arctic foxes, where there is no host genetic structure. In the case of rarer viral variants in Nunavut and Northwest Territories, the geographical distribution of the host haplotype correlates with that of the viral variant. Long distance movements of Arctic foxes would therefore seem to facilitate patterns of movement of virus variants. Microsatellite analysis provides finer scale resolution of host/virus distribution patterns and geographical barriers to gene flow; results in progress will be discussed. Expansion of this study will involve extending the geographical range to include greater coverage of Nunavik accompanied by more detailed genetic analyses. This work provides baseline data on fox population structures and correlation with virus variants that can form the basis for modeling studies for the prediction of future fox rabies outbreaks. In line with the goals of the project for which this study is a sub-component, it provide information on zoonotic diseases in the North that will help to determine the role

of wildlife in human exposure to zoonoses and develop strategies for managing diseases affecting the health of both wildlife and people in the Arctic.

A TRANSDISCIPLINARY APPROACH TO RESEARCH ON ARCTIC MARINE WILDLIFE: LESSONS FROM THREE CASE STUDIES IN NUNAVUT, CANADA

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The effects of environmental pressures, including climate change, contaminants, and industrial development, are expected to continue to increase in the Arctic. Marine species have been negatively affected by habitat loss due to declines in sea ice extent and thickness. Developing strategies to manage these issues requires current and reliable knowledge taking into account potential impacts on all aspects of the Arctic environment, including human communities that are affected by widespread change in environmental conditions and wildlife resources. Understanding these pressures involves the expertise and perspectives of natural and social scientists, as well as Inuit community experts. Different understandings of phenomena from the perspective of Inuit Knowledge and science have created challenges for decision making and solutions development. However, the requirement to consider multiple perspectives in research and management is underscored by the establishment of institutions designed to promote and protect Inuit interests in northern research and wildlife co-management. There is a recognized need for the articulation of research approaches and methods that meaningfully engage Inuit communities and scientists together in the co-production of knowledge about Arctic wildlife. However, research approaches defined by traditional disciplinary boundaries are often challenged in generating knowledge that fully represents the complexity of pressures impacting Arctic environments. Transdisciplinarity emerged in the 1970s, out of a distinct recognition of the need to involve academic and societal stakeholders in research. Transdisciplinary research approaches are specifically oriented towards addressing problems of significance to society, incorporating societal actors who are directly affected by the research problems, and including multiple perspectives in the definition and analysis of problems. With an emphasis on both process and results, transdisciplinarity offers promising opportunities to positively restructure relationships between scientists and Indigenous community members and the processes through which their knowledge systems are brought together in research and decision making. We use a transdisciplinary approach to engage scientists and Inuit community members in research about Arctic marine wildlife. This project is examining three case studies involving interactions between scientists and Inuit community members in research on two marine mammals and one Arctic marine fish species. Through multiple methods it will examine factors influencing knowledge co-production among these individuals in relation to ringed seals (Pusa hispida), polar bears (Ursus maritimus), and Greenland halibut (Reinhardtius hippoglossoides) through activities in Iqaluit, Kugaaruk and Pangnirtung, NU. The project will explore the utility and effectiveness of a transdisciplinary approach to knowledge co-production as a means towards more effective research in Arctic Indigenous communities. Preliminary results from these case studies suggest that transdisciplinary approaches have the potential to guide the development of meaningful research that produces better, more robust knowledge about wildlife.

ANTHROPOGENIC NOISE IN THE ARCTIC MARINE SOUNDSCAPE: EFFECTS ON MARINE MAMMALS 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.

IDENTIFYING INUIT YOUTH HEALTH PRIORITIES: RESULTS FROM NUNAVIK YOUTH CONSULTATION ACTIVITIES WITH PARTICIPANTS TO A REGIONAL YOUTH LEADERSHIP CONFERENCE

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Significant advances have been made in our understanding of Inuit health and well-being in all Inuit regions of the Canadian North in the last decade. The Qanuippitaa? (Nunavik) and Qanuippitali? (Inuvialuit Settlement Region, Nunavut, Nunatsiavut) Inuit Health Surveys provide critical insight into Inuit health and the things that affect it. However, youth were not included in those surveys and represent a significant percentage of the population in all regions. As a result, the lack of data on Inuit youth health represents an important gap in our understanding of Inuit health today. Inuit youth have particular health issues and needs, and Inuit health officials and communities have identified the importance of involving youth in the future of health research in the Arctic. Participants to the Inuit Health Survey planning workshop in Kuujjuaq in 2012 identified that "youth, for many reasons, need to be part of this whole process. Their health needs - both as identified from their perspective as well as from a perspective of experience - need to be fleshed out and considered in health survey/cohort planning." (Report from the Inuit Health in Transition Study: The Circumpolar Cohort Nunavik Planning Workshop). Participants also identified the focus on youth as a timely priority to address, as they comprise a large proportion of the Inuit population, and because of their important role in the future of their regions. The next version of the Nunavik Inuit Health Survey, Qanuilirpitaa, is set to take place in 2017, and will include a youth cohort. In August 2015, the Qanuilirpitaa planning committee worked with the Nasivvik Centre, and Inuusuktut Quajisarnilirijut (a youth driven initiative created through Nasivvik to produce health research for Inuit youth by Inuit youth), to consult Nunavik youth on their health priorities and how to engage them in this future research. The Inuusuktut Qaujisarnilirijut team engaged youth participants in consultation activities throughout the Qanaq Youth Conference (Nunavik's biennial youth leadership conference) in Inukjuak, Nunavik. The objective of the consultation study was to gather youth perspectives on health priorities and health research to contribute to the planning of the 2017 youth component of Qanuilirpitaa. During the 5 day conference, youth between the ages of 18 and 35 were consulted through an interactive workshop, a short survey and focus group discussions. Preliminary results from the survey and focus groups speak to where youth currently get, and would like to get health information, health issues of priority for Nunavik youth, and how youth would like to be engaged in research in their region. Results from the consultation will be used to assist in the development of survey content, methods and areas of focus for

Qanuilirpitaa's youth cohort study and will inform future health research with Inuit youth populations.

EPIBENTHIC SPECIES AND HABITATS IN INNER FROBISHER BAY, BAFFIN ISLAND: PRELIMINARY RESULTS

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In August of 2015, the first leg of a larger mapping project in Frobisher Bay, Nunavut began sampling subtidal benthic habitats using drift video and grab sampling aboard the Nunavut fisheries research vessel M/V Nuliajuk. Sites were chosen in areas with existing multibeam sonar coverage, as well as sites from previous studies for long-term ecological (LTES) monitoring (Wacasey et al., 1979; Wacasey et al., 1980; Cusson et al., 2007). Sites were selected with the following criteria: depth < 200m (limit of camera system), backscatter values ranging from high to low, possible geomorphic features, and widespread geographic distribution around the Bay. Due to challenging ice conditions, sampling was restricted to Inner Frobisher Bay. Of the 22 sites sampled in summer of 2015 (including 8 LTES), 7 were sampled using both video and grab while, 15 were grab sampled only. Each site consisted of 2- ten minute camera drifts resulting in a total of 14 drifts completed ranging in depths from 30-170m. Here we report the preliminary abundance and distribution results for the 7 video sites. Observed bottom-type consisted mainly of a fine grain matrix with scattered gravel and boulders. Most sites were predominately flat terrain, with the exception of the offshore extension of a moraine exposed on land (Site 4a). Fauna were densely distributed within sites. Crinoids were the dominant species at 4 sites, an unknown tunicate species, possibly Cione was dominant at 2 sites and, sponges were dominant at 1 site. Also present were 2 types of soft coral (Anthomastus sp., nephtheid soft corals.), anemones, whelks, brittle stars, seastars, pycnogonids, shrimp, sea cucumbers, sponges (Polymastia sp. and stalked sponges). These preliminary results show Inner Frobisher Bay has a diverse assemblage of species and habitats.

EFFECT OF SAMPLING DEPTH ON AIR-SEA CO2 FLUX ESTIMATES IN RIVER-STRATIFIED ARCTIC COASTAL WATERS

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In summer-time Arctic coastal waters that are strongly influenced by river run-off, extreme stratification severely limits wind mixing, making it difficult to effectively sample the surface 'mixed layer', which can be as shallow as 1 m, from a ship. During two expeditions in southwestern Hudson Bay, off the Nelson, Hayes, and Churchill River estuaries, we confirmed that sampling depth has a strong impact on estimates of 'surface' pCO2 and calculated air-sea CO2 fluxes. We determined pCO2 in samples collected from 5 m, using a typical underway system on the ship's seawater supply; from the 'surface' rosette bottle, which was generally between 1 and 3 m; and using a niskin bottle deployed at 1 m and just below the surface from a small boat away from the ship. Our samples confirmed that the error in pCO2 derived from typical ship-board versus small-boat sampling at a single station could be nearly 90 μatm, leading to errors in the calculated air-sea CO2 flux of more than 0.1 mmol/(m2s). Attempting to extrapolate such fluxes over the 6,000,000 km2 area of the Arctic shelves would generate an error approaching a gigamol CO2/s. Averaging the station data over a cruise still resulted in an error of nearly 50% in the total flux estimate. Our results have implications not only for the design and execution of expedition-based sampling, but also for placement of in-situ sensors. Particularly in polar waters, sensors are usually deployed on moorings, well below the surface, to avoid damage and destruction from drifting ice. However, to obtain accurate information on air-sea fluxes in these areas, it is necessary to deploy sensors on ice-capable buoys that can position the sensors in true 'surface' waters.

A STATIONARY ICE-PENETRATING RADAR SYSTEM FOR THE STUDY OF TERRESTRIAL AND FLOATING GLACIER ICE

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The use of radar techniques in studies of the cryosphere is widespread. Since the realization in the late 1950s that ice is nearly transparent to radar waves, scientists and engineers have used radio-echo sounding techniques on glaciers and ice-sheets to map ice thickness and bed topography. In the last two to three decades, technological advances in electronics and computing power helped to bring about better radar instruments as well as finer analysis techniques. As a result, englacial and subglacial properties could also in some circumstance be studied with the use of ice-penetrating radars (IPRs). In most of these studies, the IPRs are operated as roving systems producing spatial information that is considered time-invariant for the duration of the survey. By contrast, we want to focus on temporal changes that may occur at the bed or within the ice and that can potentially be detected by a radar capable of autonomous operation over weeks or months and so, at a given location. On the instrumentation side, the system includes typical components found on impulse radar systems, some of them having been modified to prepare it for medium to long term deployment: a high voltage pulser with remote fiber-optics drive control and low mean power drain; resistively-loaded dipole antennas; a radar receiving unit equipped with an embedded controller and receiving electronics; on-board software to manage the radar acquisition and optimize power usage; photo-voltaic panels and controller; and a switch timer. The first implementation of the instrument was deployed for two 6-week periods, a year apart in 2014 and 2015 in the Yukon's Saint-Elias Mountains, Canada. The first objective was to assess whether the system could run autonomously without major fault. Second, using a major margin lake drainage event known to happen yearly in the radar vicinity, assess whether the system could detect englacial and/or subglacial signatures related to the event. Following these experiments, the latest results from these deployments are presented. A third deployment for the monitoring of an ice-island in the arctic is planned for autumn 2015. This latest implementation of the stationary IPR includes a low power satellite communication modem that was added to the system with the appropriate software changes to handle high level message protocol, data compression, and transmission, as well as an on-board backup power module. Adequacy of stationary radar technology for englacial/subglacial land-based glacier monitoring, indirect detection of basal meltwater as indicative of subglacial geothermal activity, and ice-island decay monitoring will be discussed.

THE TRANSFER OF INORGANIC CARBON THROUGH THE WATER COLUMN IN THE CANADIAN ARCTIC OCEAN.

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Increasing carbon dioxide levels in the atmosphere are having drastic effects on the global oceans. The Arctic Ocean is particularly susceptible to change as warming, sea-ice loss and a weak buffering capacity all influence this complicated semi-enclosed sea. In order to investigate the inorganic carbon system in the Canadian Arctic, water samples were collected in the Canadian Arctic Archipelago and the Beaufort Sea during three summer seasons in 2013, 2014 and 2015 and were analyzed for dissolved inorganic carbon (DIC), total alkalinity (TA), DI13C and 18O isotopes. Carbon isotopes are used to investigate the role of biological production on the uptake and transfer of inorganic carbon to depth. A preferential uptake of the lighter 12C relative to the heavier 13C isotope during biological production leads to a fractionation of the 13C/12C isotopes in both the organic matter and the water column. This results in a depletion of DI12C in the high productivity surface waters and an enrichment of DI12C at depth. This biological interaction and other processes including freshwater input, brine formation, water mass mixing and gas exchange will be investigated over the entire water column. Differences in the carbon system across the Archipelago are assessed using depth profiles of 13C and related carbon system parameters.

TIME TRENDS OF MERCURY IN ARCTIC CHAR IN EAST AND WEST LAKE, CAPE BOUNTY ARCTIC WATERSHED OBSERVATORY, MELVILLE ISLAND, NUNAVUT

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The Cape Bounty Arctic Watershed Observatory (CBAWO) utilizes two adjacent, geologically similar watersheds, West and East, which are currently undergoing climate-driven changes. Climate over the period 2007-2012 was unusually warm during summer months and resulted in changing hydrology and permafrost degradation across the area. In addition, the West catchment experienced numerous large active layer detachments during the 2007-8 period while the East catchment has experienced relatively minor disturbances. These alterations to runoff patterns, erosion and permafrost degradation may also drive changes in the biogeochemical cycling of mercury (Hg). We are investigating whether these changes are also seen in mercury bioaccumulation in arctic char and the food webs of West and East Lakes. We hypothesize that increased Hg inputs into West Lake will result in increasing concentrations of Hg in char. To investigate this landlocked Arctic char (Salvelinus alpinus) have been collected for analysis of total Hg (THg) annually from 2008 to 2015. THg was determined in all fish samples at Environment Canada labs in Burlington (ON). Carbon (C) and nitrogen (N) stable isotope analysis showed that char have significantly more depleted δ13C in East vs West Lake (mean ± SD; -26.86±1.06 ‰ (N=73) vs -24.98±1.44‰ (N=100)) indicative of greater terrestrial carbon inputs to West Lake. Also δ15N is significantly lower in West Lake char (10.06±0.81 ‰ vs 10.99±0.70‰) suggesting differences in food sources. The combined results from 2008 to 2015 collections show that the West Lake adult char have significantly higher Hg concentrations (0.159 ± 0.08 μg/g) compared to East Lake (0.097 ± 0.04 μg/g) and this difference is even greater if results are adjusted for δ15N using analysis of covariance. Condition factors (g*100/cm3) for char in West Lake have declined since 2008 and over the period 2011-2015 have been significantly lower than those in East Lake (0.60±0.10 versus 0.68±0.09) indicating they are thinner than fish of the same length in East Lake. This may be due to difficulty feeding in West Lake's turbid waters, particularly after 2008. Hg concentrations have declined in East Lake char over the period 2008 to 2015 (averaging -4.6%/yr) but not in West Lake (<1 %). Results for East Lake are consistent with observations of Hg in landlocked char in 4 other lakes of similar size on Cornwallis Island, where declines of -5.5 to -19%/yr have been observed since 2005. None of these lakes have significant permafrost disturbance. The higher concentrations and lack of a decline of Hg in West Lake char are consistent with higher inputs of THg to West Lake resulting from extensive permafrost disturbance in the West watershed.

NORTHERN SEAS: INVENTORYING HISTORIC LOGS FOR ARCTIC CLIMATE AND ECOSYSTEM DATA

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The Northern Seas project is designed to document the nature and extent of past changes in multiple linked components of the Arctic System. It incorporates data rescue and the standardization and integration of multiple and unique datasets over critical time periods, model-based assimilation of observations, use of proxy records, diagnostic analysis of synthesized observations, paleoreconstructions, and explanation of human-environment interactions. In this paper we discuss data rescue from historical written sources including ship's logs and commercial whaling and sealing records dating to the past 400 years. The emphasis is on records pertaining to the Beaufort Sea, the waters Canadian Arctic Archipelago, Hudson and Baffin Bays, and the Labrador Sea. We present examples of the types of data recoverable from these records and ways in which it can be integrated existing synthesis and summaries of paleoenvironment, regional climate, and sea ice evolution, and used to inform modeling exercises and scenario building.

RESULTS OF THE NORTHERN CONTAMINANTS PROGRAM PHASE 9 INTERLABORATORY STUDY

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Interlaboratory studies support participants to achieve high quality analysis of environmental contaminants and help to improve understanding of the challenges faced in these complex analyses. The Northern Contaminants Program (NCP) Quality Assurance/ Quality Control (QA/QC) Program conducted the Phase 9 interlaboratory study to assess the performance of laboratories providing data to NCP and to the Arctic Monitoring and Assessment Programme (AMAP). This growing annual interlaboratory study examines contaminants of concern such as trace metals, persistent organic pollutants (POPs) and emerging contaminants. With 52 laboratories, participation in the NCP III Phase 9 Interlaboratory Study (NCP III-9 ILS) has more than doubled since Phase 1, in which 19 laboratories participated. Participants in the NCP III-9 ILS were provided with up to seven natural matrix materials and 14 injection-ready standards for analysis of organic and inorganic environmental contaminants. Data quality assessments were conducted for polybrominated diphenyl ethers (PBDEs), brominated/chlorinated flame retardants (BFRs/CFRs), dioxins/furans/dioxin-like polychlorinated biphenyls (PCDDs/PCDFs/DLPCBs), organochlorine pesticides (OCs), polychlorinated biphenyls (PCBs), perfluoroalkyl acids (PFAAs), polychlorinated naphthalenes (PCNs), chlorinated paraffins (CPs), organophosphorous flame retardants (OPFRs), trace metals, total mercury, and methyl mercury. Results were evaluated using "Robust Statistics: a method of coping with outliers." The increasing number of participating laboratories in this study is important for expanding the database and allows for better data comparability. This is critical for emerging contaminants for which there are limited natural matrix reference materials available. An overview of the NCP III-9 ILS study design and results will be discussed.

AN ASSESSMENT OF FIELD PHOTOGRAPHIC METHODS FOR DERIVING PERCENT VEGETATION COVER

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Percent vegetation cover (PVC), defined as the percentage of the ground surface covered by green vegetation, is an important biophysical variable and a key indicator of ecosystem health and productivity. Among the conventional field techniques for measuring PVC, the point-frame method is the most widely adopted for arctic studies. However, this method is time-consuming and laborious. Although field digital images have proven to be an efficient technique to derive PVC, few arctic studies have compared this method to the point-frame method for estimating PVC. The objectives of this study are: 1) to compare PVC derived from field digital images with PVC measured by the point-frame method; and 2) to build statistical relationships between PVC and various vegetation Indices (VIs) to 'scale-up' PVC to satellite scales. In July-August 2015, a field campaign was conducted in the Apex River Watershed, Iqaluit, Nunavut, Canada (63.74° N, 68.49° W). The point-frame method was employed to obtain the PVC measurements of 56 plots. Normal colour and near-infrared false colour digital images of each plot were collected by a normal camera and a NDVI (Normalized Difference Vegetation Index) camera (TetraCam Inc.). Object-Based Image Analysis (OBIA) will be used to classify these data and derive PVC. Spectral indices, i.e., NDVI and SAVI (Soil-Adjusted Vegetation Index) will be derived from the false colour data. Linear regression will be examined to determine the strength of the relationships between the two methods for estimating PVC. The PVC estimates of the two methods are expected to have a strong correlation for single-layer canopies and a weak correlation for multi-layer canopies since the PVC of multi-layer canopies estimated by the point-frame method often exceeds 100%. To improve the correlation, canopy height, will be included to adjust the PVCimage - PVCpoint-frame regression model. To scale-up field measured PVC to satellite scales, linear regression

models will also be built between PVC and VIs. Although NDVI has demonstrated strong relationships with PVC in many studies, it is not clear how different cover types endemic to this environment may be best modeled using other indices. For low vegetation cover, SAVI, designed to correct for the influence of soil brightness, is expected to be more suited to modelling PVC. Hence, it may be more suitable to partition arctic landscapes into community types prior to modelling biophysical variables using different spectral indices.

MACRO-SCALE SEA ICE SURFACE ROUGHNESS AND MELT POND FRACTION IN THE CANADIAN ARCTIC ARCHIPELAGO

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Understanding the mechanisms of sea ice melt pond formation and evolution on summer first-year sea ice (FYI) and multiyear sea ice (MYI) types is important for understanding ocean-sea ice-atmosphere exchanges and parameterizing sea ice models. High resolution optical imagery provides valuable summer melt pond fraction information for different sea ice types; for example, by using supervised classification algorithms. We pose the following exploratory research questions: (1) What is the relationship between winter sea ice surface roughness and summer melt pond fraction? (2) How does this relationship differ between FYI and MYI? To address these questions we use co-located summer high resolution GeoEye-1 multispectral optical imagery and winter airborne laser altimeter roughness data from an area composed entirely of landfast sea ice in the Canadian Arctic Archipelago in 2015. The optical imagery is composed of co-located panchromatic and multispectral image pairs with spatial resolutions of 0.5m and 2.0m respectively. In order to combine the high spatial and spectral resolutions of the panchromatic and multispectral images, a Gram-Schmidt pan-sharpening algorithm is used. The pan-sharpened images are classified using a supervised classification algorithm to extract the following classes: melt pond, sea ice and open water. After this process, melt pond fraction statistics of summer FYI and MYI are extracted and compared to co-located macro-scale surface roughness statistics of winter FYI and MYI.

MICROBIAL HYDROCARBON BIODEGRADATION IN PERMANENTLY COLD ARCTIC MARINE SEDIMENT

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Some of the released hydrocarbons from the Deepwater Horizon oil spill were discovered trapped in a deep cold-water plume or deposited onto cold marine sediments. Low temperature bioremediation documented in these environments is instructive for considering Canada's Arctic marine environment, where industrial activity is accelerating. Uncertainty about the fate of hydrocarbons in cold marine systems demands that a better understanding of low temperature hydrocarbon biodegradation is needed. Permanently cold marine sediment from the Canadian Arctic, at Scott Inlet (N71° W70°; in the vicinity of natural seabed hydrocarbon seepage), was incubated under aerobic and anaerobic (sulfate reducing) conditions to examine biogeochemical potential for hydrocarbon removal. Diesel was used as a simple hydrocarbon source while organic acids (OA) amendment was used as a control for stimulating microbial activity. Sediment incubated at 4°C with diesel under aerobic conditions showed increased carbon dioxide production in microcosms with higher concentrations of diesel (0.1, 0.3, and 0.9% v/v) over 150 days. Under anaerobic conditions, no evidence of hydrocarbon degradation was seen at 4°C over this time frame, consistent with hydrocarbon biodegradation being much slower in the absence of oxygen. Incubations amended with OA instead of diesel showed rapid activity under both oxic and anoxic conditions. This suggests that microbial communities in permanently cold marine sediment close to known hydrocarbon seeps are able to degrade simple hydrocarbons aerobically, and potentially anaerobically under sulfate-reducing conditions at cold in situ temperature.

TRACKING AND MAPPING ARCTIC ALIENS: BIOGEOGRAPHICAL ANALYSIS OF BENTHIC INVERTEBRATES IN COASTAL WATERS OF BAFFIN ISLAND, NUNAVUT.

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Due to rising temperatures and accompanying shifts in chemistry, stratification, and circulation, changes in the Arctic Ocean are outpacing research. As water temperature increases, the northern ranges of many species are expanding pole-ward, allowing competition with, and potential exclusion of, native Arctic species. Increased vessel traffic, made possible by reduced ice cover and made necessary by growing northern communities, further facilitates the introduction of non-indigenous species (NIS). The full impact of present and future invasions on complex Arctic food webs is unknown. Benthic video and faunal samples were collected in subtidal habitats between 10 and 200 m depth near Qikiqtarjuaq, NU in August of 2013, 2014 and 2015. The Qikiqtarjuaq dataset includes 360 ponar grab samples and 168 eight-minute seafloor videos within a 770 km2 area. Sampling was conducted within the same depth range (10-200m) in Frobisher Bay in August of 2015. The Frobisher Bay dataset includes 22 Van Veen grab samples and 14 ten-minute seafloor videos within a 1078 km2 area. Further sampling will be conducted via ROV in the inner Frobisher Bay in October, 2015. All fauna will be identified to the lowest taxon possible to generate a full catalogue of benthic species present in the study areas. All identified species will be classified as native, NIS or cryptogenic through comparative analysis with historical records, recent publications, and global marine species databases (Canadian Aquatic Invasive Species Network, Canadian Register of Marine Species, World Register of Marine Species, Encyclopedia of Life, NISbase, etc). This project will build upon the recent Arctic NIS research carried out by Goldsmit, Howland and Archambault [Aquatic Invasions, 9(3), 327-341 (2014)] by expanding survey efforts from 20 to 200m depth, incorporating new study areas, and sampling more taxa. A biogeographical analysis of non-indigenous species present or likely to arrive is particularly relevant for Qikiqtarjuaq and Frobisher Bay. Expanded deep water ports have been proposed for both Qikiqtarjuaq and Iqaluit; both communities are hopeful that this infrastructure will be funded and constructed in the near future. As infrastructure and shipping traffic increase, so do the potential introductions of non-indigenous species. This study will offer valuable baseline data upon which NIS monitoring may be built.

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

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Northern college training programs, like Nunavut Arctic College's (NAC) Environmental Technology Program (ETP), are producing the Arctic's next generation of front line environmental workers and decision makers. These individuals are being trained to help identify, understand, and address the many challenges confronting the North and position communities and organizations to take advantage of opportunities in an ever-changing Arctic environment. Further, they are often tasked with being critical knowledge translators, working between communities of scientists, resource users, industry and government. As such, it is critical that they have the appropriate skills and tools to help them engage on these issues, understand and communicate their status and importance to a northern community audience. To date, many online courses, workshops, in-class presentations and on the land science camps have been conducted in Arctic communities to support the enhancement of local capacity to understand and take action on critical environmental issues such as the presence of environmental contaminants in the Arctic food chain. However, few are typically documented and shared, and even fewer are evaluated as to their impact on participant or student learning outcomes. For the past 9 years, a group of educators, scientists, hunters, community representatives and decision makers have come together to deliver the environmental contaminants training workshop to students of the ETP program at NAC in Iqaluit, NU. This one week workshop combines lectures, interactive lab activities, and group discussions to introduce and teach ETP students: how

contaminants monitoring programs are designed and conducted in northern Canada; wildlife tissue sampling techniques; and the challenges in communicating about contaminants research and issues at the local, peer-reviewed and policy levels. Bringing together science and Inuit Qaujimajatuqangit, the training modules draw upon scientists to introduce students to the lab environment and local experts to teach students traditional methods for butchering and skin preparation of marine birds and seals, and identifying abnormalities in harvested game. Through interactive sessions with researchers, hunters, community members and decision makers, students learn a variety of techniques to assess, manage and communicate the potential health risks posed by environmental contaminants in country foods. This year the workshop was documented and evaluated as to its contribution to student learning in 6 learning domains fields (depth and breadth of knowledge, knowledge of methodologies, application of knowledge, communication skills, limits of knowledge and understanding, and professional capacity and aptitude). Through short pre and post module surveys, interviews with course instructors and students, a review of course materials and classroom observation, the impact of the workshop on student learning was explored. It is hoped that the documentation and sharing of this experience (e.g. the workshop approach, modular structure, and integrated curriculum design), along with the evaluative feedback on the course impact in the areas of learning and development, will help other programs and communities wanting to enhance the capacity of students or residents to be better engaged and prepared to address challenges they may face related to environmental contaminants.

A BRIEF HISTORY OF SUCCESSION: RE-EVALUATING PROGLACIAL SUCCESSION AFTER 20 YEARS

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Glaciers and ice caps in the Canadian Arctic Archipelago have been melting rapidly in the past few decades, exposing new terrain for colonization by plants. Yet the pathways of this colonization are not yet completely understood, especially in the high Arctic where the harsh environmental conditions place extreme restrictions on plant growth. In addition, few studies have examined how the high rates of warming experienced in the Arctic may be influencing these successional pathways. The retreat of Twin Glacier at Alexandra Fiord, Ellesmere Island, Nunavut, has been photographed and marked annually since 1980. Ground survey photographs show a change in the position of the glacial terminus, as well as a decrease in the thickness of the glacier compared to the surrounding hills. Both processes have exposed terrain that is now being colonized by plant communities. In 1994 and 1995, the foreland of Twin Glacier was surveyed as part of a Master's thesis project on plant succession. This study assessed the vegetation cover and diversity, soil seed banks, and seed rain along seven transects adjacent to the 1994 terminus. The study revealed that succession at the site followed a directional-replacement model, transitioning through four main stages over the past 44 years. As Twin Glacier is cold based, and consequently causes minimal subglacial erosion, it was also possible to address the effects of paleosols on succession. The study found that total vegetation cover was significantly higher on paleosols compared to glaciofluvial sediments, suggesting they provide a more favourable environment for plant establishment and growth. Twenty years later in 2015, we relocated all seven transects from the earlier study. Parts of three transects had been eroded by changing river paths. However, due to its remote location the rest of the study site has remained untouched. In 2016, we will resurvey the Twin Glacier foreland. We will assess the vegetation cover and diversity along the earlier transects. Moreover, we plan to assess plant communities on the newly deglaciated terrain. Results will help to develop an understanding of how succession has continued over the past twenty years. It will also enable us to discover if successional patterns have evolved.

TESTING A 'FIELD COLLECTION APP' TO SUPPORT THE INCLUSION OF INUVIALUIT OBSERVATIONS IN BELUGA (DELPHINAPTERUS LEUCAS) MONITORING IN THE INUVIALUIT SETTLEMENT REGION, NT, CA.

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The use of digital technology in community based monitoring has been growing rapidly in recent years. The use of smart phones and tablets for collecting information about the environment provides the potential for real-time data to be collected consistently and comprehensively, especially in remote areas such as the Arctic. The goal of this project was to develop and test an App to collect observations about beluga whale health and habitat use, based on forms previously developed in the communities of Inuvik, Paulatuk and Tuktoyaktuk, Inuvialuit Settlement Region (ISR), NT. A collector App was developed using ArcGIS online, to support the collection of local observations about beluga whales in the ISR. Two separate apps were created to collect information about harvested or observed whales, that could be used both on and offline to record observations, using an ArcGIS online account. Five tablets were distributed to Hunters and Trappers Committees and/or whale monitors in early July, 2015, to be used in conjunction with paper forms filled out by monitors, researchers and community members. Text, photos and location of observations were recorded with the device using either the online or offline modes; data entered in the offline mode was synchronized when the tablet was connected to the internet. This pilot study indicated that the offline functionality was excellent, and it was possible to synchronize with ArcGIS without any issues. Issues that need to be addressed include the need for on-going IT support throughout the study season, an improved format for the collection of data, and early set up and distribution of tablets and accounts. Overall, there was widespread interest in using this type of technology to record observations. The use of this type of App could improve the collection and transmission of local observations in the ISR.

ARCTIC BIOMAP: DEVELOPING COMMUNITY RESEARCH INFRASTRUCTURE TO UNDERSTAND AND MANAGE COMMUNITY SPECIFIC SPECIES BIODIVERSITY, WILDLIFE HEALTH AND ENVIRONMENTAL CHANGE

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The Arctic is undergoing unprecedented and accelerated system-wide environmental change, much of which is still poorly understood. There is very little community-specific data on the changing biodiversity, wildlife health, and environment in Northern Canada. A novel approach using increased community participation and technology is required and may prove crucial to better understand and manage the rapidly transforming Arctic. This research partnered with Northern communities in Yukon and Nunavut in Canada to build community based research infrastructure to develop real-time monitoring program and geospatial informational database to understand the local risks from environmental change (extreme/ unusual weather events, fire, local land changes) and human disturbances (resource development) to food security, biodiversity, and wildlife health issues. Using these participatory technologies we hope to rework scientific boundaries to incorporate indigenous view points in research and policy making which are essential to address the rapid transformations in the Arctic caused by climate change, and Arctic development. In short, Arctic BioMap will facilitate a forum for continuous exchange and communication among community members, scientists, resources managers, and other stakeholders, providing useful and useable community-specific information on environmental and health observations needed to inform resource management, and adaptation planning.

SHIP-BASED MEASUREMENTS OF AIR-SEA HEAT AND CO2 EXCHANGE BY EDDY COVARIANCE FROM A MEDIUM-SIZED ICEBREAKER

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Carbon budgets for polar oceans require better constraint of air-sea CO2 fluxes over the continuum of sea ice concentration from open water to full coverage. Wind speed-based parameterizations are widely used to describe gas exchange in high latitudes and may be adequate under a variety of open ocean conditions. However in any of the four seasons the air-water interface in the Arctic can modified by ice, waves and surfactants,

and thus represent an environment where wind speed-based parameterizations are unlikely to be adequate. The micrometeorological technique eddy covariance (EC) allows for direct, continuous and non-invasive tower-based eco-system scale estimate of surface fluxes, and as such is often used as a reference measurement in terrestrial systems. However, the technique has not been widely used as a tool to constrain parameterizations for air-sea fluxes because of difficulties in making the necessary ship-based measurements. In addition ship's equipped for ice breaking are particularly challenging platforms to undertake EC measurements because of the vessel's shear size and unique hull design. Here we present and discuss unique EC measurements of air-sea fluxes of momentum, heat and CO2 acquired from the medium-sized icebreaker, CCGS Amundsen, as part of the 2011 ArcticNet cruise. Although biasing effects of flow distortion are evident in fluxes associated with some relative wind directions, on the whole the fluxes appear robust, and will allow for a critical assessment of wind-speed based parameterizations.

ASSESSING INUIT FOOD SECURITY IN LIGHT OF CLIMATE CHANGE AND EXAMINING ADAPTATION OPTIONS

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The 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. The objectives of the research are to i) characterize elements of the community food system, ii) document the ways in which multiple stresses (climatic and non-climatic) affect food security, iii) document current adaptive strategies employed to manage or cope with stresses to food security, and iv) identify opportunities and barriers to enhancing food security. Vulnerability science (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. Importantly, 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 harvest may at times be limited by the absence of a functional community freezer or icehouse. 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).

ECOLOGICAL SUCCESSION AS A DRIVER OF NEAR-SURFACE GROUND ICE CONTENT IN MINERAL SOIL PERMAFROST OF THE NORTH SLAVE REGION, NWT: IMPLICATIONS FOR ESTIMATING GROUND SUBSIDENCE

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Rapid climate warming has increased thaw rates of permafrost (ground at or below 0°C for two or more years). If thaw occurs where permafrost is ice-rich (i.e., high ground ice content), ground subsidence will ensue proportionately. Subsidence can damage infrastructure,

alter landscapes, and affect the well-being of people living in the area; therefore, it is imperative to understand the distribution of ground ice for use in future planning. Permafrost thaw can also lead to the alteration of entire ecosystems by releasing water stored as ice, disrupting groundwater flow pathways, and causing soil disturbances and mass wasting. There has been some work to model the distribution of ground ice in areas of discontinuous permafrost. However, there have been few in situ studies in mineral soils of the boreal forest, which compare the relative importance of the multitude of factors that influence and predict ground ice content. A field study was conducted to examine the influence of ecological factors on the occurrence of ground ice content of the mineral soil permafrost in the North Slave region of the Northwest Territories. Data were collected at twenty sites to sample the gradient of ecological succession for two main forest types: black spruce, and white spruce/white birch. At each site, topography (hummock size, slope, and elevation), forest structure, and ground vegetation composition was measured. Near-surface permafrost was cored to quantify ground ice present at each site. The objective of this research is to gain a better understanding of the ecological drivers of ground ice in boreal forests with fine-grained mineral soil. Preliminary results suggest an increase in permafrost ground ice content as the forest progresses in its ecological succession. There also appears to be a difference in ground ice content variability between successional stages for each forest type. Furthermore, the data suggest white spruce/white birch forests are more ice-rich in the near-surface permafrost than black spruce forests. These results have applications for larger scale efforts to map near surface ground ice from vegetation characteristics.

LASER SCANNING ISSUES ON MAN-MADE AND TUNDRA SURFACES

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With industrial development underlain by permafrost and/or rising global temperatures, there is an increasing chance of the degradation of permafrost. Few methods currently exist to accurately quantify ground subsidence related to the thaw of permafrost with surveying equipment and terrestrial laser scanners (TLS). With modern technologies it is possible to measure smooth surfaces (e.g., a road) within a few millimeters of accuracy, however, in the natural environment it is not so simple. Vegetation, or any material that is known as a surface cover, can interfere with the accuracy of the actual surface. Due to this nature, the definition of a surface is not well defined for natural environments. A Leica MultiStation (MS50) was used to survey many locations in the Slave Province and around Yellowknife (Northwest Territories) during the summer of 2015 (June-August). The results (point clouds) from the MS50 give an x, y, and z coordinate of the point. The given results produce the elevation (z coordinate), which can give an accurate representation of the surface. However, LiDAR is affected essentially by four main factors: the geometry, instrumental effects, target scattering characteristics, and atmospheric effects. The geometry and the target scattering characteristics will be focused on. The geometry deals with the incident angle. In general it is assumed that the lower the incident angle is the higher the accuracy, which is hard to achieve in the natural environment, with the use of a TLS. The target scattering characteristics are characteristics of the targeted surface (e.g., the irregularity of the surface or reflectance) that do not follow the Lambertian scattering law. The primary objective of this study will be to build on other experiments that have been conducted (e.g., Kaasalainen, S., et al, 2011; Soudarissanane, S., et al, 2007; Kaasalainen, S., et al, 2005) to search for correction methods. The use of the computer programming language Python will be used in order to calculate the accuracy of the z coordinate. The goal of this research is to determine how strongly the measured elevation of a surface is affected by variations in the incidence angle and distance of the scan, as well as how the variations are related to the roughness of the target surface. With the proposal of this research a better understanding of the incidence angle and backscattering (referring to the direction of the scattering of the particle) will come to be, and as such a better understanding of a surface in the natural environment.

THE ECONOMIC IMPLICATIONS OF CLIMATE CHANGE ON THE TIBBITT TO CONTWOYTO WINTER ROAD

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Climate change is one of the major threats to northern infrastructure in Canada, including winter roads upon which communities and the mining industry are reliant. A multi-disciplinary project team including the Northern Climate ExChange, International Institute for Sustainable Development, Risk Sciences International, EnviroEconomics, and Nodelcorp Consulting evaluated the climate-related vulnerabilities and related costs and benefits of the Tibbitt to Contwoyto Winter Road (TCWR). The TCWR, built mainly over frozen lakes, is the main access road for four diamond mines and is the busiest heavy-haul ice road in the world. Companies transport goods to the mines via the TCWR during the winter season to supply year-round operations. Any interruptions to road access that shorten the season could lead to increased costs for the diamond mines, as demonstrated by the costly shortened road season in 2006. This study included an evaluation of the climate-related vulnerabilities of the TCWR and an evaluation of the related costs and benefits. Length of the operational season – driven by temperature – was identified as the key vulnerability affecting the viability of the TCWR. Two future scenarios were developed for the road based on the vulnerability of the road's operational season length to temperature (freezing-degree-days and melting-degree-days): i) an adaptation scenario based on difficult climate conditions; and ii) a critical conditions scenario based on highly challenging climate conditions. An economic analysis compared the key costs arising from the two scenarios based on multiple climate variables and affected stakeholders. Based on this economic analysis, key cost drivers were identified that will continue to pose risks to TCWR operators and users as climate continues to change. The results of the study can inform future planning and economic assessments for winter roads across the North. The findings from the study provide valuable information for road operators and users as they plan for the future of the TCWR or other winter roads in the region.

DISTRIBUTION OF POLAR BEAR (URSUS MARITIMUS) DENNING HABITAT IN CANADA

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Female polar bears build maternity dens in coastal areas throughout the Arctic. Denning is critical in the life history of each polar bear; with northern ecosystems increasingly affected by climate change and as development continues to expand northwards, the habitat that supports denning is important to identify and protect. In some regions, such as western and southern Hudson Bay, denning areas are well defined and protected areas have been established (i.e., Wapusk National Park in Manitoba and Polar Bear Provincial Park in Ontario). Unfortunately, in much of the Canadian Arctic, denning areas are not well defined. Traditionally, denning areas have been identified in Canada through research on polar bears (i.e., using aerial or ground surveys) and through traditional ecological knowledge. Most recent published polar bear denning area information has been collected through traditional knowledge surveys which emphasize the importance of traditional knowledge in developing effective monitoring plans. Polar bear denning information was compiled using existing literature including government and consultant reports, peer-reviewed scientific articles, and traditional ecological knowledge studies. Each area with reported denning activity across the Canadian Arctic was identified and mapped using GIS. Once all data sources were compiled, the resulting map showed important polar bear denning areas in Canada and also indicated areas that are data deficient and require more investigation. Current sea-ice models predict that the last areas of summer ice to occur will be the Canadian Arctic Archipelago; however, the resulting map that was created indicates major data gaps in these same areas. It is also evident that there has been very little published data to address questions of denning habitat characteristics, changing habitat suitability, or shifts in habitat use within the Canadian Arctic (with the exception of the western Hudson Bay). We suggest that more effort should be devoted to identifying and monitoring polar bear denning areas in coming years. We also stress the value of collaborations with local communities and other traditional knowledge studies in identifying and monitoring polar bear denning areas on the landscape as well as planning management strategies into the future.

SHARING NUNATSIAVIMMIUT KNOWLEDGE IN SUPPORT OF REGIONAL LAND USE PLANNING AND POLICY DEVELOPMENT: VISUALIZATION OF COMPLEX CONCEPT MODELS.

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Understanding and managing the use of land is a challenge that requires the union of comprehensive knowledge, sound policy, and action. This challenge is particularly important in local and regional geographies in the Arctic and sub-Arctic. The North is experiencing rapid environmental, social and economic change. This change is creating pressures on traditional, existing and future uses of land while raising questions about establishing equitable and sustainable land use management regimes that can support long-term development of a region. In the Inuit region of Nunatsiavut, Canada, Nunatsiavimmiut knowledge and land use practices are living, dynamic systems. The embodied and orally transmitted forms of Inuit knowledge are highly effective in local geographic and cultural contexts, however broadly sharing this valuable knowledge can be a challenge. Local and traditional knowledge are being documented using tools such as Geographic Information Systems, however the constraints of data models, limited methods of representation, and expertise required to use GIS represent barriers to access for community members and policy makers alike. In this project geography and geographic concepts provide a starting point for linking Inuit knowledge (Nunatsiavut) with local decision makers, younger generations, and members of the scientific community. Using existing or newly documented Inuit knowledge we are working with knowledge holders to organize the documents conceptually and then generate a model that is stored in an information system (an ontology). To promote knowledge sharing and enable the evaluation of data we have developed an integrated visualization and mapping tool that allows land use planners, community members, and other interested parties to access the ontology and learn more about the Nunatsiavimmiut and scientific knowledge of the environment. Here we present the technical innovations made during the most recent development iteration. From previous experience it was clear that a more robust method was required for visualizing complex concept space including models with many hundreds of concepts and nested, hierarchical relationships. Tools were developed to allow for browsing concepts at many different scales from the global concept model to detailed sub-models related to specific topics. Additionally, to provide an appropriate level of detail at different model scales, tools were developed to show and hide nested sub-models. These features were added to existing functionality that includes an integrated geographic mapping system to support the visualization of specific, mapped instances of geographic features (e.g. wildlife feeding grounds, estimated range areas), display of related multimedia, and the ability to filter results on both the concept and geographic maps based on when a concept or geographic feature existed. We conclude with a discussion of future work to develop mechanisms to deal with models that include "many-to-many" relationships and "poly-hierarchies" (concepts that exist within multiple hierarchies).

FACTORS INFLUENCING THE SPATIAL AND TEMPORAL OCCURRENCE OF THERMO-EROSIONAL LANDFORMS ALONG THE YUKON COAST, CANADA.

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Processes associated with permafrost degradation in the arctic coastal zone are highly dynamic and account for significant amounts of organic carbon released to the Arctic Ocean. Thermo-erosion, as a mechanism of rapid permafrost thaw, reshapes arctic landscapes and has a clear impact on the mobilization and distribution of carbon and nitrogen in permafrost terrains. However, few studies report on the diversity of thermo-erosional landforms

or assess the factors involved in their development. This study highlights the diversity of thermo-erosional drainage pathways -- including gullies and valleys -- and specific thermokarst features such as retrogressive thaw slumps and active layer detachments, and determines the prevailing factors accounting for their distribution and driving their expansion over the last 60 years along the Yukon coast. We used a large set of high-resolution satellite images from 2011 (GeoEye-1 and WorldView-2) for geocoding aerial photographs from the 1950s using the software OrthoEngine from PCI Geomatica. The aerial photographs were received from the National Air Photo Library, Canada. This dataset allowed us to manually digitize and classify thermo-erosional gullies, valleys, retrogressive thaw slumps and active layer detachments for the 1950s and 2011 using ArcGIS 10.3. We gathered additional observations during fieldwork in July and August 2015 on gully and valley morphologies, and on the current development stage of retrogressive thaw slumps. Based on remote sensing analyses, we calculated and compared the surface area occupied by slumps in 1950s and in 2011 as well as the types, number and lengths of thermo-erosional drainage pathways over the same period. We coupled these information with additional datasets related to climate, geology and topography, and performed multivariate statistical analyses using the software R. Over this time span, we observed an important spatial heterogeneity in the landform dynamics among the different geological units. The number and the surface area of retrogressive thaw slumps increased on average. We did not detect a specific increase in the length of thermo-erosional drainage pathways over the whole area, however, in some specific geological units they decreased in length due to important coastal erosion. This dataset will be complemented by soil organic carbon data collected across several thermo-erosional landforms during fieldwork conducted in 2015 in order to understand the processes of carbon mobilization within specific thermo-erosional landforms.

A BAFFIN BAY ACOUSTIC COMMUNICATION AND NAVIGATION SYSTEM: PRELIMINARY ACOUSTIC PROPAGATION MODELING RESULTS

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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, ee 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.

DEVELOPING A HYDROLOGICAL MONITORING PROGRAM FOR THE PEACE-ATHABASCA DELTA (ALBERTA, CANADA) USING WATER ISOTOPE TRACERS

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The Peace-Athabasca Delta (PAD), protected mainly within Wood Buffalo National Park and located in northern Alberta, is a globally recognized landscape of ecological significance. It is a designated Ramsar Wetland of International Importance, a UNESCO World Heritage Site and the world's largest inland boreal freshwater delta. Hundreds of shallow lakes provide important natural resources for nearby indigenous communities and habitat for a variety of flora and fauna. Floodwaters from periodic ice-jams and during the open-water season are critical to sustaining these waterbodies. Concerns over the supply of freshwater in the delta persist because of hydroelectric regulation on the Peace River (W.A.C. Bennett dam [since 1968] and the recently approved Site C dam), water withdrawal by upstream oilsands development on the Athabasca River and climate-driven decline of river discharge. In response to a petition by the Mikisew Cree First Nations in June 2015, UNESCO acknowledged existing knowledge gaps and ongoing threats to the delta, highlighting the need to establish measures to track hydrological change in the delta. Despite widespread concern and international attention, there is presently no long-term hydrological monitoring program, in part due to the logistical challenges presented by its northern remote location and the dynamic (spatially and temporally) nature of this deltaic landscape. However, development of a monitoring program is an essential aspect of detecting periods of low water and flood events, hydrological trends over time, and determining their causes. Here, we present results from the early phases of establishing a water isotope hydrological monitoring program for lakes in the PAD. The hydrologic information generated will serve as a key component of a larger, multidisciplinary effort to track pathways of contaminant distribution and aquatic ecological change. During the 2015 ice-free season, we sampled 62 lakes and 9 river sites that span the hydrologic gradient of the PAD. Samples were collected 4 times between late May and mid-September to capture seasonal hydrologic variations. Using water isotopes tracers, we document a large range of hydrologic conditions among lakes due to varying relative importance of river flooding, rainfall and snowmelt input, and evaporation to the lake water balances. Within the context of 7 prior years of water isotope data spanning 2000-2006, the 2015 season was generally drier than comparable monthly values of previous years. This is particularly relevant in light of widespread flooding of the delta that occurred in the spring of 2014. Ongoing isotope-mass balance modelling will generate hydrological metrics for detecting status and trends useful to our agency partners including Parks Canada. Our results highlight the ability of water isotope tracers to detect spatial and temporal variability in lake water-balances and the applicability for efficient long-term monitoring in northern remote, hydrologically-dynamic, deltaic landscapes.

TO CHANGE OR NOT TO CHANGE? VARIATIONS IN COMPONENTS OF THE GREATER SNOW GOOSE REPRODUCTIVE SUCCESS OVER A 26-YEAR PERIOD.

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Long-distance migratory birds breeding in seasonal environments have a narrow time window to complete their reproduction successfully. Increasing temperatures are currently changing environmental conditions in the Arctic, which may affect the reproduction of birds. In Greater Snow Geese (Chen caerulescens atlantica), it has been shown that early nesting females within a given year achieve the highest reproductive success. Even though the summer is warming and the spring is advancing, the timing of breeding of geese has remained unresponsive to environmental changes. This is creating a potential mismatch between the actual timing of breeding and when prevailing environmental conditions are optimal for breeding. In this study, we investigate and compare long-term variations in individual components of reproductive success to determine how the relationship between those components and timing of breeding has changed over time. Laying date of the first egg in a nest is used as a

proxy of timing of breeding. Our preliminary analyses focus on pre-fledging components of reproductive success: clutch size, nesting success and pre-fledging survival of goslings. We are using a long-term dataset accumulated over 26 years of annual monitoring at the nesting colony of Bylot Island, NU, which includes 6968 nests. In the first part of the analyses we tested the effect of relative laying date (i.e. deviation from the annual median) and year on total clutch size and egg survival. The probability of egg survival was expressed as a deviation between observed clutch size at hatch in a nest and the expected value based on the mean egg survival of the population. We found a significant relationship between clutch size and relative laying date as clutch size declined seasonally, as previously found. However, a significant interaction indicates that the slope of this relationship has weakened over the 26-year period. Egg survival showed a slight increase with relative laying date but this effect also weakened over time as shown by a significant interaction between this variable and year. Detailed knowledge of seasonal variations in reproductive success components and how they changed over time will allow us to calculate the temporal change in the selection differential for laying date. This is critical in order to understand if the species can adapt to current environmental changes. We will also examine to what extent environmental conditions encountered at migratory stopovers affect the timing of migration and may pose a constraint to adjusting laying date to ongoing environmental changes in the Arctic.

PARASITIC ZOONOSES IN THE NORTH: THE EXPERIENCE OF THE NATIONAL REFERENCE CENTRE FOR PARASITOLOGY

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Communities in the North are at risk for acquiring infectious disease is transmitted by wildlife. The biology and lifecycle of numerous zoonotic parasitic agents causing cold-climate parasitoses have particularities that distinguish them from their southern counterparts in terms of their ecology, transmission, and the diseases they cause, as well as the accuracy of diagnostic testing. We review the experience of the National Reference Centre for Parasitology (NRCP) and present data on the seroprevalence of several key tissue parasites associated with endemic or epidemic human disease in the North, such as Trichinella sp, Toxoplasma gondii, Toxocara canis, Echinococcus granulosus. We also highlight new work on serological assays that specifically target Northern strains with the objective of improving the accuracy of non-invasive tests for several important pathologies.

THE ROLE OF ABIOTIC AND BIOTIC PROCESSES ON SOIL CO2 DYNAMICS IN THE MCMURDO DRY VALLEYS, ANTARCTICA.

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In the harsh conditions of the Antarctic Dry Valleys, microbial activity has been recorded via measurements of soil carbon dioxide (CO2) concentration and surface efflux. However, high temporal resolution studies in the Dry Valleys have recently shown that abiotic solubility-driven processes can also strongly influence (and perhaps even dominate) the CO2 dynamics in these low flux environments and that biological activity may be lower than previously thought. In this study, we aim to improve our understanding of CO2 dynamics (biotic and abiotic) in Antarctic Dry Valley soils, using long-term automated measurements of soil CO2 surface flux and soil profile concentration at several sites, often at sub-diel frequency. We hypothesize that soil CO2 variations are driven primarily by environmental factors affecting CO2 solubility in soil solution, mainly temperature, and that these processes may even overprint biologic production in representative Dry Valley soils. Monitoring of all sites revealed only one event lasting several weeks during the Austral summer, that likely originated from a microbial source, reaching fluxes of 0.4 μmol/m2/s. Under more typical low flux conditions (<0.10 μmol/m2/s) we observed a cyclical daily sink/source pattern, consistent with CO2 solubility cycling that would not generally have been evident with normal synoptic afternoon sampling campaigns. Subsurface CO2 monitoring and a lab controlled Antarctic soil simulation experiment confirmed

that abiotic soil solution processes were dominating CO2 production and consumption within this polar desert soil environment. This work has implications for our interpretation of both biological activity in the region, and also the use of CO2 as a marker of biotic change, which is still possible but must be done with care. This work, and its methodologies, are also being generally applicable to Arctic environments, and are being used currently at sites in Alaska, Norway, and Siberia.

THE RELATIONSHIP BETWEEN ABUNDANCE AND EFFECTIVE POPULATION SIZE IN RINGED SEALS IN WESTERN HUDSON BAY

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Over the past several decades Hudson Bay has been characterized by increased length of the ice-free season, decreased snow depth, and an increase in both spring temperature and rainfall. Alterations to the arctic ecosystem caused by climate change may affect the abundance of ringed seals (Pusa hispida) as lower recruitment has been correlated with the timing of spring break-up, warmer spring temperatures, less snowfall, and reduced snow depth. However, monitoring trends in ringed seal abundance is difficult due to the cryptic colouration, use of sea ice and underwater behaviour, and the large geographic range of the species. The expense and challenges of aerial surveys have led to the exploration of other monitoring methods using genetic parameters. Effective population size (Ne) is a parameter of interest in conservation due to its usefulness for assessing the long-term viability of populations. The increased feasibility of genetic monitoring and recent advances in our ability to estimate Ne have made it an effective tool for detecting trends in abundance of wildlife species. We grouped samples collected in the Eastern Canadian Arctic over the last 25 years into 3 cohorts based on birth year and calculated Ne to infer trends in Ne over the last 2 generations. We estimated Ne using the program MLNE that uses two temporally separated samples of genetic data. Preliminary results suggest that Ne has been relatively stable in Western Hudson Bay despite large fluctuations in aerial survey estimates of census population size (Nc). We plan to develop a model that will allow us to use Ne to infer Nc in areas where aerial surveys have not been conducted. The ability to infer trends in abundance of ringed seals will be helpful in assessing the conservation status of this species and developing co-management strategies.

ARCTIC CHARR OTOLITH TRACE ELEMENT RECORDS OF RECENT ENVIRONMENTAL CHANGE IN HIGH ARCTIC LAKES

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Arctic charr (Salvelinus alpinus) are an important fish in Arctic lakes and to the northerners as a country food source. Arctic lakes have been undergoing significant physical and chemical changes in recent years due to climate change and related permafrost thaw, and these changes have the potential to impact organisms residing in these aquatic environments. One method of monitoring and understanding this impact is through otolith analysis. Otoliths are the inner ear bones of teleost fish and are composed of annually layered calcium carbonate. As the otolith grows with the fish, it incorporates elements from the surrounding environment. A typical arctic char will live 15-25 years and investigation of the otolith record offers the opportunity to determine how the fish have responded to the significant limnological changes. This research is part of a larger study investigating mercury cycling in Arctic freshwater ecosystems that have been affected by climate and permafrost changes and includes fish sampling from 2008-2015. The primary study sites are the East and West Lakes at the Cape Bounty Arctic Watershed Observatory, Melville Island, Nunavut. Both watersheds have been affected by varying degrees of permafrost disturbance in the past eight years. Physiochemical limnological data has been assessed since 2006 and 2008 for West and East Lake, respectively. Landlocked arctic

charr were sampled from both lakes and the otoliths were removed, embedded and sectioned. Analysis was conducted using laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS) to determine trace element concentrations. We evaluated early/late otolith composition in 5 individuals from each lake, higher resolution series along growth radii of 12 individuals from each lake and finally detailed 2D elemental maps for select otoliths to investigate spatial variability in trace element concentrations across the otolith. Results indicate that both lakes have undergone significant physiochemical change following a large permafrost disturbance episode in 2007, however, the effects are far more evident in the West Lake. Both lakes have seen increased solute loads, most notably as a near four-fold increase in SO42- concentrations. In the West Lake, there has been a substantial increase in turbidity that has resulted in sustained water column stratification. Otolith analysis reveals a number of noteworthy elemental changes during the period of recent limnological change. Concentrations of elements including S, Sr, Zn, Ba, and Mg all increase sharply in the last 5-8 years of the charr's lifespan, which is the period of most significant limnological change following the disturbance event. Results further show that not only is the otolith chemistry statistically different within each individual fish from beginning to end of life but also between the two lakes. Thus, although differing limnological characteristics between lakes are causing fish to respond non-uniformly, the otolith record appears to record changes consistent with timing of observed limnological change. This research will investigate the driving factors behind this aquatic change and will seek to understand the impact of climate warming and the resulting permafrost disturbance on Arctic lake systems and aquatic food webs. If successful, this work will provide approaches for tracking aquatic ecosystem changes in Arctic lakes where observations are limited or absent.

FROM FELT TIP TO TECHNOLOGY: THE CHALLENGES OF REPRESENTING TRADITIONAL INUIT KNOWLEDGE IN A GIS PLATFORM.

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Traditional ecological knowledge (TEK) is a core value in Inuit culture and as such the preservation of the knowledge is imperative. The inclusion of TEK in environmental and resource-planning initiatives is a component of the Nunavut Land Claims Agreement. An extensive literature review revealed a gap in knowledge related to caribou research on or near King William Island, NU (KWI). Data available from the KWI region indicates that little or no caribou are found on the island, while Elders from the community of Gjoa Haven indicated that caribou are present on the island year-round. As part of a larger project entitled "Connecting Inuit Elders and Youth: Learning about caribou, community, and wellbeing" semi-directed interviews were conducted with Elders and hunters in Gjoa Haven in the summers of 2012 and 2013. During interviews, participatory mapping was used to document and share knowledge of caribou on and around KWI. A total of 32 maps were created, representing personal biographies, caribou knowledge (i.e. herd ranges, calving grounds, migration routes), and areas of importance for hunting and travel. These maps were subsequently digitized for use in a Geographic Information System to enable map compilation and analysis. There are challenges in representing participatory community-based mapping in the conventional geo-spatial paradigm of the vector model while maintaining the integrity, depth and richness of the information depicted by the Elders. This research develops spatial visualization and analytical techniques to best represent the concentration of collective Inuit spatial understandings of caribou on and around KWI. Methods include the creation of raster model probability surfaces of caribou migration routes, calving grounds and hunting grounds through the use of fuzzy inference. The surfaces and maps created will highlight the importance of the spatial representation of TEK with the goal of contributing to a more inclusive decision-making process in support of caribou co-management.

EXCHANGE THROUGH THE GULF OF BOOTHIA AND FURY AND HECLA STRAIT BASED UPON HISTORICAL DATA

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This undergraduate research project involves examining the physical oceanography of the Canadian Arctic Archipelago, with a focus on the region of Fury

and Hecla Strait and the Gulf of Boothia. The Canadian Arctic Archipelago is an important route for freshwater from the Arctic Ocean to the North Atlantic Ocean. The Gulf of Boothia and Fury and Hecla Strait connect the central archipelago to the Labrador Sea via Foxe Basin and Hudson Strait. Narrow and ice choked, the total flux of water, as well as the freshwater transport through this region is not well known. Using historical ocean observations stored in the ICES and MEDS databases, as well as from more recent ArcticNet cruises, we examine the different water masses in the region. Baroclinic geostrophic velocities and thus transports are determined, with the reference velocity taken from a high resolution numerical model. The different historical sections are thus used to examine the exchange through this region, and its variability.

MODELLING THE VULNERABILITY OF TUNDRA ECOSYSTEMS TO CLIMATE CHANGE

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Climate change occurs at broad scale and affects terrestrial ecosystems, particularly the ones located in arctic and subarctic regions. While most ecological studies focus on the impact of climate change on some populations or species, it becomes clear that ecosystem-based information is needed to better predict the future state of the Arctic. Indeed, species do not respond in the same way to climate change, creating high potential for disrupting biotic interactions in the future. This can in turn have major impacts on the services that ecosystems provide to humans, especially to Inuit populations. Moreover, the pace of economic development in the North is accelerating and increases the need to properly plan land conservation initiatives, for example by creating well-designed networks of protected areas. We present the structure and methods of an interdisciplinary project that aims to characterize the vulnerability of tundra ecosystems to climate change through modelling. Specifically, we aim to i) identify the ecosystem-scale exposures and sensitivities of the tundra to climate change by combining species distribution modelling and food-web modelling, ii) estimate and map at a regional scale the vulnerability of these northern ecosystems to climate change and iii) develop, in cooperation with policy makers, a comprehensive baseline to guide future land-conservation initiatives. This project is cofounded by ArcticNet and the Ouranos Consortium on Regional Climatology and Adaptation to Climate Change, and will begin with a case study in Northern Quebec. The climate of this region might become boreal during this century and it is well connected to reservoirs of new species located to the South, which creates a fertile environment for model building and testing. Our research will generate new tools to project the impacts of climate change on northern ecosystems as well as valuable input for policy makers regarding the creation of new protected areas.

A PHYSICAL OCEANOGRAPHY GEOPORTAL FOR THE CANADIAN ARCTIC

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Physical oceanography is a data-intensive science. Field measurement programs and numerical modeling simulations produce massive multi-dimensional datasets that are geospatially distributed, span long time episodes, and relate to a large range of disparate physical attributes. The data itself comes in many forms including text and binary data files, images, videos, and documents. Coupled with the data is metadata. Projects, people, study locations, scientific instruments, data transformation histories - these are some of the details that comprise a complete scientific dataset. As our capacity to measure and explore our physical environment increases and as collaborations between universities, government agencies, and commercial organizations continue and expand, researchers, decision-makers and other stakeholders require more timely and convenient access

to an ever-growing knowledge base. Beginning in 2013, ASL built a web-based geoportal for the Greenland Mineral Licence and Safety Authority. This geoportal serves two main purposes: 1) a central repository of physical environmental information related to the ice and metocean regimes offshore Greenland, and 2) a data visualization and exploration tool with search, mapping, statistical analysis and plotting capabilities. We designed a knowledge structure to describe all of the data and metadata and their inter-relationships based on modern software engineering methodologies. The data housed within the geoportal includes local knowledge and field measurements of icebergs, sea ice, seabed ice scours, ocean waves and currents, sea level meteorological conditions, and ocean water properties. The user interface to the geoportal is a web application accessible by all major web browsers. The user is able to search the database with a combination of temporal, spatial, physical and metadata criteria. Search results are displayed on an interactive map and through a detailed result list. Quantitative search results can be explored further: time-series data is displayed on a zoom and scroll chart at full resolution, one- and two-dimensional distribution plots and statistics for selected data segments are computed. Other results such as technical reports and project images and videos are bundled with the quantitative data and are viewed directly in the web browser. Datasets can be downloaded in their original format and in GIS-compatible formats. This project involved a number of technical challenges and innovations. The bandwidth constraints that are inherent to web applications required the development of novel data compression solutions, visual data representations that adapt to the user's resolution view level, various caching strategies, and just-in-time data fetching between the web browser and the backend web server. The geoportal user interface was carefully designed to be a single page application, i.e. all user interactions are performed on a single webpage and no complex site navigation is necessary. The user also has access to convenient tools for providing bug reports, feature enhancement requests, and receiving alerts regarding the latest uploaded datasets and system updates. ASL is now adapting the geoportal for other regions including the Canadian Arctic. This will become a data warehouse and discovery tool for all projects ASL is involved in. This work could be the basis for customized major university-based multi-disciplinary sets taking advantage of the extended features.

DEVELOPING A HYDROECOLOGICAL MONITORING PROGRAM FOR PONDS IN WAPUSK NATIONAL PARK, NORTHERN MANITOBA

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Wapusk National Park (WNP), located on the southwest coast of Hudson Bay, contains over 10,000 shallow lakes which provide key habitat for many wildlife and waterfowl, but their hydroecological integrity is threatened by climate change and rapidly increasing Lesser Snow Goose (LSG) population. For example, lake desiccation has recently been observed and has been attributed to low snowmelt runoff (Bouchard et al. 2013; Geophysical Research Letters). Additionally, studies have shown that ponds in catchments disturbed by LSG grubbing and vegetation loss experience changes in carbon cycling (MacDonald et al. 2014; Arctic, Antarctic, and Alpine Research), and increased nitrogen availability and aquatic productivity (MacDonald et al. 2015; Ecology and Evolution). To track the ongoing consequences of these stressors, we are developing the foundation of a hydroecological monitoring program for ponds in WNP in collaboration with Parks Canada. The monitoring program includes use of water isotope composition (d18O,d2H) measured at sixteen ponds located in the three main ecozones of WNP (coastal fen, interior peat plateau-palsa bog, and boreal spruce forest) during 2010-2015, which provide data to assess changes in pond hydrological conditions and capture the diverse hydrological conditions throughout the park. Isotopic modelling has been utilized to evaluate the relative roles of hydrological processes on pond water balances. Results show strong seasonal and spatial variability in the isotope composition of lake-specific input water (dI) and evaporation to inflow ratios (E/I) related to meteorological and catchment conditions. To refine measures to assess the aquatic consequences of LSG disturbance, sampling targeted five severely-disturbed ponds, five moderately-disturbed ponds, and five undisturbed ponds in 2014 and 2015. Ponds were visited

in mid-June after ice-off, late-July and mid-September before ice-on and sampled for water chemistry, water isotope composition and the upper 1 cm of sediment (2014 only). Analysis of pond surface sediments indicates that there are geochemical and biological differences associated with the degree of LSG disturbance. For example, severely disturbed ponds possess the lowest C/N ratios, reflecting high nitrogen availability, and the diatom assemblage reflects hypersaline conditions. Moderately disturbed ponds have high percentage of the diatom Denticula kuetzingii reflecting benthic mat habitat. Non-disturbed ponds are characterized by high C/N ratios and the nitrogen-fixing pigment aphanizophyll, results consistent with low nitrogen availability. Overall, the monitoring approaches will generate key metrics to assess aquatic ecosystem status and trends in response to ongoing changes in climate and LSG population.

MUSEUM DATA BROUGHT TO LIGHT: WHY THEY ARE VALUABLE DATA FOR THE CANADIAN ARCTIC?

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The marine ecosystems of the Canadian Arctic will potentially face severe environmental changes in the upcoming decades along with increasing shipping and natural resource exploitation. However, our ability to monitor and predict marine community structure changes and species range shifts are hindered by the lack of comprehensive and publicly available geo-referenced species databases. Arctic data associated to specimen collections of various natural-history museums have been overlooked in the past in meta-analysis of marine biodiversity, but over the recent years museum data have increasingly been made available online. The Canadian Museum of Nature (Ottawa, Canada) holds over 100 years history of research and sample collection in the Canadian Arctic (e.g., Canadian Arctic Expedition of 1913-1918) and has joined this international effort of data sharing. The geo-referenced species database that we present increases the spatial and temporal coverage of Canadian Arctic records of marine benthos compared to available published data from the scientific literature. The database will be made available online through the Canadian Museum of Nature Online Collection Data, the Global Biodiversity Information Facility (GBIF) and the Polar Data Catalogue.

THE CENTRE FOR ARCTIC KNOWLEDGE & EXPLORATION AT THE CANADIAN MUSEUM OF NATURE

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For over 100 years, the Canadian Museum of Nature (CMN) has been a leader in exploring and documenting the natural history and natural science of Canada's Arctic, beginning in earnest with the Canadian Arctic Expedition of 1913-1918. Today, the museum's Centre for Arctic Knowledge & Exploration aims to transform people's understanding of Canada's Arctic and its importance to Canada as a country in the 21st century, and to position the CMN as a global museum leader in Arctic knowledge and exploration. The Centre for Arctic Knowledge & Exploration is an interdisciplinary hub that is dedicated to innovative and collaborative research, collections care, data sharing, public programs, exhibits, galleries, and supervision and mentoring of students. Generating new knowledge through research is one of the core mandates of the CMN, and current Arctic research programs focus on Arctic biodiversity in botany, phycology, palaeontology, and invertebrate and vertebrate zoology. Another core function of the museum is the collection, long-term preservation, stewardship and curation of specimens, facilitating physical and digital access to these specimens for research purposes, and using the collection to engage and educate the public about the world around them. The Canadian Museum of Nature, founding member of the international Arctic Natural History Museums Alliance, houses the largest - and continually growing - collection of natural history specimens from the Canadian Arctic, with ca. 260K Arctic specimens, including >550 type specimens, as well as the Nunavut archaeology collection. These collections represent a substantial component of the global Arctic natural history record of yesterday, today and tomorrow. Some 154K of our specimens from north of 60 degrees are digitized and freely accessible online (http://collections.nature.ca/en/Search). A signature project of

the Canadian Museum of Nature is the development of a permanent gallery on Canada's Arctic, which will open in 2017 to celebrate Canada's 150th anniversary.

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.

ESTIMATING MIXING RATES AND TURBULENCE FROM GLIDER-BASED MICROSTRUCTURE MEASUREMENTS IN THE BEAUFORT SEA

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Understanding mixing rates and mechanisms in the Arctic Ocean allows us to estimate vertical heat fluxes through the water column which have the potential to significantly impact heat budgets as well as ocean-sea ice and ocean-atmosphere interactions. We present new observations consisting of 400+ quasi-vertical microstructure profiles of shear and temperature variance

alongside profiles of finescale temperature and salinity in the Amundsen Gulf region of the Canadian Arctic. We use these to characterize the variability of turbulent mixing rates in both space and time, and to begin identifying the dominant physical processes responsible for mixing in this region. The measurements were collected over two weeks by an autonomous glider in August 2015, and they represent one of the most dense microstructure sampling schemes in the Arctic to date. Profiles encompass the most prominent features of the Arctic water column, including the warm Atlantic water layer at depths below 250 m, the halocline between the Pacific and Atlantic water layers, and the surface mixed layer which exhibits a strongly stratified base. From the microstructure measurements, we calculate the dissipation rates of turbulent kinetic energy and thermal variance, and using these, estimate the distribution of mixing rates (i.e. the turbulent diffusivity). We relate this distribution to the background environment, the presence of topographic features, and the proximity to the shelf-slope in order to gain insight into the dominant mixing mechanisms.

TOWARDS A SUSTAINABLE FISHERY FOR NUNAVUMMIUT

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Amongst the many pressing challenges facing the Nunavummiut today is affordable access to nutritious, safe and culturally-relevant food. With food costs ~140% higher and 8-times more households facing moderate to severe food insecurity than in other regions in Canada, it is not surprising that reports of health problems including type 2 diabetes and childhood rickets are not uncommon. Administration of the region's resources is challenging due to various political jurisdictions, and further complicated by potential sovereignty disputes, with other countries maintaining that international laws, not Canadian regulations, should apply to the Northwest Passage. In recent years, earlier sea ice melting has dramatically increased access to aquatic resources. Ironically then, climate change may provide new opportunities for increased fishing with the potential for health and economic benefits. Vital to the success of such initiatives is Inuit Fisheries Traditional Ecological Knowledge (TEK) and the community members' considerable skill sets for the collection of field data. A TEK description of the fish distribution and contemporary changes will inform both sea ice and water-based sampling. This information will be assembled in series of mapping workshops in Gjoa Haven and other Kitikmeot communities. All of the data will be integrated in an interactive online atlas. Nunavummiut capacity will be augmented by the development of enhanced curricula with our colleagues at Nunavut Arctic College including field internships at Queen's, Carleton and Iqualuit, as well as on the waters of the Lower Northwest Passage. Through community participation, extensive sampling and the best of the next generation genomic tools, we will delineate stocks of Arctic char, Arctic cod and Northern shrimp. We will also verify that these stocks are relatively free from contaminants and disease. These rich data will allow all partners to develop a sustainable, science-based, fishing plan and food security strategy for commercial and subsistence fisheries in this region. By structuring a 'made in Nunavut' solution to the sustainable management of these emerging fisheries, it is our hope that this project will facilitate the development of commercial opportunities, augment sovereignty claims in the Canadian Arctic, increase employment, ensure a healthy food source and food security, and contribute to increased prosperity and health of the people of Nunavut's Kitikmeot region.

MAKING THE RESULTS OF NWT-BASED RESEARCH PROJECTS WIDELY AVAILABLE IN ORDER TO INCREASE ACCESSIBILITY AND ENCOURAGE COLLABORATION.

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In accordance with the NWT Scientists Act, the Aurora Research Institute (ARI) licences most research taking place in the Northwest Territories (NWT). ARI now issues over 200 Scientific Research Licences each year, and has licensed over 6000 research projects since 1974. Until recently, licence applications and the associated project results were stored onsite at the ARI headquarters in Inuvik, NWT, and could only be accessed as paper files. As the steward of this wealth of information related to NWT research, ARI decided to pursue an open-data approach in order to support

collaborative research and discovery in Canada's north, and to increase public accessibility to information related to research licensing and results. In 2012, ARI began digitizing and publishing licence application files online, creating the NWT Research Database (available at data.nwtresearch.com). The database is a fully-searchable resource currently containing information on all licensed research that has taken place in the NWT since 1991. Each project has been geotagged by linking it to the specific locations where work took place in the NWT, which allows data to be explored spatially using a map interface. Each project has also been keyword-tagged with a list of descriptors, which lets users browse and filter data. Both features improve the usability of the database, allowing citizens to access information related to research and facilitating the discovery of potential linkages among projects. The collection of publications, informal reports and correspondence related to research projects has been digitized, and will be linked to projects and principal investigators listed in the NWT Research Database. This will alert database users that there are additional materials available which can be accessed by contacting the ARI library. Geo-referencing of ARI's licensing information has demonstrated that map-based displays are an intuitive method for displaying data. The map-based interface that was used to create the NWT Research Database has been adapted to show other information that is of broad interest to local communities. In partnership with the Sahtu Renewable Resources Board and the University of Alberta Press, ARI digitized a collection of traditional place names originally described by Émile-Fortuné Petitot, who was a missionary in the Athabasca-Mackenzie region of the NWT in the mid-1800s. A spatial database and Google map interface were created, which allowed the public to explore Petitot's material as an online interactive map (data.nwtresearch.com/petitot). In addition to bringing licensing information from 1928 - 1990 online, ARI is working with partners on several more low-effort but high-value projects using this same approach. These projects allow the public direct access to resources in an intuitive way, using an approach that provides specific value for users who are familiar with the lands and regions in question.

FROM THE CANADIAN ARCTIC TO THE WESTERN COAST OF AFRICA: THE TRANS-EQUATORIAL MIGRATION OF THE LONG-TAILED JAEGER

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The population dynamics of migratory birds can be strongly influenced by event occurring away from the breeding ground, either along the migratory path or during the winter. However, the wintering locations and migratory routes of several arctic-nesting seabirds remain unknown, which greatly limit our understanding of their population dynamic. This is the case of the Long-tailed jaeger (Stercorarius longicaudus), a common seabird nesting on the tundra. Recent studies conducted on the populations nesting in Svalbard and eastern Greenland revealed that jaegers are long-distance migrants that winter in austral seas but similar information for the population nesting in Arctic Canada is lacking. The aims of this study are therefore to 1) define the migratory routes and the wintering areas of the population of long-tailed jaegers breeding in the eastern Canadian Arctic, and 2) identify potential carry-over effects, either from the previous breeding season on the fall migration and wintering area or from the wintering area and the spring migration on the subsequent reproductive success. This study is conducted on Bylot Island (Nunavut). Nests were found through systematic searches and monitored weekly to determine the phenology of reproduction and the fate of the nest. In 2014 and 2015, 20 light geolocators were deployed each year on breeding long-tailed jaegers to study their annual migration. Geolocators were deployed at 28 different nests overall. Those devices track migration trajectories by recording variations in daylight and thus in day length. In 2015, five light geolocators deployed in 2014 were recovered, 3 females and two males, including both members of a pair. All birds made a trans-equatorial migration and wintered in sites located 10 000 to 14 500 km from Bylot Island on a straight line. Two major wintering areas were visited, the eastern coast of the Gulf of Guinea from Nigeria to Angola and the Benguela upwelling area on the coast of Namibia and South Africa. One individual also crossed the Cape of Good Hope to reach the east side of South Africa. These regions are known to be productive marine areas and were generally the same areas that had been used by jaegers previously marked in Svalbard. Individuals that were successful in fledging young started their migration after the third week of August but those that failed started going back to the sea as early as the end of July, though they initially moved back and forth between the land and the sea. During the fall migration, all jaegers travelled in the middle of the

Atlantic Ocean, whereas they travelled further west during the spring migration. Improving our knowledge of the migration of birds like the long-tailed jaeger will help us to better understand their population biology. Moreover, identifying specific regions exploited by seabirds could help us identifying marine areas where conservation actions may be required.

A MODELING STUDY OF DISSOLVED BARIUM AND D18O IN THE ARCTIC

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Dissolved Barium (Ba) and oxygen isotope ratio (d18O) are widely recognized as tracers for river runoff and sea-ice melt water. Ba is highly enriched in North American rivers and less so in Eurasian rivers but in both sets of rivers still exceeds that of background Atlantic seawater. d18O's end-member value for sea ice meltwater is higher than other freshwater components in a d18O-salinity graph. The spatial and temporal variation of Ba and d18O give useful information on the Arctic freshwater budget and pathways. However, sparse field measurements can be difficult to interpret. The 3-dimensional dynamic ocean model with initial/boundary conditions, prescribed end-member values and parameterized tracer scheme are applied to simulate the regional distribution of Ba-like and d180-like tracers in the Arctic. The tracer scheme includes explicit sources and dilution of tracer concentration from runoff, net precipitation and sea-ice melt. The initial and boundary conditions are estimated from various field observations. We will present details of the configuration of the model, our plans and preliminary results of evaluation and sensitivity studies and potential uses of the tracers for future climate research.

THE BIODEGRADABILITY OF PARTICULATE ORGANIC CARBON RELEASED FROM PERMAFROST THAW SLUMPS IN THE PEEL PLATEAU, NWT

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Rapid climate warming is believed to have intensified the rate of slumping due to permafrost thaw. Retrogressive thaw slumps (RTS), one of the most dramatic manifestations of permafrost thaw, mobilize immense quantities of previously frozen soils to freshwater streams and potentially expose large stocks of previously sequestered organic carbon to mineralization to carbon dioxide via bacterial decomposition in streams. Therefore, this process may act as a positive feedback mechanism to climate warming. In the Peel Plateau, NWT, particulate flux in RTS-affected streams has significantly increased, and preliminary findings suggest that a much greater proportion of organic carbon is released as particulate organic carbon (POC) than dissolved organic carbon (DOC). Yet, while studies of permafrost-origin DOC decomposition are becoming increasingly common, permafrost-origin POC decomposition has not been examined. To determine the degree to which POC released from RTS can be degraded, incubation experiments were conducted during the summer of 2015 using stream water and slump runoff collected from three sites on the Peel Plateau. Oxygen concentrations, POC and DOC concentrations, DOM absorbance, and bacterial abundance were monitored over a 28-day period in bottles containing unaffected stream water and stream water mixed with RTS runoff. Preliminary findings suggested that treatments containing stream water mixed with RTS runoff exhibited a much more rapid decrease in oxygen concentrations due to an increase in heterotrophic respiration rates. Preliminary data shows decreases in oxygen concentration over a 7-day period for bottles containing stream water mixed with slump runoff in one experiment ranged from 3.39 - 5.65 mg/L, while bottles without RTS runoff ranged from 0.69 - 4.29 mg/L. To supplement experimental findings, POC, DOC, and nutrient concentrations were analyzed in stream water collected upstream and downstream of RTS sites as well as from RTS runoff.

CLIMATE CHANGE AND BERRIES - WHAT HAVE WE LEARNED FROM SIX YEARS OF INTEGRATED RESEARCH ON TREELINE AND TUNDRA BERRY PLANTS?

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Understanding the impacts of climate change on country food security is a primary concern among Arctic communities globally. Berries rank among the most valuable natural and cultural food sources in the North, and yet significant uncertainty remains on how present and future warming will affect northern berry crops. Uncertainty is linked to the naturally variable and complex nature of berry production, which is influenced by past and present abiotic conditions (i.e. climate variables and soil resources) and biotic interactions (i.e. with plant neighbors and pollinators) at local and regional scales. In response to recent warming trends, tall-shrubs are exhibiting a widespread, positive growth response by increasing in height, biomass and distribution. The impacts of their expansion on generally low-growing tundra berry plants has yet to be quantified and requires attention. From 2009 to 2015, we've taken an integrated approach to disentangle potential mechanisms of change in tundra berry plants across the Canadian north by: 1) consulting with Inuit elders on their knowledge and observations of vegetation and environmental change, 2) surveying and monitoring berry plant communities and pollinators across the forest-tundra ecotone, and 3) establishing warming experiments at treeline and tundra to test interactions between berry plants, tall-shrubs and the local environment. We predicted that climate-induced changes to canopy structure driven by tall-shrub expansion would be a key driver of change in berry production by increasing light competition between short, low-growing berry plants and their tall, upright neighbors. We also predicted that berry plants with truly prostrate growth forms, such as redberry/lingonberry (Vaccinium vitis-idaea) will exhibit the greatest declines in fruit production, whereas those that can compete vertically for available light (blueberry/bilberry [Vaccinium uliginosum]) will be less affected. Our research focused on three circumpolar berry plants important to northern food security: redberry/lingonberry, blueberry/bilberry and blackberry/crowberry (Empetrum nigrum). We incorporate traditional and scientific knowledge from eight locations [Nunatsiavut (Nain and Saglek Fjord), Nunavik (Kangiqsualujjuaq, Kangiqsujuaq and Umiujaq) and Nunavut (Pangnirtung, Pond Inlet, Baker Lake)] across the Canadian Sub/Arctic. Data were analyzed using climate trend analyses, ordination (non-metric multidimensional scaling) and mixed-effects models (primarily hurdle models). From our community consultations, we detected a pan-Canadian Arctic pattern that shrub abundance has increased. All communities observed changes in berry quantity and quality, however the magnitude and direction of change was locally variable. Our vegetation surveys showed that fruit production increases with decreasing canopy structure and increasing light availability across the forest-tundra ecotone. Different attributes of canopy structure were important among species and available light was only a significant predictor of fruit presence among Vaccinium species. Berry plants did not exhibit a height-fruit production trade-off, however cover was a strong predictor of fruit production among species. After two and three years of experimental warming, we detected a warming effect on fruit production of crowberry, and we found that tall-shrubs (mainly dwarf birch [Betula glandulosa]) do constrain berry production, albeit to varying degrees among species.

USING WHISKERPRINT SOFTWARE TO NON-INVASIVELY COLLECT CENSUS INDIVIDUAL DATA ON POLAR BEARS IN THE TOURIST AREA OF CHURCHILL, MANITOBA

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Polar bears (Ursus maritimus) may be particularly vulnerable to climate change due to their reliance on sea ice. Some studies have suggested polar bear populations in the Western Hudson Bay region are declining and that the bears are coming off the sea ice in poorer body condition. Photo-identification of individual bears is a non-invasive

means of collecting mark-recapture data on polar bear populations where bears are easily photographed. WhiskerPrint software is a facial recognition program that identifies polar bears using the patterns of whisker spots on each side of the snout as identifiers. However, it is unknown if the whisker spots are symmetrical on each side of the face. Fluctuating asymmetry, where an organism deviates from bilateral symmetry, is thought to be influenced by the body condition of an individual during development or early maturity and is considered a biomarker of stress. If the body condition for polar bears coming off of the sea ice is declining, it could also lead to increased asymmetry in the facial patterns of bears. There were three main objectives of this research: 1) test the ability of the WhiskerPrint software to identify individuals if only one side of the face is recorded, 2) see if any asymmetries in the two sides of the face are variable enough in the population to be used in studying fluctuating asymmetry, and 3) compare the degree of asymmetry of captive versus wild bears. To address the question of fluctuating asymmetry in individual bears, we compared the whisker spot patterns from one side of the bears' face to the other. By building a database of asymmetry data of both wild and captive bears (n=39), we have been able to compare differences in the degree of asymmetry in individual bears and compare the mean degree of asymmetry of wild bears to the mean degree of asymmetry of captive bears. Preliminary results suggest the following: 1) the WhiskerPrint program is a reliable method of identifying individual polar bears, 2) the whisker pattern from one side of the face shows no statistically significant concordance with the opposite side of its face, and 3) the two sides of the face are as different as two different bears. The photo-identification process of whisker spot patterns can be used to quantify the fluctuating asymmetry in polar bears. As sample size increases in wild and captive bears, new insights from the WhiskerPrint data set are inevitable.

WILDLIFE DISEASES IMPORTANT FOR HUMAN HEALTH AND FOOD SAFETY IN THE CHANGING ENVIRONMENT OF THE EASTERN SUBARCTIC

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We present the overall structure and goals of a new ArcticNet-funded project for wildlife diseases and human health in the Eastern Subarctic. Our project addresses gaps in the understanding of the ecology and transmission dynamics for wildlife diseases of public health importance: 1) defining mechanisms of zoonotic disease transmission among wildlife and exposure to people, 2) characterizing how wildlife, domestic animals, and people interact in a changing environment, 3) forecasting disease spread from north to south (e.g. Arctic fox rabies) and from south to north (e.g. toxoplasmosis), and 4) determining how disease transmission may be affected by

a warming and increasingly variable climate as well as a more developed and interconnected Arctic. Our project is divided into four main research foci: 1) food safety for the consumption of wild game, 2) fox genetics and rabies dynamics, 3) interactions among people, dogs and wildlife, and 4) modelling infectious diseases in a changing climate. By integrating traditional knowledge from communities in Nunavik and Nunatsiavut using a multidisciplinary approach (epidemiology, microbiology, population genetics, behavioural ecology, landscape ecology, disease modelling, and anthropology), we aim to better assess and predict the risk of exposure to diseases relevant to the health of wildlife and local communities. The project will also provide critical baseline information on zoonotic diseases in the North. These communities, public health personnel, wildlife managers, and policy makers will benefit from understanding the role of wildlife in human exposure to zoonoses (and vice versa). Furthermore, this project will contribute to developing culturally appropriate control and surveillance strategies for diseases affecting the health of both wildlife and people in the Arctic.

VALIDATION OF A NON-DESTRUCTIVE METHOD TO ESTIMATE GRAZING IMPACT OF LEMMINGS IN THE ARCTIC TUNDRA

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Populations of lemmings in northern environments are known to follow multi-annual cycles, but the causes of these fluctuations remain unclear. Predation (top-down) and food availability (bottom-up) are two hypotheses proposed to explain these fluctuations. While lack of food due to overgrazing appears to be the main factor controlling lemming populations in Scandinavia and Alaska, predation is suspected to control them in other Arctic and subarctic areas. If predators control lemmings, this should lead to a trophic cascade where plants are released from the control of herbivores, and thus we would expect little impact of lemmings on plants under those conditions. Evaluating this hypothesis requires extensive sampling of plant biomass, a tedious and destructive approach. In this study, we evaluated if a non-destructive method could adequately estimate plant biomass grazed by lemmings. The study took place on Bylot Island, Nunavut, where brown lemmings (Lemmus trimucronatus) and collared lemmings (Dicrostonyx groenlandicus) coexist. In 2013, 16 lemming exclosures (1 x 1 or 1 x 2 m) were installed in a fenced area where predator abundance was reduced and 8 others in a control site. Each exclosure was paired with a control plot randomly located within a 5 m radius. Using the point intercept (PI) method, a commonly-used method in the tundra, we sampled a quadrat (70 x 70 cm with 100 intercept points) in each of the exclosures and in their paired control sites during two consecutive years of high lemming density. This non-destructive method allows repeated sampling of the same plots annually without removing any live material. Additionally, destructive sampling was performed simultaneously with the PI in 48 other plots randomly chosen in the same type of habitat to calibrate the PI method. All live-aboveground biomass was removed, sorted out and dried to constant mass. Aerial biomass of the most abundant vascular plant species was adequately estimated by the PI method based on simple regressions (e.g. Arctagrostis latifolia $R2 = 0.63$, Cassiope tetragona $R2 = 0.995$, Dryas integrifolia $R2 = 0.978$, Salix arctica $R2 = 0.687$, Salix herbaceae $R2 = 0.955$). However, the PI provided less accurate estimates for smaller or less common species. This problem could potentially be fixed by using an exhaustive count of the rare species present in the sampled plots instead of the number of hits by the PI. For abundant species like Salix arctica, the most consumed plant by lemmings at our site, it is also possible to take several measurements on individual stems to account for variability due to the growth strategy, which would improve the comparison between grazed and ungrazed sites. The next step will be to use this calibration to estimate plant biomass in quadrat sampled only with the PI method and verify if removing predators induced a trophic cascade and allowed lemming population to reach densities high enough to deplete their food.

MULTISCALE TERRAIN ANALYSIS FOR MODELING SNOW ACCUMULATION IN THE APEX RIVER WATERSHED, IQALUIT, NUNAVUT

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Quantifying snowmelt runoff is important to hydrology in the Arctic, where snow is typically the dominant form of precipitation. The purpose of this research project is to determine snow distribution patterns and ablation rates through intensive monitoring of snow depth, meltwater production, and meteorological variables for the Apex River catchment near Iqaluit, Nunavut. The rugged topography, limited vegetation, and long wind fetches typical of the terrain of southern Baffin Island exert a strong influence on snow distribution. Effort was therefore focused on quantifying the strength of the relationship between snow cover and terrain variables. Terrain variables were calculated by digital terrain analysis performed on a high-resolution DEM of the study area, while end-of-winter snow distribution was determined through spatially intensive field surveying during the springs of 2014 and 2015. Repeat snow surveys were carried out during the melt season of 2015 to assess snow cover duration. The relationship between snow water equivalent and terrain variables was investigated by random forest, a non-parametric multivariate machine learning approach. Predictive snow distribution modeling was then performed using both multivariate linear regressions and recursive partitioning models. Snowpack ablation was also monitored from April to June 2015 through the use of spatially distributed snowmelt collectors. Subsequent work will focus on the development of a spatially distributed ablation model that can be applied to predict landscape-scale snow sublimation and melt rates. This model will be driven by energy balance data gathered at a meteorological station at the study site. This research will support both the investigation of contaminant transport in northern water systems and the long-term monitoring of the Apex River as a potential secondary water supply for the rapidly growing city of Iqaluit. Importantly, this study has benefited immensely from a partnership with the Nunavut Research Institute and Nunavut Arctic College's Environmental Technology Program, and has sought to enhance their community-based scientific monitoring initiatives wherever possible.

USING PHYSIOLOGY AND FORAGING BEHAVIOR TO MONITOR THE POPULATION SUCCESS OF ARCTIC SEABIRDS

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Seabirds are an especially important biomarkers of the health of Polar ecosystems since they are widespread and potentially very sensitive to changes in the environment. Importantly, Polar species are currently facing some of the most extreme climate-change-driven environmental variability known worldwide. Although this environmental variation is predicted to impact foraging success and hence the fitness of these species, we know little about the mechanisms which link individual responses to population changes. Making things more complicated is the fact that monitoring these species is often very difficult due to the extreme nature and isolation of their habitat. Moreover, traditional population monitoring techniques often only reveal issues years after change is already underway. As such, integrative methods that can predict population changes that involve less effort and a shorter time frame are important for rapid assessment and action. We will describe progress to date on combining inter-annual data on combining physiology and GPS spatial tracking data in response to environmental variation to examine the underlying mechanisms driving changes in population demography across several thick-billed murre (Uria lomvia) colonies. Taking both an individual flexibility and inter-colony approach to these integrative questions will hopefully allow us increase the predictive capacity of which individuals and colonies will be expected to succeed in the light of increasing climatic change in the Arctic.

TOWARD BEST PRACTICES IN ARCTIC SOCIAL AND ECOLOGICAL SUSTAINABILITY: A CRITICAL EVALUATION OF COMMUNITY-BASED MONITORING PROGRAMS

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The main objective of this study was to examine models of measuring community wellbeing in Alaska and Yukon to determine if they were Research suggests communities that establish an agreed upon model of measuring community wellbeing will benefit by having an increase in public involvement in local decision-making, and larger capture of material wealth and empowerment over resource management. The core problem is that while many communities have started to develop ways to evaluate wellbeing, there is a lack of research on the various models in the Arctic. There are several unique challenges to developing a model in Arctic communities such as the clash between mainstream and Indigenous definitions of wellbeing, the lack of data and small population sizes. For this study I conducted an in-depth search for publically available models in Alaska and Yukon and conducted semi-structured interviews with experts. Part one of the analysis was searching through records of each model to document community outreach methods, part two was an experimental content analysis to identify themes across models in both regions, and part three was a content analysis of the interviews.

KEY FINDINGS FROM "INUVIALUIT AND NANUQ: A POLAR BEAR TRADITIONAL KNOWLEDGE STUDY"

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Polar bears are an iconic arctic species. Their image and well-being has come to embody the need for awareness about greenhouse gas emissions and the consequence of a changing climate. The Inuvialuit have held polar bears prominently in their culture, art, environment and economy. Prominent scientific findings have shown a significant decline in South Beaufort polar bears between 2000 and 2008 with stabilization from 2008 to 2010. These findings were incongruent with community observations. In order to provide a more complete picture and help managers better understand and manage polar bears in the Inuvialuit Settlement Region, two co-management bodies (Wildlife Management Advisory Council - North Slope and Wildlife Management Advisory Council - Northwest Territories) led a multi-year traditional knowledge study. Seventy-two traditional knowledge holders from across the Inuvialuit Settlement Region participated in the study. The result of this work was compiled into the final report - Inuvialuit and Nanuq: A Polar Bear Traditional Knowledge Study. The findings of this report provide insight and observations on polar bears that have not been captured through scientific research, including information about the complex relationship between polar bears, sea ice, and prey. Study results supported community observations about population health and abundance and provide a new line of evidence for integration in management decisionmaking. This poster will outline the key findings of this pivotal and groundbreaking report regarding the complicated relationship between polar bear, their prey and habitat in light of a changing environment.

USE OF STABLE ISOTOPES TO DETERMINE OVERWINTERING LOCATION OF PRE-BREEDING NORTHERN COMMON EIDERS

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Northern common eiders (Somateria mollissima borealis) breeding on Mitivik Island, East Bay, Nunavut, Canada overwinter in two separate groups. Two-thirds of the breeding population overwinter near Nuuk,

Greenland and one-third overwinter near Newfoundland and Labrador, Canada. These two regions have distinct winter conditions due to the effects of the teleconnection pattern the North Atlantic Oscillation. As a result, eiders overwintering in one region may be exposed to a particularly windy and stormy winter, however; in contrast, eiders in the other region would be exposed to a mild winter. To ultimately determine the effects of distinct environmental circumstances in overwintering regions on breeding success of common eiders, the primary goal of this study is to determine the overwintering location of each eider upon arrival to the breeding colony. In this study we test the effectiveness of the use of the analysis of blood and claw tissue for the stable isotopes of carbon, nitrogen and hydrogen to differentiate between these two overwintering groups upon eider arrival to Mitivik Island during the pre-breeding period. In forest birds and passerines, hydrogen-2 is the most broadly used stable isotope to determine where overwintering birds have originated. However, isoscapes of hydrogen-2, in a marine context, are less predictable than terrestrially due to varying ocean currents. Near Nuuk, Greenland, the coast is highly influenced by ice-cap run-off, as such, the surrounding waters are expected to have an elevated level of hydrogen-2 when compared to the waters off of Atlantic Canada. Nitrogen-15 values were expected differ between these two areas due to nutrient deposits by varying currents. Carbon-13 values were expected to differ based on varying plant life present in these areas. We obtained blood and claw samples from eiders overwintering near Newfoundland, Canada and Nuuk, Greenland during the winter of 2014. These two overwintering groups indeed have distinct stable isotopic signatures of carbon, nitrogen and hydrogen. Using the stable isotopic signatures of birds overwintering in Newfoundland and Greenland we can now assign individual pre-breeding eiders arriving at Mitivik Island to their over-wintering region.

ANALYZING INTRA-SEASONAL DYNAMICS OF ICE-RICH PERMAFROST DEGRADATION IN THE LENA DELTA USING TERRASAR-X C-BAND BACKSCATTER TIME-SERIES

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Arctic warming is leading to substantial changes of Arctic environments, such as the rapid degradation of ice- and organic-rich permafrost coasts and riverbanks. Reactivation of these ancient carbon pools and the release of carbon to the atmosphere could further accelerate climate warming. Short and long term annual retreat rates of permafrost coasts and riverbanks are mostly based on optical aerial and satellite imagery. However, in the Arctic cloud coverage often limits the use of optical remote sensing. Synthetic aperture radar (SAR) systems operate unaffected by atmospheric distortions. SAR data with high temporal resolution imagery can be used to detect seasonal variations of coastal retreat. The TerraSAR-X (TSX) satellite of the German Space Agency (DLR) is a X-band active microwave system that provides high-spatial (2 m ground resolution) and temporal resolution (11 day repeat period). We used a TSX backscatter time-series from the years 2012, 2013, 2014 and 2015 to analyze rapidly eroding cliff tops along an ice- and organic-rich permafrost riverbank within the central Lena Delta. The images were analyzed using a threshold approach. The clearly visible transition line between undisturbed tundra surface and actively eroding cliff was subsequently mapped for every image. Very high resolution optical satellite images acquired in August 2010 and August 2014 were used to validate the TSX results. In spring 2015 we conducted a GPS survey and installed a time-lapse camera as well as wooden poles with 50cm distance perpendicular to a rapidly eroding cliff top sequence. Time-lapse images were acquired from late June to late August. The TSX extracted annual retreat rates are in the same range as the ones from the optical reference dataset. The intra-seasonal cliff top retreat lines from 2014 showed equal rates of 2 to 3 m per month. The time-lapse field data at the same place showed similar rates in summer 2015. TSX backscatter time-series show a high potential for monitoring rapid permafrost degradation with high spatial and temporal resolution. The results are valuable for the understanding of degradation process dynamics within a summer season. In the second part of the project we will focus on near to surface soil moisture and freeze and thaw dynamics on the watershed scale on Herschel Island, Yukon territory. In summer 2015 we installed four automated stations that measure near to surface soil moisture and temperature within a watershed on Herschel Island.

DEPTH PROFILES OF GEOCHEMISTRY AND CARBON CONTENT FROM PERMAFROST AND ACTIVE LAYERS IN TUNDRA LANDSCAPES NEAR LAC DE GRAS, NORTHWEST TERRITORIES, N.W.T

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Samples from permafrost and active layer were collected at 25 sites to examine the vertical distribution of cation concentration and organic materials as well as variation between sites in the Lac de Gras region, of the Northwest Territories, Canada. While, studies from the Mackenzie delta, Inuvik, and Herschel Island report that the active layer and near-surface permafrost are geochemically distinct, geochemistry of permafrost in the present study area is less documented. Lac de Gras is situated in a different regional setting (extensive bedrock areas) than previously studied sites with less geomorphic activities. The main aim of this research is to find if similar trends exist for the present study area as were in past studies. As most studies of permafrost geochemistry and carbon focus on active and transient layers, conditions at greater depths are less well understood. This is especially true for Tundra areas of the Slave Geological Province. Currently, the impact of climate change concerns only top few meters of permafrost. However, recent evidences of temperature increase in the ground and increasing active layer thickness requires a detailed understanding of geochemical profiles and carbon estimates from greater depths of permafrost. In the present study, soil cores were extracted from depths up to 12 m using a heli-portable diamond-drilling core. A number of sites were sampled including: peat, eskers, hilltops, hill slopes, highly vegetated areas, and hummocks and depression in valleys to examine the variability at a larger scale. All core samples were cut in 20 cm sections, logged, double-bagged, and returned to a laboratory in Yellowknife. In the laboratory, permafrost samples will be analyzed for gravimetric water content, excess ice content, electrical conductivity and major cations (Ca^{2+}, Mg^{2+}, K^{+} and Na^{+}). Sub-samples of permafrost will be brought to Carleton University's permafrost research laboratory. These samples will be analyzed for an estimation of organic carbon using loss on ignition method. The results of this research are expected to be similar to those obtained from delta region of Northern Canada for near-surface permafrost. However, due to completely different terrain environment of Lac de Gras, some differences might prevail. A major task will be to find out what those differences are and see if they can be explained with same theories and mechanisms. Similarly, conditions at greater depth of permafrost are expected to vary depending upon their surface characteristics and sub-surface materials. This will help to characterize the spatial variability of observed ion concentration and organic carbon. Moreover, it will provide a basis for understanding climate-permafrost relationship.

USING PALEOLIMNOLOGY TO ESTABLISH BASELINE SEDIMENT METAL CONCENTRATIONS AND TO RECONSTRUCT HYDROECOLOGICAL CONDITIONS, MARIAN RIVER WATERSHED, NWT

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Formed in 2005 with the signing of the Tlicho Land Agreement, the Tlicho territory occupies an area of approximately 39000 km2 in the central Northwest Territories between Great Slave and Great Bear lakes. The Tlicho Aquatic Environmental Monitoring Program (TAEMP) has since been established to assess and monitor areas within the Marian River watershed important to traditional fishing and livelihoods. The program aims to assess ecosystem health through monitoring and sampling of water, sediment, and fish throughout the region. Of particular concern is the proposed NICO mine and the potential for cumulative effects of development, land disturbance, and climate change in the Marian River watershed. While water and sediment quality monitoring in areas of industrial developments is an integral part of water management programs to ensure protection of ecosystems, absence of long-term measurements can make it challenging to define reference conditions effectively. As a contribution to the TAEMP, this research uses paleolimnological approaches

to establish baseline sediment metal concentrations in lakes and to reconstruct past hydroecological conditions. During late summer 2015, sediment cores were obtained using a gravity corer from several lakes within the Marian River watershed and sectioned at 0.5-cm intervals. Sediment sub-samples will be analyzed for a suite of radiometric (210Pb, 137Cs), physical (loss-on-ignition), geochemical parameters (organic carbon and nitrogen elemental and isotope composition, cellulose oxygen isotope composition), and biota (diatoms, pigments), as well as metal concentrations. The hydroecological reconstructions will place recent observations of low water conditions into a longer temporal context needed to assess potential causes, and provide knowledge to interpret stratigraphic patterns and trends in the metal concentration data, as has been demonstrated elsewhere (Wiklund et al. 2012 Science of the Total Environment Wiklund et al. 2014 Environmental Research Letters). Results will provide measurements of pre-development reference sediment quality conditions that can be utilized to assess for evidence of pollution based on collection and analysis of lake surface sediments deposited after the NICO mine becomes operational, as well as other potential future industrial developments.

TOWARD THE ROLE OF DIAPYCNAL MIXING ON SHELF-BASIN EXCHANGE IN THE ARCTIC OCEAN IN A NUMERICAL MODEL

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The steady decrease of multi-year sea ice in the Arctic has led to greater seasonal ice formation in winter, as winter conditions still facilitate ice formation even in a warmer climate. This impacts dense water formation rates on Arctic shelves, and moreover, the properties of the dense water formed. It has been suggested that these changes may result in higher rates of dense water exchange into the basin interior. However, this result is sensitive to the properties of the dense water formed, as well as changes in diapyncal mixing rates that may result from the increase in seasonally ice-free periods. In this work, we propose to investigate the impact of diapycnal mixing rates and mechanisms on the dense water formation and water mass exchange between the Arctic shelves and basin interior. We will quantify the rate of dense water exchange across the shelf break from 1/4 and 1/12 degree regional configurations of the NEMO model. Additional sensitivity experiments will examine the impact of diapycnal mixing rate on the properties of exchanged shelf basin water. We aim to gain insight into the sensitivity of Arctic shelf-basin exchange in regards to diapycnal mixing in terms of the magnitude and composition of the water mass exchange. This project is currently in its early stages, and we invite feedback on the current project design and goals.

FORMATION AND DRAINAGE OF AN ICE-MARGINAL LAKE TRIGGERS ICE SPEED-UP EVENT AT WHITE GLACIER, NU

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In June 2014, a time-lapse camera installed near the western margin of White Glacier on Axel Heiberg Island, NU, captured the formation and rapid drainage of an ice-dammed lake. Coincident with the drainage event, three differential GPS (dGPS) stations installed on the glacier measured increases in glacier velocity. While lake drainage induced velocity events have been observed at other glaciers (e.g. Kennicott Glacier, USA, and Gornergletscher, Switzerland), the subglacial mechanisms allowing for similar events at mostly-cold polythermal glaciers are not well understood. Moreover, the degree to which such hydrological events contribute to the total annual mass turnover, which can impact long-term glacier sensitivity and stability, has yet to be investigated for Arctic alpine glaciers. This study uses signal-processing techniques to quantify the ice displacement associated with the June 2014 event in comparison to background ice velocities determined from continuous dGPS observations. We examine the timing of the observed velocity event at the three separate dGPS stations on White Glacier and map the propagation of a kinematic wave up-glacier, originating at the location of the drainage event. This analysis also revealed that the dGPS station nearest the marginal lake tripled in velocity during the lake drainage event, experienced a 3 cm vertical uplift (likely due to hydraulic jacking), and that the horizontal trajectory of ice motion temporarily shifted in direction during the event. By incorporating observations from nearby automatic weather stations and hydrological measurements

in proglacial streams we examine the degree of climate forcing behind this event. With early studies of ice velocity fluctuations at White Glacier during the 1970s, we are also able to compare the June 2014 speed-up event with earlier dynamic events, which reported velocity increases exceeding 400% of the background ice motion. This historical context offers the opportunity to determine whether polar alpine glaciers are responding differently to hydrological stimulus after persistent negative mass balance conditions and marked ice thinning over the past half-century.

A LETHAL COCKTAIL? EFFECT OF POLLUTION AND SUB-ZERO TEMPERATURES ON SURVIVAL IN THE BLUE MUSSEL (MYTILUS EDULIS)

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In their natural habitats, organisms are exposed to multiple stressors. Heavy metal contamination stresses the cell membrane due to increased peroxidation of lipids. Likewise, sub-zero air temperatures potentially reduce membrane functionality in ectothermal animals. We tested if acute lead (Pb) exposure for seven days would influence survival in intertidal blue mussels (Mytilus edulis) after exposure to realistic sub-zero air temperatures. A full factorial experiment with five tissue Pb concentrations between 0 and 3500 μg Pb/g and six sub-zero temperatures from 0 to -17ºC were used to test the hypothesis that sub-lethal effects of Pb may increase the lethality caused by freezing in blue mussels exposed to temperatures simulating Greenland winter conditions. We found a significant effect of temperature on mortality. However, the short-term exposure to Pb did not result in any effects of Pb, nor did we find interactions between Pb and temperature. We analysed the relative abundance of major phospholipid fatty acids (PLFAs) in the gill tissue, but we found no significant effect of Pb tissue concentration on PLFA composition. Results suggest that Pb accumulation has limited effects on freeze tolerance and does not induce membrane damage in terms of persistent lipid peroxidation.

MEASUREMENTS OF NO2 AND O3 FROM THE SUNPHOTOSPECTROMETER (SPS) IN EUREKA

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The SunPhotoSpectrometer (SPS) is a heritage instrument for the ACE-MAESTRO. It has been going up to the Arctic every year since 2003 as part of the instrument suit that was deployed in Eureka for the ACE Arctic Validation Campaign. SPS along with the MAESTRO instrument make measurements during the Arctic sunrise. The SPS instrument has flown on the Shuttle as part of the STS-52 mission in 1992. It has been part of the NASA Upper Atmosphere Chemistry Research Program and has flown on the ER-2 aircraft from 1992 to 2000. It has also flown on the MANTRA 1998, 2000, 2002 and 2004 balloon flights. SPS is a single concave holographic UV-Visible spectrometer with an effective spectral range of 375 to 775 nm and a spectral resolution of 1nm. It is based on a 10-24 Reticon array detector and measures atmospheric species such as Aerosol, Nitrogen Dioxide and Ozone. In this paper recent results from the measurements during the Arctic campaign will be presented and an inter-comparison between SPS and MAESTRO will be made.

ARCTIC INSTITUTE OF NORTH AMERICA: ARCTIC DATA AND INFORMATION AT YOUR FINGERTIPS

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The Arctic Institute of North America (AINA) is home to the AINA Library collection, the ASTIS (Arctic Science and Technology Information System) Database, and the ArcticConnect network-enabled platform for

Arctic research and information sharing. The poster will provide an overview of current holdings, plans in progress for expansion and collaboration, and the future of our data and information products.

OBSERVATIONS OF SPRING SNOWMELT CHANGES IN A TUNDRA ENVIRONMENT

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Warming trends have been well documented across Canada's Arctic over the past few decades. In the western Canadian Arctic, average surface temperatures have risen approximately 2.5 degrees Celsius since 1970 and Global Climate Models (GCMs) suggest that the air temperatures in this region will continue to increase over the next few decades. Associated with trends of increasing air temperature in the North are multiple changes in the natural environment and hydrological cycle of these regions. Some of the observed changes are unexpected. For example, although an earlier start to the snowmelt season is expected due to warming air temperature, the response of a delay in snowmelt runoff is unexpected and not well understood. With such complex responses to changes in air temperature, there is a need to better understand the details of these changes. In this study we will use an extensive record of surface air temperature and snow albedo during the melt period, for a remote tundra site located in the western Arctic. We will analyze this data to consider past changes in the start and duration of the spring snowmelt.

VALIDATING CANADIAN SATELLITE OBSERVATIONS OVER THE HIGH ARCTIC: THE CANADIAN ARCTIC ACE/OSIRIS VALIDATION PROJECT AT PEARL

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Ground-based measurements provide critical data for the validation of satellite retrievals of atmospheric trace gases and for the assessment of long-term stability of these measurements. As of December 2015, the Canadian-led Atmospheric Chemistry Experiment (ACE) satellite mission has been making measurements of the Earth's atmosphere for nearly twelve years and Canada's Optical Spectrograph and InfraRed Imager System (OSIRIS) instrument on the Odin satellite has been operating for fourteen years. As ACE and OSIRIS operations have extended beyond their planned two-year missions, there is an ongoing need to validate the trace gas data profiles from the ACE-Fourier Transform Spectrometer (ACE-FTS), the Measurement of Aerosol Extinction in the Stratosphere and Troposphere Retrieved by Occultation (ACE-MAESTRO) and OSIRIS. In particular, validation comparisons are needed during Arctic springtime to understand better the measurements of species involved in stratospheric ozone chemistry. To this end, twelve Canadian Arctic ACE/OSIRIS Validation Campaigns have been conducted during the spring period (February - April in 2004 - 2015) at the Polar Environment Atmospheric Research Laboratory (PEARL) in Eureka, Nunavut (80N, 86W). This period coincides with the most chemically active time of year in the Arctic, as well as a significant number of satellite overpasses. A suite of as many as 12 ground-based instruments, as well as frequent balloon-borne ozonesonde and radiosonde launches, have been used in each campaign. These instruments include: a ground-based version of the ACE-FTS (PARIS - Portable Atmospheric Research Interferometric Spectrometer), a terrestrial version of the ACE-MAESTRO, a SunPhotoSpectrometer, two zenith-viewing UV-visible grating spectrometers, a Bomem DA8 Fourier transform spectrometer, a Bruker 125HR Fourier transform spectrometer, a Systeme d'Analyse par Observations Zenithales (SAOZ) instrument, and several Brewer spectrophotometers. In the past several years, these results have been used to validate the measurements by the ACE-FTS, ACE-MAESTRO, and OSIRIS instruments as well as the TANSO-FTS instrument on the Japanese Greenhouse Gases Observing Satellite (GOSAT). This presentation will focus on an overview of the measurements made by the ground-based, balloon-borne and satellite-borne instruments during the recent ACE/OSIRIS Arctic Validation campaigns and highlight how these have been used for satellite validation.

WHAT'S IN A PATCH? VARIATIONS IN ABIOTIC CONDITIONS BETWEEN OPEN TUNDRA AND ALNUS VIRIDIS SHRUB PATCHES

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There is clear evidence from several photographic, paleoecological, and traditional knowledge sources that shrub community dynamics are changing in the low arctic of North America. Dramatic changes in density, areal extent, and biomass have been reported in several shrub species, prompting questions regarding the importance of this shift in abundance and dominance on the tundra ecosystem. It has been proposed that these changes in growth patterns, which have been largely attributed to increasing summer air temperatures, may alter the abiotic and biotic conditions within shrub patches leading to generalized differences between shrubbed and non-shrubbed regions of the landscape. We will present the results of a study undertaken on the Tuktoyaktuk Coastal Plain north of Inuvik, NT in which we collected soil moisture, frost table depth, and organic matter thickness in ten Alnus viridis shrub patches of varying sizes and in adjacent open tundra slopes of similar topographic aspect. Preliminary results suggest that patches tend to have deeper organic matter thickness and a shallower frost table, but exhibit no clear trends along downslope oriented transects. In addition, we present a preliminary investigation of A.viridis seedling regeneration along our downslope transects, as well as comparisons between patch and open tundra locations. By improving our understanding of the influence shrubs have on their environment, the results of this study will further our knowledge of patch-level dynamics and drivers of shrub regeneration. Such knowledge will aid in predicting patterns of future expansion.

THE SEA-ICE ENVIRONMENTAL RESEARCH FACILITY (SERF) AND RESEARCH HIGHLIGHTS (2014-2015)

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The Sea-ice Environmental Research Facility (SERF) is the first experimental sea-ice facility in Canada. Located in Winnipeg on the campus of the University of Manitoba, the main feature of SERF is an outdoor seawater pool with a movable roof, numerous in situ sensors and instruments, and an on site trailer laboratory. Sea ice can be created at the pool under various controlled conditions (e.g., seawater chemistry, snow cover, heating) with the additions of chemical, isotopic and/or microbiological tracers. During the first four years of operation (2011-2015), several types of sea ice including pancake ice and frost flowers were successfully created at the SERF pool. Real-time monitoring was carried out on surface and optical properties and on the evolution of temperature, salinity, dissolved oxygen, pH, alkalinity, pCO2 and dissolved inorganic carbon, and mercury in and across the sea ice environment. The results demonstrate that SERF could provide a unique research platform for hypothesis-driven, mesocosm-scale studies to examine geophysical and biogeochemical processes in the sea ice environment. Highlighted in this presentation are new studies carried out in 2014-2015, as well as the development of a new oil-in-sea-ice mesocosm (OSIM) as part of the recently funded Churchill Marine Observatory (CMO) project.

LOCAL HARVESTER PERSPECTIVES OF SUBARCTIC MOOSE DISTRIBUTION AND RESOURCE SELECTION ALONG THE WESTERN HUDSON BAY COAST

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While moose are generally considered to be associated with the boreal forest, they also inhabit arctic

and sub-arctic regions, including much of the Western Hudson Bay coast at varying densities. There has been little formal monitoring or research on moose in this region, so populations, habitat use, and local use remains poorly understood. Our objective here was to initiate a pilot project to interview local aboriginal and licensed hunters about their perspectives and knowledge about local moose. Ten local hunters were interviewed, based on a snowball sampling approach that focused on identifying knowledgeable and experienced individuals. Moose habitat preference, population trends, habitat travel corridor use, overall health, and cultural uses of the meat were documented. Trail camera images from a long-term wildlife monitoring project were also analyzed to document moose occurrences near three remote field camps in Wapusk National Park that each represent unique habitat conditions. We documented moose observations from local harvesters in many different locations in our study area. The three main areas local hunters sighted moose most frequently, were Knife River Delta, North River, and Button Bay. Interviews found that moose are typically found near lakes, rivers, creeks, ponds, and swamps, with a strong selection for willows as cover and forage. Moose use the edge of the forest on the gravel and sand beach ridges as cover. Moose use riparian and beach ridge travel corridors to navigate through the tundra landscape. Nine out ten of the local hunters agreed that moose population is stable or increasing. Moose numbers ranging from three to twenty-eight have been sighted herding at one time. Wolves are believed to be causing the moose population to fluctuate, by pressuring moose to change locations to avoid predation. When wolves move into an area, the moose seem to quickly vacate this area, and not return for a period of time. Harsh winters with extremely cold temperatures and thick snow and summers with high densities of biting flies can have a negative effect on young moose, and may cause them to die prematurely. Moose were perceived as healthy, and there is no indication of ticks. The hunters have never observed or reported seeing a sick moose. Observed frequencies of moose in trail camera images was overall low, with moose being the 6th most common mammal observed from 2011-2014 and were only detected in June, September, and October. Forage and thermal cover in winter may have once been a limiting feature of moose habitat range, but as there are milder temperatures now in the North, moose are thriving. Habitat modification has been implicated as a factor in recent moose expansions in other areas of North America and we suspect the same in northern Canada in response to forest fires and climate change. We recommend a more comprehensive study of moose use by residents of the Hudson Bay coast be initiated and that additional monitoring using trail cameras, aerial population estimates and collaring of moose be considered to help better understand these moose populations. This would help inform resource managers and highlight any areas of concern that may affect the long-term sustainability of moose in the region.

LOCAL AND TRADITIONAL UNDERSTANDINGS OF BELUGA WHALE (DELPHINAPTERUS LEUCAS) UNDER CHANGING CLIMATIC AND NON-CLIMATIC CONDITIONS IN THE INUVIALUIT SETTLEMENT REGION, NT, CANADA.

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The beluga whale (Delphinapterus leucas) is an important species to the coastal Inuvialuit communities of the Western Canadian Arctic. Despite the ongoing local cultural and nutritional importance of beluga whale, and ongoing scientific monitoring in the region, little research has examined local and traditional understandings of beluga. The dearth of research is made more poignant by the rapid climatic changes that are occurring in the region, alongside ongoing changes in culture, economy and governance. The proposed research seeks to document local and traditional knowledge of the ecology and behaviour of the beluga whale under changing climatic and non-climatic conditions to complement current research and monitoring efforts in the Inuvialuit Settlement Region (ISR). We will achieve the following three objectives through a case study in the ISR: (1) characterize the local Inuvialuit relationship with beluga, (2) document change and stressors affecting Inuvialuit-beluga relationships, and (3) document how the linked Inuvialuit-beluga system is responding to change. This 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".

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.

TRACKING THE ICE ISLAND PII-K NEAR KANE BASIN USING TERRASAR-X AND SENTINEL-1 TIME SERIES

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The Petermann glacier, located at the north-western part of Greenland, is known for its calving events. In August 2010, one fifth of the floating tongue of the glacier is calved. The resulting "ice island" had an area of about 250 square kilometers and travalled out into Nares Straits into the direction of south through Baffin Bay. It is not yet clear, if the frequency of theses ice island are a signal of the global warming or if it can be characterized as part of the glacier's natural variability. In August 2014, an new ice island, named PII-K, with a length of 1.5 km was detected near Kane Basin. With the help of high-precision GPS units, the drift of the ice island was recorded. In addition, SAR data were acquired in order to monitor and map its movement. 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 of temporal variations in land cover and ice types. Their all-weather and day and night observation capability is an important advantage in the Arctic due to low illumination during winter period. For the monitoring of the ice island PII-K a time series of TerraSAR-X and Sentinel-1 data are selected. The time series begins in mid-October 2014 and the acquisitions are still ongoing. The TerraSAR-X data are acquired in the ScanSAR mode with a pixel spacing of 16 m. The images are single-polarized (HH). In order to achieve a high temporal coverage, four different orbits (2 in descending and 2 in ascending) are chosen. The Sentinel-1 data are acquired in the Extra Wide Swath Mode (GRD) with a pixel spacing of up to 40 m. The delivered product type is the GRD (Ground Range; Multi-Look; Detected) and the images are acquired in the dual-cross-polarization (HH/HV). The results of the SAR data are compared with the GPS measurements. The intension of this project is to understand better the movement of the ice island and to monitor the change of its shape.

INSHORE DEPTH AND TEMPERATURE PREFERENCES OF THREE SPECIES OF SHRIMP (EUALUS GAIMAIRDII, LEBBEUS POLARIS, PANDALUS BOREALIS) IN THE EASTERN CANADIAN ARCTIC

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Little is known about the distribution and habitat preferences of marine species throughout the largely unexplored waters of the Canadian Arctic. There has been increasing interest in Nunavut to determine what fishery resources may lie in the waters adjacent to local communities. During the open water season (August to October) of 2014 and 2015, 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 ecosystem surveys in conjunction with ongoing exploratory fisheries in the waters surrounding the communities of Arctic Bay (ᐃᖃᓗᖅ), Resolute (ᖃᐅᔨᐃᑦᑐᖅ), Grise Fiord (ᐊᑎᕐᐃᑦᑐᖅ) and Qikiqtarjuaq (ᖃᑭᖅᑕᕐᓗᒃ). Fishing occurred from the 99-ft commercial vessel, Kiviuq I, with the use of whelk pots (N=62) and shrimp traps (N=24) in waters ranging in depth from 11-691m. Each string of fishing gear was equipped with a temperature logger, and CTD casts were used to further examine the oceanography of these regions. Catch quantities were used to determine overall distribution and depth and temperature preferences for three species of arctic shrimp: Eualus gaimairdii, Lebbeus polaris, and Pandalus borealis. The relative composition of shrimp catch varied throughout the study: E. gaimairdii and L. polaris were encountered in varying proportions around all four communities, while P. borealis was only captured in the waters off Qikiqtarjuaq and Grise Fiord. All shrimps preferred temperatures between 0-1°C; consequently, the relatively shallow waters around Resolute Bay with bottom temperatures around -1°C led to very low catches in this area. Weighted mean depths indicate that E. gaimairdii were located in the shallowest waters (334m), followed by L. polaris (423m) and P. borealis (520m). At Arctic Bay, E. gaimairdii catches were greatest in the smaller fjords off of the main body of Admiralty Inlet, with a similar distribution observed around Grise Fiord. The presence of inshore shrimp resources near Nunavut communities appears to be largely determined by accessible fishing depths and current bottom temperatures within these waters.

APPLYING MONITORING APPROACHES TO CHARACTERIZE THE DEGREE OF LESSER SNOW GOOSE DISTURBANCE ON THE AQUATIC ENVIRONMENTS OF WAPUSK NATIONAL PARK, WESTERN HUDSON BAY LOWLANDS, MANITOBA

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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 habitat for wildlife across three different ecotypes: boreal spruce forest, interior peat plateau-palsa bog, and coastal fen. During the past ~50 years, coastal regions of WNP have witnessed rapid increases in the population density and nesting area range of Lesser Snow Goose (LSG). This has raised concerns and uncertainty about environmental effects of their activities on the abundant shallow ponds. Additionally, this region has experienced some of the greatest warming in the circumpolar North during the past ~50 years and is considered one of the most sensitive regions in northern Canada to permafrost thaw. Therefore, the influence of LSG population growth has the potential to be exacerbated by increased evaporation due to longer ice-free seasons and alterations in seasonal precipitation. Prior studies have identified a suite of limnological variables and paleolimnological indicators sensitive to catchment disturbance by LSG. For example, carbon cycling and balance is markedly altered, which is well captured by carbon isotope measurements of dissolved inorganic carbon, and diatom assemblages in surface sediments are associated with the degree of disturbance. Here we apply these and other approaches to characterize LSG disturbance on ponds spanning a large sector of

the coastal fen ecotype. During late July 2015, 30 ponds were sampled along two N-S and six E-W transects (Cape Churchill to Broad River and La Perouse Bay to the Hudson Bay coast). In situ measurements included pH, conductivity, water temperature, and dissolved oxygen concentration. Surface water samples were collected and will be analyzed for water isotope composition, nutrients (TP, TKN, DIC, DOC), and the carbon isotope composition of dissolved inorganic carbon and particulate organic matter. Pond surface sediments will be analyzed using physical (loss-on-ignition), geochemical (organic carbon and nitrogen elemental and stable isotope composition), and biological (diatoms, pigments) techniques. Spatial analysis of datasets will be utilized to map gradients and to identify 'hotspots' of disturbance, which will serve as a useful tool for Parks Canada staff to monitor aquatic ecosystem trends and status. Results will also be used to establish recommendations for future monitoring.

INORGANIC CARBON FLUCTUATIONS IN RESPONSE TO UNDER-ICE ALGAE BLOOMS AND GROWTH

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Investigations of the inorganic carbon system in the Arctic is of much importance today. With climate change strongly impacting the Arctic, studies conducted on the inorganic carbon system can help show how photosynthetic organisms are responding and coping with these changes. Past studies have examined how inorganic carbon systems change in the Arctic marine environment throughout the year, however not much exists during the transient period from spring to summer when under-ice algae communities are present. Fluctuations in inorganic components such as DIC (Dissolved Inorganic Carbon) and TA (Total Alkalinity) reflect the biological uptake and/or conversion that is occurring and the rate at which it occurs. During a 6 week field study in Qikiqtarjuaq, NU, DIC and TA samples were taken at an off-shore ice camp from select water depths to create water column profiles. Sampling occurred during the ice-algae bloom period prior to maximum sunlight intensity, and prior to sea-ice melt. These one parameter profiles will be coupled with auxiliary data- nutrients, chlorophyll, salinity, temperature, etc. - at a later date to develop a more complete profile of the water column for analysis. Preliminary data show a distinct period of decrease in DIC from late April to early May before increasing and stabilizing. TA showed no distinct fluctuations during this time period, inferring that these were biological uptakes of carbon for photosynthesis. The results should show a clear algae bloom prior to the subsequent phytoplankton bloom and before their sea-ice cover habitat is lost. Sampling also occurred during the ice-melt transition period, and those samples will be analyzed at a future time to present a more complete time-series. Anticipated results will show us the water column biology and chemistry and associated changes with the transition from spring to summer and the onset of sea-ice melt. This research will further allow us to observe and understand how sea-ice and snow cover potentially affect photosynthetic organisms prior to open-water conditions.

MARINE ARCTIC ECOSYSTEM STUDY (MARES) - AN INTEGRATED APPROACH TO THE DYNAMICS AND MONITORING OF THE BEAUFORT SEA

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MARES is an integrated ecosystem research initiative coordinated and planned by the Bureau of Ocean Energy Management, the Office of Naval Research, the National Aeronautics and Space Administration, the U.S. Coast Guard, and Shell through the National Oceanographic Partnership Program. The overarching goal is to advance our knowledge of the structure and function of the Beaufort Sea marine ecosystem so as to link atmospheric and oceanic drivers to sea ice patterns and marine mammal distribution and availability to local subsistence communities. The study, funded in 2014, focuses on the marine ecosystem along the Beaufort Sea shelf from Barrow, Alaska to the Mackenzie River delta in Canada and is scheduled to include bio-physical moorings along the US-Canadian border, glider deployments packed with bio-physical sensors, tagging of whales and ice-associated seals with

satellite CTD-Fluorometer tags, biophysical and chemical cruises including the measurement and characterization of hydrography, ice, nutrients, primary and secondary production, carbon budgets, benthic fauna, fish, as well as analysis of freshwater input and chemical loadings, and ecosystem modeling. This presentation will focus on preliminary results from the ice seal tagging that started in the summer of 2015 and describe some of the planning and possibilities for partnerships for the more comprehensive 2016 field season and beyond.

SOURCES OF METHYLMERCURY IN HIGH ARCTIC SNOWPACKS: SNOW-PHASE METHYLATION MEASURED USING ENRICHED MERCURY STABLE-ISOTOPE TRACERS.

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Mercury remains an important contaminant of concern, particularly in Arctic ecosystems where it bioaccumulates and biomagnifies in aquatic foodwebs to levels that may be of concern for the health of Arctic Aboriginal people. Numerous studies have demonstrated the importance of the atmosphere as a source of mercury to Arctic ecosystems. However, mercury is overwhelmingly deposited from the atmosphere in inorganic forms, rather than the organic methylmercury form that is bioaccumulated into biological systems. Therefore, the conversion, or methylation, of mercury from its inorganic form to its methylmercury form is a key step preceding its incorporation into Arctic foodwebs. It is typically thought that methylation of atmospherically deposited mercury occurs post-melt in anoxic environments such as lake sediments. However, recent data by various research groups has also demonstrated the occurrence of elevated concentrations of methylmercury in Arctic snowpacks, particularly at the onset of the spring melt. To determine whether snow-phase mercury methylation is a potentially important source of methylmercury in Arctic ecosystems, we developed a field-based approach of quantifying methylation and demethylation in snow and meltwater samples using enriched mercury stable isotope tracers, similar to the method used to measure these processes in lake sediments. We will present details of this method as well as preliminary data, and examine the relationships between methylation potential of snowpacks at different sites in comparison to measured snowpack loadings of both total and methylmercury at these same sites.

VALIDATION OF SIMULATED SOIL MOISTURE USING THE CANADIAN LAND SURFACE SCHEME (CLASS) FOR THE ARCTIC TUNDRA

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Soil moisture is a critical component of the global hydrological cycle, acting as a dynamic membrane between the land surface and the atmosphere. Evidence suggests that incorporating accurate soil moisture measurements into climatic models can strengthen their forecasting abilities. However, soil moisture simulation by climate models are often confounded by the unique characteristics of the Arctic, such as dynamic active layer, an impermeable permafrost layer and a highly heterogeneous soil landscape. In situ measurement of soil moisture in the Arctic would be preferred, however, due to the prohibitive cost related to traveling and installing in remote locations it is not feasible. To address this limitation, this research investigates the simulation of soil moisture at the Trail Valley Creek (TVC) research camp in the Northwest Territories using the Canadian Land Surface Scheme (CLASS) and evaluating the ability of the CLASS model to accurately simulate soil moisture in the Canadian Arctic using a network of in situ measurements. The in situ soil moisture validation data set were taken at 15 permanent stations installed around two meteorological stations within the TVC watershed. Five stations had probes buried at 5 (horizontal), 10 (vertical) and 20cm (vertical) depths while the remaining 10 stations had probes buried at 5 (horizontal) and 20cm (vertical) depths. In addition to the network measurements, in situ soil moisture measurements were taken along transects over a ten kilometer area from mid-June to August 25, 2015. These data were evaluated to understand the variability of soil moisture observed in the region and to use as a validation data set for the modeling. For the modelling soil moisture water budget using CLASS, the atmospheric forcing data was acquired from the main meteorological station (Main Met) present at TVC. Model initialization variables were

either taken in field or were derived from the default values for this environment. A modification of the CLASS code was implemented to increase the number of the soil layers from the base configuration (which includes three modelled soil layers: 0-10 cm, 10-35cm and 35-410cm) to a 10-layered model. Inter-comparison of the soil moisture estimates from both the base configuration (3 layers) with the multilayered approach is conducted using the in situ data sets. Results suggest significant differences between the multi-layered simulations and the base configuration due to the underrepresentation of the permafrost boundary and the importance of this boundary on variations of soil moisture observed. Discussion of differences observed between the model simulations between each of the in situ stations and the role of micro-topography (the hummock/hollow interface) and soil type (mineral or organic soils) is also addressed.

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.

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 20cm 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 cm3cm-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 cm3cm-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.

OIL SPILL CANDIDATE DETECTION FROM SAR IMAGERY USING A CONDITIONAL RANDOM FIELD MODEL FOR SUPPORTING OPERATIONAL OIL SPILL MONITORING

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The detection of marine oil spill candidate from synthetic aperture radar (SAR) images is largely hampered by SAR speckle noise and the complex marine environment. In this paper, we develop oil spill candidate detection algorithm based on the conditional random field (CRF) model for supporting operational SAR oil spill monitoring. The proposed algorithm consists four steps. First, an intensity thresholding approach is used to estimate the initial labels of oil spill candidates and the background. Second, a Gamma mixture model (GMM) is trained using all the pixels based on the initial labels. The prior distribution of the targets and the background is deliberately exploited to increase the separability of the targets and the background. Third, a stochastic clique approach is integrated into the CRF model to account for the global-scale spatial correlation effect, and to better resist the influence of SAR speckle noise and background heterogeneity. Last, based on the GMM model and the graph-structure implemented by the stochastic clique approach, a graph-cut optimization approach is used for inferring the final labels. Experimental results on RADARSAT-1 ScanSAR imagery demonstrate that the proposed algorithm can efficiently and accurately delineate oil spill candidates without committing too much false alarms.

INTERMEDIATE AND DEEP WATER CIRCULATION CHANGES IN THE ARCTIC (2002-2013): INFERRED FROM THE DISTRIBUTION OF 231PA/230TH IN THE WATER COLUMN

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The Arctic has experienced decreasing sea ice extent and changing transport of Atlantic Water. Measurements made on different Arctic expeditions during the past decade have shown significant increases in the concentration of 230Th at specific depths. The ratio of 231Pa/230Th has been used as an indicator of ocean circulation in the Pacific and Atlantic Oceans. Here we

investigate this ratio in the Arctic using a numerical model, illustrating circulation pattern changes from a geo-tracer perspective. To simulate changes in the ratio, we coupled a 231Pa and 230Th scavenging model, which describes the exchange of tracers between the dissolved and particulate phases, to an offline NEMO model (the Nucleus for European Modelling of the Ocean) that provides the advection and mixing processes that redistribute the tracers within the ocean. Since the scavenging strength of such tracer elements are strongly affected by particle concentrations in the ocean, our scavenging coefficients are parameterized based on different ice concentrations which, to a great extent, influences the biological processes in the Arctic. The tracer fields are initialized from all available water column data of dissolved and particulate 230Th and 231Pa. The model is run over the period of 2002-2013 with full inter-annual forcing. This poster outlines our model configuration and presents preliminary results. It displays how the changes of ice and circulation affect the tracer fields within the ocean.