ArcticNet

Abstracts

2016 Annual Scientific Meeting

Réunion scientifique annuelle

5-9/12/2016, Winnipeg, MB
FROBISHER BAY: A NATURAL LABORATORY FOR THE STUDY OF ENVIRONMENTAL CHANGE IN CANADIAN ARCTIC MARINE HABITATS.

Aitken, Alec (1), B. Misiuk (2), E. Herder (2), E. Edinger (2), R. Deering (2), T. Bell (2), D. Mate(3), C. Campbell (4), L. Ham (5) and V.. Barrie (6)

(1) University of Saskatchewan (Saskatoon, Canada); (2) Department of Geography, Memorial University of Newfoundland (St. John’s, NL, Canada); (3) Polar Knowledge Canada (Ottawa, Ontario, Canada); (4) Marine Resources Geoscience, Geological Survey of Canada (Dartmouth, NS, Canada); (5) Canada-Nunavut Geoscience Office, Natural Resources Canada (Iqaluit, NU, Canada); (6) Marine Geoscience, Geological Survey of Canada (Sidney, BC, Canada)

Frobisher Bay is one of the few locations in the eastern Canadian Arctic with a long history of geological and ecological study, providing long-term datasets and study areas that facilitate longitudinal studies of marine habitat change. The bay presents the perfect opportunity to demonstrate the capabilities of geological and ecological seabed mapping for understanding and managing coastal environmental change in Canada’s Arctic. This research project combines seabed sampling (i.e., grab samples, box cores, piston cores, Agassiz trawls, video recording) and multibeam echosounding surveys to assess benthic habitats, benthic biodiversity, and geological hazards within Frobisher Bay. Long-term Ecological Monitoring: Grab samples and trawl samples acquired repetitively in the inner bay by the Fisheries Research Board of Canada (FRBC) in the 1960’s and 1970’s revealed a benthic macrofauna dominated by mollusks, amphipods, ophiuroid echinoderms and polychaetous annelids. These sites were sampled again in 2015 and 2016 using comparable grab sampling equipment, as well as drop video transects, to provide a more complete habitat characterization. This recent sampling effort recorded heterogeneous substrates composed of various proportions of boulder, cobbles, gravel, sand and mud forming a thin veneer over bedrock at water depths less than 200 metres. Grab samples confirm the relative abundance of mollusks, ophiuroids and tubiculous polychaetes as constituents of the infauna in the inner bay. Drop video images captured a diverse epifauna not previously described from the FRBC research. A variety of bryozoans, crinoid echinoderms, sponges and tunicates recorded in the images remain to be identified. Habitat characterization will allow us to quantify ecological change in benthic invertebrate species composition within the habitat types represented at selected sampling stations through time. Such long-term studies are crucial for distinguishing directional change in ecosystems. Marine Geological Hazards and Seabed Disturbance: Extensive multibeam echosounding surveys have recorded more than 250 submarine slope failures in inner Frobisher Bay. The impacts of geological hazards on the marine benthos inhabiting Baffin Island estuaries are poorly known. Mass movement processes operating in Baffin Island fjords include debris flows initiated on the upper slopes of fjord-head deltas and rockfalls initiated on steeply sloping valley walls. Debris flows are associated with macrofaunas characterized by low density and diversity, while rock falls place coarse rock clasts into deep water, where they create important habitats for epifauna dependent on hard-bottom substrates. Like the aforementioned mass movement processes, submarine slope failures in inner Frobisher Bay occur episodically. Benthic grab samples and box cores, and ROV video collected at known slope failure sites within inner Frobisher Bay in 2015 and 2016 will be used to assess the impact of these disturbance events on seabed habitats by comparing benthic species diversity at sites both “on” and “off” slope failures. ROV video images acquired in 2015 on submarine landslides near Hill Island in the inner bay, the site of repeated submarine slope failures, revealed a benthic epifauna characterized by the presence of sponges, crinoid and ophiuroid
echinoderms, and tunicates at sites adjacent to slope failures.

THE POLAR DATA CATALOGUE: DATA AND INFORMATION FOR CANADA AND THE WORLD

J. Friddell, Alix, Gabrielle, D. Bangs, D. Church, Y. Dong, C. Fagan, D. Friddell, F. Lauritzen and E. LeDrew

Polar Data Catalogue/Canadian Cryospheric Information Network, University of Waterloo (Waterloo, Canada)

For the last decade, the Polar Data Catalogue (PDC, https://polardata.ca) has been the chosen repository for data and information produced by the ArcticNet scientific community. The PDC, headquartered at the Canadian Cryospheric Information Network, University of Waterloo, archives and serves online data files and metadata records describing datasets from ArcticNet and other polar research and monitoring programs in Canada and around the world. To improve our service to the ArcticNet community and other partners and users, we have made the following enhancements to the PDC during 2016: • New data in the PDC: Since 2015, our data collection has grown from approximately 200,000 data files to more than 2.7 million, and the number of metadata has grown to over 2,440 records. In addition, two RADARSAT mosaics of Antarctica have been added to the PDC satellite image collections (https://www.polardata.ca/pdcssearch/), providing the first full-continental snapshot from 1997 which can now be compared to subsequent mosaics from 2000 and 2008. These satellite image collections and many more were highlighted in the Data Compendium (http://www.asc-csa.gc.ca/eng/blog/2016/04/22/data-compendium-20-years-of-radar-images.asp) of the World Meteorological Organization’s Polar Space Task Group, released on Earth Day 2016. We continue to work with our partners to add to the PDC archive, thus increasing its reach and utility to users. • New PDC Metadata and Data Input application (https://www.polardata.ca/pdcinput/): This tool is used by researchers to contribute their data and metadata to the PDC. It has been completely redesigned and rewritten to improve and modernize the user interface and underlying technology. Bi-lingual support (French and English) is coming in the next version. • PDC Geospatial Search application: The Map Viewer (https://www.polardata.ca/pdcssearch/PDC_ViewMapApp.ccin?ccin_datasets), which graphically displays select PDC data sets on a map, has been redesigned, with a completely new user interface, and mooring datasets from ArcticNet have been added for visualization. In addition, the full PDC Search application is currently being overhauled, with the focus on improving the user interface and updating the code with the latest web technologies. • International connections: In 2016, PDC was approved as Canada’s National Antarctic Data Centre (NADC) and as a member of the World Data System, both of which represent growing confidence in the PDC and increasing connection to the international data community. As Canada’s NADC, we are working with Polar Knowledge Canada to provide data management services to Canada’s Antarctic research community and to share Antarctic metadata with the Global Change Master Directory. • Data publication: In collaboration with DataCite International and the National Research Council of Canada, we are registering Digital Object Identifiers (DOIs) for ArcticNet and other datasets in the PDC. DOIs for data are similar to DOIs for published scientific articles in that they link to a unique web location where a dataset can be permanently found, and they provide credit and visibility to researchers who contribute data to the PDC. We look forward to working with the ArcticNet community to make progress on archiving and registering DOIs for the many valuable ArcticNet data sets produced since 2004.

RESEARCH PRIORITIES IN THE GWICH’IN SETTLEMENT AREA:

Amos, Amy, J. Boxwell

Gwich’in Renewable Resources Board (Inuvik, Canada)

The Gwich’in Renewable Resources Board (GRRB) has established a research priority setting process in the Gwich’in Settlement Area (GSA). This process includes the ongoing collection of research interests from the communities as one of its key criteria. The GRRB uses the end product to help set its work plan and make decisions on project funding. Examples can be given of community-based monitoring programs that are closely linked to community interests with full involvement of the community. The research interests from the communities include research that is not related to the GRRB’s mandate but could be of interest to other researchers. The GRRB is interested in finding
other ways to advertise these interests to promote research that addresses community needs.

IMPACTS OF LAKE ICE AND LANDSCAPE PERTURBATION ON THE WATER QUALITY AND PRODUCTIVITY OF SMALL TUNDRA LAKES IN THE NORTHWESTERN ARCTIC

Amos, Edwin (1), E. Hille (1), P. diCenzo (2), F. Wrona (2) and B. Paquette-Struger (2)

(1) Western Arctic Research Centre, Aurora Research Institute (Inuvik, Canada);
(2) Water and Climate Impacts Research Centre, University of Victoria (Victoria, Canada)

The Western Canadian Arctic is experiencing more intense climate warming than other parts of the world, with temperatures increasing at approximately 1˚C per decade. This has led to notable increases in ground and permafrost temperatures. For instance, there has been an increase in the frequency of Shoreline Retrogressive Thaw Slumping (SRTS) in the Upland Region Northeast of Inuvik over the past several decades. SRTS occurs when ice-rich shoreline sediments thaw, making the terrain unstable and causing it to slump. Research has linked SRTS to changes in the water quality of adjacent lakes. Over the past 12 years, the Aurora Research Institute (ARI) has worked closely with the Water Climate Impacts Research Centre (WCIRC) to support several research programs aimed at improving our understanding of how climate change and landscape perturbation, such as SRTS, has and will continue to affect lake ice, water quality, and productivity in small tundra lakes in the Upland Region Northeast of Inuvik. In 2014 and 2015, ARI deployed one YSI Sonde in each of two comparable small tundra lakes (Lake 5A: Control; Lake 5B: Affected by SRTS). The two YSI Sondes measured the dissolved oxygen (DO), pH, conductivity, and Chlorophyll A (ChlA) concentration of each lake at 1-hour intervals throughout the year, reflecting both under-ice and ice-free conditions. ARI then deployed a string of HOBO Dataloggers next to the YSI Sondes in each lake, sampling water temperature every hour at 1m intervals from the lake bed to the lake surface. In August 2015, ARI measured the dissolved oxygen (DO), pH, conductivity, and Chlorophyll A (ChlA) concentration of 10 additional lakes in the study region (3 affected by SRTS, 3 affected by a recent burn, and 3 pristine). This poster will present a project overview and preliminary results from the 2014/2015 field seasons, with the goal of exploring how lake ice, SRTS, and fire affect the water quality and productivity of small tundra lakes in this region.

DETERMINANTS OF HEALTHY AGING IN LABRADOR: PERSPECTIVES FROM OLDER ADULTS AND SENIORS

Andersen, Andrea (1), M. Mills (2), M. MacDonald (2), M. Wood (2), M. Wilson (3) and N. Pollock (2)

(1) Labrador Institute, Memorial University (Happy Valley-Goose Bay, Canada);
(2) Labrador Institute, Memorial University (Happy Valley-Goose Bay, NL, Canada);
(3) Labrador Grenfell Regional Health Authority (Happy Valley-Goose Bay, NL, Canada)

In Canada, the demographic shift towards a rapidly aging population has helped spark an important dialogue about how communities and health systems provide care for seniors. Health determinants such as social support, food security, and the built environment play important roles in promoting seniors’ health, and in delaying the onset and impact of diseases associated with aging. In combination with health system issues such as access to care and cultural safety, these factors shape people’s perspectives on aging and illness, and influence the ways communities foster wellness. In Labrador, efforts to promote healthy aging are needed given the challenges related to accessing health services and long term care in the region’s rural and northern communities. By examining the local context for aging, this project seeks to contribute policy- and clinical-relevant knowledge to regional planning related to seniors’ services. The objectives of this study are to understand how older adults and seniors perceive ‘healthy aging,’ and to explore what community-level factors, experiences, and services promote health and quality of life for seniors. This community-based, qualitative study involves a partnership between the regional Inuit government, a local wellness coalition, and the research team based in Labrador. During the initial phase of the project, we carried out community consultations to develop an understanding of local seniors’ issues and the current state of supportive services. We engaged organizations that serve seniors including faith groups, health and social care programs, and local governments. These consultations helped develop community-relevant and appropriate
interview questions. We then conducted semi-structured interviews with 19 community-dwelling adults aged 60 years and older, who were residents of the Labrador Inuit community of Makkovik, or the central Labrador community of Happy Valley-Goose Bay. The interviews were completed in participants’ chosen location, often their homes. We followed-up with participants by phone after one week, then met face-to-face after three months. We used a thematic content analysis to explore factors that contribute to healthy aging and to understand the health-related service needs of seniors. We shared the initial results with participants and stakeholders for feedback. Participants emphasized the important role of family support in meeting basic needs, providing care during illness, delaying transitions into long term care, and helping seniors continue to live at home. These relationships also help facilitate involvement in food harvesting, other land-based activities, and social and cultural events. However, the availability of family supports can be substantially impacted by shifting regional economic conditions. Factors such as limited employment opportunities can lead to temporary or long-term out-migration by young families who often have supportive roles in the lives of seniors. This trend can create multiple challenges for families, communities, and health systems in their efforts to help seniors live at home and in their home communities.

DO ARCTIC GULLS MOVE DIFFERENTLY THAN THEIR SOUTHERN COUSINS?

Anderson, Christine (1), M. Mallory (1), G. Gilchrist (2), R. Ronconi (3), C. Weseloh (3) and D. Clark (4)

(1) Acadia University (Wolfville, NS, Canada); (2) Environment and Climate Change Canada (Ottawa, ON, Canada); (3) Canadian Wildlife Service (Halifax, NS, Canada); (4) Massachusetts Department of Conservation and Recreation (West Boylston, MA, United States)

Herring Gulls are a wide ranging generalist species. Their population size has increased exponentially since the Migratory Birds Convention was signed 100 years ago, making them an interesting counterpoint to the common conservation focus on decline and fragility. Their ecological flexibility allows them to exploit changing environmental conditions. The rapidly changing Arctic environment may open new niches for generalists like Herring Gulls, while closing the niches of more sensitive specialist species. We were curious how the relatively unstudied Arctic breeding Herring Gulls behave in comparison to their southern breeding cousins in Atlantic Canada and Ontario, and what this might mean in a changing Arctic. We used state-space models to analyze satellite transmitter tracks to compare their patterns of movement and habitat use. We found that Arctic breeding gulls spent remained in the north for up to several months before migrating, and migrated 3 times further than the southern breeding gulls, spending their winters in the Gulf of Mexico. The Arctic breeding gulls spent 70% of their winter in marine habitats, while southern breeding gulls spent only 40% of their time in marine habitats, and a much greater proportion in anthropogenic habitats. This difference in winter habitat use may help to explain previous studies showing that arctic breeding Herring Gulls have higher survival rates than southern breeding gulls. The gulls we tracked wintered in the immediate vicinity of the Deepwater Horizon explosion in 2010, another illustration of how the arctic is interconnected with other ecosystems.

SHORT BREAK OF POLAR NIGHT JET IN EARLY WINTER RELATED WITH COOLING OVER SIBERIA

Ando, Yuta (1), K. Yamazaki (2), Y. Tachibana (1), K. Kodera (3), M. Ogi (4) and J. Ukita (5)

(1) Weather and Climate Dynamics Division, Mie University (Tsu, Japan); (2) Hokkaido University (Sapporo, Japan); (3) Institute for Space-Earth Environmental Research, Nagoya University (Nagoya, Japan); (4) Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada); (5) Department of Environmental Science and Technology, Niigata University (Niigata, Japan)

Lower stratosphere atmospheric circulation over the polar cap region in the winter is called polar night jet (PNJ). The climatological PNJ increases from October to January. However, during late November, the PNJ stops increasing temporarily. In this study, we examined the cause of stopping increasing of the climatological PNJ. The upward propagation of planetary wave over Siberia from troposphere to stratosphere is important for the stagnant of the PNJ. The upward propagation of planetary wave is related with strength of the trough over Siberia. The longitudinally asymmetric forcing by land–sea heating contrasts might be one of the main
causes of the stagnant of the PNJ. The results of this study might suggest that a gap between fall and winter exist during late November.

CLIMATE CHANGE AND SEA ICE: MARINE SHIPPING ACCESS IN HUDSON BAY AND HUDSON STRAIT (1980-2014)

Andrews, Jonathan (1), D. Babb (2) and D. Barber (3)
(1) University of Manitoba - Centre for Earth Observation Science (CEOS) (Winnipeg, Canada);
(2) University of Manitoba - Centre for Earth Observation Science (Winnipeg, Canada);
(3) University of Manitoba- Centre for Earth Observation Science (Winnipeg, Canada)

Marine shipping has been increasing in Hudson Strait and Hudson Bay and the shipping route that travels through these waters to the Port of Churchill may soon become a federally-designated transportation corridor. A passive microwave-based sea ice concentration dataset was used to characterize the timing of sea ice on the shipping corridor to the Port between 1980 and 2014. Efforts were made to produce results in a readily accessible format for stakeholders of the shipping industry; for example, open water was defined using a sea ice concentration threshold of ≤15% and results are presented in terms of real dates instead of relative anomalies. Between 1980 and 2014, the average breakup date on the corridor was July 4th, the average freeze-up date was November 25th, and the average length of the open water season was 145 days. However, each of these three variables exhibited significant long-term trends and spatial variability over the 35-year time period. Regression analysis reveals significant linear trends towards earlier breakup (-0.66 days/year), later freeze-up (+0.52 days/year), and a longer open water season (+1.14 days/year) on the corridor between 1980 and 2014. Moreover, the section of the corridor passing through Hudson Strait displayed significantly stronger trends than the two sections in Hudson Bay (i.e. “Hudson Islands” and “Hudson Bay”). As a result, sea ice timing in the Hudson Strait section of the corridor has diverged from the timing in the Hudson Bay sections. For example, the 2010–2014 median length of the open water season was 177 days in Hudson Strait and 153 days in the Hudson Bay sections. Significant linear relationships were observed amongst breakup, freeze-up, and the length of the open water season for all sections of the corridor, and correlation analysis suggest that these relationships have greatest impact in Hudson Strait.

BIOTIC CONSTRAINTS TO TALL SHRUB RECRUITMENT IN THE TUNDRA

Angers-Blondin, Sandra (1), I. Myers-Smith (2) and S. Boudreau (3)
(1) School of GeoSciences, University of Edinburgh and Centre d’études nordiques, Université Laval (Edinburgh, United Kingdom);
(2) School of GeoSciences, University of Edinburgh (Edinburgh, United Kingdom);
(3) Département de biologie et Centre d’études nordiques, Université Laval (Québec, Canada)

Climate change is expected to affect ecosystem boundaries as species migrate to track their climatic optimum. In plant populations, range shifts rely heavily on recruitment from seed at higher latitudes or elevations. However, establishment can be compromised by several ecological obstacles such as the lack of suitable seedbeds or chemical interference from other plants. These constraints have been shown to impact treeline dynamics and could have similar implications for tall shrub expansion in the tundra. To determine whether plant-plant interactions have the potential to limit range shifts of tall shrubs, we ask the following question: Does vegetation above the tall shrub line affect the germination of shrub seeds? Under controlled conditions at two field sites in the Yukon Territory, we investigated two potential mechanisms of interference: 1) vegetation acts as a physical barrier preventing the seeds from reaching a suitable seedbed, and 2) chemicals released by dwarf shrubs inhibit germination of tall shrub seeds. To test the first hypothesis, we ran a scarification experiment where seeds of Salix pulchra were sown on four types of ground cover: moss-, graminoid-, and forb-dominated ground and scarified ground (all above-ground vegetation removed). Emergence was significantly higher on scarified than on graminoid- and forb-dominated ground and scarified ground (all above-ground vegetation removed). Emergence was significantly higher on scarified than on graminoid- and forb-dominated ground. This could mean that taller ground vegetation physically prevents seeds from reaching a moist and suitable substrate where they can germinate. To test the second hypothesis, we ran a germination trial where we subjected seeds of the willows S. pulchra, S. richardsonii and S. arctica to potentially allelopathic leachates from the ericaceous dwarf shrubs Vaccinium uliginosum and Cassiope tetragona. Germination in most treatments did
not differ from that of control seeds, except for *S. richardsonii* which did appear sensitive to *C. tetragona* extract. Species-specific differences in vulnerability to allelopathy could lead to differential colonisation success above the current shrub line. Shrubs have been increasing across the circumpolar region for the last half-century, impacting the structure and functioning of tundra ecosystems. Increases in growth and infilling of existing stands are well documented, but upslope or northward migration is a rarer phenomenon. Climate-driven range shifts will only occur if ecological barriers to seed dispersal, germination, and seedling survival are overcome. Our findings emphasise the need to consider biotic interactions when attempting to predict changes in ecosystem boundaries.

**4TH WORLD CONFERENCE ON MARINE BIODIVERSITY**

Archambault, Philippe (1), C. Grant (2), K. Juniper (3) and P. Snelgrove (4)

(1) Université Laval (Québec, Canada);
(2) Université du Québec à Rimouski (Rimouski, Canada);
(3) University of Victoria (Victoria, Canada);
(4) Memorial University of Newfoundland (St. John’s, Canada)

The World Conference on Marine Biodiversity has become the major focal assembly for sharing research outcomes, management and policy issues, and for discussions of the role of biodiversity and conservation in sustaining ocean ecosystems. Arranged on a 3–4 year cycle, previous WCMB meetings have each attracted more than 1000 leading specialists and participants from around the world, and catalyzed numerous sidebar sessions on marine biodiversity issues. The 4th edition of the WCMB will be held in Montréal (Québec, Canada) from May 20–23, 2018 in partnership with the Secretariat of the Convention on Biological Diversity and Fisheries and Oceans Canada. This meeting will bring together scientists, practitioners, and policy makers to discuss and advance our understanding of the importance and current state of biodiversity in the marine environment. Through a mix of keynote sessions, contributed talks and posters, and bookable venues for focused meetings, the conference program will address marine biodiversity across a deliberately wide range of relevant sectors. Participation will be encouraged from the broadest possible range of stakeholder groups from academics to industry. The theme, “Connecting with the living ocean,” will emphasize the connection between all segments of society and the ocean’s biodiversity.

**CONTROLS ON HYDROCARBON CONCENTRATIONS AND ACCUMULATIONS RATES IN ARCTIC SEDIMENTS, KIVALLIQ REGION, NUNAVUT**

Armah, Wilhelmina (1), Z. Z. Kuzyk (1), J. Ritchie (1), M. Kamula (1), R. Macdonald (2) and G. Stern (1)

(1) University of Manitoba (Winnipeg, Canada);
(2) Fisheries and Oceans Canada, Institute of Ocean Sciences, Sidney, BC, (British Colombia, Canada)

The Kivalliq region of Nunavut is becoming an important passage for marine transportation, owing in part to decrease in sea ice extent during the summer. Shipping activities associated with mining companies and the Port of Churchill, also have increased. The recently established Ukkusiksalik National Park in Wager Bay, just north of Chesterfield Inlet, may lead to cruise-ship traffic within the area in the future. This increased marine shipping has raised concerns about potential for oil spills. Thus, there is a need to determine baseline concentrations, which could be used to monitor and identify any future spills that may occur. The existing baseline hydrocarbon concentrations and distribution may reflect non-petroleum hydrocarbon sources (e.g., pyrogenic and biogenic sources) and the effects of natural processes and controls. Sediment cores were collected from seven sites in Kivalliq (across Chesterfield Inlet and Wager Bay) aboard the Nuliajuk research vessel in August 2016. Sediment cores were sub-sectioned aboard. At the University of Manitoba, samples are being analysed for 210Pb and 137Cs to establish sedimentation rate controls and organic carbon and stable carbon isotope ratios (δ13C) to characterise the geochemical setting. Selected cores are being analysed for hydrocarbon compounds using Gas Chromatography-Time of Flight Mass Spectrometry (GS TOF-MS). Polycyclic Aromatic Hydrocarbons (PAHs) and n-alkane compounds in crude oil have potential toxic effects to marine organisms when they settle to sea sediments. Certain compounds and their relative abundance (ratios) also provide useful tools for distinguishing different hydrocarbon sources. Therefore, this project will determine concentration of suites of PAH and n-alkane compounds in the sediments. By
combining the hydrocarbon data the geochronology for the cores and supporting geochemical data, we will seek to establish a solid understanding of the predominant sources and controls on hydrocarbon distribution in the region under the existing baseline conditions.

SPATIO-TEMPORAL ECOLOGY OF ARCTIC CHARR FROM INUIT QAUJIMAJATUQANGIT AND SCIENCE
Arnold, Sarah (1), Kangiqliniq HTO (2) and R. Tallman (1)
(1) University of Manitoba (Fort Simpson, Canada); (2) Kangiqliniq Hunters and Trappers Organization (Rankin Inlet, Canada)

As the pace of development and environmental change increases across the Arctic, freshwater habitats, and therefore the productivity of fish populations that use these during key life history stages such as spawning and feeding, may be affected. Of particular concern are impacts on Arctic Charr (Salvelinus alpinus), which is important to Inuit both culturally and as the primary subsistence, recreational, and commercial fishery across Nunavut. To date, research on Arctic Charr habitat use in Nunavut has occurred in high Arctic areas where they are allopatric; however, across most of the Territory they in fact co-exist in freshwater with other species such as Lake Trout (Salvelinus namaycush) and whitefish (Prosopium cylindraceum and Coregonus spp.). Although there has been little research in Canada about how Arctic Charr use lake habitat in sympatry, competitive interactions between such similar species have been shown in other systems to lead to separation of habitats and resources (e.g. food) that can favour one species. Recent proposals to develop whitefish fisheries in the Kivalliq and Kitikmeot regions of Nunavut have consequently raised management concerns about the impact of these on Arctic Charr productivity in shared ecosystems. Working with the Kangiqliniq Hunters and Trappers Organization in Rankin Inlet, this research is investigating the relative productivity and anticipated habitat use and partitioning of Arctic Charr, Lake Trout and whitefish in three interconnected lakes – Qamaniq (Peter Lake), Tasirjuaq (Meliadine Lake), and Qamanaarjuk (Little Meliadine Lake) – in the Kivalliq. Using a multi-method approach, depth-stratified gill-net sampling and pre-existing scientific data will be integrated with Inuit Qaujimajatuqangit from expert interviews in a geographic information system, to identify key lacustrine habitat characteristics for Arctic Charr, Lake Trout, and whitefish. These relationships will form the basis of an expert model that will provide a more detailed and comprehensive understanding of multi-species competitive interactions and habitat partitioning. This research will ultimately provide insight for into Arctic Charr relationships with competitor species, and habitat components, to inform multi-species fisheries management in Nunavut; and will apply a novel technique to using the rich knowledge source of Inuit Qaujimajatuqangit in decision-making.

IMPACTS OF ENHANCED TEMPERATURE AND SNOW DEPOSITION FOR SEVEN YEARS ON VEGETATION COVER, PHENOLOGY, AND CO2 EXCHANGE IN THE CANADIAN HIGH ARCTIC
Arruda, Sean (1), N. Scott (1) and G. Henry (2)
(1) Queen’s University (Oshawa, Canada); (2) University of British Columbia (Vancouver, Canada)

Arctic regions are expected to experience an increase in both temperature and precipitation over the coming decades, which is likely to impact vegetation dynamics and greenhouse gas exchange. To test this response, an experiment was installed at the Cape Bounty Arctic Watershed Observatory, on Melville Island, NU, in 2008 as part of the International Tundra Experiment (ITEX). Snow fences and open-topped chambers (OTCs) were used to manipulate snow depth and air temperature, respectively. Unlike most ITEX sites to date, enhanced temperature and snowfall were combined here in a full factorial design with eight replicates. As an added control, four plots were established well outside the enhanced snow area. Vegetation plots receive one of four treatments: unaltered (Control-Control (CC)), enhanced temperature only (Control-Warmed (CW)), enhanced snow depth only (Snow-Control (SC)), and combined snow and temperature enhancement (Snow-Warmed (SW)), plus the additional outer control plots (Outer-Control (OC)). Plant phenology was monitored throughout the summer and at the peak of the growing season a vegetation survey was conducted within each plot in order to determine the total percent cover of each plot, as well as the percent cover of individual species. Carbon dioxide (CO2) exchange was also measured within each plot on eleven days throughout the growing season. ANOVAs were used to 1) assess treatment differences in plant phenology, and 2) assess vegetation
changes since 2009, and 3) assess differences in CO2 exchange rates between treatments. The date of senescence occurred significantly earlier in plots which had not been manipulated in any way (OC), compared to all other treatments for all species. These plots also showed a distinctly earlier decrease in NDVI values immediately after the peak of the growing season. Salix arctica showed the greatest increase in cover over time at the species level. Lichen cover increased significantly in the deepened snow plots, and in general there were significant increases in percent cover in some functional groups over time. Rates of net ecosystem CO2 exchange were positive (net atmospheric gain) during the early half of the growing season, and negative (net atmospheric loss) in the latter half for all plots except those exposed to warming alone. Warming alone (no enhanced snow depth) resulted in the ecosystem acting as a significant net carbon sink for the entire growing season. Plots exposed to this warming treatment were estimated to have removed approximately 19.94 g C/m^2 from the atmosphere, whereas all other treatments were very similar to one another and estimated to have added approximately 3.12 g C/m^2 to the atmosphere, on average. Active layer depth and soil temperature data suggest that the plots within the ambient snow depth zone may be receiving some additional snow due to their proximity to the fences. CO2 fluxes measured within the outer control plots lead us to believe that the effect of warming alone could lead to this ecosystem being an even stronger net C sink under truly ambient snow conditions, however further work will be needed to demonstrate this.

**SYNOPTIC METEOROLOGICAL DRIVERS OF STORM SURGES IN THE WESTERN CANADIAN ARCTIC**

Asplin, Matthew and D. Atkinson

Department of Geography, University of Victoria (Victoria, Canada)

Declining Arctic sea ice extent and commensurate increases in fetch are increasing the risk of damaging storm surges along the Canadian Arctic coastline. Storm-driven changes in water levels can result in coastal flooding, increased wave erosion, and low-water levels (negative surge) that can introduce hazards and challenges to shipping and transportation. Extensive storm-induced flooding occurs mostly during the fall before sea ice has formed. Delayed freeze-up attributed to climate change maintains fetch in a period when strong storms and winds can occur, and will likely increase the likelihood of storm flooding and the frequency of overbank flooding. While coastal ecosystems are dependent on frequent sedimentation and salinization from small floods, larger storm floods can cause salinization of freshwater ponds and non-saline meadows, damage vegetation along the margins of permafrost plateaus, melt subterranean permafrost causing underground hollows subject to collapse (thermokarst), and affect village infrastructure. This project investigates the occurrence and drivers of storm surge events in the western Canadian Arctic, and presents a summary of storm surge events and a first-hand look at key meteorological drivers. DFO/CHS water level gauge data from a large number of water level stations was first extracted and reduced to develop a database of surge events. Identification of synoptic meteorological drivers for these vents were then conducted using a synoptic climatology based upon principal components analysis (PCA) and k-means clustering of gridded NCEP-NCAR II mean sea level pressure data. Future work will conduct numerical modeling exercises of water levels for the Amundsen Gulf Region, and identify meteorological patterns associated with “worst case” surge events. Community visits will be conducted at Tuktoyaktuk, Sachs Harbour and Ulukhaktok in late 2017 to further quantify and qualify exceptional storm surge events affecting these communities in recent years of reduced sea ice minima.
Polynya System may present opportunities for winds to generate waves capable of propagating into the thick pack ice formed over the winter. A waves-in-ice event at a study site located on the Canadian Shelf in the southern Beaufort Sea occurring 22 – 23 May 2011 is identified and analyzed for wave attenuation and dissipation characteristics. The event was monitored near the ice edge, and therefore presents information on attenuation of waves from the ice edge into the pack. Waves of T = 5 s were observed up to ~143 m and ~77 m from the ice edge respectively during two separate ice edge wave propagation observation periods. We estimated reflection coefficients of 53% and 52%, and attenuation coefficients of α = 2.4 • 10^{-2} m^{-1} and α = 5.4 • 10^{-2} m^{-1}. Estimated attenuation rates are an order of magnitude greater than comparable studies in other areas and ice regimes, and may indicate the lack of a “rollover” effect in attenuation rates.

**REGRESSION ANALYSIS OF WINTER SEA ICE DRIFT AND SYNOPTIC ATMOSPHERIC FORCING IN THE SOUTHERN BEAUFORT SEA**

Asplin, Matthew (1), D. Fissel (2), D. Babb (3), K. Borg (2), J. Barrette (2) and D. Barber (3)

(1) Department of Geography, University of Victoria (Victoria, Canada);
(2) ASL Environmental Sciences Inc. (Victoria, Canada);
(3) Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada)

Recent declines in Arctic sea ice extent and volume have led to an increasingly mobile winter Arctic sea ice pack, which subsequently affects dynamic and thermodynamic processes in the sea ice itself and the underlying ocean near-surface layer during winter. Observations of sea ice drift obtained with a large array of moored acoustic doppler current profilers (ADCP) for the winter and spring periods (January – May) of 2010 and 2011 have been analyzed to examine the response of sea ice drift to wind forcing and ocean currents over the outer continental shelf and slope of the Canadian Beaufort Sea during winters following below-average summer sea ice extent. Over extended periods spanning multiple events for each synoptic weather pattern, winter seasonal response (January – May) of sea ice motion ranges from 0.29 – 0.35% of local wind over much of the inner continental slope, which is expectedly small given the increasing sea ice extent, thicknesses, and volumes during this time period. Sea ice drifts to the right of the local wind, at angles ranging from 21.5° – 28.3°. Investigations of sea ice motion within different classifications of synoptic atmospheric circulation reveal greater variability in sea ice response to wind forcing of -0.79% – 2.54% of local wind, with turning angles ranging from 0 – 42° to the right of the local wind. The response to wind forcing is greatest for synoptic types representing the Beaufort High, and for periods of strong easterly wind forcing over the southern Beaufort Sea. The response of sea ice drift to wind forcing over individual episodes of easterly and westerly wind events is also being analyzed. The large wind-driven response of ice drift observed in this study, in comparison with the Arctic Ocean proper, may result from (1) reduced levels of internal ice stress associated with the generally thin ice cover and lower areal concentration of sea ice, (2) large atmospheric drag coefficients associated with the small ice floes in areas of comparatively higher ice concentration, and (3) smooth ice bottom, caused by melting, and the associated reduction in ice-ocean drag coefficient. In more inshore areas the ice to wind coupling is reduced owing to larger internal ice stresses experienced locally due to higher ice concentrations and increased internal ice stress arising from the proximity to the landfast ice and stamukhi zone.

**DISTRIBUTION, POPULATION DEMOGRAPHICS, AND BYCATCH OF SKATES IN THE NORTHWEST ATLANTIC**

Atchison, Sheila (1), W. Walkusz and K. Hedges

Fisheries and Oceans Canada (Winnipeg, Canada)

Increased awareness of the susceptibility of skates to fishing pressures (including incidental bycatch) has led to a number of policy and management initiatives globally and within Canada. Frameworks, such as Canada’s National Plan of Action for the Conservation and Management of Sharks, have been put in place to improve the management of elasmobranch fisheries and bycatch in Canada. This framework includes the adoption of the ecosystem approach to fisheries management, which takes into consideration ecosystem structure and function, along with the health of populations of commercial and non-commercial species. The purpose of this study is to use available fisheries-independent data to describe the distribution and population demographics (i.e., sex ratio and length frequency) of skate species in Davis Strait,
and to quantify skate bycatch using commercial trawl data. Approximately 10 species of skate are known to occur in Davis Strait (more specifically the Northwest Atlantic Fisheries Organization Subarea 0). Although there is no directed skate fishery in this area, skates are caught as bycatch in commercial Greenland Halibut (Reinhardtius hippoglossoides), Northern Shrimp (Pandalus borealis) and Striped Shrimp (Pandalus montagui) fisheries. Skates are a k-selected group, meaning they are generally long-lived, slow-growing, and late-to-mature with low fecundity. Their life history makes them particularly susceptible to exploitation as their populations are not resilient against frequent (relative to fecundity) or sustained high mortality. As skates occupy a high trophic position, skate mortality may impact the trophic dynamics of the broader Arctic marine ecosystem. Along with fishing pressure, climate change is expected to affect skate populations through altered community structure and trophic dynamics (i.e., through changes in fish distributions) in Arctic marine ecosystems. Ultimately, a better understanding of the distributions, population demographics, and bycatch rates of skates in the Northwest Atlantic will help inform the development of policies, management practices, and public awareness that will benefit the long-term health of skate populations and ecological sustainability of marine fisheries.

DISSOLVED ORGANIC MATTER, DISINFECTION DEMAND, AND NORTHERN DRINKING WATER

Aukes, Pieter (1), S. Schiff (2), M. English (3) and R. Elgood (2)

(1) University of Waterloo (Port Rowan, Canada); (2) University of Waterloo (Waterloo, Canada); (3) Wilfrid Laurier University (Waterloo, Canada)

Dissolved organic matter (DOM) plays a dominant role in determining overall water quality. Comprised of thousands of molecules with varying structural and chemical properties, DOM can influence water taste, odour, colour, and treatability. For example, DOM can react with chlorine during the treatment of drinking water to form carcinogenic disinfection by-products (DBP). The presence of DOM also increases chlorine requirements (disinfection demand) for distribution of safe drinking water. However, how DOM reacts with chlorine is dependent upon its quality, where different qualities can lead to variations in both disinfection demand and DBP. As Canada’s North continues to warm and permafrost degrades, there is the potential for large amounts of previously-frozen carbon to be mobilized into surrounding surface waters. Further, changes in subsurface flow pathways accompanying permafrost degradation lead to uncertainty over how water quality in the North may change, and how it will influence ecosystem health and drinking water quality. This study examines how different measures of DOM quality respond to disinfection demand, and how photolytic degradation may impact its final treatability. We used a latitudinal gradient of sites across the Northwest Territories, from the boreal shield taiga to tundra, to explore effects of climate and vegetation on DOM quantity and quality. Samples were collected from ponds, creeks, lakes, and the subsurface from Yellowknife (discontinuous permafrost, boreal taiga), Wekweet (continuous permafrost, at treeline), and Daring Lake (continuous permafrost, tundra), NWT. DOM characterization techniques (size-exclusion chromatography, ultraviolet and visible absorbance, DOC:DON) were coupled with measurements of disinfection demand to determine what measures of quality may predict disinfection demand and DBP formation. Furthermore, experiments were conducted under natural sunlight to assess how DOM quality and disinfection demand were influenced by photolytic degradation. Highest DOM concentrations were found from subsurface waters from discontinuous permafrost areas, and required higher amounts of chlorine when compared to ponds, lakes, and creeks. Although exposure to natural sunlight decreased DOM concentrations and the amount of chlorine required, there was no reduction in disinfection demand per molecule of carbon. These differences indicate DOM quality plays an important role in determining DBP formation, not just the overall concentration. Determining the fate and changes to DOM quality will help with our understanding of how northern drinking water quality may change in response to a warming North.
**GEOCHEMICAL TRENDS OVER 30 YEARS IN THREE RIVERS NEAR YELLOWKNIFE, NWT**

Aukes, Pieter (1), D. Hambly (1), S. Schiff (1), M. English (1), M. Palmer (2) and R. Staples (2)

(1) University of Waterloo (Port Rowan, Canada);  
(2) Government of the Northwest Territories (Yellowknife, Canada)

Northern environments are some of the most sensitive to a warming climate experiencing a number of changes such as the amount and timing of precipitation, deepening of the active layer, and degrading permafrost. Changes to the dissolved constituents within a river can influence both aquatic health and drinking water quality. Long-term water quality monitoring provides one method for assessing the sensitivity of freshwater ecosystems to change, allowing for changes to be observed over large timescales, or to observe the influence of sudden events (such as wild fires). However, it is difficult to discern either climate or anthropogenic changes from natural variability. Baseline conditions need to be established as changes may occur on different timescales. Further, seasonal differences can also influence quality and quantity of water. With increased industrial development and the continual need for sustainable drinking water resources, understanding baseline conditions allows for the determination of the current status of water quality in the Northwest Territories, as well as potential future impacts from industry and a changing environment. Here we present long-term (~30 year) geochemical datasets from the three large rivers in the Northwest Territories that feed from the north into Great Slave Lake: the Yellowknife, Cameron, and Marian rivers. Long-term trends major ions (calcium, chloride, magnesium, potassium, sodium, and sulphate), nutrients (inorganic nitrogen, dissolved organic carbon, and total phosphorus), alkalinity, pH, and total dissolved solids within each dataset were calculated using statistical analyses to examine changes to major ions and nutrients within the three rivers. These results will help identify if these sub-arctic rivers have been changing over the last 30 years, and if baseline conditions can be established for assessing future changes.

**MONITORING WOLVERINES – NON-INVASIVE AND COMMUNITY-BASED INITIATIVE**

Awan, Malik (1), J. Boulanger (2) and A. Ishalook (3)

(1) Department of Environment Government of Nunavut (Igloolik, Canada);  
(2) Integrated Ecological Research (Nelson, BC, Canada);  
(3) Arviat Hunters and Trappers Organization (HTO) (Arviat, NU, Canada)

We present the first estimates of wolverine population density in the Kivalliq region, Nunavut. We used genetic analysis to identify individual wolverines from hair samples collected by utilizing Inuit hunter’s knowledge, relevant skills and capacities. In March-April, 2015 we sampled 182 baited (caribou and scent lures) posts in 5x5 km (25 km2) cells for three 10-day sessions in a 4550 km2 area in the vicinity of north Henik Lake. Spatially explicit capture-recapture (SECR) methods were used to estimate density and population size of wolverines. We detected 40 (19F:21M) individuals wolverines over sampling with an increase in detections after the initial session. Average wolverine density was 4 .32 wolverines/1,000 km2 (SE = 0.54). This collaborative research project with Arviat Hunters and Trappers Organization (HTO) has provided valued training, employment and technical skills transfer to promote self-reliance and capacity-building in HTO. This study provides baseline data for long-term monitoring wolverines in the area, and demonstrates the efficiency of joint research projects to inform management.

**SEASONAL PRECONDITIONING AND ANOTHER ICE FREE BEAUFORT SEA DURING SEPTEMBER 2016**

Babb, David, R. Galley, J. Landy, S. Rysgaard and D. Barber

University of Manitoba (Winnipeg, Canada)

During the 2016 September sea ice minimum the Beaufort Sea became ice free for the second time in the observational record. Continuing our work from the 2012 sea ice minimum, when the Beaufort Sea became ice free for the first time, we look at how late winter dynamics seasonally preconditioned the ice pack for an early breakup and accelerated ice albedo feedback loop. We focus on a series of storms during
late winter that drove easterly winds and caused the ice pack to diverge, thereby creating areas of young ice that preferentially melted out during spring. Using ice charts from the Canadian Ice Service and Cryosat-2 ice thickness data, we identify the effect these storms had on the ice pack and set the historical context of such preconditioning. An updated analysis of solar heating of the upper ocean through areas of open water is then presented, along with a discussion of the environmental and social consequences of a potentially perennially ice free Beaufort Sea.

SPRING COMES TO BAFFIN BAY: FOLLOWING THE PHYTOPLANKTON BLOOM WITH THE GREENEDGE PROJECT

Babin, Marcel
Takuvik Joint International Laboratory, CNRS & ULaval, Département de Biologie, Université Laval, Québec, Québec G1V 0A6 (Québec, Canada)

The general objective of the GreenEdge project is to understand the dynamics of the phytoplankton spring bloom and determine its role in the Arctic Ocean of tomorrow, including for human populations. The field operations took place aboard the CCGS Amundsen as well as at an ice camp and a hunting camp near the Inuit village of Qikiqtarjuaq (Nunavut). These activities spanned the period of Spring 2015 to Summer 2016. At the ice camp, the sampling site was sampled 47 times in 2015 and 36 times in 2016, beginning in completely ice and snow covered conditions and ending in 2016 with a station on the ice edge, in quasi-open waters with the presence of ice floes. We measured background winter conditions as well as processes under ice algae bloom and phytoplankton bloom conditions. A total of 52 people contributed to the ice camp efforts over a 98-day period (April 21 to July 27), measuring a total of 70 variables to characterize the physical, chemical and biological ecosystems in the land-fast sea ice and the water column. In parallel to the ice camp operations, 52 GreenEdge researchers were aboard the CCGS Amundsen between June 3 and July 14 2016. In addition to all of the variables that were measured at the ice-camp, the Amundsen science crew also deployed autonomous platforms (gliders and bio-Argo floats), had an elaborate physical oceanography program, and conducted detailed measurements of processes in the water-column. They completed 7 transects at the approximate latitude of the ice camp, with a total of 141 stations, going from pre-bloom, to full bloom and post-bloom conditions. Due to the timing of the mission, the Amundsen crew did not observe much ice algae activity. However, this information is well documented from the ice camp time series. Sediment cores were also collected from the Amundsen to conduct paleoceanographic measurements in 2015 and 2016. Finally, GreenEdge has dedicated a large part of its program to the human component: social science, communication and outreach activities. First, interviews, supported by a hunting camp permitted us to gather Inuit knowledge, essential to building a food security model. Second, we had a film crew, Parafilms, both on the Amundsen and at the ice camp to document the science activities, which will be the foundation for a 52-min documentary and will provide the material for 12 educational web-documentaries on various Arctic-related topics. Third, an outreach program was elaborated both in Qikiqtarjuaq with the local elementary and high school and on the Amundsen with schools in France. And fourth, an informative blog was animated daily with over 60 posts in 2015 and 100 posts during the 2016 edition of the GreenEdge campaign.

TOXOPLASMA GONDII EPIDEMIOLOGY IN WILDLIFE OF NUNAVIK, NORTHEASTERN CANADA

Bachand, Nicholas (1), B. Dixon (2), A. Ravel (3), P. Leighton (3), S. Olpinski (4), G. Gilbert (4), C. Stephen (5), M. Ndao (6), A. Iqbal (7) and E. Jenkins (8)

(1) Department of Veterinary Microbiology, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon S7H 5B4 (Saskatoon, Canada);
(2) Microbiology Research Division, Bureau of Microbial Hazards, Food Directorate, Health Canada, Ottawa K1A 0K9 (Ottawa, Canada);
(3) Department of Veterinary Microbiology, Faculty of Veterinary Medicine, Université de Montréal, Saint-Hyacinthe J2S 2M2 (Saint-Hyacinthe, Canada);
(4) Makivik Corporation, Saint-Laurent H4M 2X6 (Montreal, Canada);
(5) Canadian Wildlife Health Cooperative, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon S7N 5B4 (Saskatoon, Canada);
(6) National Reference Centre for Parasitology, J.D. MacLean Tropical Diseases Centre, McGill University,
Toxoplasma gondii, a protozoal parasite, can infect most mammals and birds worldwide. Though infection in humans is usually asymptomatic, it can cause illnesses in the fetuses of susceptible pregnant women and in immunocompromised individuals. A regional health survey done in Nunavik, northeastern Canada, showed that between 37% and 87% of Inuit people from different communities were seropositive for T. gondii compared to 33% in the global human population. Handling and consumption of wildlife constitute risk factors for seropositivity in Inuit people, yet little is known about the epidemiology of T. gondii in wildlife of Nunavik. Two of this parasite’s three infective stages are transmitted differently to wildlife species from different trophic levels of the food chain. All warm-blooded vertebrate hosts can get infected by ingesting oocysts shed in the environment by felids, but only carnivores (e.g. foxes) can be infected by consuming cysts within the tissues of their prey. But because felid hosts are rare above the treeline in Nunavik, it is questionable whether oocysts are present in this region. Between April 2015 and June 2016, an ecological approach was taken to assess for the presence and distribution of T. gondii throughout Southern Nunavik by sampling native and migratory wildlife species from different trophic levels of the food chain. As sentinels for transmission of tissue cysts and/or oocysts, foxes from four locations were sampled to extract DNA from tissues (brain, heart) using the magnetic capture extraction method followed by real-time PCR. To assess endemic oocyst transmission, blood and tissues (heart, brain) were analyzed from sentinel herbivores of the terrestrial (30 caribou; 166 ptarmigan) and marine (61 ringed seals) ecosystems. The hypothesis that migratory species may introduce T. gondii into Nunavik from the south was explored by analyzing blood and tissues (heart, brain) from 156 Canada geese harvested from three locations in southwestern Nunavik. DNA of T. gondii was detected in 58% (CI: 35-81%) of foxes from four locations and 5% (CI: 2-9%) of geese from two locations, but was absent in all other species. Foxes and Canada geese therefore constitute part of T. gondii’s ecological niche in southern Nunavik. These results lend support to the hypothesis that geese may introduce T. gondii into the region where spillover into foxes, or other carnivores, could occur if cysts within geese tissues are ingested. Analyses of T. gondii genetic diversity will be done to determine sources and relationships between isolates from these two wildlife species.

DETERMINATION OF THE HENRY’S LAW CONSTANT OF CARBON DIOXIDE AT FREEZING TEMPERATURES

Bailey, Neal (1), Y. Hu (2), C. Bartels (3), T. Papakyriakou (2) and F. Wang (2)

(1) Centre for Earth Observation Science; Department of Chemistry; University of Manitoba (Winnipeg, Canada);
(2) Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada);
(3) Department of Chemistry, University of Manitoba (Winnipeg, Canada)

Increasing atmospheric CO2 is of special concern for the Arctic. Circumpolar regions are highly sensitive to the effects of CO2-induced climate change, such as increasing temperatures and ocean acidification. 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 the gas 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 inorganic carbon, and alkalinity. Preliminary results showed a trend of increasing aqueous phase CO2 concentration with decreasing temperature, and similar but less dominant relationship with salinity. Additionally, the experimentally determined Henry’s Law constants varied from the literature values estimated from simple extrapolation. Our results caution the use of extrapolated thermodynamic constants of CO2 in climate modelling, and call for experimental determination of these constants under conditions resembling those of the polar marine cryosphere.
AN OVERVIEW OF HUDSON BAY COMPLEX AND THE CURRENT RESEARCH

Barber, David G. (1,2)

(1) CEOS; (2) University of Manitoba

The Hudson Bay Complex consists of four closely-related marine regions in the Canadian Arctic: Hudson Bay, James Bay, Foxe Basin, and Hudson Strait. The Complex is the largest inland sea in the world, covering an area of roughly 1,240,000 km². The Complex receives Arctic marine water from Foxe Basin and freshwater runoff from a massive catchment basin that extends over a large portion of North America. Because of the large spatial extent of the Complex, the ecosystem and food webs are broad and varied. Arctic and Subarctic species use the area year-round and migratory fishes, marine mammals and birds are seasonally abundant. Many of the river systems in the Complex are now used for hydroelectric activity, while stretches of the Complex are used as sea routes for the movement of grain and minerals from the Canadian interior to the global economy.

The Centre for Earth Observation Science (CEOS) at the University of Manitoba is currently working with four large projects within the Hudson Bay Complex. This presentation will briefly introduce each project and how they are inter-related. 1) BaySys Project: The objective of the BaySys project is to provide a scientific basis to separate climate change and regulation impacts on the Hudson Bay system. It is a four-year comprehensive study that integrates field-based experimentation with coupled climatic-hydrological-oceanographic-biogeochemical modeling. 2) Hudson Bay IRIS: The ArcticNet Integrated Regional Impact Study (IRIS) for the Hudson Bay Complex is being written to summarize the current knowledge available for the coastal and marine environment of the Complex. The goal of this document is to provide relevant and practical information for regional decision-makers in an accessible format. 3) CMO: The Churchill Marine Observatory (CMO) will be a globally unique, highly innovate, multidisciplinary research facility located in Churchill, Manitoba. The CMO will directly address technological, scientific, and economic issues pertaining to Arctic marine transportation and oil and gas exploration and development throughout the Arctic. 4) GENICE: GENICE will combine cutting edge genomics with analytical chemistry and sea ice geophysics to characterize the Arctic marine microbiome and rates of biodegradation for a range of pollutants. The study will focus on the Hudson Bay Complex and transportation routes. Shipping traffic in the Hudson Bay is already intensifying and the region has many different Arctic communities in multiple provinces and territories.

THE CHURCHILL MARINE OBSERVATORY: A NEW RESEARCH FACILITY DEDICATED TO THE STUDIES OF DETECTION, IMPACT AND THE FUTURE OF THE OIL & GAS SECTOR IN THE NORTH: FIELD INVESTIGATIONS TO EVALUATE ICE ACTION ON THE DRAKE SUBSEA PIPELINE

Barrette, Paul and E. Gardin

National Research Council of Canada (Ottawa, Canada)

The Drake pipeline is located offshore Melville Island, in the Canadian Arctic. It has a length of 1.2 km and was connected to a production gas well in 1978. The well has since been plugged and both the wellhead and the pipeline were abandoned on the seabed. The National Research Council and its internally-funded Arctic Program are currently considering a field study on this structure, which would be carried out from the ice cover and would involve an underwater vehicle with appropriate ancillaries (cameras, notably). Physical contact with the structure or the wellhead is precluded. The purpose of this work, planned for 2019, is to see if the pipeline has sustained any damage by ice action, which is the main threat to subsea pipelines in the North. Several collaborators from both the public and the private sectors will contribute to this work by bringing in their own expertise – NRC will be leading this initiative. If/when the oil and gas sector resumes its activities in the North, the information collected during this study will help guide pipeline design and mitigate environmental risks. These activities can be subject to a significant amount of controversy, which should also be addressed prior to any further development in these ecologically sensitive areas. Community consultations will be held on both the field study itself and its prospective outcome.
WILDLIFE RESEARCH IN THE NUNAVIK MARINE REGION: FOCUS AND PRIORITIES

K. Breton-Honeyman, Basterfield, Mark, and T. Palliser
NMRWB (Inukjuak, Canada)

As the main instrument of wildlife management in the Nunavik Marine Region (NMR), the Nunavik Marine Region Wildlife Board (NMRWB) has a role in wildlife research in the coastal waters and offshore islands of Nunavik (Arctic Quebec). In recognizing the need for a coordinated research effort, the NMRWB has a mandate to review research proposals, maintain a research database, and identify research requirements and deficiencies as well as relevant people and agencies to undertake that research. Furthermore, the NMRWB has responsibilities to promote and encourage training and employment of Nunavik Inuit in the fields of wildlife research and management. To assist the NMRWB in carrying out these functions the Board was granted funds, which the Board used to establish a Wildlife Research Fund. Through this research fund, the Board supports government proposed wildlife research in the NMR that aligns with its mandate and priorities. The NMRWB seeks to fund projects that meet several criteria. The research should meet the needs of the NMRWB for making management decisions, including the recognition of the value of Nunavik Inuit knowledge of wildlife and wildlife habitat. Research projects should also provide training or employment opportunities for Nunavimmiut, and should include meaningful consultation with, and reporting to, involved communities. Projects should strive to include participation of Nunavik Inuit in data collection, make use of local guides, and hire support locally wherever needed. In addition to research into individual species, frequently for population assessments, the NMRWB has also funded projects that look at broader issues or that deal with ecosystem wide impacts (e.g. hydroelectric impacts on sea ice, and invasive species monitoring). In order to better understand the wildlife research priorities of the region’s hunters, a survey led by NMRWB staff, was conducted in 2015 and 2016; however, this abstract only speaks to the preliminary results of the 2015 survey. In addition to identifying research needs, the survey also asked about preferences for methods and approaches to wildlife research, and preferred means of results communication. The surveyed members of the hunter’s associations identified ringed seals as the species that most needed additional research attention, followed by beluga, sea birds, and eider ducks. Hunters identified the collection of baseline data for the purpose of informing development projects as the topic that most needed further investigation. In terms of preferred approaches to research, harvest sampling was the most preferred method, with observational methods, and genetics also being favoured, whereas tagging was the method that hunter’s requested be avoided. Hunters varied in how they wanted to receive results, though through in-person (i.e. community meeting) and radio broadcasts were preferred over written documentation. Through ongoing consultation and collaboration with the regional hunter organizations and other co-management partners, the NMRWB is committed to an efficient and coordinated wildlife research in the NMR to support an effective system of wildlife management.

AN INVESTIGATION INTO THE IMPACTS OF PERMAFROST SLUMPING ON THE THOMSEN RIVER WATERSHED IN AULAVIK NATIONAL PARK

Beattie, Sarah (1), P. Sinkins (1), F. Wang (2), N. Bailey (2), J. Culp (3), J. Lento (3), A. Dykstra (3) and S. Kokelj (4)

(1) Parks Canada Agency (Inuvik, Canada);
(2) Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada);
(3) Department of Biology, University of New Brunswick (Fredericton, Canada);
(4) Northwest Territories Geological Survey (Yellowknife, Canada)

In our warming climate, permafrost slumps continue to occur in alarming numbers along the banks of the Thomsen River and its tributaries. However, the impacts of these slump events on the Thomsen River watershed, at both a local and regional scale, remain unknown. Community members from Sachs Harbour, the closest community to Aulavik National Park, have recently expressed their concern regarding the effects of increased slumping activity on fish populations in local watersheds. Thus the main objectives of this work are to investigate the chemical and biological impacts that these slump events are having on the tributaries leading into the Thomsen River (local scale) and the Thomsen River as a whole (regional scale). This project is being carried out in close collaboration with the University of Manitoba, whose researchers have taken specialized permafrost, water and benthic invertebrate samples at slump sites to further analyze
for the presence of contaminants such as mercury. Additionally, in collaboration with the University of New Brunswick, algae and benthic invertebrate samples were taken at slump sites to further investigate the impacts of slumping on primary production and benthic invertebrate community composition. This work was carried out this past July during both helicopter- and canoe-based sampling campaigns. The visible effects of slumping on the morphology of the landscape and the watershed will be discussed, and preliminary water quality results both upstream and downstream of the slump sites will be presented. This project is supported by the Aulavik National Park Advisory Board, the Polar Continental Shelf Program and the Government of the Northwest Territories. In summary, this work demonstrates how strong collaboration among organizations operating in the Western Arctic can help to thoroughly address Northerners’ concerns on how their lands and traditional food sources are being affected by climate change.

SPACE USE AND POPULATION DYNAMICS OF THE DECLINING TORNGAT MOUNTAINS CARIBOU

Bélanger, Édouard (1), Mathieu Leblond (1), Steeve D. Côté (1)

(1) Caribou Ungava, Université Laval, Centre d’études nordiques (Québec, Canada)

The Torngat Mountains caribou herd in northern Quebec-Labrador is rapidly declining. Few studies have examined the causes of this decline and little is known about the space use and population dynamics of this important cultural entity for indigenous people. Using 35 Argos and GPS collars fitted on caribou between 2011 and 2015, we assessed space use relationships between Torngat Mountains caribou and the neighbouring Rivière-George migratory caribou herd and future population trends of the Torngat Mountains caribou. The overlap between the two herds declined substantially during the past 25 years and was negatively correlated with the Rivière-George herd abundance. This could result in decreased genetic exchanges and immigration between herds. The decline of the Torngat Mountains caribou was principally attributed to the low survival of adult females, originating from subsistence harvest and predation. Average annual adult female survival over the study period was 71%. Demographic models indicated that the population was in danger of declining to fewer than 50 individuals by 2029. Using different management scenarios, we determined that the best management action to reduce the decline of the Torngat Mountains caribou would be to decrease harvest, particularly on adult females.

MINING ECONOMIES, MINING FAMILIES: EXTRACTIVE INDUSTRIES AND BUSINESS DEVELOPMENT IN THE CANADIAN SUB-ARCTIC

Belahneh, Anteneh and S. Schott

Carleton University (Ottawa, Canada)

This paper focusses on the impacts of major extractive industries on business development in Nunatsiavut and Nunavik. The economic links between the Voisey’s Bay, Raglan mines, the mining industry and large scale hydro and local businesses were assessed through focus group discussions and a piloted survey. The discussions with business owners revealed three major themes surrounding the mining industry and economic development in these two regions. The first theme that emerged is that the benefits of mining are distributed differently between communities closer to the mine and larger regional hubs. This distribution of benefits seems to vary considerably by region. The second theme was how different economic benefits of mining are distributed at different stages of mine development with different experiences, expectations and challenges at each stage of the mining process. The final theme is specific to specialization of local companies and how the Impacts and Benefits Agreements (IBAs) between mining companies and communities might not be beneficial to specialized local businesses. Preliminary insights indicate that the ability of non-specialized local businesses to partner up with outside companies puts specialized local companies in a vulnerable position. In this paper we evaluate results from focus groups discussion in Kuujjuaq, Québec and pilot surveys in Goose Bay and Nain, Labrador, and discuss the structure and objectives of a comprehensive business survey with all Inuit owned businesses in each region.
FIRST CHARACTERIZATION OF HIGH ARCTIC SNOW PHYSICAL PROPERTIES AND ALBEDO, WARD HUNT ISLAND (83° 4’N, 74° 8’W)

Belke Brea, Maria (1), F. Domine (1), G. Picard (2) and L. Arnaud (2)

(1) Département de géographie, Université Laval, Québec, Québec, G1V 0A6, Takuvik Joint International Laboratory, Université Laval, Québec, Québec, G1V 0A6, Centre d’Études Nordiques, Université Laval, Québec, Québec, G1V 0A6 (Québec, Canada); (2) University Grenoble Alps and CNRS, LGGE UMR5183, 38041 Grenoble, France (Grenoble, France)

Snow covers the high Arctic during most of the year and influences the energy budget and ground temperature by modulating the heat exchange between the soil and the atmosphere. Moreover, the absorption and propagation of incoming solar light is determined by surface snow. The impact snow has on the energy budget results from its physical properties, mostly density, thermal conductivity and specific surface area (SSA), a measure of grain size. Snow properties are determined by post-deposition transformations, a process called metamorphism. The driving forces for metamorphism are wind transport and the high temperature gradient between the cold air and the soil which remains warm, mostly due to the freezing of soil water, a process that spans over months. Detailed snow studies have so far been conducted no further north than 73° N latitude. With this study we performed the northernmost snow measurements with the objective to investigate the differences between the very high Arctic snow pack and those further south. The climatology at Ward Hunt Island is characterized by extremely low temperatures and frequent strong winds causing high redistribution of snow. Moreover, the paucity of vegetation causes soils to be dry. These extreme conditions are presumed to be the reason for the very peculiar snow pack found on Ward Hunt Island. We measured 10 snow pits which showed a highly variable basal layer, compared to other Arctic sites like Bylot Island (73°N) and Barrow (71°N). While other Arctic snow packs usually show a basal layer of well-formed large depth hoar crystals, such crystals were poorly formed or absent at Ward Hunt. Basal layer densities reached 400 kg/m³, a lot higher than the usual 250 kg/m³. Basal layer SSA attains maximum values of 25 m²/kg rather than the more common 10 m²/kg value. Albedo values range from 0.91 to 0.95 and are therefore similar to other Arctic locations. This is not surprising as snow-light interactions take place within the upper 15 – 20 cm of the snow pack, which were found to be similar to other Arctic locations. Our on-going investigations attempt to determine whether these unusual characteristics are due to the extreme climate or to the very low soil moisture, which would accelerate soil cooling and limit the duration of the high temperature gradient typical for the Arctic.

ATMOSPHERIC CIRCULATION RESPONSES TO SEA ICE DECLINE ON HUDSON BAY

F. Fazel-Rastgar (1), Bello, Richard (1), R. Bello (2) and K. Higuchi (3)

(1) York University (Toronto, Canada); (2) York Univeristy Department of Geography (Toronto, Canada); (3) York Univeristy Gradaaute Program in Geography (Toronto, Canada)

The mechanisms responsible for recent increases in wind speed over Hudson Bay and their relation to sea ice decline are examined by analyzing NARR (The North American Regional Reanalysis Model) and NCEP (National Center for Atmospheric Research) physical and meteorological data over the past several decades. Monthly and seasonal means for years 2010-2015 and anomalies (departures from the 1981-2010) over the Hudson Bay region show significant changes in winds and temperatures mostly in the north-west, eastern and James Bays area. Hovmoller Diagram daily maximum and minimum, and yearly mean surface temperatures analyses from 1948 to 2015 clearly denote rapidly warming atmospheric temperatures for the Hudson Bay region from mid 1998. Sea surface albedo, surface and air temperatures, mean sea level pressure and surface wind vector anomalies for each season from 1998 to 2015 have been investigated. These reveal the formation of contrasting structures between cyclonic and anti-cyclonic local wind circulations over Hudson Bay mostly in the east, north and north-west regions associated with the change in mean sea level pressure patterns, the increase in near surface air temperature and decreasing surface albedos. The historical total accumulated Hudson Bay ice coverage both seasonally and yearly during 1980-2015, using Canadian Ice Service data shows enhanced ice reduction in the north and north west and eastern Hudson Bay rather the central part consistent with historical albedo changes.
MODELLING HEAT TRANSPORT AND SUBGLACIAL DISCHARGE FROM THE GREENLAND ICE SHEET IN GODTHÅBSFJORD

Bendtsen, Jørgen (1), J. Mortensen (2) and S. Rysgaard (3)

(1) ClimateLab (Copenhagen, Denmark);
(2) Greenland Climate Research Centre (Nuuk, Denmark);
(3) Center for Earth Observation Science (Winnipeg, Canada)

Tidewater outlet glaciers in fjords around Greenland connect coastal water masses with the Greenland Ice Sheet. Coastal water masses may be transported into the the bottom layers of the fjords and the associated heat transport therefore has the potential to increase melting of glacier ice. Together with runoff and subglacial discharge (i.e. sub-surface discharge of meltwater from the glacier), melting of glacier ice contributes to the freshwater forcing of the fjords and thereby influences stratification and circulation. Feedbacks between ocean heat transport and freshwater forcing from the various freshwater sources may therefore be in operation. Here we apply a high-resolution regional model of Godthåbsfjord, located at the west coast of Greenland at 64°N and in direct contact with the Greenland Ice Sheet via three tidewater outlet glaciers. The model includes the largest freshwater sources from runoff in the area. Subglacial freshwater discharge from three tidewater outlet glaciers, where entrainment of bottom water is taken into account, are included explicitly in the boundary conditions. A model sensitivity study analyze the influence of subglacial discharge and runoff on heat transport towards the glaciers. Model results are compared with observations of temperature, salinity, δ18O and current measurements (ADCP) in the inner part of the fjord and near the tidewater outlet glaciers. The influence of subglacial discharge on the circulation in the fjord is shown to be mainly due to the influence from the freshwater forcing. Thus, entrainment associated with subglacial discharge has only a minor influence on the heat transports in the fjord. However, entrainment increases transport of bottom water towards the surface significantly and therefore subglacial discharge indirectly affects the cycling of, for example, biogeochemical substances as nutrients.


Benkort, Déborah (1), F. Maps (2), S. Plourde (3) and D. Lavoie (3)

(1) Université Laval (Québec, Canada);
(2) Université Laval (Québec, Canada);
(3) IML (Institut Maurice Lamontagne) (Mont-Joly, Canada)

In the rapidly changing Arctic, the warming of the water masses and the receding sea-ice cover will inevitably lead to drastic changes in the timing and fate of the planktonic creatures at the base of the whole marine food-web. Zooplankton is crucial to pelagic marine ecosystems owing to its role of hub of matter and energy between planktonic primary producers and all the upper food-web levels, from fish larvae to marine mammals. Understanding the impacts of the natural variability of physical forcing on zooplankton physiology and population dynamics appears essential to better apprehend the dynamics, evolution and management of Arctic marine ecosystems. Krill is an important component of zooplankton communities but it remains difficult to study owing to its complex life cycle and high mobility. In this study, we developed species-specific bio-physical models for two krill species in the Gulf of St Lawrence (GSL): the Arctic krill Thysanoessa raschii and the northern krill Meganyctiphanes norvegica. The Gulf of St Lawrence is the southernmost limit of seasonal sea-ice cover in the North Atlantic, and it is a unique environment where water masses and planktonic species from both the Arctic and the Atlantic meet and thrive. We present here a physiological individual-based model (IBM) that took into account the critical processes of growth, moulting and reproduction in adults from both species as a response to environmental forcing. The model is based on first principles of biology and physiology: energy and mass balance, allometric relationships, Arrhenius temperature dependence for biological processes and the mechanistic Holling-type functional response for feeding. Moreover, the decoupling between growth (resulting from the balance between ingestion and metabolism) and moulting (resulting from a temperature-dependant schedule) allows for variable body masses and complex processes such as moulting.
towards a smaller body size. Egg production as an energetic balance and death by starvation complete the model. We present an application in the particular seasonal regime of the GSL and highlight species-specific features and differences that allows us to explain their respective habitat within the GSL.

NEW ICE-TETHERED OBSERVATIONAL PLATFORMS IN THE ARCTIC OCEAN PACK ICE

Berge, Jørgen (1), M. Geoffroy (2), G. Johnsen (3), F. Cottier (4), B. Bluhm (2), P. De La Torre (3) and S. Falk-Petersen (5)

(1) UiT The Arctic University of Norway (Tfomsø, Norway);
(2) UiT (Tromsø, Norway);
(3) NTNU (Trondheim, Norway);
(4) SAMS (Oban, United Kingdom);
(5) APN (Tromsø, Norway)

The Arctic Ocean faces rapid climate change, which impacts both physical and biological components of the marine ecosystem. Due to complicated and costly logistics inherent to sampling ice-covered areas, most studies conducted in the Arctic are based on relatively short-term sampling (weeks to months) centered around the minimum ice season. Given the need for longer-term monitoring, several autonomous ice-tethered observational platforms have been developed and deployed in the Arctic since the last decade. Most platforms were developed to measure physical data, which highlights a critical need for ice-tethered observatories monitoring biological processes. A recently initiated infrastructure project funded by the Norwegian Research Council has as its main ambition to develop and deploy fully automated platforms with capabilities of measuring both physical and biological data. The platform will be tested out in a Svalbard fjord in early 2017, and the first full scale deployment in the pack ice is estimated to occur in 2019.

LEARNING ABOUT RINGED SEAL HEALTH FROM CONTAMINANTS SCIENCE AND INUIT QAUJIMAJATUQANGIT: AN EDUCATIONAL WORKSHOP IN RESOLUTE (QAUSUITTUQ), NUNAVUT

D. Henri (1), Black, Amie (2), M. Houde (2), J. Provencher (3), D. Muir (2), S. Ferguson (4) and D. Yurkowski (5)

(1) Environment and Climate Change Canada (Montreal, Canada);
(2) Environment and Climate Change Canada, Government of Canada (Ottawa, Canada);
(3) Acadia University (Ottawa, Canada);
(4) Fisheries and Oceans Canada, Government of Canada (Winnipeg, Canada);
(5) University of Windsor (Windsor, Canada)

The ringed seal is a species of high cultural, economic and nutritional importance for Inuit living in Nunavut. Scientists conducting research on ringed seal ecology and contaminants in the Canadian Arctic work towards better understanding the ecology and health of this species, often in collaboration with northern community members. This project addresses a shared interest among Nunavummiut and scientific researchers in enhancing communications and community capacity building related to contaminants research on ringed seals in the Canadian Arctic. It engages youth, elders, community members and scientific researchers in learning about ringed seals from both Inuit Qaujimajatuqangit (traditional knowledge) and scientific perspectives through an educational workshop. A one-day educational workshop was conducted in Resolute (Qausuittuq), Nunavut, in fall 2016 in collaboration with the Qarmartalik School and the Resolute Bay Hunters and Trappers Association. The main goals of the workshop were to: (1) allow scientists working on contaminants in ringed seals to share information about their work with northern residents (with a focus on youth in particular); (2) provide an opportunity for Inuit elders to share their knowledge with students and researchers in seal ecology and traditional methods for butchering seals, preparing seal skin and identifying abnormalities in harvested game; (3) increase the engagement and interest of northern students in contaminants research and traditional seal harvesting; and (4) identify best practices for engaging and communicating with Inuit youth as part of contaminants research. This workshop included interactive presentations made by scientific researchers, seal
dissection and seal skin preparation activities guided by local elders, as well as educational games and artistic activities. It resulted in a learning and capacity building opportunity for Inuit youth from the community of Resolute. This collaborative project also led to the development of innovative methods of community and youth engagement around contaminants monitoring in wildlife. The experience and insights gained from this work can be helpful to northern community members, educators and researchers interested in increasing youth engagement in scientific research, improving researchers’ understanding of Inuit Qaujimajatuqangit, and developing educational opportunities linking Inuit knowledge and contaminants research on Arctic wildlife.

ASSESSING THE PHYSIOLOGICAL IMPACTS OF CAPTURE ON NARWHAL (MONODON MONOCEROS)

Black, Sandra (1), J. Orr (2) and S. Ferguson (2)

(1) University of Calgary Faculty of Science (Calgary, Canada);
(2) Fisheries and Oceans Canada (Winnipeg, Canada)

Capture events in wild animals are inherently stressful, and effects on individual animals must be weighed against the value of the resultant data and the potential for using less invasive methods to obtain similar data. Constant vigilance and improvement of methods is a primary responsibility of any researcher engaged in work that requires capture and handling of wild species. Narwhal, a species of great significance to the Inuit peoples of the eastern Canadian Arctic, have been captured in stationary nets and handled for the attachment of satellite tracking tags since the late 1980’s to provide critical information about movements, population numbers and stock composition. Narwhal are brought to the surface as soon as possible after entangling in the net, and are handled at boat side or moved into shallow water near shore while the tagging procedure is carried out. Since 2004, blood samples, physiological parameters, physical exams and behavioural observations have been collected on a total of 62 captured narwhal during the handling period to assess levels of physiological stress and recovery. Data will be presented for males and females, as well as sub adult and adult narwhal. During the 12 years of this study handling protocols and limits for weather and available light have been refined, resulting in a decreased average handling time, from 42 minutes in the early years to 34 minutes in the years from 2009-2016. Skin injuries as a result of entanglement in the nets are catalogued and behavioural observations, respiratory rates and end tidal carbon dioxide levels are reported. Most commonly, elevated respiratory rates recorded early in the handling period decrease while the whale is handled nearshore. Paired blood samples collected early and late in the handling period were analyzed for blood gases, pH, bicarbonate, lactate and base excess in the field. While metabolic acidosis is a common finding, most whales showed initial buffering of acidosis and a decrease in lactate levels before release. Net capture of narwhal causes a behavioural response which leads to physical exertion, anaerobic muscle activity, and some skin injuries from the net. Animals become acidotic as a result of the capture and struggle, however there is good evidence from heart and respiratory rates, blood gases and other measured metabolites that physiological recovery begins soon after capture and increases with time. No physical impairment has been noted in animals on release, tag location returns reveal both expected levels of movement and valuable information about narwhal migrations and populations.

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

Blade, Michelle and B. Moorman

University of Calgary (Calgary, Canada)

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

RESPONSIBLE RESEARCH: ADDRESSING COMMUNITY CONCERNS IN A HOLISTIC APPROACH. BUILDING BRIDGES BETWEEN ACADEMICS FOR IMPROVING THE WELLBEING OF INUIT COMMUNITIES.

Blangy, Sylvie
CNRS CEFE (Montpellier, France)

The Arctic is one of the most rapidly changing regions on the planet. Inuit communities face many challenges and are concerned about their future and wish to better understand the likelihood of social, environmental and economic changes related to ongoing industrial development and climate change. To address these concerns, the OHMI (www.ohmi-nunavik.in2p3.fr) program was built in 2013 in collaboration between the Kativik Regional Government (KRG), the Nunavik Research Centre (Makivik Corporation), the inter-institutional Center for Northern Studies (CEN) based in Québec and several research institutions in France coordinated by the CNRS. They joined forces to develop an integrated, interdisciplinary, collaborative, holistic and participatory research program. The research priorities were defined with the Nunavimmiuits: mining impacts, employment, risks and safety, wildlife vulnerability, youth/Elders knowledge transmission, food security and circumpolar agriculture (greenhouse), landscapes transformation, protected areas, Inuit culture, language and identity preservation, and renewable energy were selected. The OHMI program aims at answering those concerns at the same time and looking at the cumulative impacts instead of studying one at a time and one after the other. All the research themes are tightly intertwined. In this session we are presenting the results of three of these projects and analyzing how each of those contributes to improving the wellbeing of the 14 Nunavik communities. 1) links of the Inuit with dogs. 2) adaptation strategies for Inuit facing mining implantation 3) Nordic agriculture in greenhouses to improve the quality of food. These first results bring a new perspective in conducting research in the north and with isolated communities in a collaborative manner.


Bleau, Stéphanie and R. Siron
Ouranos (Montréal, Canada)

Ouranos’s Northern environment program seeks to improve knowledge on adaptation, enhance outreach and increase knowledge transfer. It strives to complement and support existing initiatives for all levels of governing bodies involved in the development of the region. This presentation provides a mid-term review of the research program. Emphasis made on research projects under-way will keep audience up to date, enable transfer of recent knowledge acquisition and show applied use for decision-makers and end-users. Discussions will address the need to know the state of adaptation and where to go from here. New research work undertaken to establish a baseline relevant to Nunavik’s climate conditions and adaptation preparedness will be shown. A brief follow up on the storminess and storm surges study in Hudson Bay and James Bay area will outline the main outcomes. RD priorities for the next years of the program will conclude this talk. Ouranos (http://www.ouranos.ca), a scientific consortium on regional climatology and adaptation to climate change, provides stakeholders and decision-makers with up-to-date data and information to help society adapt to climate change. Bringing together researchers from many disciplines and different institutions it conducts integrated research projects that combine climate science (e.g. climate change scenarios) and RD (on vulnerabilities, impacts and adaptation) to meet the needs of end-users, policy-makers and decision-makers, mainly in Quebec. The Northern Environment program and supported projects are developed in collaboration with partners in this area: research networks such as ArcticNet and the Centre for Northern Studies (CEN), the Federal Provincial (Quebec) governments, universities, as well as Nunavik authorities, stakeholders and communities.

Boivin-Rioux, Aude, M. Gosselin and M. Blais
UQAR-ISMER (Rimouski, Canada)

The Canadian Arctic has been identified as one of the most vulnerable environments in regards to climate change. Phytoplankton are a key component of the Arctic food web; their fate depending on their cell size. For example, mesozooplankton do not graze efficiently on particles < 5 µm. Since water temperature, vertical stratification strength and ocean acidification are increasing in the Arctic Ocean, it is expected that the growth of ultraphytoplankton (cells < 5 µm) will be favored over larger algal cells. We used a large data set collected over the last 10 years in the Canadian Arctic during the ArcticNet project to test this hypothesis. Since 2005, samples for size-fractionated chlorophyll a (chl a) biomass were sampled in Beaufort Sea (BS), Amundsen Gulf (AG), the Canadian Arctic Archipelago (CAA) and Baffin Bay (BB) from July to October. The results show large regional and inter-annual variations. In BS, the biomass was low and generally dominated by ultraphytoplankton. In contrast, nanophytoplankton (5-20 µm) dominated the algal biomass in the other regions. Microphytoplankton (cells > 20 µm) blooms were observed in late summer, especially in CAA. Chl a biomass was generally higher on the Greenland side of BB. An increase in ultraphytoplankton biomass in BS may be related to changes in water temperature, vertical stratification strength and ocean acidification. Flow cytometry data will be used to confirm this trend in the BS area.

ASSESSING THE CONTRIBUTION OF MIGRATORY CARIBOU TO THE DIET OF GRAY WOLVES AND BLACK BEARS IN NORTHERN QUÉBEC AND LABRADOR

Bonin, Michaël (1), C. Dussault (2) and S. D. Côté (1)

(1) Laval University, Caribou Ungava, Centre d’études nordiques (Québec, Canada);
(2) Caribou Ungava, Ministère de la Forêt, de la Faune et des Parcs du Québec (Québec, Canada)

Caribou populations are widely declining and factors such as climate change and human disturbances are commonly referred as causes for these declines. Still, the role of predators on the population dynamics of caribou is poorly understood. Rivière-George (~8,900 individuals) and Rivière-aux-Feuilles (~320,000 individuals) migratory caribou herds are both declining in northern Quebec-Labrador and individuals from both herds are exposed to predation by gray wolves and black bears. However, the extent to which these predators are consuming caribou and are potentially contributing to its decline is unknown. Wolves are suspected to be the main predator of caribou and predation by black bears could be mainly directed toward calves through opportunistic or active predation events. We aim to determine the relative contribution of migratory caribou to the diet of wolves and black bears at different periods of the year on an individual and population scales. We will also link the habitat selection of predators to the proportion of caribou in their diet during a critical period for caribou, calving time, by investigating the content of feces collected at clusters of satellite locations for black bears and wolves during that period. Using biological samples (hairs, muscles, blood, feces and stomach contents) collected from wolves and black bears equipped with GPS collars and from a collaborative program with native trappers, we will reconstruct the diet of each predator by combining 3 methodological approaches: identification of macro-remains in feces and stomach contents, stable isotopes (δ13C, δ15N and δ34S) and DNA barcoding. Combining these approaches will allow us to obtain a reliable estimate of the variations in prey selection by each predator at different time scales. Understanding the patterns of prey selection and consumption by predators constitute a first step to understand their impacts on the population dynamics of their preys and foster our comprehension of their ecology in arctic ecosystems.

COMPARISON OF THE INFLUENCE OF COASTAL PROXIMITY ON GROUND THERMAL REGIMES AT TWO HIGH ARCTIC SITES.

Bonnaventure, Philip (1), S. Smith (2) and A. Lewkowicz (3)

(1) University of Lethbridge (Lethbridge, Canada);
(2) Natural Resources Canada (Ottawa, Canada);
(3) University of Ottawa (Ottawa, Canada)

Air and ground temperature data collected at Canadian Forces Station Alert (82°N, 62°W) and in the vicinity of Eureka (80°N, 86°W) on Ellesmere Island in Nunavut have been analyzed to investigate
the potential role that air temperature inversions play in influencing the spatial variation of permafrost thermal conditions in coastal areas of the High Arctic. In both locations frequent and persistent air temperature inversions have been documented using a series of weather stations and instrumented boreholes deployed along an elevation gradient at the Eureka site. The weather stations also extend further inland (up to 5 km) compared to Alert (2.3 km). During inversion periods, which may last several days, air temperatures in the valley bottoms at lower elevations can be considerably colder than adjacent stations located at higher elevations and distances from the coast. At Eureka air temperatures increased away from the coast on an annual and seasonal basis with mean annual temperatures increasing logarithmically inland by 1.6°C from -17.2°C to -15.6°C. Mean annual ground surface temperatures varied from -13.3°C to -14.3°C but did not show a consistent trend inland on either an annual or a seasonal basis, likely due to spatially variable distribution of snow along the transect. There was however, a trend inland in mean ground temperatures at 0.5 m and 5 m depths, which increased inland by up to 3°C and 1.1°C respectively. At Alert similar patterns were observed. Ground temperatures were highest at the lowest elevation site at the coast with a mean annual ground temperature of -11.5°C at a depth of 24 m which is close to the zero annual amplitude depth. This site also receives the greatest amount of snow compared to the other four sites located further inland, complicating the impact of the inversion on the spatial heterogeneity of permafrost temperature. However, at sites further inland with little snow cover, ground temperatures are lower in the valley bottom located compared to a site at higher elevation on the valley wall. Calculated TTOP (temperature at the top of permafrost) values for the Alert sites indicate that the occurrence of air temperature inversions during the winter combined with the variable snow cover explain the observed of ground thermal patterns seen at Alert. We conclude that both air and ground temperatures increase inland at least up to 5 km around the Eureka area according to the logarithm of the distance from the coast. This analysis shows that air temperature inversions can produce considerable heterogeneity in the thermal field in the air and in depth across High Arctic landscapes.

**USE OF PASSIVE ACOUSTIC MONITORING (PAM) TO DETERMINE PRESENCE OF CONTACT CALLS IN WILD BELUGA WHALE (DELPHINAPTERUS LEUCAS) POPULATIONS**

Booy, Karyn (1), V. Vergara (2), M. Marcoux (1) and S. Ferguson (1)

(1) The University of Manitoba (Winnipeg, Canada);
(2) Vancouver Aquarium (Vancouver, Canada)

“Contact calls” are vocalizations found across social mammals and birds, and can be described as signals used to keep contact between members of a group. Contact calls have been found to be used when groups must coordinate their movements together (ex: migration), when animals have lost contact with one another, as well as to establish identity and recognition between group members such as mother and offspring or between mates. A specific contact call has also been detected for captive belugas, evident in instances of birth or death of a calf, during separation and reunion of mother and calf, as well as in situations requiring group cohesion. Only recently identified in the wild populations of St. Lawrence, Hudson’s Bay and Cunningham Inlet, contact calls remain poorly understood in wild populations. Through this study, we intend to determine if contact calls can be identified within 3 geographically separate wild beluga populations. Acoustic data gathered via passive acoustic monitoring (PAM) over multiple years from the three Arctic regions of Cumberland Sound, Beaufort Sea, and Hudson’s Bay will be analyzed for the presence of beluga contact calls. Statistical differences between identified calls from different geographical locations will be examined in terms of duration, frequency, pulse-repetition rate, and presence of mixed components in the call (i.e. tonal components or tonal-like pulsed components). Through this analysis, we hope to determine if contact calls differ between geographic regions. To date, only one other study has attempted to identify the presence of contact calls in wild beluga populations. This study is the first of its kind to compare contact calls across geographically separated beluga populations. Findings from this study will provide a better understanding of the evolution of communication across geographically separated populations and give greater insight into the poorly understood repertoire of beluga vocalizations.
CLIMATE WARMING ENHANCES JUVENILE ARCTIC COD RECRUITMENT IN CANADIAN ARCTIC SEAS

Bouchard, Caroline (1), M. Geoffroy (2), M. LeBlanc (1) and L. Fortier (1)

(1) Université Laval (Québec, Canada);
(2) Université Laval (current affiliation: University of Tromsø) (Québec, Canada)

Arctic cod (Boreogadus saida) typically represents 95% of the pelagic fish assemblage in Canadian arctic seas and is the main food of several seabirds, ringed seals (Pusa hispida) and belugas (Delphinapterus leucas). Forecasting the response of arctic cod to climate change is crucial. The size of a year class is dictated by the number of juvenile fish that survive to recruit in the population. We tested the hypothesis that higher sea surface temperatures in spring-summer and earlier ice breakup results in a larger biomass of epipelagic juvenile arctic cod in early fall. The abundance and biomass of age-0 arctic cod in the fall estimated by acoustics and validated by plankton surveys over 8 years in 9 regions of the Canadian Arctic was negatively correlated to ice breakup week in spring-summer and positively correlated to spring-summer SST. Since 1979, ice breakup has occurred earlier by as much as 6.3 days/decade in some regions. We forecast a general increase in arctic cod biomass over the present century. However, the relaxation of extreme climatic conditions in arctic seas should harbor the replacement of the hyper-specialised arctic cod by sub-arctic and boreal forage fish such as the capelin (Mallotus villosus) and the sand lance (Ammodytes spp.).

TEMPORAL AND SPATIAL VARIABILITY IN BERRY PRODUCTIVITY ACROSS THE CANADIAN ARCTIC


(1) University of British Columbia (Vancouver, Canada);
(2) Department of geography, University of British Columbia (Vancouver, Canada);
(3) Département de Chimie-Biologie, Université du Québec à Trois-Rivières & Centre d’études nordiques, Université Laval (Trois-Rivières, Canada);
(4) Jardin botanique de Montréal, Institut de recherche en biologie végétale (Montréal, Canada);
(5) Memorial University of Newfoundland (St-John’s, Canada)

Berry shrubs are circumpolar species that possess high nutritional value, which benefit both animals and northerners. They are known to produce a great abundance of fruits but the climatic and environmental factors influencing their annual productivity are poorly known. In the context of rapid cultural, environmental and land use changes in the Arctic, a coordinated distributed research effort was initiated under the International Polar Year and continued as part of ArcticNet to better understand the ecology of berries. We present the first analysis of this ongoing research effort that brought together local knowledge holders, schools and scientists to better understand spatial and long-term trends in berry productivity. Data were collected in 12 communities and research stations in the Northwest territories, Nunavut, Nunavik and Nunatsiaq since 2008. Berries were collected from three species (Vaccinium uliginosum, Vaccinium vitis-idaea, Empetrum nigrum) in the field following standardized protocols. Fresh weight was measured in the lab soon after harvest or from frozen berries. We used the Canadian gridded meteorological data to evaluate the influence of climate variables on inter-annual productivity. Results from linear mixed-effects models show clear association between berry productivity and winter precipitation as well as summer and spring temperatures. Abundance of berries varies greatly between sites and does not show clear latitudinal trends. Sites located in the Eastern Arctic tended to be more productive with Pangnirtung, Kangiqsujuaq and Iqaluit showing the highest yields. This study presents the most complete and thorough investigation of berry producing shrubs in the Canadian Arctic and is set to become a reference point for these ecologically and culturally important species.
CRITICAL REFLECTION ON THE ‘STATE OF THE FIELD’ OF PARTICIPATORY RESEARCH (TOPICAL SESSION, ROUND-TABLE DISCUSSION)

Boulanger-Lapointe, Noémie, M. Stoller and P. Johnston
University of British Columbia (Vancouver, Canada)

Northern research is experiencing a turn towards inclusive and participatory forms of research. Across natural and social sciences, researchers regularly aim to incorporate Indigenous concerns and interests into their research designs, often seeking out local participation and input into the planning and conduct of academic inquiries. Community-based and participatory research of this kind has fostered much optimism about the potential to build lasting relationships between researchers and communities, and to ensure that northern research ultimately benefits northerners. This panel uses these and similar trends in northern research to critically reflect on the ‘state of the field’ of participatory research. In particular, to assess how the goals of inclusion and empowerment, as advocated by the use of community-based methods are being met through participatory research. Among other things, this panel will discuss research financing, project duration and timelines, the ability to include youth participants, and broader objectives of relationship building between researchers and communities. In doing so, the panel aims to advance the discussion concerning challenges and structural barriers, but also novel approaches and solutions to foster participatory research in the North.

MAXIMIZING OPPORTUNITIES FOR INUIT EMPLOYMENT AND LOCAL BUSINESS DEVELOPMENT: LESSONS FROM THE VOISEY’S BAY, RAGLAN, AND MARY RIVER MINE DEVELOPMENTS

Bradshaw, Ben (1), S. Schott (2) and T. Rodon (3)
(1) University of Guelph (Guelph, Canada);
(2) Carleton University (Ottawa, Canada);
(3) Laval University (Quebec, Canada)

In popular discourse, large-scale mine developments are commonly viewed with both naïve optimism and extreme wariness. Both views hold some truth. Inuit knowledge of, and academic and professional research centred on, mine developments in the Arctic and Sub-Arctic tells us that significant economic benefits can be realized through training and skills acquisition, wage employment, entrepreneurial initiatives, and the securing of transfer payments and royalties. At the same time, mine developments are known to generate income inequalities within communities, accaparate critical human, social and cultural capital, disrupt traditional cultures, and generate harmful environmental legacies. While some continue to debate the pros and cons of mine development in absolutist terms, others are seeking to ways to maximize benefits and minimize harm through, for example, negotiated agreements, adaptive management, and human resource development. In this proposed session, which ideally will be run as a roundtable, the voices of Inuit leaders and administrators, mining executives, and academics will be drawn upon to identify means to maximize opportunities for Inuit employment and local business development based on experiences from the Voisey’s Bay (Vale), Raglan (Glencore), and Mary River (Baffinland) Mine Developments.

VIGILANCE BEHAVIOURS IN RINGED SEALS AND HARBOUR SEALS IN CHURCHILL, MANITOBA

Breiter, C-Jae and S. Petersen
Assiniboine Park Zoo (Winnipeg, Canada)

Seals haul out for a number of reasons including assisting in thermoregulation and in the moulting process, resting, predator avoidance, social interaction, pupping, and nursing. For Arctic seals, there is a risk of polar bear predation while hauled out and therefore vulnerability to predators may strongly influence where and how long seals haul out as well as how vigilant they are while hauled out. If vigilance is a measure of risk, then relative levels of vigilance in a variety of contexts may be used to inform our knowledge of predation. Polar bears (Ursus maritimus) use sea-ice to hunt their prey, primarily ringed seals (Pusa hispida) and bearded seals; however, they have also been found to use harbour seals (Phoca vitulina) in the Western Hudson Bay to a lesser extent. We expect that in Churchill, ringed seals have a higher predation risk while hauled out on the ice in Hudson Bay to moult than harbour seals who haul out in the Churchill River Estuary at the same time. To test this prediction, we observed 106 harbour seals and 54 ringed seals during late May-early June of 2015 and 2016 and quantified their vigilance behaviours. Ringed seals raised their head to survey
their surroundings significantly more (F=23.908, p<0.001) than harbour seals. However, total time spent looking around when vigilant was not different between the two species. This may be because while vigilant behaviour is associated with risk and traded off with resting for ringed seals; in harbour seals, risk is low but social interactions require individual to watch their conspecifics to a greater extent.

DEFINING THE NICHES OF BEAUFORT COASTAL FISHES USING BIOTRACERS: STABLE ISOTOPES, FATTY ACIDS AND TOTAL MERCURY

Brewster, Jasmine (1), C. Giraldo (2), H. Swanson (3), W. Walkusz (4), T. Loewen (5), J. Reist (6), S. Ostertag (6), G. Stern (7) and L. Loseto (6)

(1) University of Manitoba, Centre for Earth Observation Science, Fisheries ad Oceans Canada, (Winnipeg, Canada);
(2) Fisheries and Oceans Canada (Winnipeg, Canada);
(3) University of Waterloo (Waterloo, Canada);
(4) Fisheries Oceans Canada (Winnipeg, Canada);
(5) Fisheries and Oceans Canada, University of Manitoba (Winnipeg, Canada);
(6) Fisheries and Oceans Canada (Winnipeg, Canada);
(7) University of Manitoba, Centre for Earth Observation Science (Winnipeg, Canada)

Shingle Point, an important fishing site in the summer months is part of the Tarium Niryutait Marine Protected Area. Indigenous groups from the Western Arctic return to this historical settlement each year for subsistence fishing and a return to a traditional life style. The unique coastal-estuarine environment of Shingle Point is heavily influenced by the marine water from the Beaufort Sea and freshwater from the outflow of the Mackenzie River. This provides an intermediate habitat to a diverse population of fishes in the summer months before they return to their respective marine and freshwater habitats. The objective of our study was to characterize the niche (habitat use and diet) of the fish populations that co-occur in this coastal environment. In the first part of our study, stable isotopes (SI), and fatty acids (FA) were used to assess the niches of sixteen species of fishes consistently captured at Shingle Point over three summers (i.e. 2011-2013). Consumer’s trophic positioning in the food web and general habitat were characterized using δ15N and δ13C values. Twenty-three FA were used to identify the general diet of these fishes. Results revealed three isotopic groups indicating similar habitat use, and five dietary groups among the sixteen species of fish. In the second part of the study, the niche of seven species from the sixteen previously described, were further analyzed, using total mercury (THg) as an additional indicator for habitat and diet. Traditional Ecological Knowledge along with SI and FA were used to choose the seven species occupying a diverse range of habitat, foraging strategies, diet, and cultural importance. We tested the predictions that a) benthic feeding fish will have higher levels of mercury then pelagic feeding fishes, b) higher levels of mercury will be found in higher trophic feeding species, and c) highly mobile and opportunistic feeding fishes will have higher variability in mercury. Preliminary analyses indicate that two mercury groups exist with the seven species, higher mercury (0.24±0.01-0.27±0.02 ug/g) and lower mercury (0.04±0.01-0.05±0.00 ug/g). THg was tested as a trophic indicator to determine, if this contaminant could provide additional information on trophic ecology of these fishes. Variations between mercury niches (using THg and δ13C) and isotopic niches (δ15N and δ13C) existed within and among the seven fish species.

SPRINGTIME IN THE MACKENZIE DELTA: THE SOCIOCULTURAL IMPORTANCE OF MUSKRATS TO GWICH’IN AND INUVIALUIT TRAPPERS

Brietzke, Chanda and T. Lantz

University of Victoria (Victoria, Canada)

Climate change is affecting the Arctic more than any other region in the world. In the Mackenzie Delta, the hydrological cycle is changing, ground temperatures are increasing, and the timing of freeze-up and break-up have been impacted by increasing temperatures and precipitation. Ongoing changes to the land and peoples’ access to it strongly impact the health of northern communities by affecting food security, physical health, and overall wellbeing. Throughout the 1900s, Gwich’in and Inuvialuit residents of the Mackenzie Delta relied heavily on the muskrat (Ondatra zibethicus) for food, fur, and income. In recent years, many residents of the Delta have reported a decline in muskrat abundance that is outside the normal range of variation. This decline is likely to have significant impacts on local communities who rely on muskrats for subsistence and trapping income. The objective of this research was to understand
how relationships between people and muskrats in the Mackenzie Delta developed and changed over the last century. To accomplish this, we employed a collaborative, community-based research methodology with organizations and community members in the Delta. We conducted 20 semi-structured interviews with participants from Aklavik, Inuvik, Fort McPherson, and Tsiigehtchic from June 2015 to April 2016, reviewed transcripts from 11 interviews on environmental change conducted between 2010 and 2014, and hosted 3 community discussions in the spring of 2016. Our interviews and meetings highlighted the historical and contemporary importance of muskrats in the Mackenzie Delta. The majority of participants discussed the fundamental role of muskrats as a source of income and subsistence, and also described the significance of cultural activities associated with muskrat trapping. Interview and meeting participants reported a large decline in muskrat abundance in recent decades and pointed to changes in habitat, climate, interactions with other wildlife, and low harvesting pressure as possible causes. The higher costs of trapping, low fur prices, and muskrat population declines have contributed to reduced harvesting effort since the 1980s. However, most participants were not concerned about the continuity of muskrat harvesting as a cultural tradition, and expressed optimism and certainty about the future of muskrat harvesting. The sociocultural role of muskrats in the Mackenzie Delta has changed over the last 100 years, but these animals still occupy a prominent position in the cultural traditions and mixed economy of Gwich’in and Inuvialuit residents.

PERMAFROST SOILS: GEOTECHNICAL INDEX PROPERTY VARIABILITY
Brooks, Heather and G. Doré
University Laval (Quebec, Canada)

This analysis uses geotechnical borehole and sample data from three databases complied by the Geological Survey of Canada to determine the variability of geotechnical index properties of permafrost soils. The analysis included 2,662 boreholes up to 60 m depth within the MacKenzie Delta region of Northwest Territories and 7,539 samples, each with soil and ice classifications and geologic setting. Gravimetric and volumetric moisture content were analyzed by general soil type for their coefficient of variation (COV) with depth and geologic setting. As expected, variability between geologic settings corresponded to the nature of the soil’s depositional environment and volumetric ice content decreased with increasing depth. General soil type was also used to classify samples in the calculation of the COV of dry density, specific gravity and atterberg limits tests on samples where testing was available. Based on the geotechnical index property variability, the variability of calculated thermal conductivity from the equations of Kersten (1949) and Côté and Konrad (2005a) by conducting Monte Carlo simulations. Côté and Konrad’s (2005a) thermal conductivity showed decreased variability when compared to Kersten’s (1949). The variability in permafrost soil properties can be used as a starting point in statistical based engineering calculations of infrastructure in permafrost regions.

SOIL BRIDGING EFFECTS WITHIN PERMAFROST AND COLD REGIONS INFRASTRUCTURE
Brooks, Heather and G. Doré
University Laval (Quebec, Canada)

Accidents, infrastructure closures and reductions in capacity, and delays, due to the bridge formation or rapid collapses within the infrastructure embankments, have been reported for infrastructure in China and Canada. However, the failure mechanics are not understood. Soil grain position, negative pore pressure generation and frozen soil flexure were investigated as possible mechanisms for bridging. Given published literature and laboratory testing, soil grain position and negative pore pressure generation are unlikely mechanisms for bridging. Frozen soil flexure equations, under elastic or secondary creep conditions, depending on the rate of loading, are presented for two thermal and load cases.

PERMAFROST-SUPPORTED LINEAR INFRASTRUCTURE RISK ANALYSIS SOFTWARE - DESIGN AND GOALS
Brooks, Heather and G. Doré
University Laval (Quebec, Canada)

Risk analysis has been used in non-permafrost regions as a decision making tool to justify expenditures; however, the application of these
techniques to permafrost infrastructure is limited. Risk for a danger (adverse event which causes infrastructure damage) is the product of hazard and consequence. The probability and costs of a danger’s occurrence is a hazard and the consequence, respectively. A computer program, created in the form of a Microsoft Excel macro and associated input spreadsheets, will calculate the risk for a section of permafrost-supported linear infrastructure, using statistical methods applied to limit state design criteria to determine hazards for common dangers, estimated direct costs for the repair of a hazard’s occurrence, and a scaling factor to account for the indirect costs of damage to the infrastructure’s users. Hazard calculations are based on geotechnical index property variation. Included within the program will be a climate change fragility analysis and a summation of the overall risk for the roadway section analyzed. Repeated analyses along the infrastructure can provide a section-by-section risk profile of the roadway and how this risk may change due to a warming climate. Results may be used as a decision making tool for cost/benefit analyses to justify the use of adaptation methods, prioritize repair or reconstruction locations and monies, and plan for future conditions.

LIS EXTENT AND PALAEO-ICE STREAMS DYNAMICS ON THE NORTHEASTERN BAFFIN SHELF, EASTERN CANADIAN HIGH ARCTIC

Brouard, Etienne and P. Lajeunesse
Centre d’études nordiques & Département de géographie, Université Laval, Québec, Canada (Québec, Canada)

Recent multibeam bathymetry and subbottom profiler data were collected during the 2015 and 2016 ArcticNet cruises aboard the CCGS Amundsen to investigate the pattern and dynamics of former ice-flow on the northeastern Baffin Shelf and in the Baffin Island fjords. Merged with data from previous ArcticNet cruises (2003-2014), the new dataset reveals glacial landforms suggesting that the Laurentide Ice Sheet (LIS) extended to the shelf edge in three troughs (Pond Inlet Trough, Buchan Trough and Scott Trough) at the Last Glacial Maximum (LGM). On the inter-trough areas, perpendicular-to-ice-flow ridges interpreted as moraines suggest the LIS extended on the shelf, but it is unclear if it reached the shelf edge as no data covers the shelf edge in the inter-trough areas. In Pond Inlet, Buchan and Scott troughs, sets of highly elongated bedforms (MSGLs, crag and tails, drumlins, streamlined medial moraines and lateral-shear moraines) show that ice streams operated in these routes during the LGM. The presence of medial shear moraines suggests that ice-streams were experiencing spatial variations in ice-flow velocities, probably reflecting the advection of ice from different tributaries (i.e., different fjords) and reflecting the presence of sticky spots. Two types of sticky spots are observed: bedrock bumps and till-free areas sticky spots. The onset zones of the ice streams appear to be linked to topographical and geological controls. Upstream extent of elongated bedforms are mostly observed at the transition from crystalline bedrock to sedimentary bedrock and in topographic lows downstream of a (fjord-mouth) sill. In Sam Ford Trough, the absence of such elongated bedforms and the presence of perpendicular to the trough ridges, suggest that is was characterized by slower sheet-flow, much like inter-streams areas. The slow ice-flow in the trough is probably due to the advection of ice discharge from Sam Ford Fjord into the Scott Inlet Ice Stream. The ice-flow route from Sam Ford Fjord to Scott Inlet can be inferred from the northward orientation of glacial lineations and drumlins at the junction of Sam Ford Fjord and Hecla Griper Trough. Grounding zone wedges and moraines are observed in the troughs and in the fjords, respectively. The location of these deposits suggests that the retreat of the LIS from the shelf edge to the fjords head has been marked by several periods of grounding-line stability. These results therefore suggest a more episodic retreat style than previously suggested (e.g., Praeg et al., 2007; Briner et al., 2012).

CHANGING ARCTIC TERRESTRIAL SNOW COVER: AN UPDATE OF CURRENT UNDERSTANDING

Brown, Ross (1), D. Vikhamar Schuler (2), O. Bulygina (3), C. Derksen (1), K. Luojus (4), L. Mudryk (1), L. Wang (1) and D. Yang (1)

(1) Environment and Climate Change Canada (Montréal, Canada); (2) Norwegian Meteorological Institute (Oslo, Norway); (3) All-Russian Research Institute of Hydrometeorological Information (Obninsk, Russia); (4) Finnish Meteorological Institute (Helsinki, Finland)
This talk presents an update of the 2011 Snow Water Ice and Permafrost in the Arctic (SWIPA) assessment that provided baseline information on observed and projected change in Arctic terrestrial snow cover. There is increasing awareness that Arctic snow cover is responding to multiple environmental drivers and feedbacks that interact to produce spatially, temporally, and seasonally varying responses in Arctic snow cover extent, accumulation, melt process and other snow properties. These snow cover changes generate a cascade of interactions and feedbacks that affect Arctic climate, lake and river ice, the ground thermal regime, hydrology, vegetation, biogeochemical activity, exchanges of CO2 and trace gases, and ecosystem services. The talk will provide an overview of some of the main drivers of Arctic snow cover change along with updated estimates of trends in snow cover from surface observations, satellite data and modelling studies. The update provides multi-dataset evidence of continued reductions in Arctic snow cover, with the largest negative trends occurring over high latitudes and elevations consistent with polar amplification of warming and enhanced albedo feedbacks. The talk will also present snow cover change projections from the CMIP5 suite of global climate models and from CORDEX-Arctic regional climate models. Climate model projections for scenario RCP4.5 show that efforts to limit CO2 emissions result in Arctic annual snow cover duration stabilizing at a new equilibrium level about 10% lower than current values by 2100, unlike scenario RCP8.5 which generates an accelerating loss of Arctic snow cover throughout the 21st century. An update of current understanding of the impacts of a changing snow cover will be provided to close the talk. The SWIPA update report will be published in spring 2017.

WHERE THE RIVER MEETS THE SEA: INVESTIGATING NUTRIENT DYNAMICS IN THE KITIKMEOT RIVERINE COASTAL DOMAIN

Brown, Kristina (1), W. J. Williams (2), E. C. Carmack (2), A. Schimnowski (3), J. Nivingalok (4) and C. Clark (2)

(1) Woods Hole Oceanographic Institution (Woods Hole, United States);
(2) Fisheries and Oceans Canada, Institute of Ocean Sciences (Sidney, Canada);
(3) Arctic Research Foundation (Winnipeg, Canada);
(4) Kugluktuk Hunters and Trappers Organization (Kugluktuk, Canada)

Coronation Gulf and Queen Maud Gulf are two semi-enclosed, connected basins in the southern Canadian Arctic Archipelago (CAA). They are connected to the ocean by shallow straits in the west (Dolphin and Union Strait, 18m sill) and north-east (Victoria Strait, 20-30m sill) that restrict inflow of the relatively salty, nutrient-rich Pacific-origin waters that flow through the CAA. In addition, with a terrestrial drainage area spanning more than 4 times their size, freshwater inputs from rivers draining into these basins are substantial, delivering about 70 cm of freshwater annually to the surface of the entire semi-enclosed sea. This large river inflow, combined with restricted inflow of marine water leads to low salinity in the region and hydrography that is distinct from the rest of the CAA. In August 2016, we sailed aboard the R/V Martin Bergmann to quantify the dominant physical, biological, and geochemical processes within this marine region of the Kitikmeot. As part of this effort, we investigated the river-to-ocean geochemical contributions of three large rivers in the Kitikmeot Region: the Burnside, Ellice, and Coppermine Rivers. We conducted CTD transects from each river mouth into the marine-dominated portion of the estuary and sampled geochemical constituents along the salinity gradient. Preliminary results illustrate the delivery of nitrate + nitrite (NO3 + NO2) and reactive silicate into the estuary with river waters, augmenting surface concentrations. However, river inputs were generally orthophosphate (PO4) deficient, with PO4 concentrations increasing as river inputs mixed with marine waters in the estuary. The confluence of terrestrial (N) and marine (P) sourced nutrients in these three estuaries suggests that the riverine coastal domain of the Kitikmeot has an important ecological role in contributing to the productivity of the region. Permafrost thaw and precipitation north of the Arctic Circle are anticipated to increase with climate warming, potentially changing the character and magnitude of terrestrial inputs to the Kitikmeot Marine Region. Understanding the impacts of changing terrestrial nutrient delivery to the Kitikmeot marine system will require dedicated studies that consider the dynamics of each river’s annual flow cycle, physical controls on upwelling and estuarine mixing, and the importance of seasonal transitions during ice formation and break-up.
EVALUATING THE EFFECTIVENESS OF WILDLIFE RESEARCH COMMUNICATION IN NUNAVUT COMMUNITIES

D. Henri (1), Brunet, Nicolas (2), Grant Gilchrist (1)

(1) Environment and Climate Change Canada (Montreal, Canada);
(2) University of Saskatchewan (Saskatoon, Canada)

Given the significant role that wildlife plays in Inuit subsistence activities and cultural identity, the Inuit living in the Canadian Arctic today have a strong interest in understanding and participating in research projects conducted on wildlife species. Scientific literature as well as reports from northern research agencies and Inuit organizations have consistently found that effective communication strategies throughout the research process help to ensure that research programs are beneficial to local stakeholders, and that research questions and findings are locally relevant. This promotes trust, reciprocity and local empowerment in the research process. The goal of this pilot study is to assess the effectiveness of communication practices conducted by wildlife researchers in Nunavut communities. Our case studies are being conducted in the communities of Cape Dorset and Coral Harbour, Nunavut, Canada. We are focusing our attention on scientific communication initiatives carried by the northern marine bird research group of Environment and Climate Change Canada; a long-standing research relationship with these two communities. Specifically, our objectives are: (1) to assess local perceptions of wildlife researchers and research; (2) to examine what communication methods and approaches Nunavummiut generally view as most effective; and (3) to identify best practices and policy orientations for communicating scientific findings related to wildlife species of cultural and economic significance in northern communities more effectively. Reports from community members clearly indicated a need for enhancing existing communication and engagement efforts deployed by wildlife researchers. Preliminary findings suggest that some communication methods used by wildlife researchers, such as community meetings, have become ineffective in some cases. By contrast, we found that a combination of methods including local radio announcements and the distribution of illustrated pamphlets or posters tended to reach the most people. Their success was enhanced if they are distributed in collaboration with local agencies such as local Hunters and Trappers Organizations. Our work also confirmed that new and innovative communication tools and strategies are required to reach school-aged children who typically do not participate in fieldwork and other aspects of scientific research on wildlife. Given that 41% of Nunavut’s population is under age 20, we believe that young people should not be neglected in efforts of communication and engagement. Specific efforts to communicate with young people will increase training possibilities with future generations of hunters, local decision-makers, and resource managers. It is also apparent that the role of wildlife research in socio-economic development (e.g. job opportunities) is not yet recognized nor entirely supported by government and university policies and practices in northern Canada. Lastly, we will discuss how investing in effective communication strategies can challenge academic and government researchers working under time and budgetary constraints, and particularly among those with limited prior training or expertise in wildlife science communication in indigenous communities.

SPRING TRANSITIONS IN SURFACE WATER pCO2 BETWEEN OPEN WATER, MARGINAL ICE ZONE, AND PACK ICE IN BAFFIN BAY

Burgers, Tonya (1), B. Else (2), S. Luque (1) and T. Papakyriakou (1)

(1) University of Manitoba (Winnipeg, Canada);
(2) University of Calgary (Calgary, Canada)

Over the past few decades a strong decline in sea ice cover within the Arctic Ocean has been observed. This change in the icescape of the Arctic Ocean has led to a broadening of the marginal ice zone (MIZ), a transition zone between the open ocean and pack ice where open ocean processes (such as waves) can rapidly alter the properties of the sea-ice cover. Such changes in sea-ice cover will in turn affect the biological productivity, and biogeochemical cycling in certain regions of the Arctic Ocean, with implications for the Arctic marine carbon cycle. In this study we investigate springtime changes in surface water pCO2 as sea-ice coverage transitions between the open ocean, the MIZ, and pack ice. Measurements for this study were carried out during spring 2016 as part of the GreenEdge cruise onboard CCGS Amundsen. During this cruise the Amundsen completed a series of transects from open water, through the MIZ, and into pack ice in Baffin Bay. Measurements of surface seawater pCO2, temperature, and salinity were continuously recorded by an
underway system. Changes in pCO2 across these three environments will highlight the influence of surface ocean and sea-ice dynamics, as well as the spring phytoplankton bloom on surface seawater carbonate chemistry.

**AIR-SEA EXCHANGE OF CARBON DIOXIDE IN THE ANTARCTIC MARGINAL ICE ZONE**

Butterworth, Brian (1) and S. Miller (2)

(1) University of Calgary (Calgary, Canada); (2) University at Albany, State University of New York (Albany, United States)

In the marginal ice zone the effect of sea ice on air-sea gas exchange is poorly understood. Some model and laboratory results suggest that enhanced waterside turbulence from shear and buoyancy forces can enhance carbon dioxide flux in the marginal ice zone, while most regional carbon budget estimates scale fluxes linearly to the fraction of open water in a grid cell. We measured air-sea CO2 flux using an unattended, closed-path eddy covariance system installed on the Research Vessel Icebreaker (RVIB) Nathaniel B. Palmer (NBP) during 9 cruises over 18 months between January 2013 and June 2014 in the Southern Ocean and Antarctic marginal ice zone. Fluxes were combined with the measured water-air carbon dioxide partial pressure difference (ΔpCO2) to compute the air-sea gas transfer velocity (k660).

The open-water data showed a quadratic relationship between k660 and the neutral 10-m wind speed (U10n), in close agreement with decades-old tracer-based results and much lower than cubic relationships inferred from previous open-ocean eddy covariance studies. This open water relationship was used as a reference to investigate the effect of sea ice on gas transfer velocity in the marginal ice zone. It was found that the gas transfer velocity decreased in proportion to sea ice cover, in contrast to predictions of enhanced gas exchange in the presence of sea ice. The results affect the calculated magnitude and spatial distribution of carbon dioxide flux in polar regions.

**ARCTIC OIL: POLICY, LAW, AND INTERNATIONAL COOPERATION**

Byers, Michael

University of British Columbia (Vancouver, Canada)

With present prices, no oil and gas activity is taking place in Canada’s Arctic. This pause in development puts the Canadian government in a perfect position to create informed, carefully considered policies for when activity recommences. This presentation will recommend a number of “no regret policies” that will serve Canada’s interests, even in the absence of renewed oil and gas activity in the Arctic. These include:

- **Resolve international legal disputes:** Canada has four international legal disputes in the Arctic, and while these are long-standing disputes, they should be easy to solve through diplomacy. Working with neighbouring countries to solve the Hans Island dispute, the Lincoln and Beaufort Sea boundary disputes, and the dispute over the status of the Northwest Passage would help provide certainty concerning the applicability of Canadian law—including safety and pollution prevention regulations, exploration licenses, insurance and liability regimes, royalties, etc.—across all of Canada’s Arctic.
- **Improve international environmental instruments:** The Arctic ecosystem is fragile and threatened, and steps must be taken to ensure its safety. Both an oil spill prevention agreement and a ban on the use of high sulphur fuel oil for shipping are needed. Protecting the environment will help to gain social license for resource projects.
- **Adopt new domestic laws and regulations:** Although some issues cannot be solved unilaterally, new domestic laws and regulations can protect Canadian interests in the Arctic and create momentum for the negotiation of international agreements. The creation of traffic separation schemes and meaningful marine protected areas, lifting liability caps and always requiring a same-season relief well capability —would all serve Canada well and encourage other countries to follow. All of the above recommendations, which are based on existing knowledge, are necessary to enable safe and efficient oil and gas activity to recommence in Canada’s Arctic—if and when prices rise sufficiently to offset the high costs of Arctic operations. These recommendations would protect the environment and the interests of Arctic Indigenous peoples, increasing the likelihood of projects obtaining the social license needed to proceed.
PREPARING THE RESILIENCE TO CLIMATE CHANGE OF THE DEMPSTER HIGHWAY, YT, CANADA.

Calmels, Fabrice (1), L.-P. Roy (1), B. Horton (1), S. MacDougall (2) and M. Taillefer (1)

(1) Yukon Research Centre - Yukon College (W, Canada);
(2) Yukon Highways and Public Works (Whitehorse, YT, Canada)

The Dempster Highway is the only road connection to the western Arctic, and when the Inuvik-Tuktoyaktuk Highway is built, it will be part of the infrastructure linking southern Canada with the Arctic Ocean. The road is almost entirely built over permafrost, and is subject to various hazards. Recognizing the need to ensure year-round availability of the Dempster Highway in the context of increasing traffic and a changing climate, Yukon Government Department of Highways and Public Works (HPW) and the Northern Climate ExChange (NCE - Yukon Research Centre) have initiated several projects aiming to develop a durable management of the infrastructure. A functional plan that specifically considers contributions of climate change to geohazards along the highway is elaborated, requiring to assess climate and geohazard vulnerability for the road. In this context, two specific studies investigate both hazard and infrastructure related issues. The first survey focuses on sinkholes that are developing along the southern part of the highway. Suspected causes of those are permafrost degradation or water movement within the road embankment. The study aims to understand and, if possible, remediate the issues caused by this geohazard. The second research investigates permafrost condition and ground temperature under a newly built culvert. The installation is monitoring the impact of the culvert on underlying permafrost using an innovative combination of temperature monitoring and electrical resistivity tomography (ERT). Two ground temperature arrays measure the effectiveness of the insulation layer located between the culvert and underlying permafrost. The ERT array, buried below the culvert and the insulation, is used to monitor the evolution of the permafrost condition. Temperature sensors located between each electrode of the array allow to correlate ground temperature and resistivity values. This relationship be used to extrapolate 2D thermal regime based on resistivity profiles. We present here preliminary results of these studies that should help to develop more efficient maintenance and construction practices for the forthcoming changes.

COMMUNITY DYNAMICS OF BOTTOM-ICE ALGAE IN DEASE STRAIT OF THE CANADIAN ARCTIC

Campbell, Karley (1), C.J. Mundy (1), J. Christopher Landy (1), A. Delaforge (1), C. Michel (2) and S. Rysgaard (3)

(1) University of Manitoba (Winnipeg, Canada);
(2) Department of Fisheries and Oceans, University of Manitoba (Winnipeg, Canada);
(3) University of Manitoba, University of Aarhus, Greenland Institute of Natural Resources (Winnipeg, Canada)

Sea ice algae contribute to the productivity of the Arctic marine system when they bloom in the spring. During this time ice algae respond to physical changes in the sea ice environment by modifying cellular carbon (POC), nitrogen (PON) and pigment (chl a) content, and by adjusting their photophysiology. In this study we examined how ratios of these cellular components responded to the evolving snow-covered sea ice environment near Cambridge Bay, Nunavut. We also estimated photosynthesis-irradiance (PI) curves using oxygen-optodes and evaluated the resulting time-series of PI parameters under thin and thick snow-covered sites. There were no significant differences in PI parameters between samples from different overlying snow depths, and only maximum photosynthetic rates and the photoacclimation parameter changed significantly over time. The transmission of photosynthetically active radiation (TPAR) was an important factor in this study: driving the seasonal changes in the maximum photosynthetic rate and photoacclimation parameters, limiting daily photosynthesis, and causing greater POC:chl a estimates in late spring and under thin snow cover. Nitrogen limitation was pronounced in this study, likely reducing algal photosynthetic rates, and increasing POC:PON ratios to over six times the Redfield average. Our results highlight the influence of both light and nutrients on ice algal biomass composition and photophysiology, and suggest a limitation by both resources over a diel period.
SEASONAL DYNAMICS OF ALGAL AND BACTERIAL COMMUNITIES IN ARCTIC SEA ICE UNDER VARIABLE SNOW COVER

Campbell, Karley (1), C.J. Mundy (1), C. Belzile (2), A. Delaforge (1) and S. Rysgaard (3)

(1) University of Manitoba (Winnipeg, Canada); (2) Université du Québec à Rimouski (Rimouski, Canada); (3) University of Manitoba, University of Aarhus, Greenland Institute of Natural Resources (Winnipeg, Canada)

Diatoms and heterotrophic bacteria dominate the microbial communities of sea ice during the spring. We assessed the composition of the spring bottom-ice community in Dease Strait, Nunavut, and investigated potential controls of biomass and production from early March until early June. We found that flow cytometry and light microscopy estimates of photosynthetic nanoeukaryote (2-20 μm) abundance gave comparable results, and using the average from the two methods we documented a change in the size of cells over the spring from largely pico- (<2 μm), to nano- and microeukaryotes (20–200 μm). This shift in algal size corresponded to a bloom in diatoms that drove increases in chlorophyll a, particulate organic carbon and primary productivity. Low salinity and nutrient deplete conditions in the region appeared to support rapid growth of the centric diatom Attheya spp. in particular. Increases in the number and productivity of heterotrophic bacteria in this study were largely associated with the number of photosynthetic picoeukaryote cells, potentially due to their supply of dissolved organic carbon substrate. Our results suggest that low nutrient and high light conditions predicted for the Arctic in the future may favour an algal community of centric diatoms that could increase the production potential of the ice, while picoeukaryotes remain important constituents of the ice community through their role in carbon cycling.

A COMMUNITY-DEFINED DIGITAL LIBRARY FOR THE INUUVIALUIT SETTLEMENT REGION

Campbell, Sandy (1), A. Shiri (2), D. Rathi (2), C. Cockney (3), S. Farnel (4), E. Maloney (5) and R. Stobbs (6)

(1) University of Alberta (Edmonton, Canada); (2) University of Alberta. School of Library and Information Studies (Edmonton, Canada); (3) Inuvialuit Cultural Resource Centre (Inuvik, Canada); (4) University of Alberta Libraries (Edmonton, Canada); (5) University of Alberta. School of Library and Information Studies (Edmonton, Canada); (6) University of Alberta. School of Library and Information Studies. (Edmonton, Canada)

The Inuvialuit Settlement Region (ISR) is an administrative and cultural area of the western Canadian Arctic that incorporates the six communities of Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk and Ulukhaktok. These communities are distant from each other. For example, Inuvik is 674 km from Ulukhaktok. The Inuvialuit Cultural Resource Centre (ICRC) has a mandate to collect, preserve and share cultural materials with all of the communities. These materials including language learning materials in the three Inuvialuktun dialects, photographs, and oral histories. The Digital Library North project is a collaboration between the ICRC and the University of Alberta. The project combines academic research with the creation of a digital library that is community defined, community owned and operated and tailored to meet the needs of the people of the ISR. The project employs a variety of research methods (participatory research, environmental scanning, ethnography, open houses, community workshops, surveys, information audits and community leader engagement) specifically selected to ensure community engagement with and input into the development and testing of the digital library. In particular, the project team adapted and created a unique environmental scanning model. Data collected in the initial scan was incorporated into later iterations of the model and also continues to shape the data collection methods that the team uses. The result of this is a digital library uniquely adapted for the ISR. Community recommendations have been incorporated into the structure of the prototype digital library, particularly in the web-page and search interface design. Sustainability and community ownership of the digital library are foundational values for the project and are being accomplished through the use of open source software, training of ICRC staff and employment of local student workers. Research is ongoing into improving the scalability of the digital library framework, creating culturally appropriate metadata, developing multilingual indexing and exploring the potential for user-generate commentaries, particularly related to photographs. Next steps will include adding more materials,
expanding the types of materials in the digital library collection and user training to be delivered in the six communities.

HUDSON BAY: THE CLIMATOLOGY OF THE ATMOSPHERE, SEA ICE AND OCEAN
Candlish, Lauren, J. Andrews, N. Theriault, J. Landy and D. Barber
CEOS, University of Manitoba (Winnipeg, Canada)

Climate change is significantly affecting in the Arctic environment. The temperatures of the ocean and the atmosphere are warming. The timing of the annual freeze and thaw of sea ice is shifting to a longer open water season. The motion, location, volume, and thickness of the sea ice are shifting patterns. New weather trends are emerging. All of these changes mean polar animals are changing their ecological cycles (Stewart and Lockhart, 2005). The Hudson Bay Complex is not immune to the changes that are occurring throughout the Arctic. The Complex is a highly dynamic environment undergoing rapid change. Changes in climate and freshwater regulation will affect (or have affected) processes between the freshwater, marine, sea ice and atmosphere systems. Over 1.4 m of freshwater is supplied annually by melting sea ice with another 0.9 m by runoff from the Complex’s watershed (Déry et al., 2011; Granskog et al., 2011; Prinsenberg, 1988). Most of this is supplied to the southern half of the Bay, where most of the ice melts and where over two-thirds of all terrestrial runoff to the Bay emerges (Granskog et al., 2011). Strong vertical stratification imparted by this annual replenishment of freshwater dominates biogeochemical cycling in Hudson Bay, causing the chronic nutrient limitation that has been invoked to explain low biological productivity compared to other estuarine systems (e.g. Anderson and Roff, 1980; Ingram et al., 1996; Ferland, 2011; Sibert et al., 2011). Seasonal timing and volumes of both sea-ice melt and runoff will be affected by changing climate, and timing and location of runoff is additionally affected by diversion and seasonal storage for hydroelectric purposes. This presentation will highlight the key characteristics of the climate of the Hudson Bay Complex that are important for natural systems, ecosystems and human activities. The presentation will focus on the physical processes (in regards the atmosphere, ocean and sea ice) that are occurring in the Hudson Bay Complex. It will look at the average climatology of key variables for the atmosphere, ocean and sea ice, what changes have happened during the recent past, and what changes we are expecting to see in the near future.

FACTORS OF HETEROGENEITY OF LICHEN HEATH RETREAT ON THE MINGAN ARCHIPELAGO NATIONAL PARK RESERVE OF CANADA
Caouette, Marianne (1), S. Boudreau (2), M. Simard (3) and E. Lévesque (4)
(1) Université Laval, CEN, UQTR (Québec, Canada); (2) Université Laval, CEN (Québec, Canada); (3) Université Laval (Québec, Canada); (4) UQTR (Trois-Rivières, Canada)

In the Mingan Archipelago National Park Reserve of Québec, Canada, an important greening has been observed at the expense of terricolous lichens since 1967. This phenomenon occurring in lichen heaths is most likely linked to the encroachment of herbaceous species and shrubs like black crowberry (Empetrum nigrum L.). Aerial photographs of the Mingan archipelago from 1967 to 2009 reveal a decline that appears heterogeneous at a local scale, with some lichen heaths decreasing rapidly in extent and others appearing stable over time. Our aim was to determine which local-scale characteristics (substrate, aspect, slope, etc.) promote the retreat of the lichen heath on the islands. Using supervised classification on the aerial-photo chronosequence (1967, 1988 2009), vegetation maps of seven islands have been generated in order to track the evolution of plant communities and quantify the decline in lichen cover. Preliminary analyses show a retreat of the lichen heat ranging from 60% to 90% depending on the island. Also, an exhaustive characterisation of different sites (stable or retreating) has been carried out during the summer of 2016. We are now investigating the link between the rate of the retreat and various local parameters. Preliminary observations suggest that the presence of a thin layer of organic matter is related to the persistence of terricolous lichen cover. The combination of air-photo interpretation and close inspection of on-site conditions enabled us to have a better understanding of changes occurring on the Mingan archipelago and local characteristics involved in the encroachment of vascular plants. This will extend our comprehension of northern ecosystems dynamics, which undergo a massive greening.
HOLOCENE SEDIMENT DYNAMICS ON THE NORTHWESTERN GREENLAND GLACIATED MARGIN: INSIGHT FROM SEDIMENTOLOGICAL, MINERALOGICAL AND MAGNETIC DATA

Caron, Myriam, J.-C. Montero-Serrano, G. St-Onge and A. Rochon

UQAR-ISMER, GEOTOP (Rimouski, Canada)

To place the recent observations of Greenland’s ice loss in perspective, it is necessary to compare them with its natural variability through the Late Quaternary. In this context, the eastern Baffin Bay continental margin is of particular interest because it receives the products of glacial erosion and icebergs from the NW Greenland Ice Sheet margin. Thus, in this study, we use sediment grain size, bulk mineralogy and magnetic records from three sediment cores (AMD14-204, AMD14-210 and AMD14-Kane2B) recovered along the NW Greenland margin in northern Baffin Bay to (1) track changes in sediment inputs and transport pathways and (2) document ice-sheet/ocean interactions between the West Greenland Current (WGC) and the northwestern Greenland Ice Sheet during the Holocene. The chronology of the sediment cores was constrained by combining paleomagnetic analyses (inclination, declination and relative paleointensity of the Earth’s magnetic field) with AMS-14C ages from mollusk shells and/or benthic foraminifers. The results indicate that all three sedimentary sequences cover the last 10 000 years. The sediment cores located from northwestern Greenland (AMD14-204 and AMD14-210) are characterized by high plagioclase contents derived from dominantly felsic rocks (granite and gneiss), whereas core AMD14-Kane2B located in Nares Strait exhibits a higher concentration in quartz and dolomite contents mainly derived from the carbonate-rich sedimentary rocks of Ellesmere Island. Overall, our sedimentological, mineralogical and magnetic proxies indicate fluctuations in the detrital sedimentation during the Holocene along the NW Greenland margin likely reflecting changes in the Greenland Ice Sheet dynamics. Indeed, specific variations of almost all the detrital proxies measured in this study are synchronous with other NW Greenland records, supporting the hypothesis that the NW Greenland Ice Sheet fluctuations are mainly driven by changes in the intensity of the WGC, themselves related to Holocene climate variability.

INFUSING NORTHERN VOICES IN THE NORTHERN MARINE TRANSPORTATION CORRIDORS

Carter, Natalie and J. Dawson

University of Ottawa (Ottawa, Canada)

Increased navigability of Arctic waters, as a result of climate change, is intersecting with a global appetite for untapped natural resources, increasing Arctic tourism, and growing traffic through the Northwest Passage. This situation is testing Nunavut’s safety and security, and is challenging communities. Corridors have been mapped in the Arctic Ocean as part of the Northern Marine Transportation Corridors Initiative (NMTI) co-led by the Canadian Coast Guard, Canadian Hydrographic Service, and Transport Canada. The goal of the initiative is to reduce the likelihood of shipping accidents. The NMTI do not yet consider marine areas that Inuit and northerners use for livelihood activities and travel. To ensure a safe Arctic shipping environment through a corridors approach, and reduce tension and concerns about marine areas among community members, these factors must be addressed in the implementation of the NMTI. This presentation outlines results of the MEOPAR funded Arctic Marine Activities Integration and Synthesis project which included identifying 1) significant socio-cultural, archaeological, and ecological sites and travel routes in the Canadian Arctic for overlay and integration into the NMTI; 2) potential impacts of shipping on those sites and community members; and 3) recommendations for management of the NMTI. Participatory mapping, and semi-structured group discussions and interviews, co-facilitated by Inuit community researchers, were conducted in one community in each Nunavut region. Communities were purposively selected based on known concerns about shipping expressed by community members. Participants were: active, current users of marine areas with expert knowledge of significant socio-cultural, archaeological, and ecological sites and travel routes, and related potential impacts of shipping. Discussions were conducted in Inuktitut, simultaneously interpreted to English, audio-recorded, and transcribed verbatim. Analysis focused on maintaining the integrity of respondents’ narratives. Maps were digitized using ArcGIS. Study results include digital maps of significant socio-cultural, archaeological, and ecological sites and travel routes, and preferred corridor locations, speed limits, no-go zones, no-anchor zones, and no-icebreaking zones in
each of six seasons. Participants identified impacts of shipping including changes to nearby ecology (animals, shoreline, ice conditions); increased danger, delays, and expenditures when hunting; decreased mental and physical health; loss of Inuit and northerners’ culture and tradition; restricted country food access; food insecurity; economic losses; and new job opportunities. Participants reported that disruption of sea ice break-up and formation by icebreakers and marine vessels is especially disruptive to Inuit and northerners’ ability to use local travel routes, hunt and camp safely on ice, practice traditional activities, and re-supply camps. Also local knowledge will be less applicable as marine vessels modify ice conditions, animal habitats, and local travel routes. Acquiring new knowledge quickly enough to enable continued cultural practices will be challenging. Participants’ recommendations for NMTC management including monitoring and enforcement of corridors use, and improved communication between government, marine vessels, and communities. This study documented that Inuit and northerners must be and wish to be included on an on-going basis in the implementation and management of the NMTC.

ROLE OF RIVERS AND STORMS DETERMINING ARCTIC PRODUCTIVITY

Castro de la Guardia, Laura (1), X. Hu (1), M. Claret (2), P. G. Myers (1) and E. D. Galbraith (3)

(1) University of Alberta (Havana, Cuba);
(2) McGill University (Montreal, Spain);
(3) ICREA, Barcelona (Barcelona, Canada)

In an effort to understand future Arctic ecosystem impacts, we investigate the sensitivity of phytoplankton in the Arctic Ocean to changing environmental conditions. We focus on the effects of storms and river discharge because they strongly impact the surface ocean where the phytoplankton community lives. Phytoplankton are the base level of the Arctic food web, and thus they have an important role regulating the abundance of Arctic marine mammals and fish. Through their active uptake of carbon, the phytoplankton community also has the potential to reduce atmospheric carbon dioxide concentrations and thus counteract global warming. Nutrients are essential for the development of phytoplankton. Sources of nutrient to the surface waters include mechanically mixed waters from below the nutricline, and river discharge. The loss of sea ice in the Arctic is exposing the ocean surface to more frequent storms. This has led to the hypothesis that storm-induced mixing is responsible for a new phytoplankton growth in late summer. On the other hand, the role of riverine nutrients sustaining the large concentration of phytoplankton in coastal regions, as observed by ocean-colour satellite sensors, is controversial and still an open question. Using an ocean-seaice-biogeochemical model (i.e. NEMO-LIMBLING) we set up a suite of experiments to determine the importance of storms and river discharge on the total phytoplankton growth in the Arctic. We determine which regions are most vulnerable by quantifying the total change in productivity, and describe the physical processes driving the change. In addition we determine the biogenic carbon export as a way of measuring the potential impact of storms and river discharge on the atmospheric carbon dioxide concentrations. A good understanding of these process can help us evaluate, predict and adapt to future ecosystem changes.

SERVING COUNTRY FOOD PROJECT: INCREASING ACCESS TO TRADITIONAL FOOD IN GOVERNMENT-FUNDED FACILITIES & PROGRAMS IN NUNAVUT

Caughey, Amy (1), N. Gonzalez (2), J. Sargeant (3), A. MacRury (4), W. Joy (4) and K. Barker (4)

(1) Goverment of Nunavut (Iqaluit, Canada);
(2) Aarluk Consulting (Iqaluit, Canada);
(3) University of Guelph, Ontario Veterinary College, Center for Public Health and Zoonoses (Guelph, Canada);
(4) Government of Nunavut (Iqaluit, Canada)

Food insecurity across Nunavut is well documented, and traditional food is an important contributor to health and nutrition in the Territory. Increasing access to country food in facilities (such as hospitals) and community-based programs (such as preschools) has the potential to benefit those Nunavummiut most vulnerable to food insecurity. Over two years (July 2014 to May 2016) the Government of Nunavut (GN) Department of Health undertook to develop recommendations for serving country food in GN-funded facilities and programs. Phase 1 of the project included a literature review of zoonotic disease in Arctic species of interest (caribou, fish, seal, whale, and muskox), and a review of risk mitigation strategies and policy approaches. As well, key informant interviews were conducted with hunters,
CHRs, Inuit organizations, government departments, facility managers, Environmental Health Officers and nutritionists in Nunavut. Current practice related to traditional food safety in health settings in Canada and Greenland was reviewed. Draft recommendations were developed. During the second year of the project, draft recommendations were returned to regional HTOs and key informants, modifications were made, and various resources were developed, including a Guidebook for Serving Country Food in GN-funded facilities programs and a Reference Guide for policy makers. As well, fact sheets related to zoonotic disease (Anasakid nematodes, botulism, brucellosis, erysipelo thorix, toxoplasma, and trichinosis) were created. Recommendations from this project include further country food safety knowledge exchange between harvesters and veterinarians, expanding Nunavut-specific food safety training for facility staff, and identifying health research priorities around zoonotic disease.

ARTIFICIALLY-GENERATED SEA SPRAY AEROSOLS FROM ARCTIC WATERS

Chang, Rachel (1), J. Abbatt (2), A. Bertram (3), S. Bhatia (1), M. Boyer (1), D. Collins (2) and V. Irish (3)

(1) Dalhousie University (Halifax, Canada);
(2) University of Toronto (Toronto, Canada);
(3) University of British Columbia (Vancouver, Canada)

Oceans cover 70% of the earth’s surface, yet their emissions into the atmosphere are still poorly constrained. This is in part due to the large variety of water and biological conditions under which previous measurements were taken. In this study, we use the Dalhousie Artificial Wave Tank to simulate wave breaking and generate artificial sea spray aerosols using surface water collected on board the CCGS Amundsen from July to August 2016. Aerosols generated were measured for various physical and chemical properties (e.g. size distributions, chemical composition, ice nucleation activity, cloud condensation nuclei activity). These results will be presented and compared with ocean conditions and biology to determine the effect of changing water mass on aerosol composition and production efficiency. Results from this work are important as summer sea-ice coverage reduces and increased open waters will allow increased sea spray aerosols to be emitted into the atmosphere.

SPATIAL AND TEMPORAL VARIABILITY OF INTERNAL WAVES AND THEIR EFFECT ON MIXING IN THE CANADIAN ARCTIC OCEAN

Chanona, Melanie (1), S. Waterman (1) and Y. Gratton (2)

(1) University of British Columbia (Vancouver, Canada);
(2) Institut National de la Recherche Scientifique (Québec, Canada)

Traditionally, the Arctic Ocean’s unique density structure has acted as a barrier to vertical heat transport, preventing the upward mixing of heat contained in deep, warm Atlantic-sourced water and isolating the surface sea-ice pack. However, there are growing concerns that increases in internal wave energy arising from the intensification of storms and decreases in sea ice cover could enhance vertical mixing rates and thus erode this stratified barrier. The present study aims to complete a widespread survey of internal waves and turbulent mixing in the Canadian Arctic Ocean in order to better assess the risks associated with changing ocean energy and heat budgets. Using over 4200 geographically distributed vertical profiles of ocean temperature and salinity collected by ArcticNet between 1997 and 2016, we calculate strain profiles in the region and map the potential energies that characterize the internal wave field as a function of space and time. We then aim to evaluate the driving forces behind the observed variability by investigating links with tidal energy, wind forcing and rough bathymetry. The energy spectra will further be used to estimate vertical diffusivity rates. Our work is still in its preliminary stages, and as such we invite feedback on our project plans and early results. We believe the large scope of the analysis will provide the opportunity for an improved understanding of internal wave field energetics and mixing patterns that exist in the Canadian Arctic Ocean. It further promises greater insight into the underpinning mechanisms that drive spatial and temporal variability.

TAXONOMIC COMPOSITION AND PHOTOPROTECTION STRATEGY OF MELT POND ALGAE IN THE CANADIAN ARCTIC

Charette, Joannie (1), M. Gosselin (1), M. Blais (1) and M. Levasseur (2)

(1) ISMER (Rimouski, Canada);
(2) Université Laval (Québec, Canada)
In late spring-early summer, snowmelt results in the formation of melt ponds on sea ice surface that can be colonized by unicellular algae. Until now, only a few studies have focused their attention on melt pond marine ecosystems in the Arctic. Hence, it is imperative to acquire new knowledge on the structure and functioning of the melt pond communities and to understand their linkages with their environment in order to better assess their survival strategies in this high light-low salinity environment. In this context, we examined taxonomic and pigment composition of melt pond algal community of the Canadian Arctic during summer 2014. Photosynthetic nanoeukaryotes (2–20 µm) made up 48–74% of the total algal abundance. Flagellates, mostly unidentified flagellates, dominated the protist community, accounting for 71–99% of the total cell abundance >2 µm. Pennate diatoms were present in all melt ponds, except one, and accounted for 5–26% of the community. We were able to distinguish five different groups of melt pond regarding their taxonomic composition. Photoprotective carotenoids (PPC) were found in high proportion in melt ponds, accounting for more than 20% of the algal pigment composition. Two mycosporine-like amino acid (MLAA) were also found in melt ponds. The high photosynthetic performance of the algae indicates that these photoprotective mechanisms (i.e. PPC and MLAA) were efficient to prevent damage caused by sunlight.

A EAST HUDSON BAY NETWORK RESEARCH INITIATIVE ON REGIONAL METAL ACCUMULATION IN THE MARINE FOOD WEB: PRELIMINARY RESULTS

Chételat, John (1), J. Heath (2), L. Arragutainaq (3), A. Kasudluak (4), G. Lameboy (5), R. Mickpegak (6) and A. Nalukturuk (7)

(1) Environment and Climate Change Canada (Ottawa, Canada);
(2) Arctic Eider Society (St. John’s, Canada);
(3) Sanikiluaq Hunters and Trappers Association (Sanikiluaq, Canada);
(4) Amnitrivik LHC (Umiujaq, Canada);
(5) Cree Nation of Chisasibi (Chisasibi, Canada);
(6) Sakkuq LHC (Kuujjuaraapik, Canada);
(7) Inukjuak (Inukjuak, Canada)

Communities in East Hudson Bay are concerned about ecosystem changes observed in recent decades, particularly related to sea-ice and oceanographic conditions, and also about potential impacts of contaminants from long-range atmospheric transport and regional human activities. A community-driven research network (the East Hudson Bay Network [EHBN]) has been established to measure and better understand large-scale cumulative environmental impacts in East Hudson Bay. Building on EHBN collaborations and activities in five communities (Sanikiluaq, Kuujjuaraapik, Inukjuak, Umiujaq, Chisasibi), this project funded by the Northern Contaminants Program is generating new information on metal bioaccumulation that will provide a regionally-integrated perspective on metal exposure in the East Hudson Bay marine environment. The five communities are sampling coastal bioindicator species (blue mussel, common eider) annually for three years (2015 to 2017). Offshore bioindicators (ringed seal, herring gull, plankton, fish) are additionally being collected from Kuujjuaraapik and Sanikiluaq. These locally-important bioindicators of metal accumulation will be used to characterize geographic and habitat-specific variation (coastal and offshore zones) in East Hudson Bay.

This poster will introduce the main objectives of the community-based project and outline the study design. Preliminary results will be presented from collections in 2015 of herring gull eggs (n=10), ringed seals (n=16), blue mussels (n=21) and common eiders (n=24). Animal tissues were analyzed for total mercury, 24 elements by ICP-MS, and carbon and nitrogen stable isotopes. Spatial variation of tissue metal concentrations among communities will be examined. Food web structure will be characterized using carbon and nitrogen stable isotope ratios to investigate influences of trophic position and carbon source on metal accumulation. Over this three-year project, important baseline information on metal levels in the East Hudson Bay marine food web will be generated to allow for future tracking of impacts from environmental change, long-range atmospheric transport, and regional human activities.

DOES GROWTH RATE INFLUENCE MERCURY ACCUMULATION IN ARCTIC FRESHWATER FISH? EVIDENCE FROM MUSCLE RNA:DNA RATIOS

Chételat, John (1), Y. Shao (2), M. Richardson (3), D. Crump (4), G. MacMillan (5), M. Amyot (5), H. Gill (4), P. Drevnick (6), G. Köck (7) and D. Muir (8)

(1) Environment and Climate Change Canada (Ottawa, Canada);
Cold, unproductive lakes in the Canadian High Arctic support long-lived, slow growing populations of Arctic char (Salvelinus alpinus). Somatic growth dilution theory predicts that fish with slower growth at a given age will have a higher concentration of mercury because less biomass is produced per unit of mercury consumed. Elevated levels of mercury in char muscle (of 1-3 µg/g wet weight), which far exceed the Canadian standard of 0.5 µg/g for retail fish, have been reported for some populations, and it remains unclear whether slow growth of lake-dwelling Arctic char has a detrimental effect on their mercury levels. We conducted a three-year study in the eastern Canadian Arctic to compare mercury bioaccumulation in long-lived, slow-growing populations of Arctic char (n = 124 fish) and short-lived, fast growing populations of brook trout (Salvelinus fontinalis) from the sub-Arctic (n = 61 fish).

We used a novel biochemical approach by measuring the RNA:DNA ratio of muscle tissue as an index of fish growth rate. This nucleic acid index tracks the short-term growth rate of tissue because growth involves protein synthesis, which is facilitated by cellular RNA. We found that RNA:DNA ratios in Arctic char muscle were higher in summer than winter, and higher in more productive lakes where the char were larger for a given age. These RNA:DNA patterns were consistent with the expected positive relationship between RNA:DNA ratio and fish growth. However, RNA:DNA ratios of brook trout were lower than Arctic char even though the brook trout showed faster long-term growth (size at age). The muscle RNA:DNA ratios were species-specific, and higher ratios in Arctic char may reflect an adaptation to poor external growth conditions by increasing their production of RNA. We used statistical models to examine the relative importance of dietary methylmercury (MMHg) concentration, and fish length, age, trophic position, and short-term growth rate on mercury levels in the study fish. After controlling for all other variables, growth rate (estimated using the RNA:DNA ratio) did not explain differences in fish total mercury concentrations within or among lakes. Age was a highly significant explanatory variable, reflecting the importance of bioaccumulation over time in long-lived fish. We conclude that dietary MMHg concentration and length of exposure (age) are the main factors controlling mercury bioaccumulation in lake-dwelling brook trout and Arctic char in the eastern Canadian Arctic. An implication of this finding is that improved growth, anticipated under a warming Arctic climate, will not likely reduce mercury concentrations in fish muscle.

FLOW PATHS AND WATER SOURCES DURING THE THAW PERIOD OF A HILLSLOPE UNDERLAIN BY PERMAFROST, APEX RIVER WATERSHED, IQALUIT, NU

Chiasson-Poirier, Gabriel (1), J. Franssen (2), D. Fortier (2), T. Tremblay (3), M. Lafrenière (4) and S. Lamoureux (4)

(1) Université de Montréal (Sherbrooke, Canada); (2) University of Montréal (Montréal, Canada); (3) Canada Nunivut Geoscience Office (Iqaluit, Canada); (4) Queen’s University (Kingston, Canada)

In the context of Arctic warming temperatures, it’s currently suggested in the literature that groundwater pathways and contribution to surface water will increase owing to permafrost degradation (Connon, 2014). However, groundwater fluxes and their contribution to surface waters remain difficult to predict due to uncertainties about spatio-temporal variation of thaw depths (i.e., frost-table depths) which are essential to understand the how water flow on hillslope (Wright, 2009). While recent research (Meerveld, 2015) investigated with sophisticated wells and pressure sensors installation the role of bedrock topography on the rutting of groundwater flows in southern watershed, this methodological approach remains unused in permafrost areas. The dynamic state of the active layer during the thawing season greatly complicate the use of this technic. The outcomes of a research using an adapted methodology of such installation will be essential to fill the lack of knowledge about the relation between groundwater flow dynamics and active layer development on permafrost hillslope. In this research we instrumented a hillslope-stream sequence of the Apex River watershed, Iqaluit, Nunavut (68° 33’ W,
63° 45’N), where the subsurface flows are limited to the unfrozen surface layer or active layer by an impervious frost table. We aim to provide a detailed characterization of the flow paths and water sources changes through the thaw season of the active layer. Closely related to each other we also want to assess how different thawing depths or soil characteristics can enhance or limit the hydrological connectivity in the hillslope-stream sequence and vice-versa, verify the influence of the hydrological dynamics on the evolution of the active layer thawing depth. To accomplish this, we identified these specific research objectives; (i) track the flow direction and accumulation evolution of suprapermafrost groundwater across a hillslope, (ii) characterize the relation between the physical processes governing the routing of shallow groundwater flows and the feedback of flow dynamics on the active layer development and (iii) Assess the relative importance or the different water sources (rain, groundwater, lake, overland flow) contributing to the streamflow of a little stream adjacent through the thawing season. Water levels were recorded continuously (20min) between July 8th and August 26th in 28 piezometers installed over a glaciofluvial deposit hillslope and readjusted weekly to the depth of frost table. A detailed analysis of piezometer water levels in response to rainfall inputs allowed us to identify preferential routing and storage of water across the hillslope, and how the hydrological dynamics of the study site also responded to (or were associated) to the increasing of the active layer depth and the spatial variable evolution of frost-table (i.e., topography). A total of 148 water samples (groundwater wells, stream, lake and rain) was collected for chemical (EC, Stable Isotopes and DOC) analysis. End-member mixing analysis will be used to confirm the proportion of groundwater and other sources (e.g., precipitation, surface runoff) that contributing to streamflow. This knowledge will be essential 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.

**DATA MANAGEMENT PLANNING THROUGH THE DATA LIFECYCLE: A GUIDE FOR POLAR SCIENTISTS**

Christoffersen Vossepoel, Shannon

Arctic Institute of North America, University of Calgary (Calgary, Canada)

Proper data management planning can help to ensure that data can be found and understood, unnecessary duplication is avoided, results can be validated, research is visible and has impact, data can be cited and credited, and that researchers can comply with funder mandates. In this session, learn everything you need to create a Data Management Plan (DMP) that will: • Satisfy funder requirements; • Increase your data’s reusability; • Ensure your data is searchable and citable; • Cover everything from raw data to metadata to publication. Whether you work in the physical sciences, social sciences, or humanities, learn the best practices for managing your data and ensuring its longevity. Data management standards, citation, open access (and ethical open access), submission information, and repositories will all be covered.

**THE NCP PUBLICATIONS DATABASE**

Christoffersen Vossepoel, Shannon, L. Howard, L. Howard and V. Rajdev

Arctic Institute of North America, University of Calgary (Calgary, Canada)

Established in 1991, the Northern Contaminants Program (NCP) was created in response to rising concerns over elevated levels of contaminants in wildlife that are important to the traditional diets of northern Indigenous peoples. The NCP works closely with the Arctic Council’s Arctic Monitoring and Assessment Programme (AMAP), and the results of NCP projects represent the main Canadian contribution to AMAP. The NCP Publications Database contains more than 3500 publications resulting from the Northern Contaminants Program. Hosted by the Arctic Institute of North America’s ASTIS Database, ASTIS also administers the NCP Publications Repository on its server, making available NCP publications that are not otherwise accessible.
WHAT DOES COMMUNITY-BASED RESEARCH MEAN AND HOW DO WE DO IT? REFLECTIONS FROM STUDENTS AND YOUNG RESEARCHERS WORKING ACROSS THE CANADIAN ARCTIC

E. Galappaththi, Clark, Dylan and IK–ADAPT Research Group (1)
McGill University (Montreal, Canada)

With growing focus on the human dimensions of climate change in the Arctic, there is a push for researchers to ask questions that are relevant to communities and to engage with the lived knowledge and experience of participants as an ongoing dialogue. The term ‘community-based research’ is often referenced to indicate an open partnership between community members, stakeholders, and researchers, however, there is variation in practices and implementation. There are particular hurdles for the numerous young researchers and student conducting research in the Arctic given their limited experience. In this study a group of young researchers and students from the Indigenous Knowledge for Adapting to Health Effects of Climate Change project (IK-ADAPT) research team reflect on how they navigate community-based research in the Arctic given their limited experience. In this study a group of young researchers and students from the Indigenous Knowledge for Adapting to Health Effects of Climate Change project (IK-ADAPT) research team reflect on how they navigate community-based research in the Arctic given their limited experience. Common themes and challenges are outlined, including defining ‘community-based research,’ motivations for research in the region, and tensions between academia and community oriented approaches.

VULNERABILITY TO UNINTENTIONAL INJURIES ASSOCIATED WITH LAND-USE ACTIVITIES AND SEARCH AND RESCUE IN NUNAVUT, CANADA

Clark, Dylan (1), J. Ford (2), T. Pearce (3) and L. Berrang Ford (2)

(1) Climate Change Research Group, McGill University (Montreal, Canada);
(2) McGill University (Montreal, Canada);
(3) University of the Sunshine Coast, and University of Guelph (Maroochydore, Australia)

Injury is the leading cause of death for Canadians aged 1 to 44, occurring disproportionately across regions and communities. In the Inuit territory of Nunavut, unintentional injury rates are over three times the Canadian average. In this study, we develop a framework for assessing vulnerability to injury and use it to identify and characterize the determinants of injuries on the land in Nunavut. We specifically examine unintentional injuries on the land (outside of hamlets) because of the importance of land-based activities to Inuit culture, health, and well-being. Semi-structured interviews (n=45) were conducted in three communities that have varying rates of search and rescue (SAR), complemented by an analysis of SAR case data for the territory. We found that risk of land-based injuries is affected by socioeconomic status, Inuit traditional knowledge, community organizations, and territorial and national policies. Using the Vulnerability to Injury Framework we were able to analyze the impact of these factors on safety. Socioeconomic status emerged as a root or distal factor to land safety at an individual and community scale, affecting the sensitivity of individuals, influencing the condition of machinery, the amount of gear an individual had, and the level of land-use they could afford. The ability to adapt to hazards and the changing Arctic environment was also found to be affected by socio-economic status, influencing the ability to purchase new protective technologies, community resources for prevention efforts, and emergency response resources. Notably, by moving beyond common conceptualizations of unintentional injury, we are able to better assess root causes of unintentional injury and outline paths for prevention.

INTEGRATING GENOMICS, PHENOTYPES AND LOCAL ECOLOGICAL KNOWLEDGE TOWARDS IMPROVING CAPELIN STOCK MANAGEMENT IN CANADIAN ATLANTIC AND ARCTIC WATERS

Clément, Marie (1), M. Clément (2), L. Bernatchez (3), P. Sirois (4), G. Murray (5), F. Mowbray (6) and T. Doniol-Valcroze (6)

(1) Memorial University (Happy Valley-Goose Bay, Canada);
(2) Memorial University (Fisheries and Marine Institute in partnership with the Labrador Institute) (Happy Valley-Goose Bay, Canada);
(3) Université Laval (Québec, Canada);
(4) Université du Québec à Chicoutimi (Chicoutimi, Canada);
(5) Duke University (Durham, United States);
(6) Department of Fisheries and Oceans (St. John’s, Canada)
Capelin (Mallotus villosus), a keystone species in marine ecosystems, plays a critical socio-economic role for Canadians. For example, changes in capelin abundance and distribution may directly impact the populations of predators, including economically important fisheries and species with high importance for food security (e.g., salmonids, mammals, and birds) in indigenous communities. Despite their economic, social and ecological values, however, capelin populations remain largely unknown, particularly in northern regions. This is principally attributed to ice cover preventing capelin spring surveys from extending northward and the remoteness of scientists, who are generally based in southern regions. Therefore, scientists and managers need to rely on local ecological knowledge to obtain information needed to improve management practices. This poster describes a new research project involving the integration of expertise in genomics, phenotypes (morphology), life history traits, with local knowledge and societal considerations towards: i) Identifying management units based on adaptive genetic differences and local adaptations in Canada and quantifying the genetic connectivity between capelin stocks exploited in Canadian and Greenland waters; ii) Incorporating genomics with phenotypic traits to refine stock structure delineation, document life history and stock characteristics; iii) Incorporating local knowledge and the findings of an observer network into science and stock management strategies. Integrating knowledge from multi-disciplinary fields to delineate and characterize stocks will provide a better understanding of capelin population dynamics, management units and will clarify whether the Labrador Sea and Baffin Bay represent a contact zone between stocks from the Canadian Atlantic, Arctic and/or West Greenland.

Coastal ecosystems in the Arctic are being affected by climate change leading to permafrost thaw, to a shifting streamflow regime and to changing fluxes of freshwater and sediment to the Arctic Ocean. The hydrological and sedimentary response of large rivers to climate change have been focus of numerous investigations as they cover 53% of the area draining into the Arctic Ocean (e.g. Holmes et al. 2012). Small catchments are yet widespread and could contribute large amounts of sediment to the nearshore zone. Streamflow and sediment transport is being monitored continuously only at few sites (Favaro Lamoureux 2015), which constrains the understanding regarding water quality and nutrient availability. This project is addressing this knowledge gap by investigating streamflow regime and sediment dynamics of two adjacent catchments on Herschel Island in the western Canadian Arctic. We present an overview of the extensive ecosystem monitoring between 2014 and 2016. Data of vegetation coverage, active layer depth, soil organic carbon and nitrogen collected 2014 and 2015 highlight the great spatial variability of reservoirs in the catchments. The hydrological stations at the outflow of each catchment collect data of water height, temperature and conductivity. Snow water equivalent estimations, retrieved from snow probing along transects in 2016, contribute to an understanding of the hydrological configuration of the catchments, which are characterized by a nival regime. The data analysis further suggests a changing decoupling and coupling of the hydrological regime with snow, depending on the time in the season. Water samples were collected to determine concentrations of dissolved organic carbon and nitrogen as well as suspended particulate sediment. The latter will be linked to turbidity values, which amount up to 132.0 NTU for the western drainage basin of only 1.4 km2. Turbidity values in the eastern catchment (1.6 km2) are generally smaller, with a maximum of 77.3 NTU. By comparing both watersheds, sources and controls of sediment mobilization are going to be investigated. This study will contribute to a baseline for pan-Arctic assessments of sediment flux to the Arctic Ocean. Holmes, R.M., McClelland, J.W., Peterson, B.J., et al. (2012). Seasonal and annual fluxes of nutrients and organic matter from large rivers to the Arctic Ocean and surrounding seas. Estuaries and Coasts, 35, 369–382, DOI 10.10007/s12237-011-9386-6. Favaro, E.A., Lamoureux, S.F. (2015). Downstream
patterns of suspended sediment transport in a High Arctic river influenced by permafrost disturbance and recent climate change. Geomorphology, 246, 359-369, DOI 10.1016/j.geomorph.2015.06.038.

THE ENUK APP; PARTICIPATORY SOFTWARE DESIGN OF AN ENVIRONMENTAL MONITORING TOOL IN RIGOLET, NUNATSIAVUT.

Cook, Oliver (1), D. Gillis (1), S. Harper (1), A. Cunsolo (2), A. Sawatzky (1), I. Shiwak (3), C. Flowers (4) and The Rigolet Inuit Community Government (5)

(1) University of Guelph (Guelph, Canada);
(2) Labrador Institute of Memorial University (Happy Valley-Goose Bay, NL, Canada);
(3) ‘My Word: Storytelling and Digital Media Lab’ (Rigolet, Nunatsiavut, Labrador, Canada);
(4) Rigolet Community (Rigolet, Nunatsiavut, Labrador, Canada);
(5) Rigolet (Rigolet, Canada)

The intense and rapid effects of climate change are being felt strongly by the Inuit populations of the Canadian Arctic. With deep ties to the environment for sustenance and livelihood, numerous negative health and cultural impacts are being felt. To help combat and adapt to these stresses there has emerged an increased desire for the development of novel Information and Communication Technology systems (ICTs) in this area. Design of such systems, both hardware and software, can be challenging however due to the remoteness of communities, technological restrictions, harsh conditions and unique cultural qualities associated with the region. A participatory software design approach to this task offers an interesting perspective to these challenges potentially revealing aspects that might be missed or made more difficult by more traditional software design paradigms. With a focus on strong collaborative relationships with stakeholders, mediation of ethnocentric biases, in-situ experience based investigative techniques and a fostering of personal ownership for the system this approach is particularly suited for this context. For this project we are working with the Inuit community of Rigolet, Nunatsiavut, Canada to design, develop and evaluate The eNuk App; a participatory environmental monitoring tool that will help monitor and respond to environmental changes and associated impacts on community health. Development is currently underway of a website and iOS app. Design of this tool is being conducted as a series of iterative prototype creation phases emphasizing continual community evaluation and full integration in decision making. The mutual sharing of stakeholder knowledge and software design methods and tools during this process is essential in the effective co-creation of locally relevant and useful tools. Initial investigations with Rigolet Community members have revealed some of the environmental limitations, stakeholder expectations, cultural factors and technological elements that influence the selection of a software’s features and capabilities. The first functional prototype based on these factors has begun testing and will be used to evaluate the usability, features and perceived usefulness of the software and motivate the creation of prospective designs. Results from this study will help to inform future ICT projects within Rigolet and within the greater field of climate change adaptation by providing foundational design principles, tools and reflective experiences gained over the course of development. As well, a working prototype of the system will be produced, owned and made freely available to the Rigolet community to be continued and used.

LONG-TERM GLACIER SLOWDOWN IN THE CANADIAN ARCTIC


University of Ottawa (Ottawa, Canada)

Field and remote sensing measurements indicate that glaciers and ice caps in the Canadian Arctic have experienced strongly negative mass balance over the past several decades, with the rate of mass loss increasing towards the present day. This has resulted in an increasing volume of meltwater production at the glacier surface, and therefore a likely increase in meltwater transport to the glacier bed. When assessing the response of glaciers to climate change, an important question is whether this increasing meltwater will result in a net glacier speedup (e.g., due to increased basal lubrication) or glacier slowdown (e.g., due to increased efficiency of the subglacial drainage system). In this study, recent field and remote sensing measurements of glacier motion on outlet glaciers of Penny Ice Cap, Baffin Island, and White Glacier, Axel Heiberg Island, are compared with glacier motion measurements made 50+ years ago. These comparisons indicate that there has been an overall decrease in glacier velocity, although the patterns are spatially variable. Slowdowns
have been dramatic at low elevations, reaching >50% at some locations, but changes have been moderate at higher elevations near the equilibrium line.

**IMAGING AIR VOLUME FRACTION IN FIRST YEAR SEA ICE USING X-RAY TOMOGRAPHY**

Crabeck, Odile

University of Manitoba (Winnipeg, Canada)

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 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-atmosphere 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 brine volume fraction. We differentiate micro bubbles (1 mm), large bubbles (5 mm) and macro bubbles (5mm). While micro bubbles were the most abundant type of air bubbles, most of the air porosity observed resulted from the presence of large and macro bubbles. The ice texture (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.

**HIGH-PRECISION SURVEYING OF DRIFTING ICEBERGS AND ICE ISLANDS**

Crawford, Anna (1), D. Mueller (1), G. Joyal (2) and G. Crocker (1)

(1) Water and Ice Research Lab, Department of Geography and Environmental Studies, Carleton University (Ottawa, Canada);
(2) Laboratoire de Géosciences marines, Département de géographie, Université Laval (Quebec City, Canada)

Offshore industries operating within Canadian waters are often in the vicinity of hazardous icebergs and ice islands (large, tabular icebergs). Drift and deterioration models, along with mass estimates from above-water (sail) dimensions, can be used to inform risk-mitigation decisions. However, precise mass estimates are difficult to obtain and models are inadequately validated due to a lack of iceberg or ice island deterioration data. Field trials were conducted offshore Newfoundland and Labrador from the CCGS Amundsen in April 2015 to compare the precision of terrestrial laser scanning (TLS) and aerial structure-from-motion photogrammetry (SfM) for iceberg and ice island surveying. Two survey targets, 53,000 m² and 7,000 m² in surface extent, were repeatedly surveyed with a vessel-mounted Optech Iliris-HD laser scanner and helicopter-borne aerial photography for SfM 3D point cloud generation. GPS units were deployed prior to surveying and utilized for the drift correction and scale assignment of the TLS and SfM surveys, respectively. A precision assessment was conducted by comparing all points clouds associated with a particular technique and field target in CloudCompare (V. 2.6.2) software with the Multiscale Model-to-Model Cloud Comparison algorithm. Algorithm outputs were used to calculate the minimum magnitude of deterioration ($T_{mag}$), occurring in any linear dimension, which must occur before confident detection by a survey technique. The quality of the deployed GPS unit was a key determinant of $T_{mag}$. The SfM $T_{mag}$ values were between 2.5 m and 0.40 m when associated with the deployment of lower-quality tracking beacons and dual-frequency GPS units, respectively. The TLS surveys were not as precise and $T_{mag}$ ranged from 6.5 m to 3.3 m for the same GPS deployment scenarios. The deterioration processes (e.g., wave erosion, surface ablation) which can be observed, and the magnitude of mass loss before detection of either acute (local calving) or chronic (general, more consistent sidewall recession) deterioration, is largely influenced by $T_{mag}$ and the position of the survey platform in relation to the survey target (i.e., nadir-oriented aerial photography or side-looking TLS). Mass estimates differed between surveys by 4% for SfM surveys with the high quality GPS units, which was much less than the 11% of TLS surveys for the same target. Though SfM surveys were unable to provide adequate coverage of vertical sidewalls due to a near-nadir camera angle, this can be alleviated in future field campaigns with a final circumnavigation off the target’s edge with an oblique camera angle. We have successfully applied both SfM and TLS surveying
to free-drifting icebergs by correcting for survey target movement and have defined the errors in our method. Researchers can now use the $T_{mag}$ values in their study of iceberg or ice island deterioration for industrial or other research applications, such as the distribution of freshwater inputs in the world’s oceans. Furthermore, iceberg and ice island deterioration models can be improved by examining the process and pattern of deterioration across an iceberg or ice island sail while measuring concomitant environmental data.

**BIOLOGICAL CHARACTERIZATION OF COASTAL HABITATS IN CHURCHILL, MANITOBA**

Cyphiot, Valérie (1), P. Archambault (2) and K. Howland (3)

(1) UQAR-ISMER (Rimouski, Canada);  
(2) Département de biologie, Université Laval (Québec, Canada);  
(3) Fisheries and Oceans Canada (Winnipeg, Canada)

Coastal habitats provide unique conditions as it is the location of strong land and ocean interactions which allow a specific diversity of species to establish. However, in the Canadian Arctic, this unique habitat may experience a growing number of impacts such as oil spills and aquatic invasive species, in future years. In this context, effective, low-cost sampling methods are required to obtain baseline data on Arctic species and coastal environments in remote areas. The Emergency Spatial Pre-SCAT (shoreline cleanup assessment technique) for Arctic Coastal Ecosystems (eSPACE) project developed a classification of habitats by videography using parameters such as substrate and geomorphology. In order to verify the relationships between this habitat classification and the biological composition, the objective of this study was to characterize coastal benthic communities and associated habitats in Churchill, Manitoba. To ground truth the videographic classification of habitat with biological data, species abundance, diversity and biomass of algal and benthic communities were collected in six different habitats (Boulder beach, sand beach, bedrock platform/ramp, marsh, mixed sediment beach, mixed tidal flat). In each habitat, four randomly selected 100 m segments were sampled in the intertidal zone during low tide. Fifteen quadrats were randomly sampled in the lower mediolittoral zone. Hard substrate and soft sediments were collected and sediments were sieved on 1 mm mesh size. A standardize one hour timed walk was also perform to fully assess biodiversity of each habitat. Results show differences and similarities between biological composition of each habitat which will allow for direct information on the relative biological importance of the sampled habitats and help to validate the classification of these habitats.

**CYCLING OF DISSOLVED ORGANIC MATTER IN PERMAFROST AND GLACIAL MELT WATER IMPACTED FRESHWATER SYSTEMS OF THE CANADIAN ARCTIC**

Dainard, Paul (1), S. Schiff (1), P. Aukes (1), M. English (2), V. St. Louis (3), I. Leehnerr (4), R. Elgood (1) and K. St. Pierre (3)

(1) Department of Earth & Environmental Sciences, University of Waterloo (Waterloo, Canada)  
(2) Department of Geography & Environmental Studies, Wilfrid Laurier University (Waterloo, Canada);  
(3) Department of Biological Sciences, University of Alberta (Edmonton, Canada);  
(4) Department of Geography, University of Toronto-Mississauga (Toronto-Mississauga, Canada)

Global warming has the potential to mobilize organic matter from frozen Arctic soils and glacial deposits. The sensitivity of the Canadian Arctic to climate change has been similarly well documented. In particular, fluxes in carbon stocks could impact global carbon cycling and, perhaps more immediately and critically, northern freshwater and marine ecosystems. For instance, dissolved organic matter (DOM) has the capacity to bind heavy metals that accumulate in the Arctic such as Fe, Cd, Cu, Pb, Zn, and Hg, facilitating their transport and release in natural waters. DOM is a major light absorbing constituent of natural waters, rendering it a key determinant in the extent of the photic zone. DOM from different sources can have distinct composition and chemical properties, influencing its ability to bind to heavy metals, which in turn affects heavy metal speciation and toxicity to aquatic microbiota. The susceptibility of DOM to major loss mechanisms such as photochemical and microbial degradation is also based on its composition. It is therefore important to assess chemical characteristics of ‘old’ DOM released from Arctic soils and glaciers, sources and sinks of this organic material, and how its prevalence affects heavy metal binding. The Lake Hazen watershed of Quttinirpaaq national park, Nunavut
was selected as a glacially-impacted freshwater system well-suited to address these queries. Lake Hazen has undergone rapid change in the past 5 to 8 years. To better understand vectors of this change temporal and spatial variability in stable carbon (d13C) measurements of dissolved organic carbon (DOC), dissolved inorganic carbon (DIC), and particulate organic carbon (POC) were assessed throughout the catchment. Absorbance and fluorescence (excitation emission matrix spectra; EEMS) spectroscopies were coupled with d13C measurements and used to better describe the quantity and quality of DOC present as well as to delineate its sources and sinks. These techniques helped resolve particulate desorption/mixing mechanisms that controlled the transformation of DOC along glacial rivers. In particular, the Lake Hazen sediment archive of d13C compared to the d13C of suspended POC illustrated the importance of DOM and POM delivered from glacial rivers to Lake Hazen. This study served as a surrogate for larger scale change associated with permafrost and glacial melt water impacted freshwater systems. Findings were used to glean influences to carbon distribution, dynamics, and overall cycling in the high Arctic.

**ENHANCED BOTTOM ICE ALGAL BIOMASS ALONG A TIDAL STRAIT IN THE LOWER NW PASSAGE OF THE CANADIAN ARCTIC**

Dalman, Laura (1), B. Else (2), B. Williams (3), E. Carmack (3), K. Campbell (1), D. Barber (1) and C.J. Mundy (1)

(1) University of Manitoba (Winnipeg, Canada);
(2) University of Calgary (Calgary, Canada);
(3) Institute of Ocean Sciences, Fisheries and Oceans (Sidney, Canada)

Access to water column nutrients has been shown to control the accumulation bottom ice algal biomass during the later period of the spring bloom. A small collection of Canadian Arctic studies in the 1990s further demonstrated that increases in ice algal biomass were associated with spring tides under landfast sea ice. It has been hypothesized that this increase was associated with boundary layer dynamics, where stronger tidal currents during spring tide caused greater mixing of the upper water column that leads to enhanced fluxes of water column nutrients into the ice. To further assess the influence of increased surface currents on biomass accumulation in the bottom ice, we sampled surface currents, water column and sea ice nutrient concentrations, and ice algal biomass along a transect that traversed a tidal strait in a nutrient-limited system. The study took place on landfast first-year sea ice in Dease Strait near Cambridge Bay, Nunavut from 27 April to 20 May 2016. Sea ice and water column samples were collected under thin snow cover (<5 cm)—to minimise variability in light transmission between sites—along an ice thickness gradient from thick ice (175 cm) observed in an embayment of Dease Strait through to thinner ice (165 cm) observed within a constricted tidal strait between the Finlayson Islands at the centre of Dease Strait. Preliminary results show that the gradient in ice thickness was inversely related to ice algal biomass, which increased towards the tidal strait. Surface currents were greatest between the islands, which closely matched the increase in ice algal biomass. These observations support previous findings that ice algal biomass depends on a flux of nutrients which is associated with the strength of currents. However, we also observed a secondary peak in ice algal biomass away from the ice bottom (approximately 8 cm from the ocean-ice interface), potentially suggesting that the increasing surface currents cause a bottom ice brine convection mechanism within the ice. The poster discusses these preliminary results and presents three possible mechanisms that influenced ocean-ice nutrient fluxes to our bottom ice algal community: 1) water column mixing, 2) ocean-ice molecular diffusion, and 3) within ice convection.

**IMPORTANCE OF NEW AND REGENERATED PRODUCTION IN YOUNG SOUND – A HIGH ARCTIC FJORD IN NORTH EAST GREENLAND**

Dalsgaard, Tage and M. K. Sejr

Arctic Research Centre, Aarhus University (Aarhus, Denmark)

This study was carried out in Young Sound, a high Arctic (74°N) fjord in north east Greenland in early August (campaign 1) and in late September/early October (campaign 2) 2014. The fjord is approximately 80 km long, 2 – 7 km wide with a mean depth of 100 m varying from a sill at the entrance with a depth of 45 m and the deepest basin with a depth of 360 m. Young Sound receives freshwater from rivers during the melt season leading to a very fresh surface layer and a strong stratification. We estimated primary production (PP) from differences in O2 concentration in bottles
incubated in situ in light and dark and new (PPn) and regenerated (PPr) production from in situ parallel incubations spiked with 15NO3- and H13CO3- or 15NH4+ and H13CO3-. Incubations were performed with water from the deep chlorophyll maximum and from 1 m placed at in situ depth and position for 24 – 48 hours. Total 13C-primary production varied between 0.15 and 0.22 with a mean of 0.20 µM C d-1 for campaign 1. During campaign 2 PP was lower and more variable and ranged from 0.02 to 0.36 with a mean of 0.13 µM C d-1 corresponding to a decrease of 37%. The average relative contribution of PPn and PPr also changed from the first to the second campaign with PPr decreasing from 22% to 6% of the total production. Relative PPr (PPr/total PP) was nicely linearly correlated with the NH4+ concentration (R2 = 0.85), whereas relative PPn (PPn/total PP) was linearly correlated with the concentration of NO3- + NO2-. Young Sound appears to sustain a very low primary production and appears to be nitrogen limited during summer and autumn months. This limitation is mainly created by a strong stratification caused by freshwater runoff from land and the decrease in stratification strength from the first to the second campaign was apparently not sufficient to relieve this limitation. It is also very clear that in the summer and autumn months this PP is heavily dominated by regenerated production which is probably a result of very little mixing of nutrient rich deep waters into the photic zone. It is likely that PP will continue longer into the autumn in the future with later and later formation of ice cover in the Arctic. However, assuming that the increase in the dominance of PPr in the autumn months is representative of autumn conditions, it is likely that an extended period of PP in late autumn will mainly lead to PPr. Therefore, the stimulation of the biological pump due to prolonged production in the autumn will be small.

MONITORING ICEBERG MOVEMENT IN BAFFIN BAY

Dalton, Abigail and L. Copland
University of Ottawa (Ottawa, Canada)

Tidewater glaciers drain a significant proportion of the Greenland Ice Sheet, and the ice caps of the Queen Elizabeth Islands, Nunavut, and provide the primary source of icebergs and ice islands (large tabular icebergs) in Canadian waters. The Canadian Ice Service produces charts which identify the presence of icebergs, but currently has little knowledge about the sources and sinks of icebergs in Canadian waters. To understand where these icebergs and ice islands originate from, where they drift to, how they deteriorate and the time scale of these processes, a series of satellite tracking beacons were deployed in summer 2016. These were helicopter-deployed from aboard the CCGS Amundsen, and provide near real-time (hourly) information concerning the movement of 13 icebergs and ice islands within Baffin Bay. Initial results show that, to date, the most active iceberg has drifted approximately 315 km at a rate of about 6.3 km/day. Some of the icebergs have also exhibited a spiraling pattern as they drift west across Baffin Bay and are influenced by ocean currents and tides. Results from this work provide information about patterns of iceberg movement, including common areas where icebergs become grounded in relation to bathymetry.

DISTRIBUTION AND HABITAT ASSOCIATIONS OF TWO SUBPOLAR CETACEANS, SPERM WHALES (PHYSETER MACROCEPHALUS) AND NORTHERN BOTTLENOSE WHALES (HYPERDOON AMPULLATUS), IN BAFFIN BAY-DAVIS STRAIT

Davidson, Ellyn (1), S. Ferguson (2), J. Higdon (3) and M. Treble (2)

(1) University of Akureyri (Edmonton, Canada);
(2) Fisheries and Oceans Canada (Winnipeg, Canada);
(3) Higdon Wildlife Consulting (Winnipeg, Canada)

As a result of climate warming in the Arctic, it is the expectation that Arctic species will be pushed towards the poles as the distribution of subpolar species extends northward. Subpolar cetaceans have seldom been studied to understand their spatial patterns, including seasonal shifts in distributions, into the Arctic marine environment. Two such subpolar cetacean species are the sperm whale, Physeter macrocephalus, and northern bottlenose whale, Hyperdoon ampullatus, both of which occur in the Baffin Bay-Davis Strait (BB-DS) region. In order to gain an understanding of their habitat preferences, data indicating cetacean presence for the east and west sides of BB-DS were mapped and then associated with the basin’s physical parameters (sea surface temperature, sea surface salinity, depth, and slope). These data for the east and west BB-DS were collected differently and therefore analyzed separately.
Of the eastern sightings, greater sperm whale density occurred near Nuuk. Of the western sightings, sperm whale presence occurred in the central area. Greater northern bottlenose whale density was recorded in central west Baffin Bay. The best generalized additive model for sperm whales in eastern BB-DS indicated that all variables, with the exception of slope, together explained 24% of the variance. For western BB-DS, sperm whales distribution was associated only with salinity, explaining 14% of the variance. The best-fit model for northern bottlenose whales indicated a relationship with salinity and depth, explaining 16% of the variance. With these sightings and associations, we can begin to understand what habitat types sperm and northern bottlenose whales prefer within Arctic basins. This knowledge is important for conservation management, and for predicting future Arctic distributions for both of these species, especially when considering climate change, industrial development, and ecosystem shifts.

USING FATTY ACID BIOMARKERS

Debets, Cassandra (1), B. Young (2) and S. Ferguson (2)

(1) University of Manitoba (Winnipeg, Canada);
(2) Fisheries and Oceans Canada (Winnipeg, Canada)

Ringed seals (Pusa hispida) are an abundant pinniped in the Arctic and are dependent on the sea ice for reproduction, molting and ultimately their survival. Current environmental changes have resulted in increased temperatures, reduced sea ice extent, and longer open water periods in Hudson Bay. Considered to be 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 dietary methods such as stomach content and stable isotope analyses have identified feeding patterns and helped inform which potential prey species may be the most important. There is a great diversity of fatty acids in the marine environment, which makes them useful in determining the feeding patterns of ringed seals by comparing the fatty acid composition found in the blubber layer with those found in the potential prey. Blubber samples (n=247) collected by local Inuit hunters during their annual subsistence hunt have been analyzed from three Nunavut communities (Arviat, Chesterfield Inlet, and Sanikiluaq). Using fatty acids and other morphological information collected, comparisons between diet and body condition can be made. Future work will focus on quantifying the proportion of prey found in the diet of individual ringed seals and can improve our understanding of how environmental changes are
INVESTIGATING DIETARY PATTERNS OF HUDSON BAY RINGED SEALS (PUSA HISPIDA)

AN INDEX TO INTEGRATE LOCAL AND REGIONAL VULNERABILITY TO CLIMATIC CHANGE IN THE CANADIAN ARCTIC

Debortoli, Nathan, J. Sayles, D. Clark and J. Ford
McGill University (Montreal, Canada)

North to south, east to west, governments around the world are trying to assess their vulnerability to climatic change and extreme weather events. Assessments often take one of two forms. Regional and national level assessments provide coarse-grained quantitative information about large regions, which is of limited use to decision makers in local communities. Local community assessments often rely on nuanced qualitative and mixed-methods data, which can be difficult to scale-up. There is currently a real lack of locally relevant regional vulnerability assessments. This is concerning because while adaptation must be locally relevant, it must also take regional contexts into account, including interdependencies among and between local and regional groups. To address this, we are developing an integrative, multilevel vulnerability assessment in the Canadian Arctic that can support integrated local-to-regional planning. While sparsely populated, the Canadian Arctic is home to both Inuit and other Canadians, many of whom rely directly or indirectly on land-based activities for their livelihood. Environmental changes, however, such as temperatures changes, permafrost thaw, storm surges, and loss of sea ice are greatly impacting resource dependent livelihoods. While previous research provides a comprehensive picture of climate related vulnerabilities among these communities, few studies have fostered an integrated framework to map and assess the totality of vulnerability to natural hazards and climatic change scenarios. We present a first step in developing a Canadian Arctic Vulnerability Index to assess resource dependent communities’ vulnerability to climatic change including a baseline scenario and future projections. We modify an existing framework and methodology used in the Brazilian National Vulnerability Assessment. We then assess 1) what indicators are available at local, regional and federal level in the Arctic, 2) their feasibility for inclusion in the model, and 3) their importance for local communities. Our work will downscale weather data from Global Climate Models to regional and local levels to understand local changes on wind speed and direction, temperature, precipitation, permafrost thaw, and sea ice extent. Other indicators include, but are not limited to, income, access to technologies such as snow machines and GPS, housing quality and quantity, education, mental health, wider economic activities and opportunities, and built infrastructure. We also consider intercommunity collaborations, search and rescue activities, and collaborations among and between local, provincial, and federal agencies as well as between public and private sectors. Our aim is to assess present and future vulnerabilities to climate changes in an integrative way that can assist local, province, and federal governments to target adaptation measures in hotspots areas.

SLOPE MORPHOMETRY AS AN INDICATOR OF HAZARDS AND RISKS IN SOUTHWESTERN NUNAVIK – CASE STUDIES FROM UMIUJAQ AND LAC À L’EAU-CLAIRE, NUNAVIK

Decaulne, Armelle (1), N. Bhiry (2), J. Lebrun (2) and S. Veilleux (2)
(1) CNRS UMR6554 (Nantes, France); (2) Geography Department, Université Laval (Québec, Canada)

Recently we have investigated gravity movements on slopes in the Tasiapik valley (SE Umiujaq) and in two islands of the inner ring of Lac à l’Eau Claire (Wiyâshâkimî). These study sites are located at the border and within the Tursujuq National Park, respectively, in Nunavik. We focused mostly on morphometric characteristics of slopes by measuring the succession of slope angles from the apex to the distal zones of cones and talus. We present a first step in developing a Canadian Arctic Vulnerability Index to assess resource dependent communities’ vulnerability to climatic change including a baseline scenario and future projections. We modify an existing framework and methodology used in the Brazilian National Vulnerability Assessment. We then assess 1) what indicators are available at local, regional and federal level in the Arctic, 2) their feasibility for inclusion in the model, and 3) their importance for local communities. Our work will downscale weather data from Global Climate Models to regional and local levels to understand local changes on wind speed and direction, temperature, precipitation, permafrost thaw, and sea ice extent. Other indicators include, but are not limited to, income, access to technologies such as snow machines and GPS, housing quality and quantity, education, mental health, wider economic activities and opportunities, and built infrastructure. We also consider intercommunity collaborations, search and rescue activities, and collaborations among and between local, provincial, and federal agencies as well as between public and private sectors. Our aim is to assess present and future vulnerabilities to climate changes in an integrative way that can assist local, province, and federal governments to target adaptation measures in hotspots areas.
rockwall, favoring massive transfer of rocky materials in the future. In Lac à l’Eau-Claire, slopes are shorter and in several instances constitute the full height of the cones and talus as rockwalls have been almost totally dismantled. However, slopes there are still active and gravity processes still threatening. In this area, the trap formed by lowland peat-bogs will reveal dating regarding past slope processes activity.

**DEMERSAL FISH FAUNA IN EASTERN CANADIAN ARCTIC AND NORTHERN LABRADOR SEA BASED ON ROV AND TRAWL SURVEYS: BIODIVERSITY, DISTRIBUTION, AND RELATIONSHIPS WITH CORALS AND SPONGES**

de Moura Neves, Barbara (1), K. Hedges (2), M. Treble (2), V. Wareham (3), E. Edinger (1), P. Snelgrove (1) and K. Gilkinson (3)

(1) Memorial University of Newfoundland (St. John’s, Canada);
(2) Fisheries and Oceans Canada, Freshwater Institute, Central and Arctic Region (Winnipeg, Canada);
(3) Fisheries and Oceans Canada, Northwest Atlantic Fisheries Centre, Newfoundland region (St. John’s, Canada)

Knowledge of the ecology of deep-water demersal fishes in the Eastern Canadian Arctic is still limited. As part of the ArcticNet project HiBio (Hidden Biodiversity and vulnerability of hard-bottom and surrounding environments in the Canadian Arctic), the main objective of this study is to investigate the biodiversity and distribution of demersal ichthyofauna in Baffin Bay and Davis Strait, and to assess corals and sponges as potential fish habitat. Our dataset consists of (1) fish and invertebrates presence, abundance, and biomass data from Fisheries and Oceans Canada (DFO) fish stock assessment trawl surveys, and (2) high definition video data obtained using the Super Mohawk remotely operated vehicle (ROV) deployed from the CCGS Amundsen. The DFO surveys occurred from 2004-2015 at Northern Labrador, Hudson Strait, Davis Strait, and Baffin Bay. These surveys utilized either a Campelen, Alfredo, or Cosmos trawl, deployed at average depths between 72-1490 m. We conducted ROV-bottom video transects at seven sites in Baffin Bay (2014-2016, July and October), and at two sites at Northern Labrador (2016). ROV transect lengths ranged from 0.4 to 2.1 km, at depths of 59-941 m. At least 47 fish families and 16 coral families were identified from the DFO surveys. Maximum fish abundance in a single trawl set was obtained for Arctic cod (Boreogadus saida) and deep-water redfish (Sebastes mentella). The gorgonian Primnoa resedaeformis yielded the highest catch of coral biomass per single set (850 kg). Analysis of our ROV video surveys so far indicates lower diversity and abundance of fish and coral species in the region of Baffin Bay in relation to the ROV surveys. Fish species identified from the videos represent at least nine families, including Greenland halibut, grenadiers (Family Macrouridae), eelpouts (Lycodes sp.), skates (family Rajidae), redfish (Sebastes sp.), rocklings (Gaidropsarus sp.), wolfish (Anarhichas minor and A. denticulatus), Greenland cod (Gadus ogac), sea snails (e.g. Careproctus reinhardtii), and sculpins. Corals from five families have been identified from ROV videos, including nephtheid soft corals, bamboo corals (Keratoisis sp.), and sea pens (Umbellopsis enrinus, Anthoptilum grandiflorum, and Pennatula sp.). Analyses to date cannot confirm whether seasonality or other factors contributed to the low fish biodiversity identified in the ROV surveys in Baffin Bay, but further analyses may help to clarify this. Ongoing analyses aim to investigate potential relationships between fish distribution/biodiversity and corals/sponges in the study area. With Arctic bottom fisheries expected to increase in intensity in coming years, improving our knowledge on Arctic benthic biodiversity can help to increase the probability of sustainable fisheries in these environments.

**SPRING-SUMMER COMMUNITY SUCCESSION OF PHYTOPLANKTON AND ZOOPLANKTON IN DEASE STRAIT, CANADIAN ARCTIC ARCHIPELAGO**

Delaforge, Aurélie (1), W. Walkusz (2), K. Campbell (3), M. Gosselin (4), S. Rysgaard (5) and C.J. Mundy (3)

(1) The Centre for Earth Observation Science (CEOS) - University of Manitoba (Winnipeg, Canada);
(2) Department of Fisheries and Oceans Canada (Winnipeg, Canada);
(3) Centre for Earth Observation Science, Faculty of Environment, Earth and Resources, University of Manitoba (Winnipeg, Canada);
(4) Institut des sciences de la mer de Rimouski, Universite du Quebec a Rimouski (Rimouski, Canada);
Polar environments are profoundly changing due the decrease in sea ice extent and thickness. Evidence has suggested that these environmental changes may have already altered the taxonomic composition of marine phytoplankton and zooplankton in the Canadian High Arctic. Both phytoplankton and zooplankton assemblages have a major influence on the function of the pelagic food web and so affect the rate of carbon export from the open ocean surface waters to the deep layers. However, only a few studies have analysed the oceanography of Dease Strait, Canadian Arctic Archipelago. In this study we investigated phytoplankton and zooplankton community succession and composition in relation to key environmental factors during the spring-summer (March through July) seasonal transition in Dease Strait. Winter nutrient inventories were low in the region, which led to relatively low net phytoplankton biomass accumulation in comparison to other regions of the Canadian Arctic due to a low spring nutrient inventory in the region. Preliminary results of the phytoplankton taxonomic composition analyses revealed that picoeukaryotes dominated the <20 μm fraction of the phytoplankton community. Cells >20 μm were dominated by dinoflagellates in late winter, and as the seasons progressed, diatoms became more abundant. Preliminary results of the zooplankton taxonomic composition analyses revealed that during winter and early spring the diversity of organisms was low. However, as the seasons evolved, zooplankton biomass increased and the differences between the depths sampled also increased. Additional analyses are underway and will be presented.

SPRING-SUMMER PROGRESSION OF PHYTOPLANKTON AND HETEROTROPHIC BACTERIA IN DEASE STRAIT, CANADIAN ARCTIC ARCHIPELAGO

Delaforge, Aurélie (1), C. Belzile (2), K. Campbell (3), M. Gosselin (2) and S. Rysgaard (4)

(1) The Centre for Earth Observation Science (CEOS) - University of Manitoba (Winnipeg, Canada); (2) Institut des sciences de la mer de Rimouski, Universite du Quebec a Rimouski (Rimouski, Canada); (3) Centre for Earth Observation Science, Faculty of Environment, Earth and Resources, University of Manitoba (Winnipeg, Canada); (4) Centre for Earth Observation Science, Faculty of Environment, Earth and Resources, University of Manitoba, Canada; Arctic Research Centre, Department of Bioscience University of Aarhus, Denmark; Greenland Institute of Natural Resources, Nuuk, Greenland (Winnipeg, Canada).

TRENDS AND PATTERNS OF INDICES OF ICE SEVERITY AND SHIPPING ACTIVITY IN THE CANADIAN ARCTIC SINCE 1990

Delaney, Frances (1), L. Copland (2), J. Dawson (2), A. Tivy (1) and L. Pizzolato (2)

(1) Canadian Ice Service (Ottawa, Canada); (2) University of Ottawa (Ottawa, Canada)
Over recent decades, declining sea ice extent in the Canadian Arctic has occurred during a period of increased Arctic shipping, particularly since 2007. To investigate whether a relationship exists between indices of sea ice severity as defined by regulatory codes and this shipping activity, sea ice charts from the Canadian Ice Service (CIS) were converted into sea ice navigability charts. These conversions were completed using the Arctic Ice Regime Shipping System (AIRSS) and Polar Code classifications, which define which ship types are permitted to travel through ice infested waters. A comprehensive shipping activity database was then overlaid with the charts; this was produced by using a Least Cost Path (LCP) approach to connect point-based data from Vessel Traffic Reporting Arctic Canada Traffic Zone (NORDREG zone) data from 1990 to 2012. A comparison of these datasets provides information concerning changes in the Arctic shipping season over time, and whether any significant relationships exist between trends in shipping activity and indices of sea ice severity. Initial results suggest that the Arctic shipping season is increasing in both length and extent over time, although relationships between changes in spatial shipping activity and sea ice are complex. For some ship categories it appears that sea ice severity and extent are important, but for other locations and ship types non-environmental factors, such as tourism, resource extraction, and community re-supply needs appear to be dominant. These results can be used to better inform route recommendations for projects such as the Canadian Coastguard’s Northern Marine Transportation Corridors project.

5 YEARS OF THE CANADIAN RANGERS OCEAN WATCH (CROW).
Dempsey, Mike, S. Zimmermann, J. Eert and B. Williams
Fisheries and Oceans Canada (Sidney, Canada)

The Canadian Rangers Ocean Watch (CROW) is a cooperative project between Fisheries and Oceans Canada (DFO) and the Department of National Defence (DND) that began in 2011 and has now run continuously for 5 years. Our objective is to establish sustainable environmental marine monitoring in the Northwest Passage that can be used for outreach and education, policy and governance, and scientific analysis. Under CROW, hard-to-get, wintertime oceanographic data is collected in the southern Northwest Passage by Canadian Rangers during their routine snowmobile patrols. DFO supplies scientific equipment and training to the Rangers and subsequently analyses the data and reports-back to the Rangers’ communities. The DND Rangers supply their unmatched expertise in travelling on sea ice and their Traditional Knowledge of the region. By combining the resources of DND, DFO, and other partners, CROW is a cost-effective and sustainable way to monitor change in the marine system across the span of the Canadian Arctic Archipelago. We aim to build time-series of essential climate-related parameters and link participating communities with one another through these marine observations. Data collected include CTD profiles, ice thickness, snow depth, zooplankton and seasonal ice temperature buoys. We will talk about the results and the challenges and opportunities involved in this collaborative study.

IDENTIFYING THE ROLE AND VALUE OF PARTICIPATORY MAPPING IN AN INUIT KNOWLEDGE RESEARCH CONTEXT: A REVIEW OF MAPPING PRACTICES AND APPLICATIONS ACROSS THE CANADIAN ARCTIC OVER THE PAST FORTY YEARS

de Paiva, Alex (1), G. Ljubicic (2), S. Mitchell (2) and J. Heath (3)
(1) Carleton University (Ottawa, Canada); (2) Carleton University (Ottawa, Canada); (3) Arctic Eider Society (Ottawa, Canada)

Participatory mapping has had a long history in the Arctic, particularly since the Inuit Land Use and Occupancy Project (ILUOP) undertaken from 1973 - 75. Indeed, participatory mapping projects have been the foundation of comprehensive land claims, used to develop and improve natural resource management strategies, and for Inuit knowledge documentation. Despite its widespread use, there has been little critical assessment of the role and value of participatory mapping in an Inuit cultural context. In particular, we seek to investigate the role and value of participatory mapping for learning, documenting, and representing Inuit cultural and geographical knowledge. Undertaking a comprehensive literature review of the ways participatory mapping has been used across the Canadian Arctic has provided insight into trends in mapping methodologies, goals, and applications over the past forty years – from ILUOP till present. Preliminary findings indicate that participatory mapping has largely...
been used to provide baseline land use and occupancy information in support of land claims, natural resource management, land use planning, and environmental impact assessments. While this recognizes the value of Inuit knowledge, recent work indicates community desire for greater involvement and control over projects and the information and maps generated. This has led towards a greater push for community-driven projects that look at not only environmental knowledge, but also representation of important cultural knowledge and context. These findings help to provide insight into how participatory mapping approaches have evolved over time, in an effort to compile lessons learned and best practices in ensuring mapping is undertaken in culturally appropriate and meaningful ways.

GASTROINTESTINAL PARASITISM OF DOGS IN KUUJUAQ, NUNAVIK: DOCUMENTING ZOONOTIC DISEASE RISK FOR DOGS AND PEOPLE

Déry, Hélène (1), C. Aenishaenslin (2), E. Avard (3), D. Bélanger (4), L. Callaghan (5), B. Ford (3), M.-C. Frenette (4), E. Jenkins (6), A. Ravel (4), A. Simon (4) and P. A. Leighton (4)

(1) Université de Montréal (Longueuil, Canada);
(2) Department of Pathology and Microbiology, Faculty of Veterinary Medicine, Université de Montréal, Saint-Hyacinthe J2S 2M2 (Saint-Hyacinthe, Canada);
(3) Nunavik Research Centre, Makivik Corporation, Kuujjuaq, J0M 1C0 (Kuujjuaq, Canada);
(4) Department of Pathology and Microbiology, Faculty of Veterinary Medicine, Université de Montréal, Saint-Hyacinthe J2S 2M2 (Saint-Hyacinthe, Canada);
(5) Northern Village of Kuujjuaq, Kuujjuaq, J0M 1C0 (Kuujjuaq, Canada);
(6) Department of Veterinary Microbiology, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon S7H 5B4 (Saskatoon, Canada)

Gastrointestinal parasites of dogs are an ongoing health risk in Arctic communities both for the domestic dog population and for people since many of these parasites are zoonotic and can cause human disease. In Kuujjuaq, the largest community in Nunavik, dogs are ubiquitous and form an integral part of the community; however, the degree to which Kuujjuaq dogs are affected by parasites, and their potential for transmitting zoonotic parasites to people, remains poorly documented. The objectives of our study were to: 1) characterize the Kuujjuaq dog population in terms of demographics and spatial/temporal patterns of activity 2) measure the prevalence of gastrointestinal parasites in Kuujjuaq dogs 3) determine what factors influence the prevalence of gastrointestinal parasitism in Kuujjuaq dogs. In order to document the spatial and temporal distribution of attached and free-roaming dogs, we carried out 12 visual censuses from May-August 2016. During each census, all roads in the village were surveyed systematically by car, all attached and free-roaming dogs were counted, and their locations noted. Overall, a 172 individual attached dogs were counted, with a mean of 7 free-roaming dogs observed during each census. In addition, the activity of free-roaming dogs was documented using a network of 37 trail cameras as part of parallel study on wildlife (see Frenette et al. poster). For objectives 2 3, we focused on the following parasites that include key zoonotic parasites of dogs in the Arctic: Echinococcus granulosus, Toxocara canis, Toxascaris leonina, Diphyllobothrium spp., Giardia duodenalis and Cryptosporidium spp. In summer 2016 we initiated a prospective cohort study of Kuujjuaq dogs in order to determine which parasites are the most prevalent and what factors influence parasitism. From May-August, 31 dogs were examined, feces were collected from each dog and owners were asked questions about habits (diet composition, housing, medication, exercise, etc.). Feces were also collected opportunistically throughout the community to obtain parasitism data for free-roaming dogs. Ongoing laboratory analyses will quantify parasite prevalence using fecal flotation, except for Giardia and Cryptosporidium that will be quantified with a commercial immunofluorescent antibody test. The cohort study will continue in summer 2017 with a reexamination of the same dogs and recruitment of additional dogs, if possible. Documenting the prevalence of parasites in the Kuujjuaq dog population and the determinants of parasitism in individual dogs is essential in determining which treatment approaches would be most appropriate for improving human and animal health. Linking this information to the distribution and abundance of dogs in the environment will help identify where and when the risk of zoonotic parasite transmission to people is most likely to occur.
EXAMINING THE WEATHERING PROCESSES AND INTERACTIONS OF CORN OIL IN SEA ICE
Desmond, Durell, T. Neusitzer, M. Lemes, J. Xidos, N. Firoozy, G. Stern, D. Barber and P. Mojabi
University of Manitoba (Winnipeg, Canada)

Remote sensing systems has played an increasingly important role in locating and tracking oil spilled in the open ocean for remediation purposes. However, methods for specifically detecting oil in ice and snow are in the early stages of development and require further research as the presence of sea ice impedes detection. Due to the inhomogeneous nature of sea ice, often air, sediment, salt, and brine are incorporated into the material greatly complicating the interactions between the oil and sea ice as well as the interactions of the remote sensing signal. However, it has been hypothesized that active microwave remote sensing has the potential for detecting oil in sea ice through the measurement of the normalized radar cross-section (NRCS) of the ice. The NRCS of sea ice depends on the roughness of the ice surface as well as the complex permittivity profile of the ice, which in turn depends on the ice temperature and bulk salinity profiles. In the event of an oil spill in the Arctic, it is speculated that the temperature and salinity properties will be influenced through the inclusion of oil in the sea ice and the subsequent evolution of the ice and oil through weathering processes and interactions, thereby affecting the NRCS of the sea ice. An artificial oil-in-ice mesocosm experiment with the use of corn oil was conducted in a coldroom at the Centre for Earth Observation Science (CEOS) during December 2015 – March 2016 as a precursor to using crude oil in currently running artificial mesocosm experiments (2016-2017). Although the composition of vegetable oil differs from that of crude oil, corn oil was used as a safer alternative, for a test run, due to its similar dielectrics, density, and overall affinity for water with respect to the light crude oil, Petroleum Crude Oil (Sour) from Tundra Oil Gas Partnership, which is being used for the crude oil experiment analogue. This research explores the weathering processes of corn oil (e.g. dissolution, evaporation, percolation and migration through brine channels) and its impact on the complex permittivity of the sea ice and resulting NRCS due to its presence. The use of the analytical instrument two-dimensional Gas Chromatography Time of Flight Mass Spectrometry will provide a spatial and temporal mapping of the corn oil composition and respective concentrations. The respectively found total concentrations can then be utilized in the modeling of complex permittivity, which can then be subsequently used for the modelling of the simulated NRCS. Additional theoretical experiments will include the use of Guassview 9, Episuite, and Molecular descriptor programs in order to model salt water solubility as well as evaporation of the chemical compounds found in corn oil at cold temperatures as a support and verification of certain weathering tendencies.

PREDICTING SEA-ICE CONDITIONS WITH A LOCAL THERMODYNAMIC MODEL FORCED BY REAL-TIME DATA FROM THE CAMBRIDGE BAY OCEAN OBSERVATORY
Dewey, Richard (1) and A. Loewen (2)
(1) Ocean Networks Canada (Victoria, Canada); (2) University of Victoria (Victoria, Canada)

Ocean Networks Canada maintains a cabled ocean observatory in Cambridge Bay, Nunavut. The shallow water system includes a shore-based weather station and in-water sensors to monitor the coastal marine conditions in 6-8m of water. The observatory is serviced each summer, resulting in a near continuous record of the marine conditions since September 2012. The data include standard meteorological measurements (air temperature, wind speed and direction, and solar radiation), and near bottom measurements of seawater temperature, salinity, dissolved Oxygen, and sea-ice draft thickness. A sea-ice thermodynamic model forced by and validated against observatory data has been developed to improve forecast skill of sea-ice formation, growth, and melt. Polar Knowledge funded enhancements to the model and observatory data as part of the Safe Passage project include improved formulations of heat conduction and forecast dates of both freeze-up and break-up. These critical periods often limit safe transportation on the ice and in the marine environment and are likely to evolve dramatically under the influence of climate change.
WARMING CONDITIONS AND THE MATCH-MISMATCH BETWEEN PHYTOPLANKTON AND ZOOPLANKTON IN THE BEAUFORT SEA

Dezutter, Thibaud, C. Lalande, C. Dufresne and L. Fortier

Université Laval (Québec, Canada)

As part of ArcticNet’s Long-Term Oceanic Observatories (LTOO) project, moored sediment traps have been deployed at the Beaufort Sea shelf break since 2003 to monitor the downward flux of biogenic matter. Here, we use phytoplankton cells and zooplankton (swimmers) collected in sediment trap samples from 2009 to 2015 to investigate the match or mismatch between primary production and the vernal migration of zooplankton from winter depths to the surface layer. Interannual differences in timing between the phytoplankton bloom and the migration of copepods were investigated in function of water temperature from current meters deployed on the same moorings, as well as satellite-derived sea ice concentration and snow depth. The occurrence of the key copepod Calanus glacialis was associated with peaks in abundance of the true ice-algae Nitzschia frigida, while Calanus hyperboreus and their nauplii were associated with peaks in diatom abundances. In most years sampled, C. glacialis arrived ~15 days before the export of N. frigida, while C. hyperboreus nauplii coincided with peaks in diatom fluxes. However, an unusually warm upper water column in fall 2012 and winter/spring 2013 accompanied with late snow melt and sea ice break-up delayed the export of N. frigida and resulted in C. glacialis arriving ~90 days earlier than the export of ice algae. A ~90 days delay was also observed between C. hyperboreus nauplii and the peak in diatom fluxes. As ice algae and phytoplankton are essential food source for the reproduction and development of Calanus copepods, those mismatch events likely have negative impact on their recruitment and on the transfer of energy within the Arctic food-web.

EVALUATION OF CORDEX-ARCTIC DAILY PRECIPITATION AND TEMPERATURE-BASED CLIMATE INDICES OVER CANADIAN ARCTIC LAND AREAS

Diaconescu, Emilia Paula (1), A. Mailhot (1), R. Brown (2) and D. Chaumont (3)

(1) Institut national de la recherche scientifique, Eau Terre Environnement (Québec, Canada);
(2) Environment and Climate Change Canada (Montréal, Canada);
(3) Ouranos (Montréal, Canada)

This study focuses on the evaluation of daily precipitation and temperature climate indices and extremes simulated by an ensemble of thirteen Regional Climate Model (RCM) simulations from the ARCTIC-CORDEX experiment with surface observations in the Canadian Arctic. Five global reanalyses products (ERA-Interim, JRA55, MERRA, CFSR and GMFD) are also included in the evaluation to assess their potential for RCM evaluation in data sparse regions. The study evaluated the means and annual anomaly distributions of indices over the 1980-2004 period. The results showed that RCM and reanalysis performance varied with the climate variables being evaluated. Most RCMs and reanalyses were able to simulate well climate indicators related to mean air temperature and hot extremes. However, performance was general poor for indicators related to cold extremes. Likewise, only a few RCM simulations and reanalyses were able to provide realistic simulations of precipitation extreme indicators. The multi-reanalysis ensemble did not systematically provide superior results to individual datasets. However, this was evident for climate indicators related to mean air temperature and hot extremes.

Biodiversity of Eastern Canadian Arctic and Subarctic Sponges: New Results from ROV-Based Targeted Sampling of Hard-Bottom Environments.

Dinn, Curtis (1), E. Edinger (2), B. de Moura Neves (2), V. E. Wareham (3) and S. P. Leys (1)

(1) University of Alberta (EDMONTON, Canada);
(2) Memorial University of Newfoundland and Labrador (St. John’s, Canada);
(3) Department of Fisheries and Oceans (St. John’s, Canada)

The diversity of deep-water sponges (Porifera) in the Canadian Arctic has historically been overlooked, in part because of difficulties associated with sampling deep hard bottom environments where these organisms are commonly found. As part of the ArcticNET HiBio (Hidden biodiversity and vulnerability of hard-bottom
and surrounding environments in the Canadian Arctic) project, regions of reported coral and sponge bycatch in Baffin Bay and the North Labrador Sea were targeted for extensive sampling using remotely operated vehicle (ROV), box core, and Agassiz trawl operations aboard the CCGS Amundsen in July 2016 and October 2015. During these expeditions, 114 sponge specimens were collected at depths ranging between 72-1148m and encompassing latitudes 60°18N to 68°15N. Preliminary taxonomic analysis of specimens indicates the presence of at least 20 species from 13 different sponge families, and many specimens may be species that have yet to be described. ROV video transects revealed diverse sponge and coral assemblages among varied benthic habitats. Bottom types where sponges were found included rocky outcrops, sandy and muddy substrates, as well as areas with evidence of seafloor trawling. Sponges in the genera Geodia, Asconema, Axinella, Mycale, and Polymastia were encountered most frequently. Thin encrusting sponges were common on hard substrates. Most interestingly, sponges were also found growing among coral rich habitats and on dead coral skeletons among dense Keratoisis bamboo coral thickets in SE Baffin Bay. Current federal government survey methods of deep sea fauna rely primarily on bottom trawls which are often damage specimens during collection. Sampling by targeted box core and ROV allows the collection of largely intact specimens in comparison to conventional scientific trawling, facilitating species identification. Sponges will be identified through classification of spicule (skeletal element) morphology and DNA-barcoding with various genetic markers (COI mtDNA, 18S or 28S rDNA). To date, unique morphologies and compliments of spicules have been found in two subarctic specimens from inner Frobisher Bay (Family Acaninidae and Family Tetillidae) suggesting potential new species. ROV video data will allow the quantification of faunal abundance along transects and facilitate species identification for specimens collected in ROV surveyed sites. These data will provide insight into sponge species distributions in the eastern Canadian Arctic and will be used to identify areas of high diversity and ecological importance.

**HYPERSPECTRAL REMOTE SENSING OF PHYTOPLANKTON COMMUNITY COMPOSITION IN THE BAFFIN BAY – LABRADOR SEA CONTINUUM: PRELIMINARY RESULTS**

Diotte, Frédéric (1), S. Bélanger (1), J. Charette (2), M. Gosselin (2) and E. Devred (3)

(1) UQAR (Rimouski, Canada);
(2) UQAR-ISMER (Rimouski, Canada);
(3) Bedford Institute of Oceanography (Dartmouth, Canada)

Phytoplankton community composition in the Arctic is expected to change along with the changing environmental conditions. In the Baffin Bay – Labrador Sea continuum, phytoplankton community composition differs markedly due to contrasting hydrodynamical conditions. Arctic diatoms (e.g. Thalassiosira spp., Chaetoceros spp.) dominate cold and relatively fresh waters (salinity < 33) in the Baffin Bay and the Labrador shelf waters, whereas the boreal prymnesiophyte (i.e. Phaeocystis pouchetii) dominates the intense blooms found in the northeastern Labrador Sea. Spatial and temporal variability of these dominant species, as well as North Atlantic species found later in season (e.g. diatom Ephemera planamembranacea), are likely to change in a warming Arctic. Our ability to detect those changes from space is limited by the spectral resolution of currently available multispectral ocean color sensors, which measure light backscattered from the ocean at a few visible wavelengths (~5 to 10 bands) in the visible part of the spectrum. With the emergence of the hyperspectral ocean color missions in the near future (e.g. Plankton, Aerosol, Clouds and ocean Ecosystem, PACE), one may expect an improvement of approaches for the detection of phytoplankton community composition. To assess the potential of hyperspectral remote sensing data, spectral signatures were measured in situ during ArcticNet (2014) and VITALS (2015-2016) field campaigns conducted in the Baffin Bay and the Labrador Sea. Spectral variability will be interpreted as a function of the phytoplankton spectral absorption and pigment composition (HPLC). Here we report preliminary results and discuss whether or not hyperspectral data will provide enough information to distinguish Arctic from Sub-Arctic phytoplankton species.
EVALUATING NON-INVASIVE TRAIL CAMERA PHOTOGRAPH MEASUREMENT INDICES TO PREDICT SEX AND BODY CONDITION OF POLAR BEARS

Djordjevic, Katarina (1), M. Berard (2), M. Pilon (1), D. Clark (3) and R. Brook (3)

(1) University of Manitoba (Winnipeg, Canada);
(2) University of Manitoba (Winnipeg, Canada);
(3) University of Saskatchewan (Saskatoon, Canada)

Polar bears go through dramatic changes in body condition through each year and body condition declines through summer during the ice-free period for the Western Hudson Bay population. An important predicted outcome of climate change research suggests that an increasing length of the ice-free period will result in overall declines in polar bear body condition. Multiple methods exist to determine the sex and body condition of polar bears but they often require capture and handling. A one to five point scale is currently used that categorizes animals based on a qualitative assessment of overall shape and appearance of each animal and the sex of animals is based on a poorly defined set of subjective criteria. The purpose of our research was to identify a quantitative non-invasive approach to sex and body condition determination.

Polar bear photographs were obtained using Reconyx PC-900 remote trail cameras at each of three remote field camps (2011-2016 at Nester One and Broad River, and 2012-2016 at Owl River). These cameras were motion-triggered and operated year-round. Nine sets of ratios were derived from body measurements using Photoshop and these were assessed for statistical significance in sex determination and body condition. Two significant relationships were found, body length vs. torso length and rump height vs. torso width, both for body condition. However, observed patterns with potential for further investigation were found in other ratios that should be evaluated using a larger sample size of photographs. Our findings indicate that non-invasive quantitative measurements of polar bears have the potential to reveal important information about polar bears and may help overcome existing invasive methods and those based on more subjective evaluation.

WIND-FORCED WATER DYNAMICS OVER THE EASTERN BEAUFORT SEA CONTINENTAL SLOPE

Dmitrenko, Igor (1), S Kirillov (1), A. Forest (2) and D. Barber (1)

(1) Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada);
(2) Golder Associates Ltd (Quebec, Canada)

The shelfbreak currents over the Beaufort Sea continental slope are known to be one of the most energetic features of the Beaufort Sea hydrography. The oceanographic mooring CA13-03 deployed over the Canadian (eastern) Beaufort Sea continental slope in October 2003 recorded current velocity over two consecutive years until June 2005. Data analysis revealed that the downwelling favourable local wind forcing usually associated with cyclones passing north of the Beaufort Sea continental slope toward the Canadian Archipelago generates bottom intensified shelfbreak currents with along-slope eastward flow up to 120 cm/s. These cyclones also generate storm surges along the Beaufort Sea coast with sea surface height (SHH) rising up to 1.4 m following the westerly wind maxima. The westerly along-slope wind also generates a surface Ekman onshore transport. The associated SSH increase over the shelf produces a cross-slope pressure gradient that drives an along-slope eastward geostrophic current, in the same direction as the wind. This wind-driven barotropic flow is superimposed on the background baroclinic bottom-intensified shelfbreak current that consequently amplified. In contrast, the surface intensified currents with along-slope westward flow are observed in response to the upwelling favourable wind forcing usually associated with Pacific-born cyclones passing south of the Beaufort Sea coast. The upwelling favourable easterly winds generate a surface Ekman transport that moves surface waters offshore. The associated cross-slope pressure gradient drives an along-slope westward barotropic flow that is superimposed on the background eastward transport resulting in surface intensified shelfbreak flow.
TOWARDS A COMBINED SURFACE TEMPERATURE DATASET FOR THE ARCTIC FROM THE ALONG-TRACK SCANNING RADIOMETERS

Dodd, Emma, K. Veal, G. Corlett, D. Ghent and J. Remedios
University of Leicester (Leicester, United Kingdom)

Surface Temperature (ST) changes in the Polar Regions are predicted to be more rapid than either global averages or responses in lower latitudes. Observations increasingly confirm these findings, their urgency, and their significance in the Arctic. It is, therefore, particularly important to monitor Arctic climate change. Satellites are particularly relevant to observations of Polar Regions as they are well-served by low-Earth orbiting satellites. Whilst clouds often cause problems for satellite observations of the surface, in situ observations of STs are much sparser. An accurate satellite ST dataset that provides STs with uncertainties over ocean, land and ice will assist in understanding Arctic regional change. Additionally, such a ST dataset can be used for diverse applications such as: providing a benchmark for, or being assimilated into, climate and ice models; permafrost monitoring; landcover change; hydrological monitoring and water management; and numerical weather prediction and forecasting.

The ATSRs are accurate thermal infra-red satellite sensors, designed explicitly for climate standard observations and particularly suited to observing ST. ATSR radiance observations have been used to retrieve sea, land and ice ST from a series of three ATSR instruments (ATSR, ATSR-2 and AATSR) over a period greater than twenty years. This series has been extended with the launch in February 2016 of SLSTR on Sentinel 3, which has the same key design features. We have combined land, ocean and sea-ice ST retrievals from ATSR-2 and AATSR to produce a new ST dataset for the Arctic; the ATSR Arctic combined Surface Temperature (AATSR) dataset. The method of cloud-clearing, use of auxiliary data for ice classification and the ST retrievals used for each surface-type will be described. We will establish the accuracy of sea-ice and land-ice retrievals with results from validation against in situ data and comparison with other datasets. Time series of ST anomalies for each surface type will be presented. The time series for open ocean in the Arctic shows a significant warming trend during the AATSR mission. Time series for land, land-ice and sea-ice show high variability as expected but also interesting patterns.

Overall, our purpose is to present the state-of-the-art for ATSR observations of ST change in the Arctic, with associated uncertainty estimates, and hence indicate the confidence we can have in temperature change across all Arctic surfaces.

PRELIMINARY OBSERVATIONS OF THE IDENTITY, DISTRIBUTION AND ECOLOGICAL ROLE OF THYASIRID BIVALVES IN THE CANADIAN ARCTIC

Dove, Rachelle and S. Dufour
Memorial University of Newfoundland and Labrador (St. John’s, Canada)

Bivalves of the family Thyasiridae have been found to be ubiquitous, and sometimes dominant members of benthic communities in Canadian Arctic regions. Thyasirids may function as ecosystem engineers: species with chemoautotrophic, sulphur oxidizing bacterial symbionts mine for sulphides and can enhance oxygen penetration in sediments, promoting ecological recovery after organic enrichment events. The Thyasiridae is a taxonomically difficult group, with identifications based mainly on poorly defined and variable shell characters. The identity of thyasirids from northern Canada is poorly known: most are assigned to two “catch-all” species, Thyasira gouldi and T. flexuosa where symbiont presence (and associated bioturbation potential) in those bivalves has not yet been examined. This study uses thyasirid collections from the Canadian Museum of Nature, previous ArcticNet cruises, and new material collected from Baffin Bay in 2016 to re-evaluate the diversity and potential role of thyasirids in the Canadian Arctic. From these specimens, shell outline, prodissococonch size, internal anatomy, gill ultrastructure, and, where possible, host and symbiont gene sequences are being determined. We here present preliminary results that will help to: 1) revise the taxonomy of thyasirids from a broad range of Canadian Arctic and subarctic regions; 2) determine which of these species are symbiotic; and 3) determine the distribution and ecological correlates of these species.
SOURCES AND DISTRIBUTION OF SELENIUM AND SELENONEINE WITHIN ARCTIC ECOSYSTEMS

Dufour, Francis (1), G. Massé (1), M. Lemire (2) and P. Ayotte (3)

(1) UMI Takuvik, Département de Biologie, Université Laval, Québec, Québec, G1V 0A6 (Québec, Canada);
(2) Axe santé des populations et pratiques optimales en santé, Centre de recherche du CHU de Québec – Université Laval, Québec, Québec, G1V 2M2 (Québec, Canada);
(3) Axe santé des populations et pratiques optimales en santé, Centre de recherche du CHU de Québec – Université Laval, Québec, Québec, G1V 2M2 AND Centre de toxicologie du Québec, INSPQ, Québec, Québec, G1V 5B3 (Québec, Canada)

Traditional marine foods have always been an important component of Canadian Arctic’s Inuit diet. Food derived from marine organisms possesses several nutritional benefits, including high levels of proteins, vitamins, highly energetic fatty acids (including long-chain omega-3 polyunsaturated fatty acids) and microelements such as selenium (Se). Due to its importance in reducing oxidative stress, Se is essential in human health and Inuit populations exhibit among the highest intakes worldwide. In contrast to other populations, Se is mainly present in Inuit blood as selenoneine, a recently identified organic form of Se. In addition, recent studies suggest that selenoneine may participate in methylmercury (MeHg) detoxification mechanisms. However, very little is known about the presence of selenoneine in the Arctic environment. In this study we will determine total Se and selenoneine concentrations along with essential fatty acids distributions throughout a pelagic marine food web, from low-trophic level organisms to top predators (i.e. phytoplankton and ice algae -> zooplankton -> Arctic cod -> seal and narwhal -> human). Our study will focus on some of the most important species in terms of energy transfer in the Baffin Bay area. Specimens from a second marine food web that includes benthic species (i.e. phytoplankton and ice algae -> clams -> walrus) will also be analysed to complete this environmental screening. Our data will allow for determining the relative importance of the two primary production pools as sources of environmental Se and selenoneine. Specimen sampling took place on the ice near the village of Qikiqtarjuaq and aboard the CCGS Amundsen as part of the GreenEdge field program. First analyses reveal relatively large concentrations of Se in samples from two species of benthic clams (Mya truncata and Serripes groenlandicus; 3.4 and 2.8 μg Se/g dry weight respectively), of which around 15% is selenoneine, along with large concentrations of polyunsaturated fatty acids. Analyses in other sampled species are currently carried out. Results of this study will help identifying key species rich in selenoneine and predicting the consequences of climate change on selenium and fatty acid distribution in marine foods consumed by the Inuit.

SEA ICE CARACTERIZATION IN NUNAVIK BAYS OF THE HUDSON STRAIT

Dufour-Beauséjour, Sophie (1), Y. Gauthier (1), J. Poulin (1), M. Bernier (1), V. Gilbert (2) and A. Rouleau (3)

(1) INRS-ETE / CEN (Québec, Canada);
(2) Kativik Regional Government (Kuujjuaq, Canada);
(3) Raglan Mine (Québec, Canada)

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. The Safe Passage CHARS project gives us a privileged access to three Arctic study sites, all featuring bays in the northern Nunavik coast: Salluit, Deception Bay and Kangiqsujuaq (Wakeham Bay). Through this collaboration with other investigators, Kativik Regional Government and Raglan Mine, we monitor ice extent and thickness at these sites through in situ measurements and fully polarimetric radar images. This poster will feature results from the first of three years of sea-ice monitoring: 2015-2016. RADARSAT-2 quad-pol images were acquired every 24 days from December 2015 to April 2016. Field campaigns were conducted with local community collaborators in January and April 2016. During these campaigns we observed the ice cover with a ground-penetrating radar (GPR), we extracted ice cores and we sampled the thickness of the ice and snow covers through drilling. In Deception Bay, photos of the bay were taken continuously during the ice season, and the ice thickness was continuously measured at a single location with a SWIP (Shallow-Water Ice-Profiler). Ice cores were processed to extract salinity at several depths. Porosity of some ice cores was measured in a CT-scanner. The average measured ice thicknesses in
Deception Bay and Kangiqsujuaq were 88 and 70 cm in January 2016 and 138 and 118 cm in April 2016. The average ice thickness measured in Salluit in January 2016 was 82 cm. The poster will also include sea ice classification results from the SAR images and a comparison between polarimetric parameters and the ice thickness measured in situ.

**OBSERVATIONS AND NUMERICAL MODELLING REVEAL RECENT SEASONAL AND INTER-ANNUAL PATTERNS IN THE OCEANOGRAPHY OF THE EASTERN BEAUFORT SEA (CANADIAN ARCTIC)**

Dufresne, Christiane, F. Maps, F. Dupont and L. Fortier

Takuvik Joint International Laboratory, Université Laval (Canada) – Centre National de la Recherche Scientifique (France), Québec-Océan and Département de Biologie at Université Laval (Québec City, Canada); (2) MSC, Environment Canada (Dorval, Canada)

The receding sea-ice cover in the Arctic Ocean will inevitably lead to drastic changes in the timing and fate of the planktonic primary production at the base of the whole marine food-web. Changes in light and nutrient availability or water masses stratification are some of the many physical processes linked to the sea ice dynamics that directly influence phytoplankton productivity. In this rapidly changing ocean, a comprehensive understanding of the dynamics of such physical processes is essential to describe and eventually predict the fate of the marine primary production. In this study, we described the inter-annual and seasonal variability of the major physical processes controlling phytoplankton production in the eastern Beaufort Sea and Amundsen Gulf: sea surface temperature (SST), sea surface salinity (SSS) and sea-ice thickness (SIT), using observations and model results. The CREG12 model configuration is developed by CONCEPTS (Canadian Operational Network of Coupled Environmental PredicTion Systems) and is operationally used to forecast the sea ice dynamics. It is based on the NEMO framework and its numerical domain covers the entire Arctic Ocean and the North Atlantic Ocean. We focused our study on the eastern Beaufort Sea and Amundsen Gulf since this area has been studied for almost 12 years, as part of the ArcticNet project Long-Term Oceanic Observatories (LTOO). Long-term moorings have been deployed along the continental shelf at different depths and recorded temperature and salinity for many complete seasonal cycles. We used these extensive datasets to test the model accuracy. A first comparison between computed output and observed data showed that the model reproduced with satisfying accuracy and reliability the major surface patterns in temperature and salinity. While some short-term and localized processes are not simulated, the major features of the different water masses dynamics are computed adequately. For example, on the continental slope, major upwelling events are represented. For the six moorings analysed in this study, statistical analyses showed significant agreement between output and data. Autumn months usually showed the largest differences between modeled output and observed data, owing to the use of a climatological forcing for the Mackenzie River freshwater discharge and the complex dynamics of wind-induced upwelling. After assessing the representation of surface water masses in the area of interest, simulated output was then used to describe their inter-annual and regional variability. We revealed the dominant modes of variability of the sea surface temperature (SST) and salinity (SSS) as well as sea-ice thickness (SIT) by using empirical orthogonal function (EOF) analysis on the CREG12 output. EOFs allow the identification of several independent spatial modes of variability in conjunction with their temporal dynamics. The first mode of variability of SST, SSS and SIT was largely dominated by seasonality, as expected. The second and third modes showed that the southern part of the domain is the more variable and is strongly conditioned by the coast morphology and bathymetry. This variability highlights the influence of remote winter storms on the strength and direction of the Alaskan Coastal Current and the dispersion of the Mackenzie plume.

**ANNUAL PCO2 CYCLE OF NEAR SHORE ARCTIC SURFACE WATER MEASURED AT THE OCEAN NETWORKS CANADA CAMBRIDGE BAY COMMUNITY OBSERVATORY**

Duke, Patrick (1), B. Else (1), A. Sastri (2), H. Thomas (3), K. Juniper (2) and L. Miller (4)

(1) University of Calgary (Calgary, Canada); (2) Ocean Networks Canada (Victoria, Canada); (3) Dalhousie University (Halifax, Canada); (4) Department of Fisheries and Oceans (Victoria, Canada)

The annual carbon cycle of near shore Arctic surface water will help distinguish a portion of the
Arctic Ocean’s role in the global carbon cycle. Quantifying pCO2 cycles and air-sea CO2 exchange is vital in understanding the changing dynamic of the Arctic Ocean’s role in carbon sequestration. Due to increased anthropogenic carbon dioxide emissions, the Arctic carbon sink and associated mechanisms require further investigation. I am utilizing data collected from a Pro-Oceanus CO2-Pro CV instrument, installed on the Ocean Networks Canada (ONC) undersea community observatory in Cambridge Bay, Nunavut. The installation ran successfully starting in August 29th 2015, through August 23rd 2016. This continuous annual data set will be validated in time with water samples taken at the site throughout the year for dissolved inorganic carbon and total alkalinity analysis. The data downloaded from ONC is averaged hourly with integrated maximum and minimum values. The first step of data interpretation was analysis on an annual scale. The annual variation is likely to be tied in some capacity to biological activity, atmospheric exchange, sea ice formation, boundary circulation within the bay, or calcium carbonate precipitation/dissolution. Initial data analysis shows some recognizable trends. Starting in the early winter with sea ice formation, brine rejection drives a steady increase in carbon dioxide concentration. As the porosity of the ice decreases and becomes impermeable, sea-air CO2 exchange is cut off. Through the winter, as sea ice continues to grow, the CO2 concentration increases due to respiration processes. During late winter there is an interesting decrease in CO2 concentration that requires further study resulting in a second peak before melt onset. As temperatures rise through the spring and the sea ice begins to melt, there is an associated increase in sea ice permeability and sea-air CO2 exchange. Within this period the concentration of CO2 decreases as under ice algae begin primary production, making use of light availability. As sea ice melt continues through early summer the melt-water dilutes the surface layer, leading to further reduction of the concentration of CO2. In late summer the sea ice begins to break up. This triggers a response from pelagic primary producers, contributing to the continued decreasing trend in CO2 concentration. The summer phytoplankton bloom is short lived and soon the thermodynamic effect of increased boundary layer temperature on seawater results in increased CO2. This data set verifies previous work and assumptions made in the field, but raised a large number of questions as well. Further investigation is required to definitively distinguish quantitatively, the impact of all contributing factors and the seasonal transitions within the annual cycle. The lab work to validate the dataset is ongoing. The instrument has already been redeployed for 2016/2017 data collection by ONC. I intend to present the preliminary data analysed, and the likely factors contributing to the annual trend of carbon fluctuation. To do so will share some preliminary insight into an advanced process taking place within the Arctic system.

**OCEANOGRAPHIC CONDITIONS UNDER LANDFAST SEA-ICE SURROUNDING THE BELCHER ISLANDS, SOUTHEAST HUDSON BAY**

Eastwood, Annie (1), Z. Z. Kuzyk (2), R. Macdonald (3), J. Heath (4), J. Ehn (5) and D. Barber (2)

(1) University of Manitoba (Winnipeg, Canada);
(2) Co-advisor (Winnipeg, Canada);
(3) committee member (Victoria, Canada);
(4) President and Co-founder of Arctic Eider Society, committee member (St.John’s, Canada);
(5) committee member (Winnipeg, Canada)

Hudson Bay is undergoing climate-related changes in natural streamflow and sea-ice extent, as well as altered seasonality of discharge from regulated rivers. Fresher waters circulating in Hudson Bay in winter 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. In recent winters, local current-driven polynyas around the Belcher Islands (southeast Hudson Bay) were observed by Inuit to have rapidly frozen over, closing off the habitat to the wintering eider duck population. In collaboration with the Arctic Eider Society and the community of Sanikiluaq, we began to investigate these anomalies with respect to freshwater sources and distribution between summer (open-water) and winter (ice covered period) with a focus on the seasonal transition between early and late winter. Sampling took place during two winter seasons (2014-2015) and in the intervening fall period (2015). Temporal and spatial changes in water column temperature and salinity were documented. Salinity (S) and oxygen isotope ratios ($\delta^{18}O$) were measured both in water and (melted) ice core samples, allowing us, after appropriate end-member property assignments, to determine the fractions of freshwater (i.e. river water and sea ice melt). Seasonal (fall-winter) shifts in the amounts and geographic distributions of freshwater from runoff and sea-ice melt around the Belcher Islands,
and the likely processes responsible for these patterns will be discussed.

NEW FIELD OBSERVATIONS ON DISTRIBUTIONS OF COLD-WATER CORALS AND SPONGES IN BAFFIN BAY AND THE northern LABRADOR SEA.

Edinger, Evan (1), B. de Moura Neves (1), V. Wareham (2), C. Dinn (3), M. Pierrejean (4), B. Devine (5), L. Wheeland (5), L. Miles (1), P. Archambault (4), S. Leys (3), C. Nozais (6), S. Dufour (1), P. Snelgrove (1) and K. Gilkinson (2)

(1) Memorial University of Newfoundland (St. John’s, Canada);
(2) Fisheries and Oceans Canada (St. John’s, Canada);
(3) University of Alberta (Edmonton, Canada);
(4) Université Laval (Québec, Canada);
(5) Marine Institute, Memorial University of Newfoundland (St. John’s, Canada);
(6) Université de Québec à Rimouski (Rimouski, Canada)

Cold-water corals and sponges are important structure-forming fauna at continental slope and shelf break depths throughout the Northwest Atlantic. Using ROV-video observations in Baffin Bay and the northern Labrador Sea, complemented by box-cores, Agassiz trawls, and water sampling, we examined coral and sponge faunas, and their associated biodiversity at eleven sites between 2014 and 2016. These field observations complement distributional data from fisheries bycatch in scientific surveys and commercial and experimental fisheries. Coral diversity in the northern Labrador Sea greatly exceeds that in Baffin Bay, where sea pens, especially Umbellula encrinus, and soft corals dominate the coral fauna. Umbellula sea pen meadows are also abundant in Lancaster Sound and Jones Sound. Southeast Baffin Bay appears to be at the northernmost distributional limit for Keratoisis bamboo corals in the Northwest Atlantic, although slope-depth waters on the Greenland side of central and northern Baffin Bay have not been well-sampled for corals and sponges. These bamboo coral forests host a diverse assemblage of other smaller corals, as well as sponges. Ship-board incubations compared infaunal ecosystem function in coral forest patches vs. bare sediment, to assess whether bamboo coral forests are hotspots for ecosystem function as well as biodiversity. Corals in the northern Labrador Sea include extensive forests of large gorgonian corals in the waters between Labrador and Baffin Island. Apparent distributional range extensions for several coral species were observed at the Northeast Sagleek Bank coral hotspot. High bycatch rates of large gorgonian corals on NE Sagleek Bank over the past 20 years indicate historically high abundances of corals along the shelf break; corals have been progressively restricted to deeper waters by fishing pressure. We also observed higher erect sponge diversity higher in the northern Labrador Sea than in Baffin Bay, and highly abundant and diverse sponge gardens dominated by Lophon, and other sponges in Frobisher Bay. Several species of large Geodia sponges occurred on sites south of the Davis Strait sill, but with clear fishing impacts on their abundances at upper slope depths, at Cape Dyer and on the Southeast Baffin shelf and slope. Similarly, Asconema glass sponges, and the demosponges Axinella, Phakellia, and Thenea were observed at Cape Dyer and sites to the south, and at the Disko Fan site, on the Greenland side of Baffin Bay, but not on any of the sites on the western side of Baffin Bay. Other large sponges such as Mycale occur in various locations through Baffin Bay including Navy Board Inlet, off Lancaster Sound, and the smaller sponge Polymastia occurred at all study sites. In NW Baffin Bay, Navy Board Inlet, and Jones Sound, sponges apparently dominate the geological environments that typically host diverse coral faunas in the Labrador Sea, including large, erect carnivorous sponges such as Cladorhiza and Chondrocladia, suggesting possible ecological convergence with large gorgonian corals. Cold bottom water temperatures, low primary productivity, and low calcium carbonate saturation all likely contribute to low coral diversity in the Canadian waters of northern and western Baffin Bay.

ASSESSMENTS OF THE MICROBIAL CONSORTIA ON HOST FISH OFF KING WILLIAM ISLAND IN NUNAVUT

Element, Geraint (1), E. F. Hamilton (1), K. Moniz (1), S. Arnold (2), J. Qitsualik (3), P. van Coeverden de Groot (1) and V. K. Walker (1)

(1) Queen’s University (Kingston, Canada);
(2) Department of Environment, Government of Nunavut (Rankin Inlet, NU, Canada);
(3) Gjoa Haven Hunters and Trappers Association (Gjoa Haven, NU, Canada)

The Towards a Sustainable Fishery for Nunavummiut (TSFN) Project seeks to increase our
understanding of the fisheries resources in the lower Northwest Passage in partnership with Nunavummiut communities. Our goal is to use genomic, demographic, physiological, and microbial analysis to inform strategies to retain genetically-diverse and healthy stocks for the sustainable supply of high quality fish to Inuit communities. Genetic analysis will allow the identification of fish populations, but it is also important to assess the health of this resource. Thus we are characterizing fish with respect to any parasites as well as their microbial consortia. Under the guidance of Inuit fishers, sampling expeditions were mounted in the waters around King William Island, Nunavut. Arctic char and trout were sampled across 6 different sites using multi-panel, subsistence and commercial nets, with net sets for predetermined times varying from 2-24 h. An on-site lab facilitated the immediate aseptic sampling of lateral side biofilms as well as gastrointestinal microbial consortia. A subset of the total sampled catch was processed for this particular analysis (175 Arctic char and 15 trout), with DNA subsequently extracted from these specimens. Polymerase-chain reaction denaturing gradient gel electrophoresis using primers to amplify bacterial 16S ribosomal RNA gene sequences, as well as fungal internal transcribed spacer regions in the 18S genes, allows a visual appraisal of the differences between sampled fish. It also provides part of the quality assurance necessary for sample confidence prior to Illumina sequence analysis. Although this data will be part of the information important for the establishment of a sustainable fishery and for the marketing of ‘clean’ marine products, it will also serve as a benchmark for the future. We do not know how climate change, increasing commercial shipping, energy, mineral extraction, and tourism will impact the microbial world associated with these fish, but this data will give us tools to facilitate such an assessment. Acknowledgements: TSFN Project supporters included the Dept. of Fisheries and Sealing, CanNor, and Kitikmeot community members. We would like to thank the elders for their advice, as well as Shannon Petrie and Percy Ikualluq for their help with sampling. The fish were collected under an Exploratory Fisheries Licence to PvCdG (S16/17 1004 NU (A1 A2) and Animal Used Protocol to PvCdG 2016-010.

UV-PROTECTIVE COMPOUNDS IN SEA ICE-ASSOCIATED ALGAE IN THE CANADIAN ARCTIC

Elliott, Ashley (1), C. J. Mundy (1), M. Gosselin (2), M. Poulin (3), K. Campbell (1) and F. Wang (1)

(1) Center for Earth Observation Science, Department of Environment and Geography, University of Manitoba (Winnipeg, Canada);
(2) Institut des sciences de la mer de Rimouski, Université du Québec à Rimouski (Rimouski, Canada);
(3) Research and Collections Division, Canadian Museum of Nature (Ottawa, Canada)

Marine phytoplankton are known to produce UV-absorbing compounds (UVACs) for protection against UV radiation. To assess whether the same strategy applies to sea ice-associated algal communities, MAAs were measured in algal associated with surface melt ponds, sea ice (bottom 3 cm), sea ice–water interface below melt ponds, and underlying seawater in a coastal bay of the Canadian Arctic Archipelago during the 2011 spring melt transition from snow-covered to melt pond-covered sea ice. A total of six UVACs were detected as the spring melt progressed. Of these six, three UVACs were identified to be mycosporine-like amino acids (MAAs), namely shinorine, palythine, and porphyra-334. A fourth UVAC (U1) was most likely palythene, another MAA. The greatest UVAC nominal concentrations were observed in the 3 cm bottom ice under thin snow-covered sites just prior to complete snowmelt. Normalization to chlorophyll a content revealed that the greatest contribution to UV absorption from biota was associated with melt ponds that are exposed to the greatest light intensity. Despite extensive efforts in the laboratory, the molecular identities of the other two UVACs, U2 and U3, which have an absorption maximum of 363 and 300 nm, respectively, remain to be structurally elucidated. These results confirm that Arctic sea ice-associated algal communities are capable of producing photoprotectants and that spatial and temporal variations in MAA and other UVAC synthesis are affected by snow cover and UV radiation exposure. This may be an important mechanism for species who are experiencing a changing light regime due to climatic changes in the Arctic.
OXYGEN, SALT, AND HEAT EXCHANGE MEASURED AT THE ICE-OCEAN INTERFACE DURING THE ICE ALGAE BLOOM PERIOD

Else, Brent (1), B. Butterworth (1) and S. Rysgaard (2)
(1) University of Calgary (Calgary, Canada);
(2) University of Manitoba (Winnipeg, Canada)

Recent research into sea ice gas dynamics has shown that sea ice is not an impermeable barrier to gas exchange (e.g. Loose et al. 2009). The liquid (brine) and gas (bubble) inclusions contained within sea ice appear to allow some gas transport, both convectively due to density instabilities within the highly-saline brine system, and diffusively through both the brine and gas inclusions. Furthermore, recent developments in sea ice biogeochemistry (Miller et al., 2015) have shown that many gas species undergo significant modifications within the ice itself. This means that sea ice may play an active role in cycling climatically important gases (e.g. CO2, CH4, DMS) with the atmosphere. However, interesting gas dynamics are also thought to be occurring at the ice-ocean interface; for example, Rysgaard et al. (2007) suggested that CO2 rejected from growing ice may be exported to depth, acting as a sea ice carbon pump. It is therefore important to investigate gas transfer at this often unconsidered “water surface”. In this presentation, we will describe our recent efforts to develop a multi-channel underwater eddy covariance system. This system is capable of directly measuring ice-ocean exchanges of salt, heat, momentum, and oxygen. By combining these measurements, we aim to assess the physical and thermodynamic processes that control gas exchange beneath sea ice. We present results from recent laboratory and field experiments, and discuss how this research may inform a wide variety of topics, including ice algae production, brine convection, and gas transfer at the ocean-ice interface. References:


SHIFTING HOME RANGES OF THE BATHURST CARIBOU HERD

English, Michael (1), N. Wilson (1), C. Robertson (1) and J. Adamczewski (2)
(1) Wilfrid Laurier University (Waterloo, Canada);
(2) Environment and Natural Resources, GNWT (Yellowknife, Canada)

Over the past 20 years a significant number of circumpolar barren ground caribou herds have significantly declined in numbers. While caribou populations normally cycle, recent declines have put some herds at risk of extirpation. This decline is multi-causal and dynamic. Predation and hunting pressure along with mining development and associated disturbances are often cited as primary drivers of this pattern. Changes in snowpack may also be impacting how caribou, especially tundra caribou, move and use their winter ranges. The annual snowpack in the winter foraging area of the Bathurst herd covers their primary winter food source —lichen—for between 7 and 8 months of the year. This research focuses on the role of snow and changes to the annual snowpack on the decline of the Bathurst caribou herd. Many authors have cited changing winter conditions in caribou habitat in the northern hemisphere. These changes involve incursions of warmer southern air and concomitant changes in the snowpack structure related to warmer temperatures and/or rain-on-snow events. For example, widespread warming in the Wekweeti region in early March 2016 resulted in the formation of a snowcrust of 10 and 20cm in thickness and a density in the range of glacial firn ice. These changes in snowpack structure may have significant impact on food access and related energy expenditures. Through the spatial-temporal analysis of caribou collar data, this study has identified a significant shift in Bathurst herd winter foraging grounds after 2005. Prior to 2006 the caribou spent winter months in the boreal forest across a large area generally extending south of the treeline between Great Bear and Great Slave lakes. Post 2005 the caribou began winter foraging near the treeline and northwards into the tundra. This movement to the northeast into the boreal-tundra transition and low arctic tundra may be related to changing snowpack structure due to incursions of warmer southern air during the winter period. Increasing snowpack density increases energy expenditure by the caribou. A shift northeastward may move the caribou into areas that are not as impacted by these incursions of warm air. Tundra snow is normally much denser.
than the boreal snowpack and further movement north/northeast into the low arctic tundra will pose food access challenges as well. For the Bathurst herd, their winter range may be impacted by increased wildfires in the south, and harder, denser snow conditions in the north. Temporal analysis of home range snowpack water equivalent (SWE) were completed for these separate regional ranges (boreal: 1996-2005 and treeline-tundra: 2006-2014) to identify geographic changes in the relationship between caribou locations and SWE. In both cases, though more pronounced in the treeline-tundra region, caribou preferred areas of higher SWE (i.e., denser or deeper snowpack). This study relates the fire dates to rates of lichen recovery to assess how important this factor is in the geographical shift of this herd. The apparent northward shift of the Bathurst herd during the winter period may in part relate to the areas in the boreal forest that have burned over the past several decades.

INVESTIGATIONS OF FISH HEALTH AND CONTAMINANTS IN LAKES AND RIVERS IN THE NORTHWEST TERRITORIES: CASE STUDIES INVESTIGATING COMMUNITY CONCERNS

Evans, Marlene (1), A. Amos (2), J. Jumbo (3), P. Simon (4), R. Bjornson (4), L. King (5), P. Cott (6), G. Low (7), M. Guzzo (8), C. Goater (9), T. Bollinger (10), H. Swanson (11), J. Keating (1) and D. Muir (1)

(1) Environment and Climate Change Canada (Saskatoon, Canada);
(2) Gwich’in Renewal Resources Board (Inuvik, Canada);
(3) Sambaa K’e Dene First Nation (Trout Lake, Canada);
(4) Deninu Ku’e First Nation (Fort Resolution, Canada);
(5) Lutsel K’e Dene First Nation (Lutsel K’e, Canada);
(6) NWT Environment and Natural Resources (Yellowknife, Canada);
(7) Dehcho First Nations (Hay River, Canada);
(8) University of Manitoba (Winnipeg, Canada);
(9) University of Lethbridge (Lethbridge, Canada);
(10) University of Saskatchewan (Saskatoon, Canada);
(11) University of Waterloo (Waterloo, Canada)

Northern communities frequently are concerned about fish health and the safety of consuming fish from traditionally harvested lakes and rivers. Common physical concerns include skinny fish and discolored livers; consumption concerns focus on chemicals released from local (e.g., a mine) and long-range sources (especially mercury and persistent organic pollutants). These concerns are best addressed when communities and scientists work together to explore these issues. Here we present learning’s gained from our studies investigating fish health and contaminants. Fort Resolution, on the shores of Great Slave Lake, was concerned that the decommissioned lead-zinc mine at Pine Point had and continued to adversely affect fish and environmental health in the Resolution Bay area. With the participation of community members, we investigated metal concentrations in water, sediments, and fish. Fish appeared healthy and metals concentrations were similar to or lower than at regions distant from the mining site. Community concerns were largely alleviated from this study. Skinny fish periodically are reported from various communities throughout the north; our very limited data suggested that they were old fish. Trout Lake recently reported increased numbers of skinny walleye and provided us with 10 skinny and 10 normal walleye for examination. Skinny fish were more than 20 years old with small livers; mercury concentrations were high, a not unexpected observation since mercury concentrations increase with fish age and tend to be higher in shallow and/or smaller lakes. Reduced liver size may have impaired fish health, including weight. The Gwich’in have been concerned about the periodic occurrence of burbot with discolored livers in their traditional harvest and designed a study to investigate burbot health metrics based on liver appearance; contaminant concentrations also were measured to investigate consumption concerns. Burbot with unhealthy-looking livers were older (>16 years) fish, with a low condition factor and less food in their stomachs than fish with healthy looking livers. Their livers were small, relatively low in lipid and with a relatively high parasite load. Mercury concentrations were slightly higher in the older fish with poor quality livers; persistent organic pollutant concentrations did not differ substantially with liver type and were lower than in burbot from Great Slave Lake. Other instances of community concern are less easily resolved, e.g., periodic occurrences on skinny lake trout at Stark Lake, where an exploratory mine site has not been fully cleaned up. This trout population appears to be dominated by older fish with higher mercury concentrations; some fish are parasitized. The common occurrence of high mercury concentrations in predatory fish in small and medium size lakes and the occurrence
of old mine sites may have aggravated a tendency for reduced fishing pressures and contributed to harvested populations dominated by older fish potentially with larger parasite burdens, skinny bodies, and poor quality livers.

**SPATIAL AND TEMPORAL TRENDS IN PERSISTENT ORGANIC POLLUTANTS IN LAKE TROUT AND BURBOT FROM GREAT SLAVE LAKE, NORTHWEST TERRITORIES**

Evans, Marlene, D. Muir, J. Keating and X. Wang

Environment and Climate Change Canada (Saskatoon, Canada)

Great Slave Lake is the major large lake in the Northwest Territories with a substantial population living along its shores (including Yellowknife, Hay River, Fort Providence, Fort Resolution and Lutsel K’e). It can be divided into two major regions: the East Arm, located on the Canadian Shield and the West Basin, located on Paleozoic deposits. The Slave River, formed by the confluence of the Peace and Athabasca rivers, is its major inflow entering the West Basin near the community of Fort Resolution. Early research, conducted primarily by D.S. Rawson, emphasized the importance of the Slave River in enhancing the productivity of the West Basin, including the commercial fisheries. More recently, concerns have focused on the possibility that the Slave River is transporting significant quantities of persistent organic pollutants (POPs) into the lake from more developed regions to the south. These contaminants contribute to the load received from long-range atmospheric sources. Here we report on our studies investigating spatial and temporal trends in POPs in lake trout and burbot harvested from the West Basin and East Arm over 1993-2015. Contrary to our initial hypotheses, POPs concentrations tended to be higher in fish in the East Arm than the West Basin while the converse was observed for lake sediments. The low productivity of East Arm waters and reduced suspended sediments inputs from rivers may provide less opportunity for contaminant dilution through fish growth and contaminant adsorption onto particulates in the water column. Trend monitoring over 1999-2015 has determined that several POPs are exhibiting significant trends of decline with α-HCH and γ-HCH showing the greatest rates of decrease. While Σ-10PCBs, Σ-DDT, Σ-chlordane, and dieldrin concentrations are declining, the rates are much smaller and often not statistically significant. The rate of decline generally was greater for West Basin than East Arm fish, possibly because of the shorter residence time of water and greater sedimentation rates in the former region. The slow rate of decline for many POPs indicates their continued persistence in the Great Slave Lake ecosystem over more than twenty years of monitoring and reduced use in the environment. Newer organic contaminants such as Σ-PBDEs and Σ-PFCAs appear to be only somewhat less persistent.

**THE MARINE FOOD WEB OF THE KITIKMEOT REGION AND ITS IMPORTANCE IN ARCTIC CHAR TROPHIC ECOLOGY AS REVEALED BY STABLE ISOTOPE ANALYSIS**

Falardeau, Marianne (1), L. N. Harris (2), A. Fisk (3), C.J. Mundy (4), C. Bouchard (5), L. Fortier (5) and E. Bennett (6)

(1) Department of Natural Resource Sciences, McGill University (Montreal, Canada);
(2) Arctic Aquatic Research Division, Fisheries and Oceans Canada (Winnipeg, Canada);
(3) Great Lakes Institute for Environmental Research, University of Windsor (Windsor, Canada);
(4) Centre for Earth Observation Science (CEOS), Department of Environment and Geography, University of Manitoba (Winnipeg, Canada);
(5) Québec-Océan, Département de biologie, Université Laval (Québec, Canada);
(6) Department of Natural Resource Sciences and McGill School of Environment, McGill University (Montreal, Canada)

Even though Inuit livelihoods and ways of life are challenged by multiple societal and environmental changes, traditional seafood remains key to northern communities. Traditional seafood provides Inuit with a diversity of nutritional, health, cultural and socioeconomic benefits that support basic aspects of their well-being, including food security. As such, any change in the availability and the quality of seafood could affect Inuit people’s well-being. In particular, shifts in the structure and dynamics of Arctic marine food webs could have cascading effects on seafood production. Therefore, it is crucial to understand the structure, functioning and controlling variables of Arctic marine food webs to predict their response to climate change and the cascading effects on traditional seafood.
In this study, we use chemical tracers to investigate key aspects of the Arctic marine food web of the Kitikmeot Region of Nunavut and to assess its resilience to environmental variability. Arctic char (Salvelinus alpinus) is an important traditional seafood item in the region, but little is known about its trophic ecology. We thus give particular attention to understanding how this species depends on the marine food web. Most sampling occurred in 2015 and 2016 at various locations in Queen Maud and Coronation Gulfs. Phytoplankton, zooplankton and ichthyoplankton were sampled on the R/V Martin Bergmann and the research icebreaker CCGS Amundsen; benthic organisms were sampled through benthic grabs and scuba diving; Arctic char and other adult fishes were sampled as part of the Arctic char monitoring program of Fisheries and Oceans Canada (DFO); and marine mammals’ samples were obtained through local hunters. Furthermore, archived Arctic char samples dating back 1987 were provided by DFO and were used to study temporal variability in Arctic char trophic ecology. We present preliminary results of carbon ($\delta^{13}$C) and nitrogen ($\delta^{15}$N) stable isotope analysis as first insight on the marine food web of the Kitikmeot Region. This research provides important baseline information that will help us monitor this marine food web and foresee how it might respond to climate change and other stressors.

LIPIDS FOR LIFE: A CASE STUDY OF DAUBED SHANNY (LEPTOCLINUS MACULATUS)

Falk-Petersen, Stig (1, 3), H. Hop (2, 3), J. S. Christiansen (3), C. A. Meyer Ottesen (3) and S. Murzina (4)

(1) Akvaplan-niva, Fram Centre for Climate and the Environment, N-9296 Tromsø, Norway;
(2) Norwegian Polar Institute, Fram Centre, N-9296 Tromsø, Norway
(3) Department of Arctic and Marine Biology, Faculty of Biosciences, Fisheries and Economics, UiT The Arctic University of Norway, N-9037 Tromsø, Norway;
(4) Karelian Research Centre, Institute of Biology, Russian Academy of Sciences, Pushkinskaya St. 11, 185910 Petrozavodsk, Russia

The daubed shanny (Leptoclinus maculatus) is a common and abundant fish species with a circumpolar Arctic distribution. In the Barents Sea, this species is generally found from the polar front and northwards in sub-zero temperatures. The daubed shanny is considered an ecologically significant species in Svalbard waters. It has an important role in the transfer of energy from Calanus spp. to higher trophic levels and constitutes an abundant and energy-rich food source for predatory fishes and seabirds. The daubed shanny is an epibenthic fish with pelagic postlarval stage lasting up too four years and a benthic adult stage. The transition between the pelagic and benthic life mode takes place when postlarvae reach approximately 80 mm in length at 3 to 4 years of age. The pelagic postlarvae has a unique lipid sac that stores large amounts of triacylglycerols. Lipid sac consists of fragile lipid globules, clearly visible by eyes, surrounded by a simple membrane. Lipids in the lipid sac originate from the Calanus ssp. diet and are dominated by long-chained fatty acids (20:1n-9, 22:1n-11). The large lipid sac is considered as evolutionary Arctic adaptation in the development of L. maculatus in order to survive as larvae and grow up to benthic adult based on lipids stored during the early stages of life.

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

Fawcett, David (1), T. Pearce (2), J. Ford (3) and R. Notaina (4)

(1) Department of Geography, University of Guelph (Abbotsford, Canada);
(2) Sustainability Research Centre, University of the Sunshine Coast; Department of Geography, University of Guelph (Sippy Downs, Australia);
(3) Department of Geography, McGill University (Montreal, Canada);
(4) Community of Ulukhaktok (Ulukhaktok, Canada)

Climate change is already affecting Arctic ecosystems and the human communities that rely on them for their livelihoods, and these changes are expected to continue in the future necessitating human adaptation in response. Adaptation research conducted in 2005 in Ulukhaktok, NT identified particular vulnerabilities in the Inuit subsistence hunting sector and Inuit responses to these changes. These findings made significant contributions to our understanding of the human dimensions of climate change in the Arctic, but are temporally discrete, providing a static understanding of vulnerability and adaptation, which are dynamic processes. In response, this research examined the processes and dynamism of climate change vulnerability in Ulukhaktok through a longitudinal
study, using fieldwork data from both 2005 and 2016 alongside historical data, and longitudinal instrumental, economic, and harvest data. Specific objectives included: (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 2005 (Pearce et al. 2010); and (3) describe the processes and conditions which have aided or constrained adaptation over time. Data was collected through semi-structured interviews (n=32), participant observation, and closely working with an active Inuit hunter as a research partner. Among several themes, the data indicates that many of the changes recorded in 2005 have continued, with changes to wind, ice, and snow conditions being of particular relevance and altering the timing and ability of people to go hunting or the success of hunting. Furthermore, the significant role of specific economic, social, and political changes and conditions in determining individual sensitivity and responses to certain conditions was uncovered in greater detail. This research contributes a dynamic understanding of community vulnerability and adaptation in Ulukhaktok, an understanding of the dynamic processes of vulnerability and adaptation including how climatic and non-climatic variables interact and converge, and to the methodological advancement of the Vulnerability Approach through the operationalization of a longitudinal design. This research is part of ArcticNet Project 1.1 Community Vulnerability, Adaptation and Resilience to Climate Change in the Arctic.

OPERATIONALIZING LONGITUDINAL APPROACHES TO CLIMATE CHANGE VULNERABILITY ASSESSMENT IN THE ARCTIC

Fawcett, David (1), T. Pearce (2), J. Ford (3) and L. Archer (3)

(1) Department of Geography, University of Guelph (Abbotsford, Canada);
(2) Sustainability Research Centre, University of the Sunshine Coast; Department of Geography, University of Guelph (Sippy Downs, Australia);
(3) Department of Geography, McGill University (Montreal, Canada)

The last decade has seen a proliferation of community-scale climate change vulnerability assessments globally, and specifically in the Arctic. Many of these have employed a vulnerability framework, drawing upon interviews with community members to identify and characterize climatic risks and adaptive responses. This has led to the development of useful baseline understandings of vulnerability and adaptation. However, these understandings are temporally static; because vulnerability and adaptation are dynamic processes, new methodologies are needed to generate insights on the dynamics of how climate change is experienced and responded to by communities and individuals. The use of longitudinal approaches to capture the dynamism of human processes is well-established in sociology and the health sciences, but the uptake of such approaches remains limited in climate change vulnerability research. Therefore, we propose the application of two longitudinal approaches – cohort and trend studies – in climate change vulnerability assessment and review three case studies from ArcticNet research in the Canadian Arctic. These case studies offer an example of how longitudinal approaches can be operationalized in vulnerability research in the Arctic, and globally, to capture the dynamism of vulnerability through the identification of climatic anomalies and trends, the temporal development of adaptive pathways and the effects of interactions and convergences between conditions, and insights on themes critical to understanding adaptation such as social learning and knowledge sharing. This research is part of ArcticNet Project 1.1 Community Vulnerability, Adaptation and Resilience to Climate Change in the Arctic.

HUDSON BAY: FIRST WE LOSE POLAR BEARS THEN SEALS?

Ferguson, Steven (1), B. Young (1), D. Yurkowski (2), R. Anderson (2), C. Willing (2) and O. Nielsen (1)

(1) Fisheries and Oceans Canada (Winnipeg, Canada);
(2) University of Manitoba (Winnipeg, Canada)

Hudson Bay is seeing unprecedented changes to the marine ecosystem with climate warming. Polar bear research has consistently described a decline in numbers and reproduction with the loss of sea ice at the southern limit of their range. But how are ringed seals since they are the principle food of polar bears? Here, we summarize more than a decade of research by comparing environmental patterns (duration of open water season, sea surface temperature, climatic indices) to satellite telemetry (surface foraging and benthic diving behaviour; 2006-12) and hunter collection
data (reproduction, body condition, recruitment, stress; 2003-13). Two patterns appear. First, ringed seal numbers and reproduction has increased and decreased with an approximate 10 year cycle aligned with major atmospheric patterns whereas ringed seal body condition has steadily declined. Second, ringed seals have experienced punctuated changes following years of extreme ice conditions and, more recently, with a dramatic loss of sea ice. Ten aerial surveys of western Hudson Bay ringed seals (1995-2013) suggest a gradual decline in seal abundance, with a crash in ringed seal numbers between 2010 and 2013. The 2010 open water season in Hudson Bay was one of the warmest on record and resulted in the longest ice-free season during a period marked by extreme positive NAO and AO conditions. Satellite-tagged seals responded by spending less time foraging and making fewer deep dives during the critical open-water season of positive energy balance in 2010. Low foraging activity was also recorded during the following two years possibly due to reduced condition of seals and/or to a significant shift in available food resources. Following the 2010 warming event, analysis of seal samples provided by Inuit hunters indicated reduced seal reproduction (low ovulation and pregnancy rates), low pup numbers, and increased stress (cortisol levels). We conclude that negative demographic responses of Hudson Bay seals are occurring both gradually and with episodic declines.

MAPPING NEAR-SURFACE ICE FORMATION OVER DEVON ICE CAP: EVIDENCES EXTRACTED FROM SUPRAGLACIAL CHANNEL AND THE KENNAUGH ELEMENTS

Fernandes, Luísa (1), M. Sharp (1), A. Wendleder (2), A. Schmitt (3) and A. Roth (2)

(1) University of Alberta (Edmonton, Canada); (2) German Aerospace Center (Oberpfaffenhofen, Germany); (3) University of Applied Sciences Munich (Munich, Germany)

Mass losses from the Canadian Arctic ice caps, currently the major regional contributor to the non-steric component of global sea-level rise after the Antarctic and Greenland ice sheets, have increased dramatically in recent decades. Predictions of future sea level change suggest that small ice caps and glaciers will be the dominant source of eustatic sea-level rise over the next century. Likewise the quantity of melt in the percolation zone of Arctic ice caps is predicted to continue to increase. The area affected by infiltration of surface meltwater into the firm, which redistributes water mass both vertically and horizontally, is expanding. Where melting occurs at the surface in an ice cap’s accumulation area (where annual snowfall exceeds annual melt/runoff), meltwater percolates downwards into the snow and firm, where it may fill the pore volume. If the temperature of the surrounding snowpack or firm is below 0°C, the meltwater will refreeze and extensive ice bodies may form as a result. This has the direct effect of reducing meltwater runoff, relative to melt, but it may also limit vertical meltwater percolation, increase water saturation of snow and firm above the ice bodies, and promote increased surface runoff and/or mass removal by slush flows. Thus, when estimating mass loss from small ice caps, recent changes in firm structure, stored water volume, and the extent of overland flow and slushflow activity need to be considered. Tracking the growth and distribution of large ice bodies within the firm over time, may clarify how firn layers are changing in response to climate warming. This study will investigate firn of Devon Ice Cap, Nunavut, Canada, in order to determine how the growth of massive ice bodies is affecting firm water storage capacity and meltwater runoff from the ice cap’s accumulation area. We hypothesize that extensive ice bodies may form by refreezing in areas where extensive slush swamps and ponds form during the melt season. Optical Landsat-8 imagery (available since 2013) will be used to extract information about supraglacial meltwater drainage patterns and lake and slush swamp distribution. Terra-SAR-X imagery (available since 2015) will be decomposed in Kennaugh Elements, a technique to separate the total intensity backscattering strength from the polarimetric information. Changes in polarization will allow the identification of large scale freezing events of surface meltwater on the ice cap. Thus, Landsat-8 and TerraSAR-X will be used to identify year-to-year changes in the distribution of surface water storage and runoff in firm covered areas that might indicate ice bodies development at depth in the firm that prevents deep percolation of meltwater. Our results suggest that the combination of drainage system information and Kennaugh Elements is a promising approach to investigate how the presence of ice bodies affects patterns of water storage and surface runoff over the same areas in the following melt season since 2015 over Devon Ice Cap.
GROWTH HAVENS FOR ARCTIC ALGAE: RIDGES AND SNOW-ICE INTERFACE


(1) Norwegian Polar Institute (Tromsø, Norway); (2) University of Manitoba (Winnipeg, Canada)

Sea-ice ridges are difficult to access with the common ice-sampling techniques due to their complex structures. Therefore, despite some indications of them being hot spots for biological activity, they are under studied. Snow infiltration communities are common in the Antarctic, but apparently not so ubiquitous in the Arctic, where less snow accumulates on top of the ice. During the Norwegian young sea ICE (N-ICE2015) expedition north of Svalbard from January to June 2015, we observed the establishment and development of algal communities in first year ice (FYI) ridges and at the snow-ice interface during Arctic spring. Combining classical biomass and taxonomy measurements with under-ice irradiance measurements from a remotely operated vehicle, light exposure experiments, as well as radiative transfer modelling and under-ice turbulent mixing estimates, we explore the environmental factors controlling these two algal habitats. Higher biomass accumulation in ridges and at the snow-ice interface suggests a more favorable growth environment compared to the adjacent snow-covered level FYI and second-year ice (SYI). Ridges provide complex surfaces for attachment, increased light availability, and protection against strong under-ice currents. Specific locations within the ridges hosted distinct ice algal communities e.g. dominated by Nitzschia frigida growing on the under surface and sides of the submerged floes and almost unialgal assemblages of Thalassiosira bioculata forming fluffy layers on the upper surface. The snow-ice interface provides higher light levels than the under-ice water column and the ice bottom and physical protection against zooplankton grazing, therefore the snow infiltration communities were dominated by chain-forming pelagic diatoms that did not develop in the water column. Ridge and snow infiltration communities could become more common in the future Arctic Ocean, as ridges might form more frequently in a thinner and more dynamic ice pack, and the predicted increase in Arctic snowfall might lead to more FYI floes with negative freeboard during the melt season.

SNOWDRIFT SIMULATION IN WIND TUNNEL TESTING AS ARCHITECTURAL DESIGN METHOD FOR ARCTIC BUILDINGS

Fiebig, Jennifer and H. H. Koss

Technical University of Denmark DTU (Kgs. Lyngby, Denmark)

In arctic regions the sustainment of northern life such as safety, comfort, affordable housing, public transportation, architectural quality and public space in outdoor areas has been broadly investigated under different extents. Climate adaptation is one of the most important aspects in sustainable city planning. Snowdrift, in those polar and sub polar climates, is a prevailing phenomenon which can be a significant problem for the structural design and indoor climate due to meltwater penetration. Simultaneously, basic functions such as accessibility and ventilation can be affected by large snow accumulations around buildings or on roads. Architects and urban planners have to face the increasing relevance of city comfort and adaptation to the local climate in such extreme environments. Integration of snow deposition into the early design process in architecture and urban planning is not sufficiently implemented and only a small number of design strategies have been tested in snowdrift simulations. The impact of snowdrift in a built environment is usually studied in a boundary-layer wind tunnel at reduced scale using a substitution for snow. A review over the last 50 years in snowdrift simulation was the basis for a designed test set-up at the Department of Civil Engineering and will be presented. The main aspect in the scaled experimental method is the actual behaviour of the substitution material in comparison to the true-to-nature phenomenon of snow accumulation. In 1960, one of the first tested material was the widely applied sodium bicarbonate, which until today provides convincing results of the complexity of snow formation and adhesion on e.g. vertical walls. A number of different substitution materials have been tested regarding their aptitude of being phenomenologically similar to snow formations in nature. Design strategies for arctic research centres and storage houses with a single step-roof implemented in snow load codes are a limited resource for architects and planners to draw on. In fact, arctic cities are more complex in their structure and more dense like those found in mediterranean climates. The objective is to present a guideline for architecture in arctic region based on the results of parametric studies with
advantages and disadvantages in design strategies. The simulations are based on comparison to data from literature and planned field observations for the winter season 2016/2017 in Greenland.

**FOOD SECURITY EXPERIENCES IN NUNAVIK: TOWARDS A MULTIVARIATE UNDERSTANDING OF A GENDER-BASED APPROACH TO DEVELOP INTERVENTIONS AND PROMOTE FOOD SECURITY**

Fillion, Myriam (1), M Lucas (1), E A. Laouan Sidi (1) and C. Furgal (2)

(1) Population Health and Optimal Health Practices Research Unit, CHU de Québec – Université Laval, St-Sacrement Hospital (Québec, Canada);
(2) Indigenous Environmental Studies and Sciences, Trent University (Peterborough, Canada)

Background: In Canada, food security is an important public health issue in the Inuit population, and men and women of different age and socioeconomic situations are likely to have different experiences of food security/insecurity. Objective: To explore the different profiles of food security/insecurity experiences among Inuit women and men from Nunavik, Northern Quebec. Methods: The analyses included 635 participants (341 women, 294 men) from the 2004 Nunavik Inuit Health Study. Variables representing determinants of food security and relevant sociodemographic and health-related characteristics were selected. Multiple correspondence analyses (MCA) were performed separately for women and men to explore gender-specific associations between food security status, diet, socioeconomic, lifestyle and health-related variables. Sex-specific cluster analyses were used to identify groups of women and men sharing similar characteristics. Results: MCAs showed two dimensions explained 35.3% of the variance observed in women and 37.0% in men. For both women and men, the first dimension was related to harvesting practices (and country food consumption in men) and the second dimension, to perception of country foods. Cluster analyses identified three clusters in both women and men. In women, food security tended to be higher among women more involved in harvesting activities. In men, food security was significantly higher in harvesters with higher income and significantly lower in young non-harvesters with lower income. Conclusion: These results provide a better understanding of how different groups of women and men experience food security in Nunavik, and could contribute to the identification of target groups for interventions in this region.

**CAMBRIDGE BAY’S SUB-SEA CABLED COMMUNITY OBSERVATORY: PARTNERSHIPS, OPERATIONS, COMMUNITY WORK, AND FUTURE PLANS**

Flagg, Ryan

Ocean Networks Canada / University of Victoria (Victoria, Canada)

Rapidly changing environmental conditions and ever present logistical hurdles are two of the primary factors that researchers, government organizations, and private industry face when trying to understand and serve the Canadian Arctic. Establishing and maintaining long-term data-collection and research programs is key to understanding and overcoming these challenges and requires a significant amount of coordination in order to deliver successful monitoring solutions. Ocean Networks Canada’s cabled Community Observatory in Cambridge Bay provides real-time, year-round, high temporal resolution data from a wide range of shore-based and sub-sea instruments. This type of environmental monitoring requires specialized hardware and a highly capable data management system and is playing an increasingly important role in what is becoming an extremely comprehensive research program in the “Kitikmeot Sea”. The current success of the Cambridge Bay Observatory is now shown by four years of continuous data, which has supported multiple scientific publications, and is a direct result of the support that the program has received from a wide range of partners and collaborators. The annual maintenance visits, community engagement activities, and ongoing operations all work together to meet the ever changing needs of these partners, the national and global scientific communities, and the residents of Cambridge Bay. Presented here will be the ongoing efforts that have been made to improve the overall configuration of the observatory and maximize its impact by adding to the instrument complement, the contributions of the various partners that make this possible, and the adoption of this technology and community engagement model along the coast of BC and in other proposed programs throughout the Arctic.
PARTICIPATORY SCENARIO PLANNING AND CLIMATE CHANGE IMPACTS, ADAPTATION, AND VULNERABILITY RESEARCH IN THE ARCTIC

Flynn, Melanie, J. Ford and IHACC Research Team
McGill University (Lafayette, United States)

Participatory scenario planning (PSP) approaches are increasingly being utilized in research on climate change impacts, adaptation, and vulnerability (IAV). We identify and evaluate how PSP has been used in IAV studies in the Arctic—the region undergoing the most rapid warming globally—reviewing work published in the peer-reviewed and grey literature. We find that while PSP is increasingly popular, it remains in its infancy, with only 43 studies published in the Arctic over the last 15 years. Studies that have used PSP generally perform well when compared to recognized ‘best practices’ in the general literature, engage multiple ways of knowing including traditional knowledge, and are employed in a diversity of sectors. The level of community participation, however, varied between studies, and climate projections are used in just over half of the documents reviewed raising concern that important future drivers of change are not fully captured. The time required to conduct PSP, involving extensive community engagement, was consistently reported as a challenge, and for application in Indigenous communities requires careful consideration of local culture and belief systems on what it means to prepare for the future.

A CONCEPTUAL MODEL FOR BEST PRACTICE IN ENVIRONMENTAL KNOWLEDGE TRANSLATION IN INDIGENOUS COMMUNITIES

Flynn, Melanie and J. Ford
McGill University (Lafayette, United States)

Through the past decade, we have seen significant advances in our knowledge of climate impacts, adaptation and vulnerability research in the north. How this knowledge is shared with key stakeholders and decision makers (the concept of knowledge translation) is key in creating better practice and increasing research usability. Indigenous Arctic communities offer some unique challenges in terms of research results sharing and relationship building, these include language differences, remoteness of communities and different ways of knowing. All of these factors can influence the success of adaptation research in communities. Recently, we have seen an attempt to identify key methodologies of KT practice in this field. Indeed, we have seen ArcticNet sessions dedicated to this topic (ASM2014). This research synthesises available data from a broad but related set of fields including, knowledge translation in environmental resource management, indigenous communities (of which research is heavily focused on the public health field), usable science in climate change research and climate services field. Following this, we utilize semi-structured interviews with key practitioners, funders and Northern research organisations to gain practical insight into challenges and barriers to achieving best practice in the field, to answer the research question, “What are the most effective steps in knowledge translation of climate change research to Arctic indigenous communities?”

FALL UPWELLING EVENTS IN THE CANADIAN BEAUFORT SEA: ATMOSPHERIC DRIVERS, SHELF-SLOPE CIRCULATION AND SEDIMENT RESUSPENSION

Forest, Alexandre (1), P. D. Osborne (1), H. Melling (2), I. Dmitrenko (3), L. Fortier (4), G. Curtiss (5) and M. Lowings (6)
(1) Golder Associates Ltd. (Quebec, Canada);
(2) Institute of Ocean Sciences, Fisheries and Oceans Canada (Sydney, Canada);
(3) Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada);
(4) ArcticNet, Takuvik and Québec-Océan (Quebec, Canada);
(5) Golder Associates Inc. (Redmond, United States);
(6) Golder Associates Ltd. (Now at Norquest Systems) (Calgary, Canada)

Fall upwelling is a key process of the Arctic continental shelf that allows the seasonal exchange of brackish and nutrient-poor shelf waters with dense and nutrient-rich waters from the deep offshore environment. Here, we combine measurements from an extensive mooring array deployed in the Canadian Beaufort Sea in autumn 2014 with remote sensing observations and reanalysis data to investigate synoptically the dynamics of this process. We seek to understand the role of atmospheric pressure systems, wind and sea ice motion in driving water mass distributions and ocean current variability during successive upwelling episodes.
and explore the implications with respect to increases in near-bottom suspended sediment concentrations (SSC) associated with energetic along-slope flows. The sequence of events in fall 2014 initiated when a marked frontal system with low sea level pressure over the Northeast Pacific and high pressure over the Arctic Ocean developed in October and generated upwelling-favorable winds from the ENE in the Beaufort Sea. As a result: (1) shelf waters with mean salinity ≈ 31.5 moved offshore and were progressively replaced with Upper Halocline waters at ~32.5; (2) a marked negative sea level anomaly (>30 cm) was detected on the inner shelf; and (3) high-velocity currents to the SW (up to 50 cm s⁻¹) developed near the shelf break (~80 m depth) in the opposite direction to the mean circulation. When the winds faded in late October, currents near the shelf break veered back to the NE and a strong jet (~60 cm s⁻¹) trapped on the upper slope developed in response to upwelling relaxation. The latter induced a short-lived intrusion of Atlantic Water (salinity = 34.7) typically found at 240 m onto the outer shelf. While weak winds prevailed in November-December, shelf waters further increased in salinity from ~32.5 to ~33.0 due to upwelling apparently forced by longshore stress imposed by the growing ice cover moving anticyclonically under the persistent high-pressure system. Reversal of the mean shelf-break circulation with stronger currents to the SW followed by a slope-trapped jet to the NE associated with upwelling relaxation were again identified during this period. Peaks in near-bottom SSC (up to 40 g m⁻³) attributed to local seabed erosion were recorded on the upper slope during periods of both increased SW and NE shelf-break currents. However, the response was spatially different with the Mackenzie Canyon reacting specifically to the up-shelf flows to the SW and the outer central Mackenzie Shelf responding more intensely to the relaxation counter-flows to the NE. By contrast, no clear response in current speed and SSC was observed in the vicinity of the Banks Island shelf. Our results provide a detailed characterization of upwelling dynamics in the Canadian Beaufort Sea based on integration of high-resolution data and underscore the need to monitor shelf-slope exchange processes in the region to better understand their impact on ocean circulation and biogeochemical fluxes under shifting meteorological and sea ice conditions.

THE INTEGRATED BEAUFORT OBSERVATORY (IBO)

Forest, Alexandre (1), H. Melling (2), C. Lalande (3), K. Lévesque (4), A. Merzouk (4), S. Meredyk (4), L. Michaud (4) and P. D. Osborne (5)

(1) Golder Associates (Quebec, Canada); (2) Institute of Ocean Sciences, Department of Fisheries and Oceans Canada (Sydney, Canada); (3) Takuvik, Quebec-Ocean and ArcticNet, Université Laval (Quebec, Canada); (4) ArcticNet, Université Laval (Québec, Canada); (5) Golder Associates Ltd. (Vancouver, Canada)

The integrated Beaufort Observatory (iBO) is a four-year mooring 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. 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 oil and gas development and regulations in the offshore Beaufort Sea. The iBO sampling array 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 area near Banks Island. The moorings are equipped with state-of-the-art instrumentation, including acoustic Doppler current profilers for current speed and direction, ice drift and plankton/particulate matter backscattering; ice-profiling sonars for sea ice thickness, under-ice topography, and waves; water property loggers for salinity, temperature, turbidity and chlorophyll; and automated sediment traps for the measurement of biogeochemical fluxes. In addition, iBO builds upon extensive time-series acquired by DFO since the 1980’s and through ArcticNet and related projects from 2002 to 2015 (e.g. Canadian Arctic Shelf Exchange Study, Industry partnership, Beaufort Regional Environmental Assessment). With the collection of multi-year observations and the integration of historical datasets, iBO will contribute to the 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) key datasets to assess sea ice and 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. Consolidating historical datasets with the knowledge generated through the iBO program will provide the basis for the production of a State of the Beaufort Sea Report.

PROPAGATION OF FLUVIAL SEDIMENT PULSES IN A GLACIAL-FED LAKE, BROOKS RANGE, ALASKA

Fortin, David, L. Thurston, E. Schiefer, D. Kaufman and N. McKay

Northern Arizona University (Flagstaff, United States)

Sedimentation in glacial-fed lakes is characterized by a strong seasonality in sediment fluxes and high accumulation rates. These two characteristics often result in the formation of laminated sediments, some of which are dominated by seasonal cycles, and are widely used to reconstruct past hydroclimatic parameters in downcore sequences. Understanding the timing and the mechanisms that deliver and disperse sediments in glacial-fed lakes is crucial to the interpretation of glacial lacustrine sedimentary archives. This project aims to better understand how river discharge, fluvial suspended-sediment concentration, and lake thermal conditions influence sediment delivery and dispersion within Lake Peters, a 7-km-long, 50-m-deep glacier-fed lake located in the Arctic National Wildlife Refuge, northeastern Brooks Range, Alaska. During the summer of 2015 at Lake Peters, we monitored fluvial input characteristics, including discharge, turbidity, suspended-sediment concentration, water temperature and conductivity, for nearly three months. In the lake, turbidity, temperature and conductivity profiles were acquired prior to and following three high-discharge events using a Troll9500 CTD. These profiles were measured daily or every other day at a sub-meter depth resolution across the lake in order to capture the spatiotemporal evolution of the suspended sediment plumes as they spread through Lake Peters. In addition, three moorings located along the long axis of the lake were equipped with water temperature sensors in order to quantify changes in the thermal structure of the lake. During the rainfall-driven, high-discharge events of June 22 and July 3, 2015, Carnivore Creek, the main tributary to Lake Peters, peaked at 26.4 and 26.7 m3/s, respectively, and suspended-sediment concentration reached 272 and 225 mg/l. Over 24 hours, the mass of sediment exported during these events totaled 194 and 257 metric tons, respectively. Both events resulted in the formation of overflows, as the river water was several degrees warmer, and therefore more buoyant than the lake water. In both cases, the sediment plume reached the distal part of the lake 5-7 days after peak flow occurred. The turbidity profiles obtained in the lake indicate that most of the sediment delivered to the lake during these events settled in the proximal basin. In 2015, over 65% of the total suspended sediment delivered to the lake from the primary inflow occurred following a single rain event on August 3. During this event, Carnivore Creek reached a peak discharge of 43 m3/s, with suspended sediment load reaching 5694 mg/l. During this event, river water temperature varied from 5 to 7°C, while the lake bottom temperature peaked at 6°C, resulting in an underflow that quickly propagated along the lake bed and then transformed a day later into an interflow as the turbidity decreased. Over a period of 24 hours, this event delivered over 5400 tons of sediments to Lake Peters, more than 20 times the mass delivered by the next largest events. These datasets highlight the spatiotemporal variability of sediment transfer patterns and the importance of high-discharge events in glacial lake sedimentation.

SENTINEL NORTH: A MAJOR TRANSDISCIPLINARY RESEARCH AND TRAINING OPPORTUNITY FOR EARLY CAREER SCIENTISTS

Fortier, Martin (1) and M.-F. Gévry (2)

(1) Sentinelle Nord (Quebec City, Canada); (2) Sentinelle Nord. Université Laval (Quebec City, Canada)

In 2015, Université Laval received $98M over 7 years from the federal government’s Canada First Research Excellence Fund (CFREF) to support its ambitious Sentinel North strategy. CFREF helps Canadian universities compete with the best in the world and implement large-scale, transformational and forward-thinking institutional strategies. With Sentinel North, Université Laval will deploy a transectoral approach, built on a convergence of strategic research areas where it assumes a national and international leadership: Arctic sciences, optic-photonics, microbiota,
cardiometabolic health and brain health. The program will support a wide range of research and training programs contributing to its objective of improving our understanding of environmental changes and of their consequences on human health in the Circumpolar North. With an objective to help train the next generation of Northern science experts, Sentinel North will invest over $20M in transdisciplinary training programs over the next 7 years. These initiatives will include a new transsectoral doctoral program at the crossroads of northern environmental studies, life sciences, and optics-photonics as well as scholarships, internships and international mobility programs. New international PhD schools and bootcamps involving international experts in all fields of Sentinel North research will also be established. We encourage all ASM participants to come and visit our Sentinel North poster to learn more about these exciting new research and training opportunities for early career northern scientists.

**EVIDENCE OF YEAR-ROUND FEEDING FOR BOWHEAD WHALES IN THE EASTERN CANADIAN ARCTIC**

**Fortune, Sarah (1), S. Ferguson (2), M. Baumgartner (3), B. LeBlanc (2) and A. Trites (1)**

(1) University of British Columbia (Vancouver, Canada);  
(2) Fisheries and Oceans Canada (Winnipeg, Canada);  
(3) Woods Hole Oceanographic Institution (Woods Hole, United States)

The Eastern-Canada and West-Greenland population of bowhead whales (Balaena mysticetus) is widely distributed throughout the Eastern Canadian Arctic (ECA) and is known to migrate seasonally in response to changing sea ice conditions (formation and melt). However, foraging behaviour of this population and the biological importance of their seasonally-occupied habitats are largely unknown. We collected long-term movement (>365 days) and dive behaviour data for 25 bowhead whales equipped with time-depth telemetry tags—and used Hierarchical Switching-State-Space Models to quantify their movements and behaviours (feeding and traveling). Overall, we found 73% (n=12,200) of the locations where the bowhead whales occurred were associated with Area Restricted Movement (ARM) that are consistent with feeding behaviour, while 13% (n=2,205) of the locations were associated with traveling and 14% (n=2,272) were unclassified behaviours. Furthermore, 66% (n=151,314) of all dives were associated area restricted movements and 89% of these dives were probable feeding dives (square and U-shaped), suggesting that the whales were feeding while engaged in area restricted movements. We also found dives indicative of feeding behaviour increased seasonally from 17% of all square-shaped dives during winter, to 13% during spring, 40% during summer and 30% during fall. Overall, our diving and Argos location data identify 6 feeding areas (Cumberland Sound, Foxe Basin, Hudson Strait and Frobisher Bay, Hudson Bay, Gulf of Boothia, and Central East Baffin Coast) and indicate that bowhead whales forage throughout the year in the Eastern Canadian Arctic.

**A PAN-CANADIAN STUDY OF OPTICAL PROPERTIES OF SOIL DISSOLVED ORGANIC MATTER IN THE ACTIVE LAYER AND PERMAFROST**

**Fouché, Julien (1), C. Christiansen (2), M. Lafrenière (1), P. Grogan (2) and S. Lamoureux (1)**

(1) Department of Geography and Planning, Queen’s University (Kingston, Canada);  
(2) Department of Biology, Queen’s University (Kingston, Canada)

Permafrost-soils store the greatest amount of terrestrial organic carbon on Earth, and 33% of the total permafrost carbon pool is within North America. Recent ground surface warming is faster in the Arctic than elsewhere on the globe, and this trend is expected to intensify in the future, leading to permafrost degradation. Ground warming and active layer thickening may increase dissolved organic matter (DOM) export to aquatic systems as well as enhancing microbial decomposition of surface and deeply stored organic matter. Although the latter’s potential for significantly increased CO2 emissions to the atmosphere is a major concern, this permafrost carbon feedback to climate change remains uncertain. In this study, which is part of the NSERC Discovery Frontiers ADAPT project, we focus on determining the chemical structure and nutrient concentrations of soil active layer and permafrost DOM in order to assess its biodegradability, and therefore its likely fate as arctic soils warm. We investigated 13 soil cores of the active layer and uppermost permafrost from 6 sites.
across the Canadian Arctic that represent the full range from isolated Sub-Arctic permafrost areas through to continuous permafrost in the High Arctic. DOM was extracted from active layer, transition zone, and upper permafrost layer samples, representing the range of organic matter substrates that will likely become available for microbial decomposition and export just after permafrost thawing. We analysed these soil extracts for dissolved organic carbon (DOC), total nitrogen (DTN) and inorganic nitrogen (DIN), and the composition of DOM was characterized using UV-Vis absorbance, fluorescence measurements and parallel factor analysis (PARAFAC). At all sites, the chemical composition of soil extracts and the optical properties of DOM varied with depth and exhibited similar vertical trends. Our results revealed that at depths of 0.75 to 2.0 m, which correspond to the transition layer and the top of the permafrost, were characterized by higher contents of DOC, DTN and DIN with fresher and less humified organic compounds than the overlying active layer and the underlying permafrost. At all sites, the proportion of aromatic organic compounds was also the largest at the top of the transition zone and decreased with depth into the permafrost. Our PARAFAC modelling showed that all soil extracts were dominated by high molecular weight humic-like components representing more than 50% of the total fluorescence. Furthermore, tyrosine-like structures were particularly common in the top of the permafrost, accounting for 40% of the total fluorescence in sites located in the discontinuous and isolated permafrost regions. This study provides unique insights into the chemical composition and biodegradability of soil active layer and permafrost DOM from diverse permafrost sites across the Canadian Arctic. Our findings suggest that soil warming and deepening of the active layer into the permafrost across Canada will consistently release substantial amounts of fresh and relatively unhumified organic compounds as well as inorganic nitrogen into the soil solution. This important pool of newly available DOM will likely be accessible for microbial decomposition, and therefore may amplify the permafrost carbon feedback to global warming.

DIURNAL EVOLUTION OF THE TEMPERATURE SENSITIVITY OF CO2 EFFLUX IN PERMAFROST-AFFECTED SOILS UNDER CONTROL AND WARM CONDITIONS

Fouché, Julien (1), C. Keller (2), M. Allard (3) and J.-P. Ambrosi (2)

(1) Department of Geography and Planning, Queen’s University (Kingston, Canada);
(2) Aix-Marseille Université, CNRS, IRD UMR 34 CEREGE (Aix en Provence, France);
(3) Centre d’Études Nordiques, Université Laval (Québec, Canada)

Cryosols contain ~40% of the global soil organic carbon. Cryosol warming and permafrost degradation may enhance the CO2 release to the atmosphere through the microbial decomposition. Despite the large carbon pool, the permafrost carbon feedback on the climate remains uncertain. In this study, we aimed at better understanding the diurnal evolution of the temperature sensitivity of CO2 efflux in Cryosols. A Histic Cryosol and a Turbic Cryosol were instrumented in tussock tundra ecosystems near Salluit (Nunavik, Canada). Open top chambers were installed during summer 2011 and the ground temperature, the soil moisture and meteorological variables were recorded hourly while the ecosystem respiration was measured three times per day every second day with opaque and closed dynamic chambers in control and warm stations. Despite warmer conditions, the average CO2 efflux at the control stations at the Histic site (1.29 ± 0.45 µmolCO2 m-2 s-1) was lower than at the Turbic site (2.30 ± 0.74 µmolCO2 m-2 s-1). The increase in CO2 efflux with warming was greater in the Histic Cryosol (~39%) than in the Turbic Cryosol (~16%). Our study showed that the temperature sensitivity of the ecosystem respiration evolved during the day and decreased with the experimental warming. Both sites exhibited diurnal hysteresis loops between CO2 efflux and the soil surface temperature. The width of hysteresis loops increased with the solar radiation and decreased along the growing season. We developed simple linear models that took into account the diurnal evolution of the temperature sensitivity of CO2 efflux and we estimated the seasonal cumulative carbon release to the atmosphere. The calculation using solely diurnal measurements significantly differed from the seasonal carbon release modelled hourly. Our study highlighted that the time of the day when measurements are performed should be taken into account to accurately estimate the seasonal carbon release from tundra ecosystems.
BANNING ENERGY DRINKS: A POLICY PROCESS IN AKLAVIK, NT

Fournier, Bonnie (1), F. Behrens (2), K. Raine (1) and K. Kushner (1)

(1) University of Alberta (Edmonton, Canada);
(2) Hamlet of Aklavik (Aklavik, Canada)

Background: Policy actions to support healthy eating and active living in Northern Canada are in their infancy. Knowing where and how to facilitate policy action can support decision makers’ ability to effectively implement policy. Better support is required in the adoption and implementation of policies that would prevent chronic disease and increase food insecurity. However, there is a dearth of knowledge on strategies to achieve this. Research Purpose: The purpose of this study was to build knowledge and capacity to support healthy eating and active living policy interventions in Aklavik, Northwest Territories. The specific objectives of the study were: to increase understanding of how to support decision makers in policy adoption and implementation; and, to develop a culturally relevant policy tool kit. Methods: An exploratory qualitative case study was used along with participatory action research. Fourteen in-depth interviews and a wisdom circle were conducted with decision makers, policy influencers and health practitioners. A Policy Readiness Tool (PRT) was used to determine the level of readiness and adapted survey questions (Raine, et al., 2012) were asked during the in-depth interviews to explore if such policies that support healthy eating and active living would be supported in their community. There were two phases: Phase 1: Assessing policy readiness and identifying policy champions; and Phase 2: Collaborative policy tool kit development. Results: The majority of interviewees did not see a role for policy to support healthy eating and active living in their community (n=11, 79%) with awareness raising or community education as the most common suggestion. However, when asked about specific policies, there were a number of policies that were viewed more positively than others. Banning the sale of energy drinks in all public buildings was a resolution that was developed in the policy tool kit and framed as a prevention strategy. The ban did not require taking away energy drinks as it was not being sold in the recreation centre. The resolution was supported by the Hamlet and subsequently adopted and implemented. Conclusion: Adopting and Implementing policy to support healthy eating and active living is a complex process. Understanding the local context facilities the framing of policy so that it will be palatable to decision makers and more likely to be adopted and implemented. Local governments have a key responsibility to protect the health of their community members. Implementing policy and raising awareness in the community about the negative health consequences of unhealthy eating and inactivity must go hand in hand to help prevent chronic diseases such as diabetes, cardiovascular disease, hypertension and certain types of cancer.

INTERACTING EFFECTS OF SNOWMELT TIMING AND CLIMATE WARMING ON ARCTIC TUNDRA PLANTS OVER THE PAST TWO DECADES

Frei, Esther R. and G.H.R. Henry

University of British Columbia (Vancouver, Canada)

Arctic regions are particularly affected by rapidly rising temperatures and altered snow fall regimes. Snowmelt timing, which determines the start of the growing season and ultimately the character of tundra plant communities, not only depends on spring temperatures but also on the amount of winter precipitation as snow. Predictions about future snowmelt timing are difficult and experimental evidence for its ecological consequences is scarce. We investigated how experimental changes in snowmelt timing and warming affect common tundra plant species in a High Arctic evergreen shrub heath community at the International Tundra Experiment (ITEX) site Alexandra Fiord on Ellesmere Island, Nunavut, Canada. A factorial experiment with passive warming, snow removal, snow addition and control treatments was established in 1995. Open-top chambers (OTCs) to passively warm vegetation remained on plots and the snow treatments were applied each year before full snowmelt had taken place. Between 2008 and 2013 only the experimental warming treatment was sustained. We examined responses to earlier and delayed snowmelt as well as experimental warming by measuring phenological, growth and reproductive traits of the four species Cassiope tetragona, Dryas integrifolia, Luzula arctica and Papaver radicatum. Early season leaf phenology was more strongly influenced by snowmelt timing than later phenological stages such as the onset of flowering and seed ripening. Experimental warming generally advanced flowering and warming effects persisted over the course of the growing season influencing other traits.
such as flower height. Our results show the importance of understanding the complex interactions between temperature and winter precipitation that drive species’ responses to climate change in the Arctic.

CONTACT BETWEEN WILDLIFE, DOMESTIC ANIMALS AND PEOPLE IN ARCTIC COMMUNITIES: IMPLICATIONS FOR DISEASE TRANSMISSION

Frenette, Marie-Christine (1), E. Avard (2), D. Bélanger (1), D. Berteaux (3), H. Déry (1), B. Ford (2), E. Jenkins (4), N. Lecomte (5), A. Massé (6), A. Simon (1), S. Suppa (2) and P. Leighton (1)

(1) Department of Pathology and Microbiology, Faculty of Veterinary Medicine, Université de Montréal, Saint-Hyacinthe J2S 2M2 (Blainville, Canada);
(2) Nunavik Research Centre, Makivik Corporation, Kuujjuaq J0M 1C0 (Kuujjuaq, Canada);
(3) Department of biology, chemistry and geography, Campus of Rimouski, Université du Québec à Rimouski, Rimouski G5L 3A1 (Rimouski, Canada);
(4) Department of Veterinary Microbiology, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon S7H 5B4 (Saskatoon, Canada);
(5) Department of biology, Campus of Moncton, Université de Moncton, Moncton E1A 3E9 (Moncton, Canada);
(6) Ministère des Forêts, de la Faune et des Parcs, Gouvernement du Québec, Québec G1S 4X4 (Québec, Canada)

Interactions at the interface between wildlife, domestic animals and humans are a major public health concern for transmission of zoonotic diseases such as rabies. In the Arctic, wildlife may enter communities in order to access food resources, increasing the risk of disease transmission to dogs and humans. The objectives of this project are 1) to characterize the possible interactions between foxes, the primary reservoir for Arctic rabies, and dogs in northern communities, and 2) to gain a better understanding of people’s knowledge and perception of rabies in Nunavik. To do so, the spatial distribution of foxes and dogs around two communities, Kuujjuaq and Inukjuak, will be quantified using a network of trail cameras active for 1-2 months, twice a year (summer and winter). In summer 2016, 34 cameras were installed in a spatial grid surrounding Kuujjuaq, and activated for one month to detect the presence and relative abundance of wildlife near the community in summer. Results showed a wide range of wildlife species in and around town: squirrels, wolves, dogs, foxes, rabbits, bears, lynx and different species of birds. Two foxes were observed during this period at cameras located close to the municipal landfill and nearby lake Stewart. The proportion of fox and dog’s photos compared to other medium-sized mammals were respectively low (9.6%) and high (83.9%). These first results suggest that contact between foxes and dogs may be infrequent during the summer, with contacts occurring primarily near the periphery of town where there are fewer people. Ongoing analyses will test the relationships between the presence/absence of animals in each grid cell and various environmental (food, water, habitat) and anthropogenic factors (dogs, food, human density). This research will continue in 2017, during which 10 foxes in each community will also be fitted with GPS collars to track their movements over time and document the contact frequency with people and dogs. In addition, 60 residents of each community will be interviewed regarding their knowledge and observations of foxes and their interactions with wildlife around the village, as well as their perception and knowledge about rabies in their community using a pre-tested questionnaire. This ongoing study will provide the first documentation of fox movements and their interactions with dogs and humans in Arctic communities. This information is critical for assessing the disease risk posed by wildlife and anticipating how risk may be altered by northern development and the rapid demographic and environmental changes affecting the Arctic.

WHAT WE DON’T UNDERSTAND ABOUT FOOD SECURITY IN THE ARCTIC: INSIGHTS AND FUTURE DIRECTIONS

Furgal, Chris (1), C. Pirkle (2), L. Teh (2), G. Muckle (3) and M. Lucas (3)

(1) Trent University (Peterborough, Canada);
(2) University of Hawai‘i at Manoa (Honolulu, United States);
(3) Centre de recherche du CHU de Québec and Université Laval (Québec City, Canada)

Since the time of the 1996 World Food Summit we have seen a significant increase in the proliferation of literature focused on food security status at various scales and in numerous countries around the world,
including Canada. This work draws attention to an issue that encapsulates how one of society’s most basic resources—food—is distributed, accessed and used. At the same time, there has been a rise in the perceived importance and significance of food security statistics and what they indicate in terms of a population’s health status and well-being. It can be argued therefore, that highly prevalent food insecurity is a measure of vulnerability and social injustice. As part of the International Polar Year, the Inuit Health Survey in Nunavut reported the highest levels of food insecurity among an Indigenous population outside of the developing world. Preliminary data from other regions suggests a situation equally or perhaps even more dire. The recent Council of Canadian Academies State of the Knowledge report on the topic of food security in Canada’s North characterised the situation as a food security ‘crisis’, an observation corroborated by the UN special rapporteur on the right to food. While there is broad recognition of the public health importance of what we understand current food insecurity prevalence estimates indicate, there are significant ongoing challenges and limitations to these measures. Critical examination of the measurement tool being used to calculate these estimates and the implications of its’ limitations in the Inuit and other contexts is lacking. A review of the application of the most commonly used household food security measurement tool in the Inuit context is particularly illustrative of key challenges faced by researchers and knowledge users engaged on this topic in the Arctic and elsewhere. Numerous activities, programs and policies in the Arctic aim at ameliorating prevalent food insecurity. These initiatives depend on accurate measurement. Our review raises important questions about food security assessment in Northern Canada, especially considerations of instrument reliability (e.g. interrater, test-retest, etc.) and validity (construct, criterion, content, etc.). It also highlights insufficient reporting of steps taken to assure good research and evaluation practice (staff training and qualifications, pre- and pilot testing, consideration of missing observations, participant non-response, etc.). Published research appears subjugated to the “tyranny of tool”; that is, efforts to quantify food security status rely nearly exclusively on an instrument developed and validated in the United States, with limited serious efforts at cultural and contextual adaptation to the Arctic. These challenges and limitations hinder understanding and ultimately development and implementation of effective actions to address and improve food insecurity in Inuit communities. Finally, their identification necessitates changes in directions forward in terms of research and action funding, content and process if we are to have accurate, reliable and valid information with which to improve a population’s access to sufficient, preferred and nutritious food.

PETROLEUM HYDROCARBONS IN BAFFIN BAY SEDIMENT AND SEA STARS

Gaden, Ashley, A. Burt, J. Ritchie, Z. Z. Kuzyk and G. Stern

University of Manitoba (Winnipeg, Canada)

With escalating marine traffic and potentially significant prospects of oil and gas development, Baffin Bay is faced with increasing risk of petroleum hydrocarbon pollution. The Arctic Monitoring and Assessment Programme (AMAP) singles out oil spills as the most serious threat to marine ecosystems, and it recommends monitoring hydrocarbon concentrations in areas of current or potential petroleum resource development. By studying the distribution, behaviour and persistence of petroleum hydrocarbons in the Arctic marine environment, we can build capacity for developing spill mitigation strategies and preparation measures. Furthermore, baseline concentrations in pristine (un-spilled) environments must be established for regulatory measures and from which to monitor change in future scenarios. We analyzed polycyclic aromatic hydrocarbons and alkanes in paired surface sediment and sea star samples collected across Baffin Bay, including the North Water and Lancaster Sound polynyas, Peel Sound and Nares Strait during the ArcticNet field campaigns of 2013-2015. In addition to establishing background concentrations for sediment benthic species, we investigated differences in bioaccumulation patterns among sea star species, representing a variety of trophic niches. Stable isotope ratios of nitrogen and carbon provided insight on food web relation and carbon source, respectively. We present preliminary findings towards establishing a baseline state of knowledge regarding petroleum hydrocarbons in the Baffin Bay marine benthic ecosystem.
GEOMORPHOLOGICAL AND ECOLOGICAL INTERACTIONS AFFECTING PERMAFROST THAW IN THE NARSAJUAQ RIVER VALLEY, NUNAVIK, CANADA

Gagnon, Samuel and M. Allard

Centre d’études nordiques / Université Laval (Québec, Canada)

The northern circumpolar region stores ~50% of the Earth’s belowground organic carbon pool in permafrost. This carbon now threatens to be released into the atmosphere due to the warming Arctic climate. Despite the growing attention the northern regions are now receiving, field studies spanning multiple decades are scarce and consequence assessments of permafrost thawing over many years remain speculative, based on numerical models or limited to observations of short duration. In order to make direct measurements, we revisited a dozen sites in the Foucault river valley near Salluit (Nunavik) that were extensively studied in 1990 and asked: 1) How did climate change affect ice wedges and other geomorphological processes over the past 25 years? 2) How did the changes in the interaction permafrost/vegetation affect ice wedge degradation and permafrost carbon content over the past decades? Since climate warming only started around 1993 in Nunavik, we have the unique opportunity of directly comparing data pre-dating climate warming with data collected 25 years later. To answer the first question, we installed during the summer 2016 a series of high-precision extensometers capable of measuring the timing of frost cracking and width variations of the open cracks over ice wedges during the winter. Although the instrumentation changed, such a technique was used in 1990 to measure ice wedge activity. We also dug out many ice wedges in order to observe how they physically changed due to climate warming. Furthermore, changes in landscape morphology will be analysed by comparing a recent high-resolution multispectral satellite image with older images. The second question will be answered using a combination of direct and indirect measurements. To determine how the active layer behaved while the climate was warming and vegetation was changing, we will compare active layer and vegetation measurements made in 1989-1990 and 2016-2017, and use a heat conduction model. To compare the changes observed in our study site to the rest of the Nunavik region, we will combine vegetation surveys and remote sensing to produce vegetation and NDVI maps. The maps will also help us determine the carbon balance in the valley. Results from the first field campaign show that the active layer thickness doubled in many of the sites since 1990. In the pits we dug, only a few ice wedges were still visible and the vast majority of frost cracks in the active layer seemed inactive as they were crossed by dense plant root systems. The melting of ice wedges left underground tunnels in sites with thick organic surface deposits. These tunnels appeared to be the precursors of erosion gullies through the collapsing of the ground when the active layer reaches into mineral deposits beneath the organic soils. Finally, larger and higher shrub populations were observed than in 1990, and mats of mosses were invading tundra polygons and ponds. We currently hypothesise that there are some feedbacks between the expanding moss cover and permafrost thaw through changing ground thermal properties, which could have protected the ground from more warming over the past decades and reduced carbon emissions.

OPPORTUNITIES FOR ADAPTING TO CLIMATE CHANGE: CASE FROM PANGNIRTUNG, NUNAVUT, CANADA

Galappaththi, Eranga

McGill University (Montreal, Canada)

What are the opportunities for adapting to the impacts of climate change? My PhD research aims to examine opportunities for adaptation to the impacts of climate change on remote indigenous fisher populations. Part of this study will be carried out in Pangnirtung in the Canadian Arctic (the other part in Sri Lanka). The research will be structured using the social-ecological resilience approach, drawing on vulnerability and adaptation scholarship. A case study approach will be developed, utilizing the primary data collection techniques of participant observation, semi-structured interviews, questionnaires, focus group discussions, and key informant interviews. Possible climate change impacts are: loss of sea-ice, reduced snow cover, ocean acidification, fish migration, and potential reduction of daily/seasonal fish catch. Potential adaptations that might be focused on based on initial work in the community are diversification of income sources such as tourism, traditional knowledge preservation, and community institutions. Potential results could provide traditional and local fisher knowledge combine with Indigenous world views for knowledge co-production. Further, youth community organizations, elders’ knowledge and role for adaptation will unfold.
SPATIAL DIFFERENCES IN FEEDING HABITS OF POLAR BEARS IN FOXE BASIN: POSSIBLE SHIFT IN ARCTIC FOOD WEB MEDIATED BY A NEW TOP PREDATOR

Galicia, Melissa (1), G. Thiemann (1), M. Dyck (2), S. Ferguson (3) and J. Higdon (4)

(1) York University (Toronto, Canada);
(2) Government of Nunavut (Igloolik, Canada);
(3) Fisheries and Oceans Canada (Winnipeg, Canada);
(4) Higdon Wildlife Consulting (Winnipeg, Canada)

Polar bears (Ursus maritimus) in regions with seasonal sea ice regimes have shown declines in body condition, reproduction, and abundance due to changes in sea ice habitat. Yet despite declines in habitat quality and availability, the Foxe Basin polar bear subpopulation has remained stable over the last 20 years. The aim of this study was to identify ecological factors contributing to population stability. We analyzed adipose tissue samples from 103 polar bears harvested in Foxe Basin during 2010-2012 and used fatty acid signature analysis to characterize individual diets. We identified spatial variation within the Foxe Basin subpopulation, where ringed seals (Pusa hispida) were the primary prey in northern and southern Foxe Basin, but harp seal (Pagophilus groenlandicus) was a key prey item in Hudson Strait. In northern Foxe Basin walrus (Odobenus rosmarus) consumption was highest and most frequent in adult male bears, likely due to the ability to capture large-bodied prey. Bowhead whale (Balaena mysticetus) consumption was found in all age classes and sexes. Bowhead carcasses from killer whale (Orcinus orca) predation and subsistence harvest may serve as a supplemental food source during periods of low food availability (e.g. the summer ice-free season). Our results suggest that dietary diversity may have contributed to population stability in the face of sea ice loss and increasing numbers of killer whales and bowhead carcasses may be indirectly contributing to polar bear foraging success. However, this indirect interaction may be temporary if continued sea ice declines ultimately limit on-ice foraging opportunities for polar bears.

PIGMENT COMPOSITION AND PHOTOPROTECTION OF ARCTIC SEA ICE ALGAE DURING SPRING

Galindo, Virginie (1), M. Gosselin (2), C.J. Mundy (1) and S. Rysgaard (1)

(1) University of Manitoba, CEOS (Winnipeg, Canada);
(2) Institut des Sciences de la Mer (ISMER) (Rimouski, Canada)

In Polar Regions, bottom ice algal communities, which are mostly composed of pennate diatoms, are submitted to a wide range of irradiance from the onset of spring until the melt period. Algae have developed a suite of photoprotective mechanisms to prevent photoinhibition and oxidative stress caused by excess or fluctuating light conditions. Changes in light conditions will be intensified in the future due to the decrease in snow and ice thicknesses, so it is essential to better understand the mechanisms employed by ice algae to photoacclimate to higher irradiances. During the 2015 Green-Edge project near Qikiqtarjuak (Davis Strait, Nunavut), we monitored the photoprotective responses of ice algae at sites of thin (< 20 cm) and thick (> 30 cm) snow cover, measuring pigment composition by high performance liquid chromatography (HPLC) and pulse amplitude modulation (PAM) fluorometry, a rapid and non-invasive method. We also experimentally investigated the photoprotective mechanisms developed by bottom ice algae in response to relatively high irradiances (i.e. xanthophyll cycle). To do so, ice algae collected under thin or thick snow covers were incubated for 3 h under four different irradiances (10, 50, 100 and 200 µmol photons m−2 s−1) and thereafter placed at low light level (< 5 µmol photons m−2 s−1) for two hours. Our results show different algal community composition (diatoms vs heterogeneous community with more flagellates) and higher photoprotection under thin snow than thick snow cover at the end of April. However, during the melting period, the photoprotection of ice algae increased but no difference was observed between snow covers. During the light experiment, the algal community was able to photoacclimate rapidly and effectively to irradiance below 200 µmol m−2 s−1, but some differences occurred depending on the ice algal community and its light history. In addition, the comparison between experiments with ice algae issued from the same snow depth (ca. 25 cm) on experiment
day but with different light history (thick snow vs thin snow with snowfalls) suggests that ice algae from thick snow were more sensitive to light than those living under thin snow before snowfall events. Thus our results suggest that the higher light photoacclimation of the ice algae is resilient during at least 2 weeks. Finally, the photoprotective responses of the ice algal communities will be discussed taking into account environmental and biological factors, such as nutrient availability and taxonomic composition.

REPLACEMENT OF MULTIYEAR SEA ICE AND CHANGES IN THE OPEN WATER SEASON DURATION IN THE BEAUFORT SEA SINCE 2004

Galley, Ryan, D. Babb and S. Rysgaard
University of Manitoba (Winnipeg, Canada)

The last decade has witnessed the nine lowest Arctic September sea ice extents in the observational record. It also forms the most recent third of the long-term trend in that record, which reached -13.4% decade^-1 in 2015. While hemispheric analyses paint a compelling picture of sea ice loss across the Arctic, the situation with multiyear ice in the Beaufort Sea is particularly dire. This study was undertaken in light of substantial changes that have occurred in the extent of summer multiyear sea ice in the Arctic inferred from the passive microwave record. To better elucidate these changes at a sub-regional scale, we use data from the Canadian Ice Service archive, the most direct observations of sea ice stage-of-development available. We also build upon the only previous sea ice climatological analysis for Canada’s western Arctic region by sea ice stage-of-development that ended in 2004. The annual evolution of sea ice by stage of development in Canada’s western Arctic changed dramatically between 1983 and 2014. The rate of these changes and their spatial prevalence were most prominent in the last decade. In summer, total sea ice loss occurred via reductions in old and first year sea ice over increasingly large areas and over more months per year. Resultant delay of thermodynamic freeze up has increased the annual open water duration in the study region. The winter sea ice cover was increasingly composed of first-year sea ice at the expense of old ice. Breakup timing has not significantly changed in the region.

ESTIMATES OF IKAITE EXPORT FROM SEA ICE TO THE UNDERLYING SEAWATER IN A SEA ICE–SEAWATER MESOCOSM

Geilfus, Nix (1), R. Galley (2), S. Rysgaard (2) and F. Wang (2)

(1) CEOS-UoM (Winnipeg, Canada);
(2) University of Manitoba (Winnipeg, Canada)

The precipitation of ikaite and its fate within sea ice is still poorly understood. We quantify temporal inorganic carbon dynamics in sea ice from initial formation to its melt in a sea ice- seawater mesocosm pool from 11 to 29 January 2013. Based on measurements of total alkalinity (TA) and total dissolved inorganic carbon (TCO2), the main processes affecting inorganic carbon dynamics within sea ice were ikaite precipitation and CO2 exchange with the atmosphere. In the underlying seawater, the dissolution of ikaite was the main process affecting inorganic carbon dynamics. Sea ice acted as an active layer, releasing CO2 to the atmosphere during the growth phase, taking up CO2 as it melted and exporting both ikaite and TCO2 into the underlying seawater during the whole experiment. Ikaite precipitation of up to 167 μmol kg^-1 within sea ice was estimated while its export and dissolution into the underlying seawater was responsible for a TA increase of 64 to 66 μmol kg^-1 in the water column. The export of TCO2 from sea ice to the water column increased the underlying seawater TCO2 by 43.5 μmol kg^-1, suggesting that almost all of the TCO2 that left the sea ice was exported to the underlying seawater. The export of ikaite from the ice to the underlying seawater was associated with brine rejection during sea ice growth, increased vertical connectivity in sea ice due to the upward percolation of seawater, and meltwater flushing during sea ice melt. Based on the change in TA in the water column around the onset of sea ice melt, more than half of the total ikaite precipitated in the ice during sea ice growth was still contained in the ice when the sea ice began to melt. Ikaite crystal dissolution in the water column kept the seawater pCO2 undersaturated with respect to the atmosphere in spite of increased salinity, TA, and TCO2 associated with sea ice growth. Results indicate that ikaite export from sea ice and its dissolution in the underlying seawater can potentially hamper the effect of oceanic acidification on the aragonite saturation state (Ωaragonite) in fall and winter in ice-covered areas, at the time when Ωaragonite is smallest.
MONITORING PERMAFROST DYNAMICS AND THE RECOVERY OF VEGETATION COVER IN RECENTLY BURNED LICHEN HEATH BOGS IN THE GREATER WAPUSK ECOSYSTEM

Genth, Leah (1), G. Ma (2), J. Rogers (2), D. LaBun (3), J. Larkin (4) and R. Brook (5)

(1) The Park School (Baltimore, United States);
(2) The Park School of Baltimore (Winnipeg, Canada);
(3) Kelvin High School (Winnipeg, Canada);
(4) Parks Canada (Churchill, Canada);
(5) University of Saskatchewan (Saskatoon, Canada)

Canada contains one quarter of all the wetlands on earth. The Hudson Bay Lowlands ecosystem comprise one of the largest continuous wetlands in the world and is mostly underlain by continuous permafrost, which is predicted to decline 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. Forest fires also play a significant role in circumboreal forests. In 2001, approximately 19% of Wapusk National Park in the Hudson Bay Lowlands was in the process of vegetative regeneration due to recent fire activity. Some models predict a 50% increase in fire activity by the end of the century, which would result in a significant net loss of carbon being stored in the permafrost due to increases in the permafrost active layer thickness. Developing a model that relates permafrost ALT to plant species recovery in burn sites could contribute to more effective, long-term, provincial and national park management strategies in the Greater Wapusk Ecosystem. This study examined a lichen heath bog (20 Km²) where approximately half of the vegetation community was burned by fire in 1999. In both the burned and unburned areas, 52-1 m² plots were sampled along 2-m intervals for two parallel 50-m transects, 10-m apart, 11 times over the last 18 years. Each sampling year, two ALT measurements were taken at each plot and percent cover of eight vegetative types (tree, shrub, herb, lichen, moss, dead vegetation, water, and un-vegetated) was estimated within each 1m² plot. Vegetation was also estimated at the species level using a grid-point method where 40 pin drops per 1m² plot were taken at 26 of the 52 plots per site. These results indicate that ALT was significantly greater (β = 0.15, t = 7.34, P < 0.001) in the burned area (depth to frost line = 41.4 ±1.18 cm) compared to the unburned lichen heath bog (depth to frost line = 37.2 + 0.60 cm).

A model including lichen cover (β = -0.09, t = 12.8, P < 0.001), moss cover (β = -0.01, t = 4.17, P < 0.001), shrub cover (β = -0.03, t = 5.55, P < 0.001), tree cover (β = -0.02, t = 6.28, P < 0.001), water cover (β = 0.01, t = 1.88, P = 0.06), and bare ground (β = 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 (66% of the observed variation). Given the opportunity to sample more burned areas throughout the Greater Wapusk Ecosystem, these results could inform an algorithm that would predict ALT from year, vegetation, and water cover and thus advise future wildlife management strategies, as well as predicting future impacts climate change.

COMMUNITY EMPOWERMENT THROUGH YOUTH TRAINING : A COLLABORATIVE BIOMONITORING OF THE GEORGE RIVER WATER QUALITY


(1) Université du Québec à Trois-Rivières et Centre d’études nordiques (Trois-Rivières, Canada);
(2) Université du Québec à Trois-Rivières (Trois-Rivières, Canada);
(3) Université de Montréal (Montréal, Canada);
(4) Hamlet of Pond Inlet (Pond Inlet, Canada);
(5) Northern village of Kangiqsualujjuaq (Kangiqsualujjuaq, Canada);
(6) Université de Grenoble-Alpes and Centre National de la Recherche Scientifique (Grenoble, France)

Indigenous communities are facing more and more environmental issues resulting from exploitation of natural resources on their territory and from climate change impacts. As for exploitation projects, risk assessment and environmental impact studies are mostly done by external consultants. This case study presents how a Science Land camp involving Youth, Elders, local experts and researchers can be used as an empowerment tool for an Inuit community to address a local environmental issue. A consultation process was initiated with the northern village of Kangiqsualujjuaq, Nunavik, with four local organizations. The community chose to set up a long term and independent water
quality monitoring program in the George River before the start of a rare earth elements mining project. A Science Land Camp was organised with a local coordinator and the collaboration of several northern-based and southern-based partners, to add to our competencies and resources. The Science Land Camp took place from July 22nd to July 29th 2016, and consisted in a party of 23 persons including eight students from 12 to 17 years old, two elders, three guides, one assistant, three cooks, one kid and five researchers. Several workshops were organized (mapping, remote sensing, GPS) and five stations were established, allowing the training of the Youth and guides to use water quality scientific equipment to safely and accurately record the data. Work at one station included site characterization, in situ measurements with manual kits and a YSI Pro probe, plus collection of water samples for further analysis in laboratories. Each station was visited and sampled two times. In addition, a macroinvertebrate station was sampled in a tributary brook. An Inuk researcher from Pond Inlet, Nunavut, who is running a water quality program in his community, joined the team to act as a mentor for the participants. It allowed the researchers to better connect with the local students and guides and to get some cultural insights. The students learned the manipulations very fast, were engaged most of the time and remembered well the protocols. Being on the land, camping together, doing hands-on activities, mixing scientific work with other activities, sharing between generations and cultures, all these factors contributed 1) to a different perception of science for the Youth and local participants; 2) to a better connection between researchers and community members; and 3) to a greater Youth’s engagement towards the protection and the monitoring of their environment in a context of major global changes taking place in the arctic regions. Upon return to the community, the elders and a guide went on air to mention how important it was to train the Youth in water quality monitoring for the protection of the river. They also talked about their pride in seeing Inuit doing Science. The data collected is currently analysed and will be presented to the community to select water quality indicators and to share results. Finally, the planning of a second edition is in progress, leaded by the community in close collaboration with several partners.

RINGED SEAL FEEDING ECOLOGY DETERMINED THROUGH LOCAL ECOLOGICAL KNOWLEDGE AND STOMACH CONTENT ANALYSIS

Ghazal, Maha (1), C. Furgal (2) and S. Ferguson (3)
(1) University of Manitoba (Pangnirtung, Canada);
(2) Indigenous and Environmental Studies Program, Trent University (Peterborough, ON, Canada);
(3) Fisheries and Oceans Canada, Freshwater Institute (Winnipeg, MB, Canada)

Hunting seals has been an integral part of Inuit culture; sustaining traditions of sharing, knowledge of the seal resource and its ecosystem, and reinforcing intergenerational links when knowledge of the environment and hunting skills are taught to young hunters by their elders. Ringed seals are a circumpolar species, capable of maintaining breathing holes in sea ice during the winter allowing them to be the most widespread and abundant marine mammal in the Canadian Arctic. They are opportunistic predators and have a varied diet of fish and invertebrates. Studies evaluating ringed seal diet in the past have found that Arctic cod, pelagic amphipods, and mysids mainly dominate the diet in the high Arctic but a shift to capelin and sand lance has been observed in the Hudson Bay region. The volume of available published work on this subject in the Canadian Arctic is very limited to date. We developed a mixed methods ringed seal feeding ecology study to more fully understand aspects of diet and foraging ecology. The study first engaged qualitative data represented by narratives gathered through semi-directed interviews with Elders and hunters. Interviews focused on Inuit knowledge of ringed seal biology and habitat use. Second, quantitative data was collected from analysis of ringed seal digestive track contents from seals collected by hunters in three Nunavut communities: Arctic Bay, Pangnirtung, and Pond Inlet. Preliminary analysis of stomach contents in one of the communities suggests that ringed seal diets have shifted to include capelin more recently. Confirmation of changes awaits further analysis of the semi-directed interviews. Understanding the feeding ecology of ringed seals 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. Most importantly, this study will help in addressing Inuit concerns regarding the use of local Inuit knowledge as a valuable component to scientific research.
A FIELD-BASED ASSESSMENT OF THE TEMPERATURE TOLERANCE OF MIGRATORY ARCTIC CHAR (SALVELINUS ALPINUS).

Gilbert, Matthew (1), J.-S. Moore (2), L. Harris (3), B. Malley (3) and A.P. Farrell (4)

(1) Department of Zoology, University of British Columbia (Vancouver, Canada);
(2) Institut de Biologie Intégrative et des Systèmes and Département de Biologie, Université Laval (Québec, Canada);
(3) Freshwater Institute, Fisheries and Oceans Canada (Winnipeg, Canada);
(4) Faculty of Land and Food Systems and Department of Zoology, University of British Columbia (Vancouver, Canada)

The maximum performance of fish hearts is limited at temperature extremes. In temperate fish this limitation can result in oxygen shortages that impair critical activities such as feeding and migration. These impairments have not been thoroughly investigated in valuable arctic fish species such as the Arctic Char, despite the rapid rate of environmental change in the north. This paucity of research persists largely due to logistical challenges associated with conducting sensitive physiological techniques in remote arctic field settings. Given these concerns we have two goals. The first is to determine the thermal tolerance of migrating Arctic Char relative to their current and prospective temperature exposures. The second is to demonstrate that we are able to conduct this detailed physiological research in the far north by using newly developed mobile research infrastructure in the Kitikmeot Region of Nunavut. To begin addressing these goals we conducted a preliminary study on the maximum heart rate of migratory Arctic Char during acute warming and cooling. Based on changes in their maximum heart rate, Arctic char captured between 10 and 13°C had reduced performance below ~4°C and above ~19°C, with the heart beat becoming arrhythmic at ~21°C. This temperature tolerance range encompasses the river temperatures migrating Arctic char would typically encounter in the Kitikmeot region. However, Arctic Char do exploit water outside of these thermal limits, which suggests that these limits likely vary between populations and with acclimatization but that some char movements in the Arctic may be thermally restricted. This research was conducted in one of three shipping containers that have been converted into mobile research laboratories by the Arctic Research Foundation. The mobile laboratory was equipped with a 450-liter temperature controlled fish holding system, physiological instruments for the measurement of heart and aerobic performance as well as other general research equipment. The lab was powered by on board wind and solar and was equipped with a backup diesel generator. The quality of our data and reliability of equipment in the mobile laboratory was similar to that in a standard laboratory setting illustrating the practicality of conducting such research in the Arctic given appropriate logistical support. Moving forward, we will utilize these mobile laboratories to investigate population level differences in aerobic performance and temperature tolerance of Arctic char relative their migratory environments. Ultimately, this research will allow us to identify areas where the performance of Arctic Char migration may be impaired, information that would be useful for management.

SEASONAL DEVELOPMENT OF SUBSURFACE FLOW PATHWAYS, HYDRAULIC GRADIENTS, AND NUTRIENT DELIVERY TO A SMALL HIGH ARCTIC RIVER

Gillman, Matt, S. Lamoureux and M. Lafrenière
Queen’s University (Kingston, Canada)

Seasonal thaw progression and changing precipitation patterns resulting from regional climate change have the potential to substantially influence Arctic hydrology. The delivery of late-season water and dissolved nutrients to surface water are controlled in part by subsurface hydraulic gradients and the presence of subsurface preferential flow pathways (PFPs). This investigation is aimed at improving our understanding of thaw and rainfall-induced hydrological processes for the delivery of nutrients to High Arctic rivers. The study was conducted on a 320 m reach of the West River at the Cape Bounty Arctic Watershed Observatory, Melville Island, Nunavut. The research objectives were: 1) obtaining longitudinal electrical conductivity and temperature data records to assess the spatiotemporal distribution of subsurface PFPs in relation to active layer thaw progression and rainfall events; 2) modelling hydraulic gradients along transects at preferential inputs and at reference transects in relation to active layer thaw progression and rainfall; 3) comparing electrical conductivity and dissolved inorganic nitrogen concentrations within subsurface PFPs, non-PFPs, and along hillslope-hyporheic-channel gradients. Results
suggest that subsurface PFPs entering the West River are unequally distributed between the east and west channel banks. The west bank shows no immediate evidence for persistent subsurface inputs, whereas the east channel bank data exhibits three persistent, spatially consistent increases in electrical conductivity which coincide with temperature decreases, suggesting preferential subsurface inputs. Hydraulic gradients were variable across transects with respect to slope orientation and response to rainfall and active layer thaw progression. Gradients adjacent to streamflow at one location sloped towards the channel, while gradients at another site sloped away from the channel. However, neither site exhibited a response to rainfall with respect to gradient orientation. By contrast, one transect on the western bank showed hydraulic gradient reversals in orientation in response to rainfall. Another location had gradients oriented towards the channel until July 20th at which point the gradient reversed away from the channel for the remainder of the study period. Finally, a last site showed no change in the nature of gradients over the season or in response to rainfall. Electrical conductivity at all transects increased over time, however, one site exhibited consistently greater values relative to the others. Furthermore, the magnitude and nature of conductivity responses to rainfall events were variable between transects and PFP outlets, as well as over time at each site. Preliminary results suggest complex interactions between channel morphology, thaw progression, and rainfall which induce heterogeneous hydraulic gradients and PFPs. Considering the influence of hydraulics on water delivery and residence time in subsurface environments, it is likely that the spatiotemporal heterogeneity evident in hydrological conditions contributes to spatial patterns of nitrogen dynamics and delivery to streamflow. The next step in this research will compare nitrogen dynamics within varying flow pathways and under varying hydraulic settings. This work will contribute to strengthening our understanding of the link between climate-induced hydrological changes and biogeochemical consequences. Filling this knowledge gap is important to maintaining water security for northern communities, as well as ecosystems conducive to healthy fisheries and wildlife.

EVALUATION OF SUSPENDED SEDIMENT SAMPLING TECHNIQUES FOR USE IN SEDIMENT FINGERPRINTING IN THE NELSON RIVER AND HUDSON BAY

Goharrokhi, Masoud (1), D. Lobb (1), P. Owens (2) and S. Clark (1)

(1) University of Manitoba (Winnipeg, Canada); (2) University of Northern British Columbia (Prince George, Canada)

Existing methods used to collect suspended sediment were evaluated for use in sediment fingerprinting in the Nelson River and Hudson Bay. Parameters considered were the ability to collect large masses of sediment over short time periods and the efficiency and selectivity of collection. Modifications to existing samplers and new samplers were designed, fabricated and tested, and were found to be significant improvements over existing suspended sediment samplers.

MONITORING THE IMPACTS OF WIND ON WATER LEVELS AT KUGMALLIT BAY, NWT

Gordon, Andrew (1), A. Gordon (1), D. Whalen (2), S. Macphee (3), J. Pascal (4), C. Owen (1), E. Amos (1) and L. Loseto (5)

(1) Aurora Research Institute (Inuvik, Canada); (2) Department of Fisheries and Oceans, Arctic Aquatic Research Division (Winnipeg, Canada); (3) Natural Resources Canada, Geological Survey of Canada–Atlantic (Dartmouth, Canada); (4) Fisheries Joint Management Committee (Inuvik, Canada); (5) Natural Resources Canada, Geological Survey of Canada–Atlantic, and Department of Geography, University of Manitoba (Winnipeg, Canada)

Over the generations elders pass on their traditional knowledge. One set of knowledge that is passed on is with the wind and its effects on water levels due to magnitude and direction. The Inuvialuit, Inuit of the Western Arctic who have harvested belugas for 1000s of years in the Mackenzie Estuary and Kugmallit Bay say if there is west winds the water levels rise at a higher rate than normal. Kugmallit Bay, located in the southeastern Beaufort and within the Mackenzie Delta Estuary is an important summer aggregation spot for beluga whale. It is also where the Tarium
Niryutiat Marine Protected Area (TN MPA) is located, the first MPA in the Arctic. To explore and understand this traditional knowledge of the local area a weather station was set up at East Whitefish before the winter ice retreated from the bay. The weather station was installed in the summer of 2015, but upgraded in 2016 to include oceanographic conditions (temperature, salinity, water depth, and waves), this coupled with air temperature, wind direction and amplitude data and a live camera feed of the area provided the basis for a scientific comparison between winds, water levels and ocean chemistry in Kugmallit Bay. Along with the physical data collection a hydrophone was also set in the same location about 400 m from shore to record beluga vocalization, ambient noise and anthropogenic noise. Periods of sustained winds (>48 hours) from the west by northwest (>20 km/hr) increase water levels in the bay. During a 4 day period in July, strong west winds averaging 42 km/hr (gusts up to 60 km/hr) caused water levels to surge to 2.2 m, measuring 1.2 m above normal level for that location. The surge of cold ocean water into the bay during ideal wind conditions also has tendency to decrease the overall temperature. The storm mentioned above, temperatures fell almost 12° in just 48 hours. The data also showed during sustained southerly winds, water levels decreased, water temperature increased and the estuary resumed normal levels and tidal fluctuations. It is believed that these warmer less stormy conditions may provide a suitable habitat for beluga whale. Another important objective of this project is to provide real-time access to the data so it can be used as a tool by the communities to check water level and weather conditions to ensure safe travels to the area. The data was uploaded hourly and could be viewed through a publically accessible webpage. (http://dataservices.campbellsci.ca/nrcan/index.php). On average the web page was viewed 5 times per day, with noticeable increases throughout the summer, which may signify when people were checking conditions more frequently prior to travel to the area. This information provides a means to relate real-time scientific observations that can be used as a tool for scientific discovery and a tool for communications. Ultimately providing information that will aid in our understanding of what environmental factors affects beluga whale presence in the TN MPA.

BENTHIC COMMUNITIES IN THE KITIKMEOT REGION

Grant, Cindy (1), P. Archambault (2), L. de Montety (1), L. Treau de Coeli (1), M. Manseau (3) and N. Ménard (3)

(1) Université du Québec à Rimouski (Rimouski, Canada);
(2) Université Laval (Québec, Canada);
(3) Parcs Canada (Gatineau, Canada)

The Canadian Archipelago, including the Kitikmeot region (Nunavut), has been identified a few years ago as the least sampled region at the pan-arctic scale for benthic communities. The main objective of this study is to describe and compare the benthic fauna biodiversity in the Kitikmeot region in relation to environmental variables. Sampling was conducted on board the CCGS Amundsen in the Kitikmeot region along the main navigation channel through Dease Strait, Victoria Strait, Franklin Strait and M’Clintock Channel. Moreover, the recent discovery of Franklin’s ship HMS Erebus in the eastern Queen Maud Gulf allowed the characterization of benthic communities on the wreck. Preliminary results showed a fairly low number of taxa in the Kitikmeot region, reaching about 100 epibenthic taxa, compared to others Canadian Arctic ecoregions. However, 71 taxa of invertebrates were found on the wreck itself which is relatively high for the Arctic and considering the small size of the wreck. Biodiversity was higher especially for species capable of living on wooden substrates. HMS Erebus may thus have played a role as an artificial reef over the last 165 years within the Kitikmeot region. These data will fulfill a major gap which was limiting drastically the available information to develop management measures of the arctic waters.

BACTERIAL DIVERSITY AND THE NATURAL ATTENUATION POTENTIAL FOR HYDROCARBONS IN THE COLD OCEAN ENVIRONMENTS OF CANADA.

Greer, Charles W.

National Research Council Canada (Ste-Anne-de-Bellevue, Canada)

The exploration and development of oil and gas resources in Canada’s Arctic and the increased marine traffic due to loss of sea ice coverage, increase the risks of oil spills and their effects on this fragile ecosystem.
To develop effective oil spill response strategies for the Arctic environment, that could consist of a mixture of seawater and sea ice, bacterial communities from several areas of the Arctic have been surveyed, with an emphasis on natural bacterial communities and their capacity to degrade petroleum hydrocarbons. These indigenous bacterial populations have been compared to their counterparts off eastern and western Canada. The surveys have been complemented with microcosm and mesocosm studies to evaluate the impact of crude oil additions and the response of the natural bacterial populations using next generation 16S rRNA gene amplicons sequencing combined with metagenomics and metatranscriptomics. Seawater and the underside of sea ice had distinct microbial population structures dominated by Bacteroidetes and Gamma- and Alpha-proteobacteria. Exposure to oil caused notable shifts in the bacterial community structure towards known oil-degrading Gammaproteobacteria, such as Alkanivorax, Marinobacter, Colwellia, Pseudoalteromonas and other Gammaproteobacteria from the orders Alteromonadales and Oceanospirillales, and these shifts were complemented by the increased expression of hydrocarbon degradation pathway genes. In microcosm and mesocosm studies oil was degraded rapidly at -1°C (more than 50% loss of alkanes in 2 weeks) indicating that the marine bacterial community is capable of responding rapidly to the presence of hydrocarbons and degradation is possible at the extremely low temperatures encountered in the Arctic Ocean in the winter months. Additional studies are needed to optimize these degradation characteristics and incorporate these into a practical oil spill response strategy suitable for the north.

THE MARINE BIOLOGICAL CARBON PUMP IN A 4-DIMENSIONAL CONTEXT

Gremion, Gwenaëlle (1), I. R. Schloss (2), P. Archambault (3), L.-P. Nadeau (1), J.-E. Tremblay (3) and D. Dumont (1)

(1) UQAR-ISMER (Rimouski, Canada);
(2) UQAR-ISMER / CONICET / Institut Antarctique Argentin (Rimouski, Canada);
(3) Université Laval (Québec, Canada)

The ocean biological carbon pump transports organic carbon produced in surface waters to the seafloor, where it can be absorbed by benthic organisms. This last process is commonly called benthopelagic coupling (BPC), and is known to influence the abundance and composition of the benthic community. The organic matter in the water column sediments at rates that depend on the size and type of particles. In polar regions such as the North Water Polynya (NOW), northern Baffin Bay, production of organic particles is well studied. The NOW is characterized by a high primary production which feeds benthic communities that are considered hotspots of biodiversity. Production is conditioned by the special atmospheric, oceanic and sea ice conditions and processes prevailing in the area. Sedimentation rate and carbon fluxes has been measured at various depths, locations and trophic size levels, but we still lack a comprehensive understanding of how it affects the BPC in a 4-dimensional environment, i.e. in space and time. Indeed, discrete field samplings do not take into account many physical processes such as advection, which is a crucial process in order to explain the BPC. To bypass this limitation, we will use a regional circulation model, based on the MITgcm (MIT general circulation model), to look at pathways of particle sedimentation, from their production in the water column until their arrival on the seafloor. First we will try to answer the following question: Does the advection scheme of the polynya constrain the sedimentation pattern? The MITgcm model will be set up to depict an idealistic model of the NOW based on the one developed by Dumont et al. (2010). This model will represent: horizontal transport, affected by currents at various scales, sea ice dynamics, meteorological features and turbulence to account for, as realistically as possible, where the particles produced in the surface waters will reach the seabed in the specific environment of the NOW. Second, we will couple this physical model to a biological model, which will consider major biological processes such as vertical migration and grazing of zooplankton, and remineralization by bacteria, known to have an influence on sedimentation. Finally, we will study of the importance of meteorological and chemical features on the production and sedimentation patterns with the aim to understand and predict how surface organic matter production and sedimentation will contribute to transform the benthic ecosystem in future climate scenarios. Dumont, D., Y. Gratton and T.E. Arbetter (2010) Modeling wind driven circulation and landfast ice-edge processes during polynya events in northern Baffin Bay, J. Phys. Oceanogr., 40, 1356-1372. doi:10.1175/2010JPO4292.1.
SEASONAL PATTERNS OF GROWTH IN RESIDENT AND ANADROMOUS ARCTIC CHARR (SALVELINUS ALPINUS L.)

Grenier, Gabrielle (1) and R. Tallman (2)

(1) Department of Biological Sciences, University of Manitoba (Winnipeg, Canada);
(2) Fisheries and Oceans Canada (Winnipeg, Canada)

Arctic Charr, Salvelinus alpinus (L.), in the Canadian Arctic demonstrate extreme phenotypic plasticity. In populations residing in open systems, where Arctic Charr have access to the sea, two morphs of the species are commonly encountered: anadromous, or sea going individuals, and freshwater resident individuals that never migrate to the marine environment. Anadromous individuals attain a larger size at maturity relative to resident individuals. Previous work has demonstrated that early life growth patterns are important when differentiating between a resident or anadromous life history in Arctic Charr. The proposed study’s goals are to: (1) determine whether seasonal growth patterns in Arctic Charr differ between resident and anadromous individuals and (2) determine if the difference is consistent throughout life. It is hypothesized that seasonal growth patterns in Arctic Charr are dependent on life-history (i.e. residency or anadromy) and that these differences are present in early life. Growth will be estimated using otolith based back-calculation. Greater knowledge of Arctic Charr biology and ecology is essential for monitoring and management purposes. Results from this study will provide insight 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.

CHALLENGES IN DEVELOPING CLIMATE SCENARIOS THAT MEET CANADIAN ARCTIC USER NEEDS

Grenier, Patrick (1), D. Chaumont (1), R. D. Brown (2), C. Barrette (3), T. Logan (1), A. Mailhot (4) and E. Diaconescu (4)

(1) Ouranos (Montréal, Canada);
(2) Environment and Climate Change Canada (Montréal, Canada);
(3) Centre d’études nordiques (Québec, Canada);
(4) INRS-ETE (Québec, Canada)

Developing climate scenarios, namely plausible future trajectories for variables like temperature, precipitation and wind, involves various methodological choices. Examples include spatial resolution, frequency, the choice of a reference product for characterizing the historical climate, the selection of climate model simulations to post-process into scenarios, and the choice of the most appropriate post-processing technique. For each project, these choices must take account of user needs and data management capabilities, inter-variable dependencies, uncertainty in future climate change projections, etc. The process is inherently subjective as alternative options often turn out to be about equally defensible. Also, choices are often not independent, e.g. choosing to work with continuous simulations archived at a 3-hour frequency may potentially conflict with fully representing uncertainty. In this presentation, typical methodological choices involved in the development of climate scenarios as well as latest post-processing improvements are illustrated through a selection of examples from projects of the current ArcticNet phase. We also discuss our concerns about inter-project consistency (e.g. using the same ensemble of simulations), which also considers that specific user needs may require solutions that do not necessarily follow established guidelines. Finally, we present and discuss the work-in-progress list of key climate change indicators for the IRIS4 update.

VOLUME AND FRESHWATER EXCHANGE INSIDE AND OUTSIDE OF THE CANADIAN ARCTIC ARCHIPELAGO

Grivault, Nathan, X. Hu and P. G. Myers

University of Alberta (Edmonton, Canada)

The Canadian Arctic Archipelago (CAA) is a complex tangle of shallow basins inter-connected by narrow and shallow straits. It is a main pathway for liquid freshwater from the Arctic to the North Atlantic. It also receives runoff from several Arctic rivers as well as glaciers localized on the islands that compose the archipelago. This study uses the coupled ocean/sea-ice numerical model NEMO with the ANHA4 regional configuration. We consider a 52 year hindcast reconstruction (1958-2009) forced by COREv2 atmospheric forcing as well as a recent-past hindcast reconstruction (2002-2015) forced with the high spatial and temporal resolution atmospheric forcing CGRF. Both experiments use the latest remapped inter-annual
runoff. We examine the volume and freshwater transport variability through the major gates out of the CAA as well as inside different sector of the archipelago (i.e. the Queen Elizabeth Islands, Parry Channel, Amundsen Gulf and around the Prince of Wales Island). We examine the relative importance of local vs large scale dynamics in driving the variability. Passive tracers are used in order to identify the impact of local runoff on the dynamics.

REFINING BEHAVIORAL INFERENCES FROM SATELLITE TAGGED SPOTTED AND BEARDED SEALS USING DIVE AND ENVIRONMENTAL VARIABLES

Gryba, Rowenna (1), B. P. Kelly (2) and F. K. Wiese (1)

(1) Stantec Consulting (Burnaby, Canada);
(2) University of Alaska Fairbanks (Monterey, CA, United States)

State space modelling is commonly used to infer marine mammal behavior based on movements, typically in the horizontal plane. Adding vertical movements and environmental variables might improve inferences, particularly when looking at behaviours such as area restricted search (ARS), which are typically linked to foraging. We explored the value of including dive metrics and environmental variables in Bayesian state space modelling to estimate behavior of three spotted and two bearded seals tracked with satellite-linked transmitters that reported location, diving behavior, salinity, temperature, and chlorophyll fluorescence. Initial estimates, using only the horizontal movement, identified several areas where predictions of area restricted search (ARS) overlapped between species in the Chukchi Sea. The addition of vertical movements, included as covariates that influence the probability of switching between ARS and transiting states, only marginally changed the estimated percent of time spent in each state, but did alter the spatial predictions where ARS occurred for bearded seals. Estimates of travelling behaviour could be distinguished from areas of ARS by the ratio of dive duration to maximal depth but not dive shape, as indicated by the time-allocated-at-depth metric.

SR AND 87SR/86SR IN THE COASTAL CORRIDOR IN SOUTHEAST HUDSON BAY

Guéguen, Céline and C. DeFrancesco
Trent University (Peterborough, Canada)

We present dissolved Sr concentrations and high resolution 87Sr/86Sr measurements, together with salinity and colored dissolved organic matter (CDOM), to evaluate origin and mixing of shelf waters in the coastal corridor in Southeast Hudson Bay. The winter surveys (2015-2016) were conducted in collaboration with Inuit and Cree from communities located in the coastal corridor. Lower surface dissolved Sr concentrations associated with high CDOM signal in the coastal corridor surface samples suggested a stronger influence of freshwater inputs compared to the bay sites. Vertical isotopic stratification was only apparent in the coastal corridor where the 87Sr/86Sr ratios decreased rapidly below 10-15m depth. The 87Sr/86Sr of deep waters (>50m depth) was comparable to that measured in the deep World’s Ocean. Together these results indicate that dissolved Sr and 87Sr/86Sr can complement traditional freshwater mixing tracers (e.g. salinity, CDOM) and provide useful insight into mixing processes in coastal Hudson Bay.

SEA ICE THICKNESS VARIABILITY IN THE BEAUFORT SEA

Haas, Christian (1), A. Bublitz (2), A. Casey (2), CC Bajish (2) and S. Hendricks (3)

(1) York University & Alfred Wegener Institute AWI (Toronto, Canada);
(2) York University (Toronto, Canada);
(3) Alfred Wegener Institute for Polar and Marine Research (Bremerhaven, Germany)

Sea ice in the Beaufort Sea has retreated strongly in recent summers, raising interest in its role for the Arctic climate and eco system, and in allowing access for shipping and offshore resources extraction both in Canada and in Alaskan waters further downstream. However, little is known about the thickness of its remaining first- and multiyear ice regimes, and the occurrence of hazardous ice features, which continue to limit the accessibility of the region for shipping and natural resource extraction. Here we present results from spring-time airborne electromagnetic ice thickness surveys performed in the Canadian Beaufort
Sea between 2007 and 2016. These were initiated as part of the Beaufort Regional Environmental Assessment (BREA), and are now continued with support of the Marine Environmental Observation Prediction and Response Network (MEOPAR) and ArcticNet, addressing Northern Marine Hazards and improved forecasting through assimilation of ice thickness information into a sea ice model. Thousands of kilometers of various first- and multiyear ice regimes were profiled. Surveys are complemented by satellite radar imagery allowing regional extrapolation of results, and the operation of air-dropped drifting buoys. Results show large regional thickness variability with bands of first-year ice in the south and east, of heavily deformed old multiyear ice further north, and of younger multiyear ice in the Canada Basin further to the Northwest. This regional variability is hard to capture with moored ice thickness echo sounders. The thickness of multiyear ice was very variable during the observation period, with modal thicknesses ranging between 3 and 4 m except in 2013 and 2014 when it was only 2 m. First-year ice thickness ranged around 2 m except in 2016, when it was only 1 m. The conditions in 2016 suggested early that summer ice retreat would be quick until all first-year ice had melted, and would slow strongly before the thick multiyear ice would disappear. We show that these conditions indeed occurred. Results also show the widespread occurrence of extreme ice features, defined as sections of sea ice at least 100 m long and 6 m thick. These occur both in the first-year ice regime, e.g. in near-shore shear zones, and in the band of the thickest multiyear ice originating from the coast of the Queen Elizabeth Islands. Few ice islands were also surveyed, revealing thicknesses of 20 to 30 m related to initial thickness upon calving, and length of drift period. These results are important for the design of policies and regulations for safe and environmentally sustainable future offshore activities.

GOING OFF, GROWING STRONG: RESULTS FROM A MIXED-METHODS PROGRAM EVALUATION TARGETING AT-RISK INUIT YOUTH


(1) Nunatsiavut/McMaster University (Dundas, Canada);
(2) Nunatsiavut Government (Nain, Canada);
(3) Nunatsiavut Government (Nain, Canada);
(4) Food First NL (Nain, Canada);
(5) Nunatsiavut Government (Nain, Canada);
(6) Inuit Circumpolar Council (Ottawa, Canada);
(7) Trent University (Peterborough, Canada)

Objectives: Our objectives are to evaluate the Aullak, Sangilivallianginnatuk, or Going Off, Growing Strong (translated to English from Labrador Inuttitut) program in Nain, Nunatsiavut. Going Off, Growing Strong (GOGS) is a land-based program drawing together professionals, stakeholders, and community members from multiple agencies to reduce suicide in Inuit youth through enhanced cultural and social connections, and traditional knowledge and skills.

Methods: Our team (the majority of whom are based at the Nain Community Freezer, which houses GOGS) has gathered summative and formative evaluation data from the youth who participate in GOGS, their family members, teachers, and youth outreach workers using qualitative and quantitative approaches. We used qualitative, semi-structured interviews to capture the program experiences of youth, family members and other community stakeholders involved with GOGS youth. Our quantitative results are currently being analyzed and will be complete prior to the ArcticNet conference. Conclusions: Through the presentation and interpretation of our mixed methods evaluation approach, we hope to share a model for outreach to youth at-risk for suicide in a northern, Inuit context, and a model for evaluating similar programs in comparable settings with few research-related resources.
FOODBORNE, WATERBORNE, AND ZOONOTIC ENTERIC DISEASE: ECOHEALTH SURVEILLANCE FOR ENVIRONMENTAL HEALTH

Harper, Sherilee (1), C. Yansouni (2), D. Goldfarb (3), A. Cunsolo (4), S. Weese (5), A. Bunce (6) and J Sargeant (6)

(1) University of Guelph (Guelph, Canada);
(2) Department of Medical Microbiology, McGill University (Montreal, Canada);
(3) Department of Pathology and Lab Medicine, University of British Columbia (Vancouver, Canada);
(4) Labrador Institute, Memorial University (Goose Bay, Canada);
(5) Department of Pathobiology, University of Guelph (Guelph, Canada);
(6) Department of Population Medicine, University of Guelph (Guelph, Canada)

Recent research uncovered the highest rates of self-reported enteric illness (i.e., diarrhea and vomiting) reported in the world to be from the Canadian North. Infectious diarrhea and vomiting can be caused by contaminated drinking water (i.e., waterborne disease), contaminated food (i.e., foodborne disease), contact with animals (i.e., pets, wildlife), or person-to-person contact. To reduce the high rates of diarrhea and vomiting in Northern Canada, we must 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 question development, study 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 data collection framework, and an overview of how a transdisciplinary team came together to conduct this research through a systems approach.

BARRIERS AND BEST PRACTICES FOR SUSTAINABLE HOUSING IN THE CANADIAN ARCTIC

Harris, Melissa (1) and A. Khachatryan (2)

(1) MA (Toronto, Canada);
(2) Associate (Toronto, Canada)

Housing affects every aspect of life, including work, education, and family, and is therefore one of the most crucial determinants of a healthy life for individuals and communities. Throughout much of the Canadian Arctic, a deep, costly and persistent housing crisis has been the norm for decades, representing a major challenge to healthy living, education, and employment opportunities. This presentation will outline key findings from a new report on barriers and best practices related to housing in the four Inuit regions of Nunatsiavut, Nunavik, Nunavut, and the Inuvialuit Settlement Regions. Information on the current housing situation will be provided, followed by an overview of the factors and barriers affecting housing delivery. Main barriers include insufficient intergovernmental cooperation, policy gaps, inadequate consideration of demographics, insufficient or inconsistent funding, high living and housing costs, lack of housing markets and trade-offs between sustainability and housing costs. Next, examples of best practices in housing programs in the Inuit regions will be provided, as well as lessons learned. Sufficient funding is one of the most important determinants of successful housing programs. Sustainable funding combining federal, provincial and territorial sources, as well as regional and local sources (where possible) can help close the housing gap in the Inuit regions. Considering the similarities between socio-economic and housing conditions in many Inuit communities, developing a long-term national Inuit housing strategy may help improve the coordination of housing provision and stimulate the growth of sustainable housing in the region.

DOES PREY DISTRIBUTION INFLUENCE NEST SITE SELECTION AND SUCCESS IN AN ARCTIC, AVIAN TOP PREDATOR?

Hawkshaw, Kevin, A. Franke and L. Foote

University of Alberta (Edmonton, Canada)

Prey abundance and distribution can be important factors in raptor reproductive success and decision-
making. My study investigated this linkage in a dense but declining population of arctic Peregrine Falcons breeding near Rankin Inlet, Nunavut over two breeding seasons. Distance sampling and density surface modelling were used to quantify the distribution of three prey guilds on the basis of environmental covariates. In 2015, all prey groups showed strong responses to elevation gradients within the study area. Shorebirds and small mammals were most often found at low elevations, while songbirds were found at low elevations and high elevations, but less often at mid elevations. Shorebirds and small mammals also showed a positive response to vegetative productivity, while small mammals and songbirds showed a positive response to rugged terrain. Generalized linear models were used to relate the density of each prey group and other site-related covariates to nest occupancy and success in the Peregrine Falcon population. Songbird density was positively correlated with the probability of site occupancy among all historical peregrine nest sites, but none of the three prey groups were correlated with the probability of successfully fledge a single nestling or with the total number of nestlings fledged. This indicates prey density may be part of the reproductive decision-making process in arctic peregrines, but did not influence rates or degrees of success among occupied nest sites in this study area. I will present additional data from the 2016 breeding season, and further stratify my prey analysis according to falcon reproductive phenology to take into account the temporal nature of prey distribution. The results of my study will contribute to current understanding of predator-prey relations in arctic Peregrine Falcons, and assist in predicting future population trends.

YOUTH PERSPECTIVES ON SEXUALLY TRANSMITTED INFECTIONS AND SEXUAL HEALTH IN NORTHERN CANADA AND IMPLICATIONS FOR PUBLIC HEALTH PRACTICE

Healey, Gwen
Qaujigiartiit Health Research Centre (Iqaluit, Canada)

OBJECTIVE: High rates of sexually transmitted infections in the Arctic have been a focus of recent research, and youth are believed to be at greatest risk of infection. Little research has focused on understanding youth perspectives on sexual health. The goal of this study was to collect the perspectives of youth in Nunavut on sexual health and relationships with the intent of informing public health practice. METHOD: This qualitative research study was conducted within an Indigenous knowledge framework with a focus on Inuit ways of knowing. Data were collected in face-to-face interviews in 3 Nunavut communities with 17 youth between the ages of 14 and 19 years. Participants were asked open-ended questions about their experiences talking about sexual health and relationships with their family, peers, teachers, or others in the community. RESULTS: There 4 key findings, which are important for public health: 1) Parents/caregivers are the preferred source of knowledge about sexual health and relationships among youth respondents; 2) Youth did not report using the internet for sexual health information; 3) Youth related sexual decision-making to the broader community context and determinants of health, such as poverty; and 4) Youth discussed sexual health in terms of desire and love, which is an aspect of sexual health often omitted from the discourse. IMPLICATIONS AND CONTRIBUTION: The youth in this study articulated perspectives on sexual health, which are largely neglected in current public health practice in the North. The findings from this study underscore the important role of community-led participatory research in contributing to our understanding of the public health challenges in our communities today, and provide direction for future interventions and research.

APPLYING INDIGENOUS ANALYTICAL APPROACHES TO FIND ANSWERS TO A PUBLIC HEALTH QUESTION: A REFLECTION ON UNIKKAQATIGIINIQ (STORYTELLING) AND SANANIQ (CRAFTING)

Healey, Gwen
Qaujigiartiit Health Research Cen. (Iqaluit, Canada)

INTRODUCTION: Indigenous scholars have shifted the discourse away from simply negotiating respectful relationships with indigenous communities, to the development and implementation of methods that originate from Indigenous epistemology and worldviews, instead of, for example, hermeneutic and/or Eurocentric worldviews. In this article, a reflection on the experience of analyzing and interpreting stories is shared. METHOD: stories were analyzed and interpreted through a story and text-based narrative technique, Unikkaqatiginiq, and through an immersive crafting analytical experience Sananiq.
FINDINGS DISCUSSION: The processes were not mutually exclusive analytical processes; they built on each other and fed into each other in different ways permitting layered interpretations of the phenomena. Crafting and storytelling are important aspects of life for Indigenous peoples the world over. They can be the root of a cathartic experience to convey the reality of loss, grief, and traumatic grief or stress in Indigenous communities. Digital storytelling, re-storying, sewing/beading, crafting/art-making are all methods which are being promoted in indigenous communities, and increasingly recognized for their value in academia. Crafting and storytelling are a powerful and influential way to challenge the mind and plant new thoughts, to document history and experiences, to transform our understanding “surprising our consciousness into a new way of seeing” (Dion Buffalo, 1990, p. 120). Such methods are an essential contribution to our understanding of public health and the knowledge that can help move our communities forward in achieving wellness.

THE ARCTIC SEA ICE EDUCATIONAL PACKAGE: CULTURALLY RELEVANT CURRICULUM FOR NORTHERN SCHOOLS

Heath, Joel and E. Warner

The Arctic Eider Society (St. John’s, Canada)

The Arctic Sea Ice Education Package consists of 3 units that will bring the mysteries of Arctic sea ice ecosystems into your classroom and Arctic science to life in culturally relevant ways. Integrated with the Arctic Eider Society’s new Interactive Knowledge Mapping Platform (IKMAP) and available in print, eBook and online interactive formats, students will be able to apply hands on learning techniques using data collected by hunters, scientists and community based researchers across the Arctic. Students will be able to use interactive maps to interpret recent research results, explore ecosystems interactively using the first ever google street view of remote sea ice habitats, watch high definition time lapse and videos of sea ice dynamics and wildlife including seabirds diving to the ocean floor hunting for food, and be guided through a day in the life of arctic hunters and community based researchers. Designed for students in northern classrooms, these lessons address core curricular objectives in a culturally relevant context and can be adapted to the needs of any classroom. The project is being conducted in collaboration with the Kativik School Board and Esuma, ensuring lesson plans will be a direct component of curriculum in Nunavik schools, and learning outcomes will be cross referenced for use in other regions of the north and south. The presentation will outline the content of the educational package, supporting multi-media and interactive content, prescribed learning outcomes.

THE HUDSON BAY CONSORTIUM: ENVIRONMENTAL STEWARDSHIP FOR THE GREATER HUDSON BAY/JAMES BAY REGION

Heath, Joel and L. Arragutainaq

The Arctic Eider Society (St. John’s, Canada)

Stewardship and integrated management in Hudson Bay has been drifting due in part to inter-jurisdictional challenges of research, governance and assessing cumulative impacts of environmental change and development projects that cross jurisdictional boundaries in the greater Hudson Bay region. Despite being critical habitat for wildlife and having huge importance for economic development, Hudson Bay remains one of the least funded and understudied regions of Canada and one of the few still lacking an integrated governance structure. The necessity of forming an inter-jurisdictional consortium for research and environmental governance in Hudson Bay has arisen many times but has yet to be addressed. Most recently, this was outlined by both Provincial and Federal review panels in Condition 8.1 of the Certificate of Authorization for the Rupert River Eastmain 1-A Hydroelectric project in northern Quebec. This Condition and series of Recommendations indicated that a consortium for Hudson Bay be formed based on a structure akin to the International Joint Commission (IJC); that primary responsibilities fall to the various government agencies involved (i.e., Federal, Quebec, Ontario, Manitoba, and Nunavut, as well as Nunavik and the Eeyou Marine Region); and that it would include significant participation by industry, academic researchers and communities, with an emphasis on including Traditional Knowledge in the process. In December 2014, more than 100 participants met in Ottawa for a planning workshop on environmental stewardship. We identified the need to for better collaboration and communication to work together to address common goals and concerns. To that end,
participants agreed in principle to the formation of a Hudson Bay Consortium to provide networking, coordination, advocacy, and environmental governance for the Hudson Bay Region. While respecting existing jurisdictional boundaries, and with support of members, the Consortium steering committee would work to identify common issues and concerns across the Bay, develop an overarching vision for environmental stewardship, and develop a research agenda for the study of cumulative effects on the Hudson Bay ecosystem. Since the initial planning meeting in December 2014, a planning Steering Committee and planning Secretariat have been formed to begin the process of collaboratively creating the consortium in collaboration with stakeholders. A stepwise inclusive approach is being taken, with efforts in West Hudson Bay building on ongoing Roundtable meetings in West Hudson Bay and a new East Hudson Bay/James Bay Regional Roundtable beginning in Nov 2016. The presentation will provide an update on progress and momentum to-date and identify the next steps for formally creating the Hudson Bay Consortium and developing environmental stewardship for the greater Hudson Bay region.

BENTHIC COMMUNITY STRUCTURE AND HABITAT MAPPING IN FROBISHER BAY: LONG-TERM ECOLOGY IN A SUB-ARCTIC COASTAL BAY

Herder, Erin (1), A. Aitken (2) and E. Edinger (1)

(1) Memorial University (St. John’s, Canada);
(2) University of Saskatchewan (Saskatoon, Canada)

Over the next decade, Arctic coastal regions are expected to be among the most heavily impacted environments due to the effects of changing climate conditions, and the marine environment in particular is under tremendous pressure as a result of increased anthropogenic activities. Unfortunately, long-term ecology studies that allow measurement of resulting changes in the Arctic are rare. Inner Frobisher Bay provides a unique opportunity to improve our understanding of changes occurring to marine benthic communities over a prolonged period of time. Iqaluit, NU, a rapidly expanding coastal city near Frobisher Bay has experienced a steady increase in population growth, expanding commercial and subsistence fisheries, increases in marine traffic, and added infrastructure development including a proposed new deep-water Port in Iqaluit. We are comparing benthic grab and dredge sample data collected in coastal waters near Iqaluit by the Arctic Biological Station between 1967 and 1976 with samples collected between 2015 and 2017, approximately 50 years later, at the same sites to better understand long-term changes to benthic species diversity, abundance, and overall community structure, and how these changes could be related to climate warming and anthropogenic activities in this region. Benthic grab samples were collected at known slope failure sites within inner Frobisher Bay to compare and identify differences in benthic community structure related to natural seabed disturbances. Drop-video transects collected at long-term ecology and slope failure study sites will be combined with benthic grab data to produce fine scale benthic habitat maps to reveal spatial trends occurring in the benthos on a small (10’s to 100s of meters) and large (100’s to 1000’s of meters) scale which could help inform conservation plans to restore biodiversity. To date, benthic grab samples have been collected at five long-term ecology sites in 2015 and two long-term ecology and six slope-failure sites in 2016, with extensive additional sampling planned for October 2016. Sediment samples appear heterogeneous, consisting of gravel, sand and mud. Initial observations of benthic infaunal species composition at long-term ecology and slope-failure sites include the presence of barnacles, Hiattella sp., tubiculous polychaetes including maldanid polychaete worms, and bivalves including Thyasira sp. Epifauna collected in box core samples in 2016 include ophiuroid echinoderms, sea spiders (Pycnogonida sp.), and the amphipod Arcturus sp. Agassiz trawl and towed video samples collected near long-term ecology and slope-failure sites identified crinoids, erect tunicates, ascidians, euphasid crustaceans, bryozoans, sponges, ophiuroids, bivalves, gastropods, amphipods, fish species including Lycodes esmarki, soft corals, and other taxa. Initial video observations of the benthos at slope failure sites suggest a reduced abundance and diversity of fauna compared to adjacent areas off slope failures, but this has yet to be quantified through benthic grab samples. Marine benthic habitats are some of the richest habitats in the Arctic, but are also sensitive to disturbance and may be slow to recover. Long-term ecological studies are imperative to our understanding of sub-arctic marine ecosystems and will greatly aid in our ability to identify ecosystem change over time in the Arctic.
THROUGH A CHILD’S EYES: HOW VISUAL MEDIA CAN BE USED TO ENGAGE NORTHERN ABORIGINAL YOUTH IN KNOWLEDGE EXCHANGE ACTIVITIES FOR COMMUNITY-DRIVEN HEALTH RESEARCH.

Highet, Megan, A. Colquhoun, K. Goodman
University of Alberta (Edmonton, Canada)

The Canadian North Helicobacter pylori (CANHelp) Working Group conducts community-driven research aimed at exploring concerns about health risks resulting from the elevated prevalence of H. pylori infection in northern Canadian communities. Here, we discuss two separate projects aimed at integrating the views of youth into our wider research program through visual research methods. These projects were developed in collaboration with the Fort McPherson H. pylori Project planning committee, whose members expressed a preference for research that offers opportunities for youth to both participate in research and benefit from capacity building associated with projects being carried out within their community (Fort McPherson, NWT). The first project engaged youth in a contest to design a project logo to represent the Fort McPherson H. pylori Project. These drawings have been analyzed as primary data sources to provide previously inaccessible insight into young children’s perspectives regarding the impact of H. pylori infection within their community. The second project engaged junior high and high school students in a photovoice activity to explore their understandings of community concerns surrounding the impact of H. pylori infection on the lives of local residents. Considered together, these projects provide valuable data regarding social and cultural dimensions of H. pylori infection from the perspectives of Fort McPherson youth. There is a notable shortage of research aimed at addressing youths’ views on topics pertaining to community health in general, especially in the context of northern Aboriginal populations. We maintain that this under-representation stems from a number of misconceptions surrounding the nature of the challenges associated with engaging youth in participatory research. This research highlights both the successful outcomes and important benefits of engaging youth in community-driven health research, which carries societal, administrative, and scientific expectations that research will occur in a manner that is both culturally appropriate and personally relevant.

AUTOMATED LAKE ICE/WATER CLASSIFICATION OF DUAL POLARIZATION SAR IMAGERY WITH THE ITERATIVE REGION GROWING USING SEMANTICS ALGORITHM

Hoekstra, Marie, D. Clausi, J. Wang, M. Stone, L. Xu and C. Duguay
University of Waterloo (Kitchener, Canada)

Changes to the timing and duration of ice cover on lakes throughout the northern landscape has been established as a strong indicator of climate change and variability, which is expected to have implications for both human and environmental systems. In addition, monitoring the extent and timing of ice cover is also required to allow for safe passage for ships through the Laurentian Great Lakes, and more reliable weather forecasting across lake-rich northern latitudes. With its all-weather, day-and-night sensing capabilities, high spatial resolution, and large area coverage, satellite synthetic aperture radar (SAR) sensors are well suited for ice monitoring. Currently the Canadian Ice Service (CIS) monitors over 130 lakes using RADARSAT-2 SAR and optical imagery. These images are visually interpreted, with lake ice cover reported in a daily ice chart for the Great Lakes, and weekly as a fraction out of ten for all other lakes. An automated method of classifying ice and water in SAR scenes would allow for more detailed records of lake ice extent and ice distribution to be delivered operationally, as well as archived for research purposes. The Vision and Image Processing lab at University of Waterloo has developed a software system called MAGIC (MAp Guided Ice Classification) which allows for automated classification of SAR scenes. This tool offers the Iterative Region Growing using Semantics (IRGS) algorithm which has been successfully tested in the classification of SAR scenes of sea ice with up to 96% accuracy, and is under consideration for operational use. The IRGS algorithm separates homogeneous regions in an image using a hierarchical watershed approach, then merges like regions into classes. These classes are labeled using a support vector machine classifier, employing SAR gray-level co-occurrence backscatter and texture features. In this study, we have used the MAGIC system to classify ice and water in dual-polarization Sentenel-1a scenes of Lake Erie and RADARSAT-2 scenes of Lake Winnipeg. An accuracy assessment has been performed on the classification results, comparing outcomes from MAGIC with user generated reference data, as well as Great Lakes ice charts and/or the CIS fraction reported.
at the time of image acquisition. The results demonstrate
the potential of the MAGIC system to quickly and
accurately provide detailed lake ice cover information
for researchers, government, and industry alike.

REGIONAL INDICATORS FOR MARINE
MONITORING IN THE INUVIALUIT
SETTLEMENT REGION

Hoover, Carie (1), S. MacPhee (2), K. Hynes (3) and L.
Loseto (2)

(1) University of Manitoba (Winnipeg, Canada);
(2) Fisheries and Oceans Canada (Winnipeg, Canada);
(3) Fisheries Joint Management Committee (Inuvik,
Canada)

Indicators are becoming widely used in resource
management in order to capture changes in the
environment. The rapid pace at which Arctic ecosystems
are changing requires effective indicators to allow
management to engage responses when thresholds
are crossed. However, in practice many indicators
(proposed or in-use) have not been verified to ensure
they meet the original goals of management. The
overarching objective of this project is to bring together
indicators from multiple sources, along with multi-
stakeholder perspectives, to provide a comprehensive
evaluation of indicators to meet the goals of managing
agencies. The current focus of the research is a
comprehensive database of marine indicators in the
Inuvialuit Settlement Region. The preliminary database
has over 800 entries across ecological, social, and
economic datasets. We highlight the diversity and
provide an overview on the type and quality of datasets
currently being used using metrics such as length of
datasets, quality of data, availability, along with other
metrics. The completed database will be evaluated
against a previously completed comprehensive set of
regional management goals. This will ultimately allow
for effective indicators to be selected for monitoring
at the regional scale that suit the needs of multiple
co-management agencies. This research is part of
ArcticNet Project 1.8: Knowledge Co-Production for the
Identification and Selection of Ecological, Social, and
Economic Indicators for the Beaufort Sea.

BELUGA WHALE HABITAT SELECTION IN THE
OFFSHORE BEAUFORT SEA DURING LATE-
SUMMER 2007-2009

Hornby, Claire (1), J. Iacozza (2), C. Hoover (2), D.
Barber (1) and L. Loseto (3)

(1) Centre for Earth Observation Science (Winnipeg,
Canada);
(2) University of Manitoba (Winnipeg, Canada);
(3) Fisheries and Oceans Canada (Winnipeg, Canada)

The eastern Beaufort Sea stock of beluga whales
(Delphinapterus leucas) has a strong association with
estuarine habitats in the summer, but in the late summer
is observed moving into offshore waters. Little is
known about beluga use of offshore habitats, foraging
behaviour, and variables influencing these distribution
patterns. To enhance knowledge of Beaufort Sea
beluga habitat selection a resource selection function
(RSF) model was used to determine the influence of
environmental variables (chlorophyll a, sea surface
temperature, bathymetry, and distance from shore)
on the distribution of beluga in the offshore. Beluga
locations were collected by systematic aerial surveys
in August 2007-09, and offshore distributions were
observed to occur widely and randomly. Varied climatic
conditions were observed in all three years, with a
notable increase in regional sea surface temperatures
in 2007 and 2008. Despite this, beluga selected areas
with warmer sea surface temperatures (above 6°C) in all
years and appear to be attracted to higher chlorophyll
concentrations. Beluga were commonly found within
0-120 km from shore, with high-use areas along the
Mackenzie Shelf in waters 100-500 m deep, and
nearshore waters 0-50 m offshore of the Tuktoyaktuk
Peninsula and Mackenzie Estuary. The shelf region
has been identified as an important habitat supporting
principal prey species, Arctic cod (Boreogadus saida).
Similarities in habitat use among years suggest that
Beaufort Sea beluga whales may be adapting to changes
in the marine environment. Yet, anticipating future
beluga habitat selection is complex as oceanographic
conditions, resources, and resulting species distributions
can shift.
BUILDING STUDENT OPPORTUNITIES INTO APPLIED HYDROLOGY RESEARCH IN THE YUKON RIVER BASIN

Horton, Brian (1), J. Samuel (1), B. Benkert (1), J. Kavanaugh (2)

(1) Northern Climate ExChange, Yukon Research Centre, Yukon College (Whitehorse, Canada); (2) Department of Earth and Atmospheric Sciences, University of Alberta; Adjunct Professor, Yukon College (Edmonton, Canada)

Northern Climate ExChange (NCE), part of the Yukon Research Centre at Yukon College has led applied research projects all across Yukon, and into Northwest Territories and Nunavut. In 2011-2012, NCE initiated a project in collaboration with the Yukon Energy Corporation that is investigating climate change impacts on the timing and volume of flow in the headwaters of the Yukon River. In delivering this project, NCE has experimented with a number of novel ways to involve college students in the applied research. The students at the Yukon College span many levels of education – ranging from upgrading to earn high school diplomas through to obtaining bachelor’s degrees that are granted in collaboration with universities. Despite this range in skills and abilities, students from many backgrounds have been able to gain valuable practical field experience, class credit, and employment. For two summers, students were offered sponsored opportunities to join the Juneau Icefield Research Program, an unrivaled experiential education experience that attracts students from all around the world. In the classroom, data from the applied research was provided directly to students who were able to practice basic statistical methods and gain experience using raw data from a real-world setting. Other students gained summer work experience and course credit in independent studies. This variety of experiences was not without its challenges. This presentation will review the opportunities that this applied research project provided to students, and will describe the lessons learned that may help other researchers engage northern organizations and assist in the development of capacity of northern students. This project was funded by the Natural Sciences and Engineering Research Council of Canada Applied Research and Development program with matching funding from Yukon Energy Corporation.

SPATIAL AND TEMPORAL TRENDS OF POLYCHLORINATED NAPHTHALENES (PCNS) IN RINGED SEALS (PHOCA HISPIDA) FROM THE CANADIAN ARCTIC

Houde, Magali (1), X. Wang (1), S. Ferguson (2), G. Thiemann (3) and D.C.G. Muir (1)

(1) Environnement et Changement Climatique Canada (Montréal, Canada); (2) Fisheries and Oceans Canada (Winnipeg, Canada); (3) York University (York, Canada)

The production and use of polychlorinated naphthalenes (PCNs) stopped in the 1970/80s. PCNs now remain in old products such as capacitor fluids, engine oil additives, and electrical insulators and current PCN emissions are mainly as by-products of combustion such as waste incineration and production from coal. PCNs are widespread environmental contaminants that have been reported in air samples and marine mammal tissues from the Arctic although spatial and temporal data are much more limited compared to other persistent organic pollutants. The main objective of this research was to investigate the presence and the temporal trends of PCNs in ringed seals from the across the Canadian Arctic. Ringed seal blubber samples were collected by hunters in the communities of Sachs Harbour, Resolute Bay, Arviat and Nain between 2011 and 2015 and analyzed for 68 PCNs by Gas Chromatography-Hi Resolution Mass Spectrometry (GC-HRMS). Geometric mean concentrations of ΣPCNs ranged from 0.36 to 5.6 ng/g of lipid weight across sampling locations, with the lowest levels recorded in seals from Arviat, NU and Nain, NL. The higher concentrations in seals from the Arctic archipelago, and lower levels in samples from Hudson Bay and Labrador, suggest the influence of Asian contamination sources. Tetra- and pentachloro-PCN congeners predominated, representing up to 89% of ΣPCN. Mean concentrations declined at all sites through time. Mean concentrations are about 10-times higher than for the same locations sampled over the period 2000-2010. The previous PCN data were determined by low-resolution mass spectrometry and were based on fewer congeners which may explain the lowest levels reported. PCNs are more prominent contaminants in Canadian Arctic seals than previously determined based on new results using improved analytical techniques.
CHARACTERISING THE IMPACT OF THAW-INDUCED WETLAND EXPANSION ON THE WATER BALANCE OF A BOREAL FOREST-WETLAND LANDSCAPE IN THE SPORADIC PERMAFROST ZONE

Hould Gosselin, Gabriel (1), R. Connon (2), M. Helbig (3), E. Haughton (2), K. Wischnewski (4), J. Hanisch (4), T. Moore (5), W. Quinton (2) and O. Sonnentag (4)

(1) Université de Montréal (Montréal, Canada); (2) Wilfrid Laurier University (Waterloo, Canada); (3) Université de Montréal / Centre d’études nordiques (CEN) (Montréal, Canada); (4) Université de Montréal (Montréal, Canada); (5) McGill University (Montréal, Canada)

Warming air temperatures in northwestern North America induce rapid permafrost thaw and the expansion of permafrost-free wetlands at the expense of boreal forests in the low-lying areas along the southern limit of permafrost. The thaw-induced land cover change leads to fundamental changes in different watershed-scale water balance, but the direction and magnitude of these changes remain uncertain. Here, we aim to characterize changes in runoff, storage and evapotranspiration as influenced by rapid permafrost thaw for the Scotty Creek watershed near Fort Simpson, NT. The southern portion of Scotty Creek is dominated by forested peat plateaus with shallow and thin permafrost (“forest”) and by permafrost-free wetlands (“wetland”). Using three years of nested eddy covariance and hydrological measurements (2014-2016) from three small catchments, “East” (0.095 km2), “West” (0.105 km2) and “South” (0.100 km2), with contrasting wetland-to-forest ratios (East: 0.6; West: 1.1; South: 1.2), we demonstrate that with increased wetland-to-forest ratio, peak runoff during snowmelt decreases, growing season latent heat flux increases, and increased wetland water storage sustains increased catchment runoff throughout the growing season. These substantial thaw-induced changes in water balance components may have important biogeochemical implications by potentially altering the rate of dissolved organic carbon (DOC) production, its “quality” and potential for biodegradation, and hydrologic pathways, thus altering DOC export through boreal forest watersheds along the southern limit of permafrost.

THE ROLE OF COMMUNITY BASED MONITORING AND CITIZEN SCIENCE IN EARLY DETECTION OF NONINDIGENOUS SPECIES IN THE CANADIAN ARCTIC

Howland, Kimberly

Fisheries and Oceans Canada (Winnipeg, Canada)

Although species introductions in the Canadian Arctic have been limited, climate driven warming and reductions in sea ice, together with associated increases in ship traffic are expected to make this region more vulnerable to introductions of non-indigenous temperate organisms, including high risk invasive species. An important component in early detection of non-indigenous species is the establishment of a system for regular standardized monitoring. There is currently no program for monitoring non-indigenous species and shifts in coastal biodiversity in at higher risk port sites of the Canadian Arctic. Given travel costs and logistics of sampling in this region, the most cost-effective approach to regular monitoring at these locations involves development of user-friendly, standardized sampling approaches and training/engagement at the community level. As part of a recently initiated project, Fisheries and Oceans Canada and university partners are providing training to local community members and permanently stationed northern research staff in port survey collection methods and environmental DNA sampling techniques. In 2015 and 2016, hands on training was provided in the communities of Churchill, MB, Iqaluit, NU and Salluit, QC; further training is planned for communities in the Milne Inlet area of Nunavut in 2017. This training is intended to facilitate the development of long-term collaborations with northern communities and a larger more cost-effective network for future non-indigenous species and biodiversity monitoring. Early detection may be further strengthened through citizen-science which is an ideal complement to standardized monitoring. Citizens tend to be on the land, hunting, fishing and hiking on a more regular basis so have a greater likelihood of observing new and unusual species, or changes in the environment. This presentation will provide examples of non-indigenous species in other regions that have been first detected by citizens and introduce tools for reporting local observations including the Circumpolar Local Environment Observing Network (CLEO).
SIMULATED SEA ICE GROWTH IN THE CANADIAN ARCTIC ARCHIPELAGO REGION: ROUND II

Hu, Xianmin, J. Sun, T. Chan, C. Pennelly and P. G. Myers
University of Alberta (Edmonton, Canada)

The Canadian Arctic Archipelago (CAA) is the largest shallow-water area in the Northern Hemisphere which is covered in sea ice, though it is poorly observed and studied due to its complicated coastline and harsh weather. Understanding the sea ice state and growth mechanism is of importance, not only for climate, ocean and other natural environment related science, but in terms of a potential future shipping route through the Northwest Passage (NWP). We present our updated sea ice simulations using ANHA (Arctic and Northern Hemisphere Atlantic, NEMO based regional configuration) at horizontal resolutions of 1/4 degree (ANHA4) and 1/12 degree (ANHA12), respectively. High temporal (hourly) and spatial (33km) resolution atmospheric forcings (CGRF) provided by Canadian Meteorological Center (CMC) global deterministic prediction system (GDPS) are used to drive the base simulations. Both site observed ice thickness and products from GLORYS2v3, which has data assimilation, are used to evaluate our simulated ice thickness. We also carried out a 1/4 degree simulation driven with the CORE-II inter-annual atmospheric forcings to study the ice thickness and its growth (thermodynamic component and dynamic component) sensitivities to surface fields from each atmospheric dataset. Taking advantage of the high temporal resolution of CGRF forcing fields, we study the sea ice growth process up to an hourly time scale.

GENICE: MICROBIAL GENOMICS FOR OIL SPILL PREPAREDNESS IN CANADA’S ARCTIC MARINE ENVIRONMENT

Hubert, Casey (1), Gary Stern (2)

(1) University of Calgary (Calgary, Canada); (2) University of Manitoba (Winnipeg, Canada)

Reduced sea ice cover and ice-free summers have led to major increases in shipping traffic through the Northwest Passage. This activity brings increased risks of accidental releases of diesel or bunker fuel and other transportation related contaminants in to the Arctic marine environment. Climate change has also focused attention on Arctic oil exploration and attendant fears of an oil spill in the Arctic Ocean. Significant oil reserves are estimated to exist in the Arctic, yet recent decisions by major oil producers signal that drilling in the Canadian Arctic is at least a decade away. This hiatus in offshore petroleum exploration and production in the Canadian Arctic offers scientists an important window of opportunity to develop emergency preparedness plans in case this activity recommences, and that will be immediately applicable to shipping related spill risks. In this context a new research collaboration between University researchers in Calgary, Manitoba and McGill, together with international partners, will employ microbial genomics to generate credible, science-based knowledge on the role and potential of bioremediation – the biodegradation of oil by naturally occurring microorganisms. Marine microbial communities are nature’s ‘first responders’ in the event of a marine oil spill, yet little is known about this potential mitigation approach in the cold ice-laden Arctic marine environment. The ‘GENICE’ project will deliver new environmental baselines using microbial genomics, provide bioremediation viability case studies and demonstrations for cold and icy Arctic marine habitats, and enable dynamic mapping of risks and mitigation potential in regions of interest using microbial genomic biomarkers. These outcomes will interface with the complex milieu of economic policy development and learning around emergency preparedness and oil spill response in Canada’s Arctic waters. Ongoing engagement and interactive exchange of knowledge between scientists and different end-user groups will include residents of potentially affected northern communities, different levels of government including regulatory agencies, non-governmental and Indigenous organizations, and the private sector.

LANDSCAPE GENETICS OF RINGED SEALS (Pusa hispida) IN THE CANADIAN ARCTIC

Hudson, Justine (1), L. Johnson (2), C.-J. Breiter (2), K. Ritchie (3), A. Rosing-Asvid (4), S. Ferguson (5) and S. Petersen (2)

(1) Department of Biology, University of Winnipeg (Winnipeg, Canada); (2) Conservation and Research Department, Assiniboine Park Zoo (Winnipeg, Canada); (3) Department of Biological Sciences, University of

101
Manitoba (Winnipeg, Canada);
(4) Greenland Institute of Natural Resources (Nuuk, Denmark);
(5) Department of Fisheries and Oceans (Winnipeg, Canada)

Ringed seals (Pusa hispida) are an important species in Arctic food webs yet relatively few studies have examined their landscape genetics in the Canadian Arctic. Landscape genetics allows us to identify regions of gene flow restriction by combining genetic analysis with habitat or geographical features. I sampled seals from 18 locations across the Canadian Arctic and used genetic profiles built with 12 microsatellite loci to compare gene flow among locations. I used four isolation-by-distance (IBD) models and one isolation-by-resistance (IBR) model in a landscape genetic framework to infer how gene flow occurs in this environment. The IBD models were: straight line, least-cost path by sea, least-cost path using bathymetry, and least-cost path using summer median ice. For the least cost by sea and bathymetry models, a higher cost was assigned to cells based on water depth (deeper = higher cost) and ice cover (perennial ice = high cost), respectively. The IBR model correlated geography with landscape resistance (more resistance to gene flow across dispersal choke points). My results indicated that genetic differentiation among locations was low (FST 0.008-0.030) suggesting high levels of gene flow in ringed seals across the Canadian range. I observed that within the IBD models the least-cost paths were slightly better at modeling gene flow (R2 = 0.0209-0.0390, P = 0.015-0.042) than the null model (R2 = 0.0208). The distances calculated using the least-cost path by sea had the highest correlation with genetic distance (R2 = 0.0385, P = 0.015). This suggests that bathymetry and seasonal sea ice may not represent a significant barrier to movement for ringed seals. The IBR analysis highlighted several areas of resistance that could be identified in management plans to maintain gene flow.

HIGH-SPATIAL-RESOLUTION OCEANOGRAPHY OF THE CENTRAL CANADIAN ARCTIC ARCHIPELAGO

Hughes, Kenneth and J. Klymak

University of Victoria (Victoria, Canada)

A survey to map turbulent structures, determine the locations of strong property fronts, and evaluate vertical mixing rates in the central Canadian Archipelago was undertaken in late September 2015. This region is known to host waters from widely separated areas such as Baffin Bay and the Beaufort Sea. 1100 vertical temperature and salinity profiles with typical spatial separations of one kilometre or less were recorded in Wellington Channel and Penny Strait. Strong differences in water mass properties at each end of a 200 km along-channel transect were separated by an abrupt transition above shallow sills north of Cornwallis Island. Five repeat transects over this transition were consequently undertaken. Downstream of the sills, isopycnal displacements of 50 m were repeatedly observed. More generally, we find topography to play a key role in the development of the local hydrography: internal waves are ubiquitous and flow over the sill appears to be internally hydraulically controlled. Together with velocity data, we establish a picture of Pacific-origin water flowing southward over the sill and mixing with the Atlantic-origin water south of the sills. We will present estimates of the mixing rates derived from our transects, suggest what this implies for flow through the central Archipelago, and quantify the importance of small-scale processes that are not resolved in large-scale simulations or typical observational surveys.

DETECTING SPATIAL VARIATION IN HYDROLOGY AND CARBON EXPORT ACROSS A LAKE-RICH THERMOHARST LANDSCAPE (OLD CROW FLATS, YUKON, CANADA)

Hughes, Dan and Kevin Turner

Brock University (St. Catharines, Canada)

Lake-rich permafrost landscapes are widespread across northern regions and provide refuge for abundant wildlife and resources for local communities. Evidence suggests that these landscapes are highly sensitive to climate change. The traditional territory of the Vuntut Gwitchin First Nation, Old Crow Flats (OCF), YK, is a vast 5600-km2 lake-rich landscape that is internationally recognized for its ecological and cultural integrity. Pronounced changes in lake and river water levels, and land cover compositions have been observed during recent decades by local community members and in recent studies. Research presented here focuses on identifying hydrological and carbon export spatial patterns in OCF. Water samples were collected for chemical and isotopic analyses during July 2015, and
May and July 2016 from 13 lakes and 22 river sites spanning OCF. Parameters of key interest included dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) concentrations, water isotope compositions (\(\delta^{18}O\), \(\delta^2H\), and DIC and DOC \(\delta^{13}C\)), total suspended sediments (TSS) and Chlorophyll a (Chl a). Results from multivariate and spatial analysis show strong variability across the landscape. With greater evaporation and aquatic production, lakes have higher \(\delta^{18}O\), \(\delta^2H\), and Chl a compared to river sites. Increases in \(\delta^{18}O\) and \(\delta^2H\) and Chl a values along the Old Crow River network indicated infiltration of lake water with lake-to-river connectivity being more prevalent in southern OCF sub catchments. DOC concentrations were higher in these sub catchments and were marked by lower \(\delta^{13}C\) values. On the other hand DIC concentrations in southern sub catchments were lower with lower \(\delta^{13}C\) signatures. DIC concentrations in southern sub catchments were lower with lower \(\delta^{13}C\) signatures. DOC and DIC concentrations had a notable influence on the Old Crow River, especially during July 2015 and 2016 when conditions were relatively wet. A retrogressive thaw slump that formed during 2016 along the Old Crow River also increased river DOC and DIC values, however, preliminary evidence suggests that these inputs were overshadowed by carbon from lake water export further downstream. The spatial patterns detected here are providing an important reference for ongoing investigations of how changing climate and lake-rich landscapes are influencing northern water and carbon balances.

**SPATIAL AND TEMPORAL ASSESSMENT OF BIOPHYSICAL VARIABLES IN A HIGH ARCTIC WETLAND**

Hung, Jacqueline

Ryerson University

The onset of climate change has been introducing numerous problems to our environment, and in recent decades, the Arctic regions have been most notably affected. Perennial snowpacks in the high Arctic regions are fully melting in light of warmer temperatures, and consequently neighbouring ecosystems are being affected with a higher saturation of water resulting in higher soil moisture retention. With increased snowmelt feeding wet Arctic environments like wet sedge meadows, increased microbial activity and soil decay will lead to increased soil nutrient availability. Consequently, environmental responses of higher net ecosystem exchange and ecosystem respiration will release more CO2 into the atmosphere, contributing to the positive feedback loop of global warming. In this climate change narrative, Arctic ecosystems play a large role in its expected contribution of CO2 into the atmosphere. As such, understanding the dynamics at play in the dynamics of environmental variables in the most productive High Arctic environments can give researchers insight into the role that abiotic factors play in High Arctic carbon cycling, which effectively can have great influence on the global carbon cycle. The overarching goal of this study is to examine the relationships between processes and physical characteristics that are present in High Arctic vegetation environments. Measurements of biophysical variables were taken in a wet sedge meadow the Cape Bounty Arctic Watershed Observatory on Melville Island, Nunavut over the peak growing season. With the progression of the growing season, the active layer thawed and deepened, which corresponded with increases in the mean soil temperature and soil moisture within the High Arctic wet sedge tundra. Topography played a significant and noticeable influence on the spatial distribution of environmental variables. The melt of the perennial snowpack adjacent to the wet sedge meadow of interest fuelled the water availability, promoting microbial activity within the wetland. The results derived from this study will be analyzed in tandem with soil nutrient availability that will allow researchers to gain a comprehensive understanding of the ongoing processes in the most productive environment of the High Arctic. With the knowledge gathered from the changes that occur throughout the wet sedge growing season, inferences as to the spectral signatures of different nutrient profiles can be derived from comparisons between known soil nutrient availability and corresponding hyperspectral data within the meadow. Additionally, the soil nutrient potential determined for the wet sedge tundra of Cape Bounty will give insight into the effect of the climatic conditions and macro- and micro-topography on the health and productivity of the High Arctic ecosystem.

**TRACKING THE IMPOSSIBLE AT DEPTH: MARK REPORT SATELLITE TAGS REVEAL A LARGE-SCALE DIRECTED MIGRATION OF GREENLAND SHARKS**

Hussey, Nigel (1), J. Orr (2), R. Hodgson (2), A. Fisk (3), S. Ferguson (2) and Amanda Barkley (1)
The complexity of studying deep-sea ecosystems has resulted in relatively little focused research compared to coastal and photic zones. The remoteness of the Arctic compounds this further, resulting in major knowledge gaps for a region impacted by climate change and increasing anthropogenic activity. In a novel approach to document the horizontal movements of an Arctic deep-water predator, the Greenland shark (Somniosus microcephalus), multiple mark-report (mrPATs) and a pop up archival (miniPAT) satellite tag were attached to five individual sharks in Steiness Fjord, the high Arctic. The mrPATs were programmed to release and provide a location and summary environmental data every 8 ± 2 days (mean ± SD) over a total of 38 ± 4 days. This resulted in five locations for three sharks and four locations for the last two. All mrPAT and miniPAT tags successfully transmitted accurate locations within the first day of transmission except one. The tags revealed a highly directed movement of Greenland sharks traversing northern Baffin Bay from Jones Sound to Northwest Greenland that was consistent in time and distance among individuals. This is the first study to successfully track the continuous horizontal movements of Greenland sharks over large distances, and opens a new avenue for studying horizontal movements of deep-water species. The recorded temperature and depth time series data from the miniPAT, combined with mrPAT locations, also provide a tool to examine bathymetric and vertical temperature profile models to reconstruct horizontal movements over large temporal scales. As deep-water species are typically some of the most vulnerable to over-exploitation as well as the most difficult to study, this new technology is providing a window into large-scale movements that can inform fisheries and conservation management.

Ocean ambient noise is a crucial habitat feature for marine animals. Ambient noise levels are affected by natural noise sources like wind and ice, and also by anthropogenic sources like shipping traffic and seismic surveys. Ambient conditions in the Arctic are typically quieter than conditions in other regions partially due to the presence of sea ice. Climate change induced Arctic warming influences ambient noise through both decreased sea ice and increased human activity, which may negatively affect several species of marine mammals and other acoustically sensitive marine fauna. In this study, we document ambient noise levels off the west coast of Banks Island near Sachs Harbour, Northwest Territories, to provide baseline ambient noise levels in the eastern Beaufort Sea of the western Arctic. Noise levels were comparable to other studies from the Canadian Arctic and Alaska, and were typically much quieter than levels from farther south. Wind caused increased noise levels, whereas increased ice concentration decreased noise levels, dampening the effect of wind speed. Future work should expand monitoring to other locations in the western Canadian Arctic, model the impact of increased human activities on ambient noise levels, and predict the impact of these changing noise levels on marine animals.

PHOTOCHEMICAL AND MICROBIAL DEGRADATION OF DISSOLVED ORGANIC MATTER IN HUDSON BAY ESTUARINE SYSTEMS (CANADA).

Islam, Sohidul (1) and C. Guéguen (2)

(1) Environmental and Life Sciences Graduate Program, Trent University, Canada (Peterborough, Canada); 
(2) Department of Chemistry and Trent School of the Environment, Trent University, Canada (Peterborough, Canada)

The Hudson Bay embraces a sensitive environment, where anthropogenic intervention has been increasing during the last decade potentially influencing the estuarine ecosystem. Both terrestrial and aquatic sources provide the Hudson Bay with significant amounts of reactive dissolved organic matter (DOM) whose chemical structures strongly affect binding of organic and inorganic pollutants. Microbial communities and photochemical processes play a significant role in DOM cycling. Yet, our knowledge is scarce on environmental controls of arctic DOM degradation, which makes it difficult to...
predict how the DOM cycle using will respond in a changing environment. Mineralization experiments were conducted into riverine, estuarine and marine DOM. In the pre-degraded samples, 1466, 84 and 60 molecular formulae were assigned in Churchill River, Hudson Bay estuary and Hudson Bay marine environment, respectively. During the 12-day biodegradation experiment, the number of DOM compounds identified using Fourier-transform ion cyclotron resonance mass spectrometry (FTICRMS) increased which contrasts with the solar irradiation. A significant number of molecular formulae (44%) was lost upon photoexposure in the marine water samples whereas the number of molecular formulae increased in the case of river and estuary environment. The fluorescence and absorbance analyses confirmed that a significant lost in DOM upon photodegradation. Asymmetrical flow filed flow fractionation (AF4) analysis showed that the higher molecular weight DOM compounds shifted to lower molecular compounds with light exposure, congruent with the loss of larger molecular structures found using FT ICR-MS and absorbance. Together these findings revealed that photo and microbial mineralization have contrasting effects on DOM composition.

EXAMINING DIFFERENCES IN SST AND FLUXES FROM TWO DIFFERENT FORCED NEMO SIMULATIONS OVER HUDSON BAY

Jafarikhasragh, Shabnam (1), S. Jafarikhasragh (2), J. Lukovich (2), P.G. Myers (3) and D.G. Barber (2)

(1) 1. Centre for Earth Observation Science, Faculty of Environment, Earth, and Resources, University of Manitoba (Winnipeg, Canada); (2) Centre for Earth Observation Science, Faculty of Environment, Earth, and Resources, University of Manitoba, Winnipeg (Winnipeg, Canada); (3) Department of Earth and Atmospheric Sciences, University of Alberta (Edmonton, Canada)

Understanding the mechanism of producing SST in an oceanic model is complicated by different error sources such as error in near-surface atmospheric variables (e.g. air temperature, humidity, wind), the procedures used in forcing an oceanic model (e.g., different bulk formula parameterizations, damping or assimilation methods), and the model configuration itself. In this study we focus on the bulk parameterization of heat fluxes over Hudson Bay as a contribution to BaySys, a project dedicated to understanding the relative impacts of climate change and regulation on freshwater-marine coupling in the
Hudson Bay complex. This study aims at investigating SST in the Hudson Bay region produced by a forced ice-ocean general circulation model, Nucleus for European Modelling of the Ocean (NEMO), with two different atmospheric forcing. The atmospheric forcing sets the i) Common Ocean Reference Experiment, version 2 (CORE2) and the higher-resolution ii) Canadian Meteorological Centre’s Global Deterministic Prediction System Reforecasts (CGRF). Air-sea fluxes are derived from bulk formulae (following Large and Yeager (2004)) applied to atmospheric state fields from two atmospheric reanalysis data sets, CORE2 and CGRF, with prognostic NEMO model SST at 5-day intervals. The analysis focuses on the open water months of August and September to eliminate additional sources of error associated with the ice component of the model. Results show that overall net heat flux produced by the CGRF forcing simulation is higher than the net heat flux generated by the CORE2 simulation, which leads to corresponding colder SST model values for the CGRF, and warmer SST model values for CORE2 simulations. Compared to other net heat flux components including shortwave and turbulent (latent and sensible heat) fluxes, long wave fluxes represent a significant contribution in the net heat flux differences between the two simulations. Results from this analysis highlight the feedback between the modeled sea surface temperature and the bulk fluxes via bulk flux parameterization, used as a tool to get a realistic SST output. Results will further contribute to the development of forced model configurations better able to capture climate change symptoms like increasing temperature and salinity related to mass-energy flux exchanges in recent decades over Hudson Bay, relevant for the BaySys project.

USING PASSIVE WATER SAMPLERS TO DETERMINE THE OCCURRENCE AND LEVELS OF PERSISTENT ORGANIC POLLUTANTS IN THE BEAUFORT SEA

Jantunen, Liisa (1), G. Stern (2), A. Burt (2), B. Hickie (3), J. Truong (4), S. Meredyk (5) and K. Booij (6)

(1) Environment and Climate Change Canada (Egbert, Canada);
(2) University of Manitoba (Winnipeg, Canada);
(3) Trent Univeristy (Peterborough, Canada);
(4) Environment and Climate Change Canada (Egbert, Canada);
(5) ArcticNet (Quebec, Canada);
(6) NIOZ Royal Netherlands Institute for Sea Research (Texel, Netherlands)

The extent of contamination of arctic waters by toxic chemicals is limited to sparse surface measurements where little is known about how far these chemicals reach into the depths of the Arctic Ocean. To explore the occurrence and levels of persistent organic pollutants, passive water samplers were attached to moorings in the Beaufort Sea starting in 2014. These passive water samplers are semipermeable membrane devices (SPMDs) consisting of low density polyethylene sleeves filled with triolein and have been well characterized for the uptake of the target compounds. SPMDs were deployed at several depths ranging from 50-300m, covering different water masses including the mix polar layer, the Pacific water mass and deep Atlantic waters. These passive samplers were deployed in triplicate and were left on the moorings for one year. Target compounds are legacy and current use pesticides, flame retardants, plasticizers, poly aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Data will be presented on the occurrence, levels and depth profiles of these compounds. Generally, chemicals in commerce such as the flame retardants and current use pesticides are highest in the surface layer where banned and phased out chemicals such as the legacy pesticides and PCBs are higher in the mid-depths, where all chemicals are lowest in the deepest waters.

INUIT WOMEN’S CONCEPTUALIZATIONS OF, AND APPROACHES TO, HEALTH IN A CHANGING CLIMATE

Jasiuk, Linnaea (1), T. Pearce (2) and B. Bradshaw (1)

(1) University of Guelph (Guelph, Canada);
(2) University of the Sunshine Coast (Queensland, Australia)

This research examined Inuit women’s conceptualizations of, and approaches to, health in the context of adaptation to a changing climate through a case study of Ulukhaktok, NT. Climate change has been identified as possibly the biggest health threat of the 21st century and Inuit are believed to be a high-risk population. In order to support adaptation, decision makers must first understand what health means to Inuit, what health concerns are relevant and important, beyond those selected a priori by health professionals and what
adaptation strategies are both feasible and desirable for Inuit themselves. Further, it has been recognized that the health effects of climate change are differentiated by gender; specifically men and women experience different vulnerabilities and are equipped with different adaptive capacities. Data were collected through participant observation, semi-structured interviews with 29 Inuit women, free listing and line drawing. Findings indicate that Inuit women in Ulukhaktok retain a traditional conceptualization of health that is holistic in nature with attention to the mental, emotional, physical and spiritual parts of the self and which prioritizes relationships among family and the environment. Findings also indicate that Inuit women’s approach to health includes both traditional practices as well as the formal healthcare system but that the use of these two systems is highly dichotomized. Inuit women’s preventative health behaviours and mental and emotional supports are founded in traditional practices, while the formal health system is used predominantly in a reactive fashion to treat the physical symptoms of developed health conditions. This research contributes to our understanding of Inuit women’s conceptualizations of, and approaches to, health and identifies strategic health policy entry points to enhance Inuit women’s health under changing climatic conditions. This research is part of ArcticNet Project 1.1 Community Vulnerability, Adaptation and Resilience to Climate Change in the Arctic and CIHR funded project IK-ADAPT.

ECOLOGICAL IMPORTANCE OF SEA ICE IN MIGRATORY PATTERNS AND HABITAT USE OF EIDER DUCKS IN THE EASTERN CANADIAN ARCTIC

Jean-Gagnon, Frankie (1), G. Gilchrist (2) and M. Forbes (1)

(1) Carleton University (Ottawa, Canada);
(2) Environment and Climate Change Canada, National Wildlife Research Centre (Ottawa, Canada)

Arctic sea ice cover has undergone major changes in recent decades in response to global warming and the rate at which the summer sea-ice has declined in the Arctic has exceeded model projections. Closely associated with this ongoing sea ice decline is the growth of shipping activity necessary to support resource development in the Canadian Arctic. All projects must however adhere to strict federal and territorial environmental policies before proceeding, including research of how shipping may interact with marine wildlife. Using satellite tracking data, we investigated the migratory patterns of two eider duck species to identify their use of key marine habitats in the Hudson Strait and Foxe Basin region, Nunavut, CA. This region is an area of interest for year-round shipping for resource extraction and other related activities. We will examine the variations in stopover and molting sites used by eiders through coastal sea ice conditions measured using Synthetic Aperture Radar (SAR) imagery. We expect that the main staging sites used will be related to areas of open water (i.e. ice-free) offering access to benthic resources, and that the phenology of migration will be associated to the timing of ice-breakup and freeze-up. This project, developed in collaboration with Environment and Climate Change Canada, Inuit communities, Canadian universities and Industry Partners (Baffinland Iron Mines) will contribute important information when developing mitigation and emergency response measures related to year-round marine shipping activities in our study region. In the actual context of accelerated development and change in the Arctic, this will help identify patterns in bird response to variations in sea ice conditions, and will contribute to predictions of how Arctic seabirds will react to ecosystem changes under further loss of sea ice and growing unpredictability in ice conditions.

NEEDS FOR ANALYZING FOOD SAFETY RISKS FOR TOXOPLASMOSIS IN WILDLIFE HARVESTED IN CANADA’S NORTH

Jenkins, Emily (1), R. Sharma (2), E. Bouchard (2), N. Bachand (2), P. Leighton (3), A. Ravel (3), A. Simon (3) and L. Tukai (4)

(1) University of Saskatchewan (Saskatoon, Canada);
(2) Department of Veterinary Microbiology, University of Saskatchewan (Saskatoon, Canada);
(3) Département de pathologie et microbiologie, Université de Montréal (St-Hyacinthe, Canada);
(4) Community coordinator on the ArcticNet project in Nunavik (Inukjuak, Canada)

Toxoplasmosis is considered the most important parasitic zoonoses in Canada’s North, affecting northern residents (particularly in the Eastern Arctic) disproportionately compared to the North American average. Toxoplasma gondii is a zoonotic parasite that transmits through multiple routes, including food, water
and environmental transmission. Source attribution is therefore very difficult for this parasite, but there appear to be links between human exposure and consumption of local wildlife. Despite well-established frameworks for assessing microbial risks in foods of animal origin within the mainstream food supply, risk assessments for country foods are often difficult due to large knowledge gaps, or not attempted, because they are perceived as beyond the mandate of regulatory bodies responsible for mainstream food safety. In turn, environmental agencies perceive food safety and public health as beyond their mandate for conservation and preservation of wildlife and their habitat. Therefore, country food safety is slipping between these mandate gaps, perhaps indicating a need for the scientific community to lay the foundation for assessing risks of T. gondii in country foods in the Canadian North. Risk assessment includes 1) hazard identification, 2) hazard characterization, 3) exposure assessment, and 4) risk characterization. We identify knowledge gaps such as 1) What strains of T. gondii are present in the Arctic? What can this tell us about the source and transmission of this parasite in these regions, where the usual feline hosts are largely absent? 2) What is the burden of disease in animals and people? What factors might affect susceptibility and severity in animals and people? 3) Which species of wildlife, and which tissues in wildlife, are most commonly infected? What tissues are consumed, and how are they prepared, stored, and consumed? Would these methods inactivate Arctic-adapted strains of the parasite? 4) Overall, how should we classify risk associated with food-borne toxoplasmosis in terms of probability and severity of impact? Which groups of animals and people are most likely to be exposed, and to develop disease? How serious is this risk relative to other food safety issues? Where are the uncertainties in our information, technical assays, and system level understanding? As scientists, we can gather evidence to address these knowledge gaps and facilitate risk assessment. To take the next steps towards risk management (should the risk be tolerated, planned for, prevented, or mitigated?), scientists must work with communities, wildlife managers, and public health personnel to balance the potential food safety risks against the known benefits of harvesting and consuming local wildlife from nutritional, economic, and cultural perspectives. Finally, all stakeholders are needed to develop simple, timely, accurate, relevant, credible, and consistent risk communication messages and mediums. This is particularly important with regard to the inevitable uncertainties in trying to apply a rigid food safety framework to a system as complex and changing as the Canadian Arctic, which is undergoing social and environmental change at an unprecedented rate.

THE USE OF STABLE ISOTOPE ANALYSIS TO DETERMINE TEMPORAL TRENDS IN POLAR BEAR (URSUS MARITIMUS) FORAGING ECOLOGY IN RELATION TO CLIMATE CONDITIONS

Johnson, Amy (1), A. Derocher (1), N. Lunn (2), E. Richardson (2) and K. Hobson (3)

(1) Department of Biological Sciences, University of Alberta (Edmonton, Canada);
(2) Environment and Climate Change Canada, Wildlife Research Division (Edmonton, Canada);
(3) Department of Biology, Western University (London, Canada)

Polar bears (Ursus maritimus) are an important top predator in the Arctic ecosystem and they rely on sea ice for hunting their main prey, ringed seals (Pusa hispida) and bearded seals (Erignathus barbatus). However, sea ice duration and extent are declining and these changes are associated with reduced polar bear body condition, reproductive success, survival, and ultimately, population abundance. Future climate conditions are expected to cause further sea ice declines, which will reduce access to prey and affect the persistence of polar bear populations. This indicates the importance of monitoring the influence of climate change on polar bear foraging ecology in order to understand population responses to changing habitat conditions. The objectives of this project are to: 1) Determine temporal trends in foraging ecology in the western Hudson Bay population (WH); 2) Analyze variation in foraging ecology within the population; and 3) Examine the relationship between foraging trends and climate/prey population trends over the past 25 years. Stable isotope analysis (SIA) on polar bear guard hair samples from WH will be used to examine foraging ecology. Temporal trends in foraging ecology will be determined by examining dietary composition from short-term (each season) and long-term (1990-2015) SIA data. Preliminary results indicate differences among recent years in polar bear dietary composition and future analysis will determine longer-term trends in foraging ecology. Secondly, variation in foraging ecology within the population will be investigated by examining the relationship between individual polar
bear characteristics (age class, sex, reproductive status, body condition) and diet (from SIA). This will indicate how foraging trends may differ between individuals, which will improve our understanding of population trends. Lastly, the relationship between long term trends in foraging ecology and climate (sea ice dynamics and climate indices) as well as ringed seal population trends will be investigated. This will provide new information on the influence of environmental conditions and prey availability on foraging ecology. This project is significant because it will describe how polar bear foraging ecology is responding to changing climate conditions over time and how this may vary within the population. This research will be useful for monitoring the influence of climate change on polar bear ecology in the rapidly changing Arctic ecosystem.

INTEGRATING SIGNIFICANT MARINE AREAS INTO THE NORTHERN MARINE TRANSPORTATION CORRIDORS IN THE KITIKMEOT REGION OF NUNAVUT

Joyce, Jenna and J. Dawson

Environment, Society and Policy Group, Department of Geography, Environment, and Geomatics, University of Ottawa (Ottawa, Canada)

Climate change and subsequent loss of sea ice cover has increased the navigability of Arctic waters and influenced an increase in shipping activity (Dawson et al. 2014, Pizzolato et al. 2014). The Northern Marine Transportation Corridors (NMTC) Initiative, co-led by the Canadian Coast Guard, provides a framework for Arctic ship traffic and decision-making and aims to increase shipping safety by providing predictable levels of service to mariners transiting the corridors. However, the location of existing NMTCs do not fully consider ecologically significant marine areas, culturally important areas, or areas of traditional marine use by northern communities. This was identified as a significant research gap in the Arctic Marine Shipping Assessment Report (Arctic Council, 2009) and has yet to be filled. This research directly addresses this important research gap. This presentation outlines preliminary results of the project including: 1) geospatial identification of known local-use, culturally significant marine areas, and ecologically significant marine areas within the Kitikmeot region of Nunavut; 2) analysis of the density of historic ship traffic in the region, and; 3) identification of the level of congruence between ship traffic densities within the NMTC and local use areas, cultural marine areas, and ecologically significant marine areas in the region. The final project result will include a series of suitability maps that illustrate areas of high and low sensitivity to shipping activities within the NMTC as well as suggested alternative locations for the NMTC based on areas of low sensitivity. The research aims to ensure that Inuit voices and concerns regarding local marine use and significant cultural and ecological marine sites are more fully considered within federal level policies, such as the NMTC initiative. References: Arctic Council (2009). Arctic Marine Shipping Assessment Report, April 2009, second printing; Dawson, J., Johnston, M.E., and Stewart, E.J. (2014). Governance of Arctic expedition cruise ships in a time of rapid environmental and economic change. Ocean and Coastal Management, 89, 88-99. http://dx.doi.org/10.1016/j.ocecoaman.2013.12.005; Pizzolato, L., Howell, S.E.L., Derksen, C., Dawson, J., Copland, L. (2014). Changing sea ice conditions and marine transportation activity in Canadian Arctic waters between 1990 and 2012. Climatic Change, 123, 161-173. 10.1007/s10584-013-1038-3.

HOW PREDATOR-PREY INTERACTIONS CAN MEDIATE EFFECTS OF CLIMATE ON PREY NESTING SUCCESS: THE CASE OF AN ARCTIC NESTING BIRD

Juhasz, Claire-Cécile (1), N. Lecomte (1) and G. Gauthier (2)

(1) université de Moncton (Moncton, Canada); (2) Université de Laval (Québec, Canada)

Climate change can have an impact on ecosystems by reshaping dynamics of resource exploitation for predators and their prey. Over the last 20 years, an increase in summer rainfall in the High Arctic could explain a higher nesting success of the Greater Snow Goose via two mechanisms: 1-An increase in water availability translates into higher chances of repelling predators; 2-An increase in summer air temperatures improves food availability for nesting geese. Here we aim to quantify the impacts of precipitation, temperature, and primary production on geese nesting success in a large goose colony on Bylot Island (Nunavut, Canada). To do so, we experimentally modify food and water availability near incubating females, while recording their stress level and nesting success.
Simultaneous behavior observations help to quantify the resources available to geese and the predation pressure that they experience. With our long-term dataset and structural equations, we will use a mixed approach with both empirical analyses and theoretical modelling. This project will extend our understanding of the complex effects of climate change on Arctic species and predator-prey interactions. It will also provide essential information for the management of an overabundant population of Greater Snow Geese.

**MARINE PROTISTS IN EMERGING HOTSPOTS NORTH OF BAFFIN BAY.**

Kalenitchenko, Dimitri, N. Joli, J.-E. Tremblay and C. Lovejoy

Université Laval (Québec, Canada)

The marine microbial community supports Arctic higher food webs and consists of multiple trophic networks. Single celled phytoplankton are responsible for primary production and microbial heterotrophic protists contribute to the recycling and remineralization photosynthetic production. In the Arctic access to both light from above and nutrients determines the net production, however the rate of nutrient influx and the variability in light quality and availability create conditions for species selection. The species makeup of these microbial plankton in turn can have a profound influence on success of higher trophic levels and the biogeography of microbial species and species used for traditional subsistence are tightly linked. With the northward migration of the ice bridge that creates a polynya North of Baffin Bay, the Kennedy channel and Kane Basin represent emerging productivity hotspots fed by high nutrient water from the ice covered Lincoln Sea. We hypothesized that the complex bathymetry of the region would lead to watermasses being altered and transformed prior to being transported out of Kane Basin and into Northern Baffin Bay. To test this we examined the species composition of phytoplankton and other protists at multiple depths in the Kennedy Chanel, Kane Basin and near Nares Straight using high throughput amplicon sequencing both the 18S rRNA gene and 18S rRNA. There were clear differences in the surface communities in the different Basins consistent punctuated successional changes but suggesting some retention of communities within the separate basins. The deeper communities formed different clustering patterns suggesting other environmental drivers for example, variable retention times in deeper waters, were shaping the communities. Overall our results suggest a need for further studies on pelagic phytoplankton-zooplankton coupling and benthic-pelagic coupling to predict the effect of the northward moving polynya on higher food webs.

**PATTERNS AND SOURCES OF SEDIMENT AND PARTICULATE ORGANIC CARBON IN LAKE MELVILLE, LABRADOR: INFERENCE FROM 210PB, 137CS, AND Δ13C**

Kamula, Michelle (1), Z. Z. Kuzyk (1), D. Lobb (1) and R. Macdonald (2)

(1) Centre for Earth Observation Science (Winnipeg, Canada);
(2) Department of Fisheries and Oceans (Victoria, Canada)

Modern sedimentological processes, sources and distribution of sediment and organic carbon (OC) were investigated in recently deposited sediment from Lake Melville, Labrador, to better understand the impacts of anthropogenic and climatic changes to the system over the last 100-150 years. Fifteen sediment cores collected across Lake Melville in 2013 and 2014 were analysed for 210Pb and 137Cs while stable isotope δ13Corg and percentage OC were measured down select cores and surface sediment. Mass accumulation rates (MARs) were established by fitting 210Pbex profiles to a two-layer advection diffusion model and validated with 137Cs. MARs varied between 0.04 and 0.41 g cm-2 yr-1 and decreased with distance from the Churchill River, the greatest source of sediment to the system. MARs were greatest in western Lake Melville immediately east of Goose Bay, reflecting the combined contributions of fine material carried eastward in the Churchill River plume and coarser particles from the Kenamu River. The sources of sediment were investigated by comparing inventories of 137Cs and excess 210Pb (210Pbex) to expected atmospheric inputs, which suggested sediment in Lake Melville is largely sourced from the watershed. In the eastern end of Lake Melville, an elevated 210Pbex inventory was associated with particle scavenging of dissolved 210Pb from inflowing marine water and is likely linked to increased primary production in the area. Surface sediment δ13Corg values (mean = -26.2 ± 1.75‰ SD) support a mixture of both terrestrial and marine organic carbon to the system. Using a transient tracer mixing model, the depth in each
core corresponding to 90% sediment deposited pre and post hydroelectric development at Churchill Falls (1970) was established and applied to profiles of δ13Corg. This approach revealed an increase of terrestrial OC to Lake Melville post 1970 which we interpret to reflect change in climate and/or hydrology of the Churchill River.

A COMPARISON OF WATER MASS COMPOSITION AND NUTRIENT DISTRIBUTION IN TWO COASTAL MARINE ENVIRONMENTS IN NORTHWESTERN HUDSON BAY: CHESTERFIELD INLET AND WAGER BAY (UKKUSIKSALIK NATIONAL PARK)

Kamula, C. Michelle (1), Z. Z. Kuzyk (1) and R. W. Macdonald (2)

(1) Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada);
(2) Department of Fisheries and Oceans, Institute of Ocean Science (Victoria, Canada)

Arctic and sub-arctic coastal marine environments are areas of relatively high productivity. For this reason, these environments are important ecosystems that support culturally and economically important country foods such as arctic char. Arctic coastal environments and the people who rely on them for food and transportation however, are at risk due to ongoing climate change and increased industrial activity like ship traffic. To better understand and prepare for these changes, it is important to first understand the fundamental oceanographic processes taking place. Chesterfield Inlet and Wager Bay (Ukkusiksalik National Park) are two large marine coastal environments located in Northwestern Hudson Bay that have been severely understudied. Chesterfield Inlet is a long (220 km) narrow inlet with strong tidal currents that connect Baker Lake to Hudson Bay. The relatively shallow inlet receives freshwater from a number of larger rivers that drain an area of about 290,000 km2. In contrast, Wager Bay, which until recently has been uncharted, is a deep basin that receives freshwater from only a couple small rivers. Unlike Chesterfield Inlet, a sill and narrow passageway with complex currents and whirlpools restricts circulation between Wager Bay and Hudson Bay. As part of a Government of Nunavut and Parks Canada initiated research project that took place in August 2016, some of the first ever measurements of salinity, nutrients, CDOM, and δ18O were obtained in Chesterfield Inlet and Wager Bay (Ukkusiksalik National Park). Here we present and compare properties between these two coastal environments.

INUIT GOVERNANCE OF THE NORTH WATER

Karetak-Lindell, Nancy

Board of Directors (Ottawa, Canada)

The Pikialasorsuaq is a marine region that Inuit depend upon and wish to manage into the future. The Inuit led Pikialasorsuaq Commission was established by ICC in January 2016. Inuit have established the Pikialasorsuaq Commission to provide an informed Inuit vision and recommendations for the future of this region. With the vision that Inuit will continue to use and occupy Pikialasorsuaq region in perpetuity, the Commission has travelled to the communities on both sides and will complete a report of its findings and recommendations. This session will look at the progress of the Commission and the role of Arctic science in the future of the Pikialasorsuaq. The Pikialasorsuaq, “the great upwelling,” is the largest polynya in the Northern Hemisphere and the most biologically productive region north of the Arctic Circle and has been the subject of much ArcticNet research. There is still much to learn about the area and environmental concerns including baseline biological studies, the effects of climate change, shipping, resource development, and commercial fisheries. It is known however that this is a vitally important area for the northern-most communities in Greenland and Canada as a source of food, transportation and cultural identity.

THE WHOLE IS GREATER THAN THE SUM OF ITS PARTS: BIO-OPTICAL FEEDBACKS IN A THINNING ARCTIC ICESCAPE


(1) Norwegian Polar Institute (Tromsø, Norway);
(2) University of Bergen (Bergen, Norway);
(3) University of Manitoba (Winnipeg, Canada);
(4) Norwegian University of Science and Technology (Trondheim, Norway)
The Arctic Ocean is facing rapid changes, including higher light availability for primary producers due to a declining and thinning ice cover. In addition, the speed and dynamics of the sea ice pack are increasing, which could lead to more frequent lead formation and hence an increase in areas of open water or thin new ice. A detailed understanding of light transmission through thin ice and the under-ice light climate in a rapidly changing Arctic icescape still requires further studies. We monitored dynamic and thin but heavily snow-covered first- and second-year drifting pack ice north of Svalbard (80–83.5 °N) during the Norwegian young sea ICE expedition (N-ICE2015) from January to June 2015. Light transmission through different ice types and its effect on and feedbacks with ice algal and under-ice phytoplankton blooms were studied. We show that open or refrozen leads play an important role in light transmission through an ice pack with thick snow cover in spring, with important implications for biological production underneath and in the ice cover. With a radiative transfer model we studied the role of snow, colored dissolved organic matter (CDOM) and algal biomass in light transmission through the thin ice. Ice algae in the thin lead ice reached a biomass (up to 2.31 mg Chl a m-2) similar to the older thick ice, and had extremely high concentrations of intracellular UV-protecting compounds (mycosporine-like amino acids, MAAs). Further, leads in the ice pack were identified as the light conduit that enabled a phytoplankton bloom dominated by the haptophyte Phaeocystis pouchetii to grow under the dominantly opaque ice cover – transmittance through the heavily snow-covered first- and second-year ice was <1%, compared to up to 40% through a refrozen lead. Last, we discuss the potential implications for the Arctic ecosystem, if blooms of this type become more frequent in the future.

**WINTER DRIFT SPEED AND PATTERNS OF THE ARCTIC SEA ICE: 1979-2014**

Kaur, Satwant, J. V. Lukovich, J. K. Ehn and D. G. Barber

Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada)

Monthly sea ice motion maps for 36 winters (October-April) have been used to examine sea ice drift speeds and patterns at the hemispheric scale. The mean Arctic sea ice motion map consists of four primary circulations; the Beaufort Gyre (BG), Transpolar drift (TPD), Baffin Bay and a motion system in the Eurasian basin moving ice from the Kara Sea via the ocean route between the Franz Josef Land and Novaya Zemlya.

Examination of higher-order moments to identify structure in the ice drift field shows that the BG can be identified through a combination of zero skewness and minimum possible kurtosis (i.e. K=1). Ice drift normal to the zonal component traversing the central Arctic in the mean winter sea ice drift map of 1979-2014 has been analysed to describe the transition boundary between the BG and TPD. A regression analysis of the ice drift speed anomalies shows positive trends in ice drift speed in the BG, TPD, Baffin Bay, and Kara Sea; however no change in ice drift speeds is observed in the region north of the Canadian archipelago. Spatial and temporal changes in the magnitude and direction of the ice drift have been further analysed by dividing the data on the basis of variability in the Beaufort Gyre. An increase in the magnitude of the ice drift is observed for the period of 2003-06; specifically, drift speeds have increased to 15cm/s in Fram Strait for the period 2003-06 as compared to the year 1979-1981 with values of 5-7cm/s.

**TERRESTRIAL ORGANIC CARBON REMINERALIZATION IN HUDSON BAY COASTAL WATERS**

Kazmiruk, Zakhar

ArcticNet, BaySys, CEOS, University of Manitoba (Winnipeg, Canada)

Because the coastal Arctic Ocean receives relatively big inputs of organic carbon (OC) from coastal erosion and rivers, a climate change-driven increase in terrestrial OC inputs could dramatically alter the oceanic carbon budget and associated biogeochemical cycles. Since the coastal ocean is characterized by relatively high microbial production, a large fraction of OC introduced into the coastal ocean waters, in particular the particulate fraction that settles out of the euphotic zone, is probably remineralized via microbial degradation. In order to assess the extent of the OC remineralization happening in the coastal Arctic Ocean, an analysis was completed of the relationships among dissolved oxygen (DO) and dissolved inorganic carbon (DIC) and OC from past research cruises (2005, 2007, 2010) along the strongly river influenced coast of Hudson Bay. Hudson Bay is supplied by seawater from Arctic Ocean outflow. It may also provide a
good proxy system for the Arctic Ocean because of its land-locked status and large river inflow. In addition to the analysis of field data, during the recent 2016 fall cruise in Hudson Bay, a novel incubation experimental approach involving Pyro Science technology to measure DO was tested. The intention is to use this experimental approach to evaluate rates of terrestrial OC remineralization in Hudson Bay coastal waters during the June 2017 cruise. Collectively, these new data should aid in furthering understanding of the fate of the OC delivered from the continents to the coastal Arctic Ocean.

THE ECONOMICS OF DIET AND NUTRITION IN THE NORTH: RESULTS FROM A PARTICIPATORY FOOD COSTING STUDY IN THE WESTERN ARCTIC
Kenny, Tiff-Annie (1), S. Wesche (2), J. MacLean (3), M. Fillion (4) and L. Chan (1)
(1) Dept. of Biology, University of Ottawa (Ottawa, Canada);
(2) Dept. of Geography, University of Ottawa, (Ottawa, Canada);
(3) Inuvialuit Regional Corporation (Inuvik, Canada);
(4) Faculté de médecine - Université Laval (Montreal, Canada)

Rationale: Inuit experience the highest documented prevalence of food insecurity among all Indigenous peoples in a developed country. Arctic food security is multifaceted and contingent upon access to market food as well as country (wild) food. The high price of market food in northern Canada is well documented and often prohibitive. Accordingly, economic factors (namely unemployment, low income, and high food costs) were identified by respondents of the Inuit Health Survey as principle reasons for food insecurity across the north. However, limited attention has been paid to the economic determinants of diet and nutrition in this context. Methods: We undertook a participatory food costing study seasonally in communities of the western Arctic during a 14-month period (late 2014 to early 2016). Community research assistants were trained to systematically collect food prices for a list of ~100 market food items. Foods were selected to represent both items in the Revised Northern Food Basket and foods reported in dietary recalls from the Inuit Health Survey. Price data was synchronized with the Canadian Nutrient File and matched with regional food consumption data for Inuit adults. Results and Discussion: Study findings suggest that dry foods with stable shelf lives (e.g. cereal, grains, potato chips and sweet snacks) generally provide considerable energy at low cost. By contrast, naturally-hydrated / energy-dilute foods, such as as fruits and vegetables, are significantly more nutrient-dense, but generally costlier and more susceptible to degradation during shipment. As consumer decisions are generally predicated on relative, rather than absolute prices, the significant price differential between nutrient-rich /energy-dilute foods and nutrient-poor/energy-dense foods may represent a barrier for Inuit living in remote northern communities to adopt more healthful diets. These results support existing theories that link socioeconomic disparities in diet quality to food cost. Indeed, individuals facing budgetary constraints tend to shift consumption to maximize energy availability per dollar at the expense of dietary nutrient quality. Conclusion: Given the dual burden of food insecurity and obesity among Inuit, appropriate public health policies are required to attenuate the significant price hierarchy between nutrient rich and nutrient poor foods.

NARWHAL HABITAT SELECTION WITHIN THEIR WINTERING GROUND
Kenyon, Krista (1), D. Yurkowski (2), S. Ferguson (3), D. Barber (1) and J. Orr (3)
(1) Center of Earth Observation Science, University of Manitoba (Winnipeg, Canada);
(2) Department of Biological Sciences, University of Manitoba (Winnipeg, Canada);
(3) Freshwater Institute, Department of Fisheries and Oceans (Winnipeg, Canada)

Narwhals are an odontocete endemic to the Arctic known for their spiralled tusk. They are an important component of local Inuit communities’ subsistence harvests and culture. Previous satellite tracking studies have documented high summering ground fidelity and strict migration patterns, with narwhals arriving at their wintering ground within Baffin Bay early November and slowing leaving in April. This is thought to be the dominant foraging season even while their wintering ground is densely covered with sea ice. Few satellite transmitters per tagging year have lasted throughout the entire winter season, making analysis of habitat utilization during this critical and vulnerable season challenging. Studies examining winter habitat
utilization that have been conducted have focused on diving behaviour and have rarely incorporated sea ice. The objective of this study is to further understand narwhal habitat usage within their wintering grounds, specifically examining narwhal selection within bathymetry, sea ice concentration, thickness, and floe size. Nineteen narwhals were equipped with satellite transmitters in Admiralty Inlet (2009) and Eclipse Sound (2010, 2011). One narwhal overwintered in Foxe Basin and was excluded from the analysis. Of the 18 narwhals that overwintered in Baffin Bay, 15 lasted halfway through the winter season while six transmitters lasted the entire duration. Best daily positions were obtained by selecting the coordinate location with the most accurate LC, or error, value. Buffers were created around the best daily positions to account for the error, and became the used habitat. The available habitat was the area that the narwhal could have travelled to in between transmission days, calculated using the 95th percentile distance. Habitat features bathymetry, sea ice concentration, thickness, and floe size were divided into categories that are both meaningful to narwhals biologically and relatable to climate change predictions. The used and available habitat were overlaid with the habitat categories. A generalized linear mixed model and a Tukey analysis were utilized to examine which habitat categories narwhals were primarily selecting for. Narwhals selected for closed ice concentration (>95%), open water concentration (0-35%), and depths between 1.5-2.0 km while avoiding landfast ice and depths < 1.0 km. There was no significance in habitat selection within sea ice thickness or between sexes. The conflicting selection for both closed ice and open water may be due to the smaller sea ice extent in Baffin Bay in 2010, as well as the extensive narwhals movements recorded during this time. Narwhals are not known to be able to break through sea ice, so perhaps all ice thicknesses and non-moving floe forms, like landfast ice, present the same barrier to the surface. Bathymetric selection is likely related to prey species distribution. An increased understanding of important habitat within narwhals wintering grounds will assist in management decisions in the face of climate change and increased interest and development and transportation within the Arctic, to ensure that healthy narwhal populations continue into the future.

Evidence from seabed geological observations, in situ oceanographic measurements and initial oceanographic modelling converge to indicate that the Beaufort shelf break jet (BSJ) and related process amplifications are responsible for generating an observed shelf break erosional belt. A narrow (1–8 km wide) belt cut several metres into muds that were derived from the Mackenzie Delta. This belt extends 250 km along the uppermost slope and shelf break in water depths from 80 0150250m. The surface is generally smooth and planar except where post- or syn-deformation by pingo-like features (PLFs) structurally disrupt the seabed. The erosion belt is flanked by both non-depositional and depositional zones. Other seabed indicators of the current are lee-side mud depocentres (possibly comet marks) on the PLFs detected in autonomous underwater vehicle-based multibeam sonar (1 m resolution) and elongated pockmarks. Recent compilation of C14 dates from shells and foraminifera in sediment cores are correlated to seismic horizons and mapped across the upper slope. These demonstrate that strata from about 11 ka until ~8ka before present (cal.) maintain a uniformly draped blanket deposit, but by 5 ka the blanket is more affected by currents. After this time, these and underlying strata were truncated (eroded) at the uppermost slope, with removal of several metres of sediment. Adjacent non-deposition
(bypass) zones give way to local deposition, presently maintained. The patterns and erosion age constrain the genesis to oceanographic phenomena (sea-level low-stand and glacial flooding genesis would have to be earlier). This demonstrates a mid-Holocene change in mud distribution and an evolution of currents capable of the erosion. ArcticNet and DFO moorings demonstrate episodic year-round strong current and sediment re-suspension events attributed to amplifications of the BSJ that flows trapped to the upper slope. The associated current surges (20–80 cm/s) in the BSJ are primarily driven by longshore stress from storms causing upwelling and downwelling while additional processes on the shelf (e.g., wind-driven resuspension, thermohaline convection, eddy formation) add further complexity to our understanding of sediment transport dynamics in the region. Recent calculations show that sediment mobilization at the shelf break due to intensifications in the BSJ typically occurs ~3% of the time. An instrumented seabed lander in co-location with ArcticNet moorings was deployed for a year. Analyses of measured current and turbidity time series are pending. Initial 3-D, 12.5 km horizontal resolution modelling efforts output daily mean temperature, salinity, velocity and other ocean and ice parameters. It was partially validated by in situ current data measured at 8 m above the seabed. Eastward flow and occasional reversal, elements of up- and down-welling during storms, dense water cascading, meso-scale eddies due to fall and winter sea-ice formation and a sea-ice breakup event were generated by the model. Relative magnitude of modelled processes needs further investigation, but the first representations of the BSJ core between 40 and 100 m water depth overlaps the erosion/ non-deposition zone. Thus, in-situ currents capable of mud re-suspension and the superposition of the modelled BSJ and associated amplifications roughly match the mud patterns. Age constraints indicate mid-Holocene BSJ evolution and continued maintenance of shelf break bypass.

UPWELLING OF ATLANTIC WATER ALONG THE CANADIAN BEAUFORT SEA CONTINENTAL SLOPE: FAVORABLE ATMOSPHERIC CONDITIONS AND SEASONAL AND INTERANNUAL VARIATIONS

Kirillov, Sergei (1), I. Dmitrenko (1), B. Tremblay (2), Y. Gratton (3), D. Barber (1) and S. Rysgaard (1)

(1) Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada); (2) McGill University (Montreal, Canada); (3) Institut National de la Recherche Scientifique (Quebec, Canada)

The role of wind forcing on the vertical displacement of the -1C isotherm and 33.8 isohaline depths was examined based on snapshots of historical (1950–2013) temperature and salinity profiles along the Mackenzie continental slope (Beaufort Sea). It is found that upwelling is correlated with along-slope northeast (T59) winds during both ice-free and ice-covered conditions, although the wind impact is more efficient during the ice-free season. One of the most important factors responsible for vertical displacements of isopycnals is sustained wind forcing that can last for several weeks and even longer. It accounts for 14–55% of total variance in isotherm/isohaline depths, although these numbers might be underestimated. The upwelling and downwelling events are discussed in the context of the interplay between two regional centers of action - the Beaufort high and Aleutian low - that control the wind pattern over the southern Beaufort Sea. The probability of upwelling-favorable wind occurrence is closely related to the sea level pressure difference between these two centers, as well as their geographical positions. The combined effect of both centers expressed as the SLP differences is highly correlated (0.68/0.66 for summer/winter) with occurrences of extreme upwelling favorable northeast (NE) winds over the Mackenzie slope, although the Beaufort high plays a more important role. The authors also diagnosed the predominant upwelling-favorable conditions over the Mackenzie slope in the recent decade associated with the summertime amplification of the Beaufort high. The upwelling favorable NE wind occurrences also demonstrate the significant but low (-0.30) correlation with Arctic Oscillation (AO) during both summer and winter seasons, whereas the high correlation with North Pacific index (NPI; -0.52) is obtained only for the ice-covered period.

DEVELOPMENT OF DESIGN TOOLS FOR CONVECTION MITIGATION TECHNIQUES TO PRESERVE PERMAFROST UNDER NORTH TRANSPORTATION INFRASTRUCTURES

Kong, Xiangbing (1), G. Doré (1), F. Calmels (2) and C. Lemieux (1)
Permafrost is widely distributed in north hemisphere. It covers about 24% of the exposed land area. Mechanical properties of permafrost, which directly affect the stability of infrastructures, are highly temperature dependent. Under climate warming, permafrost degradation is happening and can lead to various infrastructure failures. To react to these permafrost related engineering problems, mitigation techniques should be used to preserve thaw-sensitive permafrost underneath infrastructure during its entire lifecycle. However, there are no decision tools for the selection of mitigation techniques, and no design procedures for some promising mitigation techniques, such as heat drains and air duct systems. The goal of the project is to develop engineering tools for the design of convective protection systems and includes two objectives. The first objective is to produce a decision-tool to help select the best mitigation method, considering the local context and needs in northern areas. The second objective is to improve design procedures for heat drains and air duct systems. To fulfill the objectives of this project, two models will be developed, and four field sites will be used for model validation as needed. One model for embankments without any mitigation techniques will mainly be used to quantify the heat balance for a given site condition under traditional or common design conditions. Another model for embankments with mitigation techniques will be used to assess heat extraction capacity of different protection systems as function of their design characteristics and site conditions. By using heat balance results of two models, it will be easy for the designers to select the suitable mitigation technique to protect infrastructures during their entire lifecycle. In addition, the project will also consider the cost of mitigation techniques, including construction costs, maintenance cost, etc. Finally, some cost / benefit analyses of field sites along with their thermal performance will be documented in the research. This author will present an overview of the ongoing project.

MONITORING AND MANAGING MUSKOX HEALTH FOR FOOD SECURITY AND ECOSYSTEM AND SOCIO-ECONOMIC RESILIENCE: INTEGRATING TRADITIONAL, LOCAL, AND SCIENTIFIC KNOWLEDGE: AN ARCTICNET PROJECT


(1) University of Calgary (Calgary, Canada);
(2) Government of the Northwest Territories (Inuvik, Canada);
(3) Trent University (Trent, Canada);
(4) Government of Nunavut (Kugluktuk, Canada);
(5) Polar Knowledge Canada (Winnipeg, Canada);
(6) University of Toronto (Toronto, Canada)

This work is done in collaboration with Ekaluktutiak Hunters and Trappers Association, Kitikmeot Inuit Association, Kugluktuk Angoniatit Association, Paulatuk Hunter and Trappers Committee, Olokhaktok Hunters and Trappers Committee, Sachs Harbour Hunters and Trappers Committee, and Canada North Outfitting. Muskoxen are integral to the culture, food system, economy, and ecosystem health in many parts of the Arctic, but recent widespread mortalities of muskoxen on Victoria and Banks Islands, Canada, with concomitant population declines, have raised concerns about muskox health and sustainability as well as the food safety and security for local people. We are using a combination of scientific and traditional and local knowledge to evaluate and monitor the health and vulnerability of muskoxen in a rapidly changing Arctic. Specifically, we are (i) determining the current health status of muskoxen in parts of the Inuvialuit and Kitikmeot regions, Canada, (ii) evaluating factors which influence health, including disease, contaminants, climate, disturbance, and stress, (iii) investigating the ecology of three emerging parasitic, bacterial and viral diseases in muskoxen, (iv) developing indicators of health that can be incorporated into muskox monitoring programs, and (v) establishing and implementing an integrative and responsive muskox health surveillance system that can pro-actively inform wildlife management, public health, and land-use policy. Tools, techniques, and programs developed, together with extensive training of both northerners and southerners,
will lead to improved technical and human resources for health monitoring not only of muskoxen, but other arctic wildlife, and will contribute to improved food safety and security across the North.

**MUSKOX HEALTH ECOLOGY: A GLOBAL OVERVIEW OF THE STATUS, TRENDS, THREATS AND VULNERABILITY OF MUSKOXEN IN A CHANGING ARCTIC**

Kutz, Susan (1), F. Mavrot (1), C. Gerlach (2), C. Cuyler (3) and K. Bondo (2)

(1) Faculty of Veterinary Medicine, University of Calgary (Calgary, Canada);
(2) University of Calgary (Calgary, Canada);
(3) Greenland Institute of Natural Resources (Nuuk, Greenland, Denmark)

The muskox, Ovibos moschatus or ‘the Bearded One’, is a taxonomically unique, arctic adapted, ice-age survivor of critical importance to northern peoples, economies and ecosystems. Muskoxen have a circumarctic distribution, are an important food source, and provide economic benefits through employment generated by tourism, sport hunting, and the traditional economy (sale of qiviut (wool), horns, and handicrafts). In Canada, prior to the recent significant population declines, they were also harvested commercially for food and qiviut, supplying national and international markets, all with widespread economic benefits. Recent emergence of diseases (including several zoonoses) in muskoxen, large-scale mortality events, and population declines in parts of their circumarctic range have highlighted the potential sensitivity of this species to a changing climate. In November 2016, the first International Muskox Health Ecology Symposium was held at the Faculty of Veterinary Medicine, University of Calgary. The goal was to share knowledge on muskox health ecology and sustainability across a variety of international stakeholders including community members/users, industry, wildlife management, and academia. Topics included the socio-cultural-economic-ecological value of muskoxen, population status and trends, threats, vulnerabilities and resilience, knowledge gaps, disease ecology, and existing and needed tools for muskox health monitoring and research. Outcomes from this meeting, including the current global status of muskoxen, the value, threats and resilience, knowledge gaps and directions forward, will be presented.

**RIVERINE ORGANIC MATTER ENTERING HUDSON BAY; CAN IT INFORM US OF CHANGE?**

Kuzyk, Zou Zou (1), R. Macdonald (1), M. Goni (2), P. Godin (1) and G. Stern (1)

(1) University of Manitoba (Winnipeg, Canada);
(2) Oregon State University (Corvallis, United States)

Hudson Bay, at the southern margin of the Arctic, is undergoing change due to thawing of ice. Like the Arctic Ocean, Hudson Bay is exceptionally vulnerable to warming, but understanding what the consequences are for biogeochemical cycles within the Bay presents a monumental challenge. Change will occur within the Bay as a direct consequence of change in sea ice climate, but it is likely that an equally important change will be imported to the Bay from its large and diverse drainage basins. To understand change in the Hudson Bay System therefore requires the capacity to identify and quantify imported effects from permafrost degradation, vegetation alteration, hydrological disruption and wildfire incidence. Perhaps the best opportunity to detect such change lies in the composition and quantity of organic carbon (OC) carried by the rivers that enter the Bay. Accordingly, we have measured concentrations of dissolved and particulate OC (DOC, POC) in 17 major rivers spanning a wide range in latitudes and in vegetative and permafrost domains. We have determined lignin compositions of the OC and, for selected DOC samples, the 14C ages. Lignin compositions, which depend on types of vegetation (e.g., trees, flowering shrubs, tundra), provide discrimination among rivers according to latitude range of the drainage basin, but all rivers exhibit mixed vegetative sources. In general, higher DOC and POC concentrations associated with southern rivers, which are partially covered by permafrost, suggests that warming of northern river basins with more complete permafrost cover will lead to progressively higher DOC and POC loads. Based on the lignin compositions and fluxes and the Δ14C values for DOC in selected rivers, we infer that climate signals imported to the Bay within the OC composition will be dominated by southern rivers whereas the best evidence for change within the river basins themselves will be found in small rivers that drain narrow latitudinal bands. In the case of the Nelson and Churchill Rivers, relatively old DOC (~2800 ybp) may indicate release from soils due to hydroelectric development. In a few cases DOC with high Δ14C ages had fresh lignin
compositions, which likely indicates recent release of DOC preserved in permafrost. A surprise finding was old DOC ages for the two most northern rivers, which suggests that permafrost degradation may not follow an intuitive, south to north, progression. This meridional river study provides a benchmark against which to evaluate future change mediated by permafrost thaw.

**QUANTIFICATION OF IKAITE IN FIRST- AND MULTI-YEAR SEA ICE**

Kyle, Heather and S. Rysgaard

Centre for Earth Observation Science; Department of Geological Sciences, University of Manitoba (Winnipeg, Canada)

The world’s oceans are the most significant sink of atmospheric CO2, and up to 144 TgC yr-1 of CO2 is taken up by the Arctic Ocean. Until recently, it was believed that sea ice acted as a barrier to air-sea CO2 exchange. However, recent studies have shown that air-sea exchange is possible in ice covered seas as a result of the sea ice carbon pump, where CO2 is removed from sea ice along with brine. Ikaite (CaCO3•6H2O) precipitates naturally in sea ice and CO2 is released when ikaite forms, so the precipitation of ikaite could have a significant impact on sea ice carbon fluxes. However, the spatial and temporal dynamics of ikaite in sea ice remain poorly understood. To increase understanding of ikaite precipitation in sea ice, a method of accurately quantifying ikaite is being developed. This technique uses the analysis of dissolved inorganic carbon (DIC) and total alkalinity (TA) of filtered crystals as a proxy for ikaite concentration. To determine if this method is effective, it was compared to the existing image analysis technique of ikaite quantification in a variety of settings. First- and multi-year ice cores were collected in Station Nord, Greenland and Cambridge Bay, Nunavut in April 2015 and May 2016. At all sample sites, sea ice temperature, salinity, DIC, and TA were measured. Ikaite concentrations were then calculated using the existing image analysis method and the new DIC analysis technique. Ikaite concentrations in sea ice collected from Station Nord, Greenland quantified by the two techniques overlapped within an error of one standard deviation from the mean. However, due to warm ice temperatures and low salinities, ikaite concentrations were lower than expected (less than 100 µmol kg-1 in all cases), and with low concentrations, it is difficult to establish the quality of of the new analysis method. However, more ikaite crystals were observed in sea ice collected from Cambridge Bay, Nunavut in May 2016. Analysis of data collected from Cambridge Bay is still ongoing, but preliminary TA and DIC concentrations were generally higher than in Station Nord. This is consistent with the larger number of crystals observed in Cambridge Bay sea ice.

**READINESS FOR CLIMATE CHANGE ADAPTATION IN NUNAVUT, CANADA**

Labbé, Jolène (1), J. Ford (1), M. Flynn (1) and IHACC Research Team (1,2)

(1) McGill University (Montréal, Canada); (2) University of Guelph (Guelph, Canada)

In-light of experienced and projected climate change, adaptation has emerged as an important component of climate policy in Arctic regions. While we know that adaptation efforts are underway and have growing understanding on opportunities for adaptation in the Arctic, we have limited knowledge on actual governance and institutional factors constraining and enabling adaptation, or the overall readiness of governing bodies and communities to develop, implement, and promote adaptation. Responding to this gap, this research develops a framework for examining adaptation readiness in Arctic regions, and applies it to evaluate the preparedness of different levels of government to adapt in the Canadian territory of Nunavut. In the Government of Nunavut (GN)—where potential adaptation responsibilities surround service provision such as health, education, social services, housing, and infrastructure—while there were notable developments around adaptation planning and examples of adaptation champions, readiness for adaptation is challenged at present by a number of factors. Federally—where adaptation responsibilities surround awareness raising, capacity development, resource provision—there was indication of higher levels of readiness, with evidence of high level leadership on adaptation, the creation of adaptation programs, and allocation of funds for adaptation. At both levels of government, there was optimism that with the newly elected federal government that climate change in general and adaptation in particular might get renewed emphasis. We use the insights developed to outline recommendations for moving the adaptation agenda forward in four main ways: 1) improved
political leadership, clear adaptation planning, and mandated requirement can help prioritize adaptation and strengthen decision-making; 2) support for adaptation champions, who are important for improving coordination and momentum for adapting; 3) cultural values and traditional knowledge must underpin multiple components of adaptation readiness; 4) creation of a northern specific adaptation research program.

SPATIAL VARIABILITY OF CARBON DIOXIDE EMISSIONS WITHIN A DRAINED LAKE BASIN AND ITS SURROUNDING TUNDRA, ILLISARVIK, NWT.

Laforce, Andrée-Anne, E. Humphreys and C. Burn
Carleton University (Laval, Canada)

Recent studies have shown that degrading permafrost not only results in greater losses of carbon (C) from tundra but also greater losses of ‘old’ C (Schuur et al. 2009). This forms the basis for one of the potential positive feedback effects to the climate system that has the potential to enhance climate warming globally (Schuur et al. 2015). In 1978, a small lake known as Illisarvik on Richards Island was drained. Since then, vegetation succession and permafrost growth has been monitored demonstrating great spatial variability in both throughout the basin. The field site covers a 500 m x 350 m area where ten vegetation units were selected to represent the spatial variability of the basin and surrounding tundra. Carbon dioxide released from soils of the distinct vegetation units within the basin was measured using chamber flux techniques. Microclimate characteristics of each vegetation unit, including snow depth records, thaw depth, soil moisture and near surface soil temperature, were monitored. Radiocarbon dating of the gas fluxes is also being done to help understand the source of carbon released from these soils. The hypothesis behind this research is that carbon dioxide emissions associated with heterotrophic and belowground autotrophic respiration will be greatest in the basin in areas that are moist and warm with deep active layers related to deeper snow and taller vegetation (that may also result in greater rooting density and productivity).

A CONCEPTUAL MODEL OF THE POTENTIAL SCALE AND DURATION OF CLIMATE AND PERMAFROST CHANGE IMPACTS ON HIGH ARCTIC WATER QUALITY

Lafreriere, Melissa (1) and S. Lamoureux (2)
(1) Queen’s University (Kingston, Canada); (2) Dept. of Geography and Planning, Queen’s University (Kingston, Canada)

Climate change is simultaneously altering the hydrology and permafrost conditions in Arctic watersheds. Studies from across the Arctic report substantial permafrost degradation in the form of thermokarst alteration to surface drainage patterns, associated changes in runoff volumes and timing, the export of sediments, nutrients, contaminants/metals, and dissolved and particulate organic carbon. However very few studies provide a means of projecting or even constraining the potential scale, or duration of any of these changes at a watershed scale, their interactions, or impact on downstream ecosystems. The integrated watershed research program at the Cape Bounty Arctic Watershed Observatory (CBAWO) on Melville Island, has been studying the hydrological, geomorphological and biogeochemical response of High Arctic watersheds to climate variability and permafrost degradation for more than a decade. The research includes systematic hydrological process and flux investigations (water, suspended sediment, hydrochemical, organic matter flux and composition and contaminants), integrated with landscape research directed at understanding the processes associated with permafrost disturbance and degradation, downstream lake water quality and impacts on aquatic ecosystems. This research program has been carried out in the context of paired watersheds, including nested subcatchments and plot-level process studies since 2005. This program has documented the response of this High Arctic landscape to a prominent phase of permafrost perturbation and disturbance that began in 2007 and has developed through the warmest decade on record in the region. The aim of the present study is to combine key findings from the multiple dimensions of CBAWO research carried out since 2005 to constrain the likely temporal and spatial extent of disturbance and degradation across the landscape, the processes that drive these changes in terms of biogeochemical and related water quality change, and predict the downstream nature and magnitude of water quality changes. In particular, we emphasize the duration of the likely impacts on aquatic C cycling and...
aquatic ecosystems, with implications for terrestrial-nearshore marine transfers across the region.

**SPATIAL AND TEMPORAL VARIABILITY IN PHYTOPLANKTON AND PARTICULATE MATTER EXPORT IN THE BEAUFORT SEA (2014-2015)**

Lalande, Catherine (1), M. Parenteau (1) and L. Fortier (1,2)

(1) Université Laval (Québec, Canada); (2) ArcticNet (Québec, Canada)

The integrated Beaufort Observatory (iBO) is a 4-year mooring program (2015-2018) targeting the shelf and slope environment of the Canadian Beaufort Sea. The project, co-led by ArcticNet, the Institute of Ocean Sciences (Department of Fisheries and Oceans Canada, DFO), Université Laval, and Golder Associates, and supported by the Environmental Studies Research Funds (ESRF) and Imperial Oil Limited, aims to extend existing time-series and regional coverage. As part of the iBO project, 7 sequential sediment traps were deployed on 5 mooring lines located along the Mackenzie shelf break and west of Banks Island for the measurement of biogeochemical fluxes from September 2014 to August 2015. We present the export fluxes of total particulate matter (TPM), particulate organic carbon (POC), and phytoplankton cells at these 5 sites. Whereas most TPM and POC fluxes measured at the Mackenzie shelf break were in a similar range, 2 very large peaks in TPM and POC fluxes were observed at the shallowest site on the shelf in November and March, likely due to resuspension caused by a change in current direction. TPM and POC fluxes measured at the site west of Banks Island were minimal. Phytoplankton cells collected in the sediment traps, nearly all diatoms, reflect the magnitude, timing, and duration of the phytoplankton bloom in the Beaufort Sea. Diatom fluxes started to increase at the end of April and peaked at the end of May/beginning of June at the Mackenzie shelf break, while they increased in June and peaked in August west of Banks Island. Diatoms fluxes were highest at the 2 shallowest sites at the Mackenzie shelf break and very low west of Banks Island. Contrastling fluxes between a heavy ice year (2014-2015, above) and an ice-poor year (2015-2016) will contribute to our understanding of the present and future state of the Beaufort Sea.

**EXAMINING STRATEGIES TO BETTER REPRESENT INUIT CULTURE AND MODES OF LEARNING IN EDUCATION: CASE STUDY OF ULUKHAKTOK, NWT**

Lalonde, Genevieve and T. Pearce

University of Guelph (Guelph, Canada)

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. This thesis reports on research conducted with Inuit in the Canadian Arctic to identify what aspects of culture and modes of learning Inuit desire to have included in education beyond those identified a priori by non-Inuit educators. A conceptual framework for the cultural negotiation of Indigenous education is empirically applied in a case study of Ulukhaktok, NWT to identify what Inuit think young people should learn, how they should learn it, where they should learn it and from who, and why it is important for them to learn it. Data were collected using semi-structured interviews (n=31), free-lists and participant observation. Findings show that Inuit desire to have subsistence knowledge, skills and values, and understanding of the local environment included in education, which not only builds competence in subsistence but also provides students with capacity to cope with challenges in the modern world. This involves on-the-land hands-on learning with a skilled person and/or family member. Inuit perceive school as a place for learning and the findings identify opportunities to negotiate this space to better integrate Inuit culture and modes of learning.

**SEA ICE ROUGHNESS: THE KEY FOR PREDICTING ARCTIC SUMMER ICE ALBEDO**

Landy, Jack, J. Ehn and D. Barber

University of Manitoba (Winnipeg, Canada)

The ICESat operational period 2003–2008 coincided with a dramatic decline in Arctic sea ice—linked to prolonged melt season duration and enhanced melt pond coverage. Although melt ponds evolve in stages, sea ice with smoother surface topography
typically allows the pond water to spread over a wider area, reducing the ice-albedo and accelerating further melt. We have developed this theory into a quantitative relationship between premelt sea ice surface roughness and summer melt pond coverage. Our method, applied to ICESat observations of the end-of-winter sea ice roughness, can account for 85% of the variance in advanced very high resolution radiometer (AVHRR) observations of the summer ice-albedo. An Arctic-wide reduction in sea ice roughness from 2003 to 2008 explains a drop in ice-albedo that resulted in a 16% increase in solar heat input to the sea ice cover, which represents ten times the heat input contributed by earlier melt onset timing over the same period.

SEA ICE THICKNESS IN THE EASTERN CANADIAN ARCTIC (HUDSON BAY & BAFFIN BAY)

Landy, Jack, J. Ehn, D. Babb, N. Theriault and D. Barber

University of Manitoba (Winnipeg, Canada)

Past observations of sea ice thickness in the Eastern Canadian Arctic (ECA) have generally been restricted to drill-hole measurements at a few local sites on landfast ice. Here we present a fourteen year record of high-resolution and spatially extensive ice thickness observations for the ECA, obtained from the laser altimeter ICESat and the radar altimeter Cryosat-2. Our results demonstrate that ice thickness distributions in both Hudson Bay and Baffin Bay are characteristically asymmetrical, but in opposing directions. For instance, in Hudson Bay the spring ice cover is 40 cm thicker in the northwestern region compared to the eastern region, whereas in Baffin Bay the ice is 25 cm thicker in the western half of the bay compared to the eastern half. The mean sea ice growth rate within the ECA from November to April is 235 km$^3$ mo$^{-1}$, with the fastest growth occurring through strong ice convergence in eastern Hudson Bay. Negative trends in spring ice volume are evident in nine of twelve regions of the ECA (and statistically significant in four), although the overall trend of -268 km$^3$ decade$^{-1}$ (-16 cm ice thickness per decade) is not significant. We find that years with strong and positive ice vorticity (i.e. cyclonic and convergent conditions) produce increasingly asymmetrical sea ice covers within Hudson Bay, with the level of west-east asymmetry varying from 2 to 11 cm per 100 km. However, the ice vorticity is typically negative in Baffin Bay (i.e. anticyclonic and divergent conditions) with no obvious link to the asymmetry of the spring ice cover. Finally, we estimate that large interannual variations in spring sea ice volume within the ECA lead to ±20% variations in the volume of freshwater available at the ocean surface during summer.

AN OVERVIEW OF 3 YEARS OF SNOW STUDIES IN THE GREINER WATERSHED: IN-SITU MEASUREMENTS, MODELING AND REMOTE SENSING

Langlois, Alexandre (1), A. Royer (1), D. McLennan (2), L. Brucker (3), C. Dolant (1), C.-A. Johnson (4), A. Richards (4) and G. Arhonditsis (5)

(1) Université de Sherbrooke - Centre d’études nordiques (Sherbrooke, Canada);
(2) CHARS (Winnipeg, Canada);
(3) NASA - Goddard (Washington, United States);
(4) Environment and Climate Change Canada (Ottawa, Canada);
(5) University of Toronto (Toronto, Canada)

We present work that occurred in Cambridge Bay within a main research program on winter extreme events in the Arctic. Of particular relevance, the program aims to 1) develop rain-on-snow (ROS) events detection algorithms using satellite data and 2) evaluate the effect of ROS events on snow conditions, in particular Peary caribou grazing conditions using snow measurements and simulations. The simulations are possible using the SNOWPACK Swiss model which needs meteorological data as input. The input data is provided by a snow-dedicated meteorological station currently operating in Cambridge Bay. The model is also forced with reanalysis for regional application across the whole Canadian Arctic Archipelago. It is also expected to force the model using climate model data, for future insight on snow conditions. Our results suggest an increase in ROS events over the past 35 years where occurrence tripled between 1996-2011 compared to 1979-1995. Trends in ice layers detection are identical and a negative impact is found when compared to caribou population numbers. Modleing results using SNOWPACK suggest that a threshold on snow density at 350 kg m$^{-3}$ can be used, along with ROS and ice layer occurrence to map favorable grazing conditions for Peary caribou.
THE CO-DISTRIBUTION OF SEABIRDS AND THEIR JUVENILE FISH PREY IN BAFFIN BAY

LeBlanc, Mathieu (1), A. Mosbech (2) and L. Fortier (1)
(1) Université Laval (Québec, Canada); (2) Aarhus University (Roskilde, Denmark)

In arctic marine ecosystems, arctic cod (Boreogadus saida), the main pelagic forage fish, plays a key role by transferring energy from the zooplankton to the upper trophic levels, including seabirds. The interactions between fish and seabirds at the sea-ice edge, an environment increasingly common in the warming Arctic, are poorly documented. We test the hypothesis that the abundance and biomass of juvenile fish, especially at the sea-ice edge, influence the distribution and composition of the seabird assemblage. Hydroacoustic data were recorded continuously during the CCGS Amundsen GreenEdge 2016 cruise in southern Baffin Bay, using a hull-mounted EK60 multi-frequency echosounder. Pelagic nets were deployed to document the fish assemblage and to validate the acoustic echoes. Seabird observations during transit periods and seabird sampling in Greenland waters were completed. This study will provide insights in the predator-prey dynamics of seabirds and fish in the Arctic in a context of climate change.

DOLPHIN AND UNION (RANGIFER TARANDUS GROENLANDICUS X PEARYI) CARIBOU HERD ABUNDANCE AND TRENDS, KITIKMEOT REGION, NUNAVUT

Leclerc, Lisa-Marie (1), M. Tomaselli (2), S. Kutz (3), S. Checkley (2), Kugluktuk Angoniatit Hunters and Trappers Organization (4) and Ekaluktutiak Hunters and Trappers Organization (5)
(1) Government of Nunavut (Kugluktuk, Canada); (2) Department of Ecosystem and Public Health, Faculty of Veterinary Medicine, University of Calgary. (Calgary, Canada); (3) Department of Ecosystem and Public Health, Faculty of Veterinary Medicine, University of Calgary./ Canadian Wildlife Health Cooperative, Alberta Regional Centre, Faculty of Veterinary Medicine, University of Calgary (Calgary, Canada); (4) Hunters and Trappers Organization (Kugluktuk, Canada); (5) Hunters and Trappers Association (Cambridge Bay, Canada)

The Dolphin and Union caribou (Rangifer tarandus groenlandicus x pearyi) herd is of great importance for the Inuit subsistence economy, as well as the cultural needs of community residents of Kitikmeot Region, Nunavut, Canada. Partial herd estimate and strategically total herd estimate were effectuated in 1997 and 2007. During the last survey, in 2007, the Dolphin and Union caribou herd was estimated at 27,787 ± 3,613 (SE) individuals. Since then, the numerous threats to herd have led to an increase in the monitoring efforts which have been formalized through the Dolphin and Union Research Program, 2015-2019. One of the objectives of this program was to provide a new population estimate. Thus, in fall 2015, an aerial population assessment was completed and an extrapolated herd estimate was derived using collared caribou data to capture caribou outside the survey area. The Dolphin and Union population was estimated at 18,413 ± 6,795 (95% CI, 11,664-25,182), which indicates a significant decline from the 2007 survey estimate (z-test, Z= -2.19, p= 0.036). Such signs of decline were previously identified by Inuit Qaujimajatuqangit and local knowledge gathered in a participatory study conducted in 2014 in the community of Cambridge Bay. According to this study, by the end of 2014, community residents reported observing 80% (IQR: 75-90%) fewer Dolphin and Union caribou in the Cambridge Bay area compared to levels observed in the 1990s. This is an example on how traditional and local knowledge can complement scientific information by providing both qualitative and quantitative data and, therefore, be effectively integrated into the co-management process. Such integrative approach is endorsed by the Department of Environment of the Government of Nunavut and, moving forward, can be successful not only to assess wildlife population trends, but also to understand Arctic ecological processes and provide adaptive solutions for management and conservation actions.

IS HUMAN ACTIVITY DRIVING THE PRESENCE OF RED FOXES IN THE ARCTIC?

D. Gallant (1), Lecomte, Nicolas (1,4), B. B. Slough (2) and D. Berteaux (3)
(1) Canada Research Chair in Polar and Boreal Ecology (Moncton, Canada); (2) Independent researcher (Whitehorse, Canada); (3) Canada Research Chair on Northern Biodiversity
and Centre for Northern Studies, Université du Québec à Rimouski, Rimouski, G5L 3A1 (Rimouski, Canada); (4) Canada Research Chair in Polar and Boreal Ecology, Université de Moncton, Moncton, New Brunswick, E1A 3E9 (Moncton, Canada)

Under the current climate change, the Arctic is changing rapidly and so does the distribution of a growing number of species moving towards the north. How the parallel increase of human activities on the tundra interplay with climate change to modify species’ ranges remains a knowledge frontier. Human presence in these depauperate ecosystems potentially constitutes a major disturbance factor, namely through the production of anthropogenic food subsidies favouring the survival and reproduction of predators. One major change in species distribution in the Arctic during the last century was the expansion a new top-predator, the red fox, which now poses a potential long-term threat to the arctic fox, its smaller competitor that is indigenous to the Arctic. Here we studied how the distribution of red fox changed in relation to the changing footprint of human presence over the course of the last 45 years on Yukon’s arctic coastal plain, a region under intense climate warming. We modelled changes in the distribution of red fox using fox den survey data going back to 1971. We then established a model of red fox dynamics using proxies of den occupation and breeding evidence in order to determine the relative strength of association between human activity, climate change, and predator presence. This study opens new perspectives on how anthropogenic forces are shaping new arctic ecosystems.

DETERMINING COASTAL ECOLOGICAL PATTERNS FROM BOTTLES OF WATERS; THE POWER OF THE EDNA METABARCODING

Leduc, Noémie (1), L. Bernatchez (1), P. Archambault (1), A. Lacoursière-Roussel (1) and K. Howland (2)

(1) Université Laval (Québec, Canada); (2) Fisheries and Oceans Canada (Winnipeg, Canada)

In the Canadian Arctic, important changes of the coastal biodiversity are expected due to the combine impact of the global climate changes and the increase of shipping activity. The analysis of environmental DNA (eDNA), a new cost-effective method tracing DNA from macro-organisms, may become a revolutionary tool to monitor extensive coastal biodiversity in the Arctic. Here we evaluate the potential of the eDNA metabarcoding to detect local species distribution in sensitive areas such as Arctic commercial ports (Churchill, Iqaluit and Deception Bay). More precisely, we first evaluate the spatial eDNA transport by contrasting biodiversity indices (alpha, beta, gamma) between eDNA and the local species distribution. Second, we contrast holoplankton and meroplankton detection rate related to their relative life cycle to evaluate the efficiency of the eDNA method among the different taxon of marine invertebrates. To achieve this,
we collected water samples from three different depths at 13 sites in each port. The water samples were then filtered directly on location. The eDNA was extracted and amplified using four primer sets (COI and 18S) and sequenced using next generation sequencing (i.e. Illumina MiSeq). To compare the biodiversity indices between eDNA and the spatial distribution of the species, the coastal organisms were collected using classical sampling method at each sampling site using a Van Veen grab sampler and a benthic trawl. In addition to evaluate the potential of the eDNA method to detect local biodiversity changes (e.g. biodiversity loss and introduction of invasive species) and inform about local ecological population and community patterns, this project will allow optimizing the eDNA method for possible applications in species monitoring and resource protection.

TRACING WATER MASSES AND N TRANSFORMATION PROCESSES IN THE ARCTIC OCEAN USING NITRATE Δ15N AND Δ18O
Lehmann, Nadine (1), M. Kienast (1), J. Granger (2) and J.-É. Tremblay (3)
(1) Dalhousie University (Halifax, Canada);
(2) University of Connecticut (Groton, United States);
(3) Laval University (Quebec, Canada)

The Arctic Ocean plays a key role in the global oceanic nutrient cycle by connecting two major ocean basins, the northern Pacific and the Atlantic Ocean. Water with a low N:P enters the Arctic Ocean from the Pacific, transits through the Bering Strait and the Beaufort Sea and eventually flows into the North Atlantic Ocean. How those waters are modified in terms of their nutrient composition as they pass the Arctic throughflow has yet to be explored. Coupled 15N/14N and 18O/16O isotope measurements not only give you insights into the main N transformation processes but can further be used to elucidate the origin and history of water masses. In this study, we will present water column profiles of δ15N and δ18O in nitrate collected on the CCGS Amundsen in July/August 2015, as part of the Canadian Arctic GEOTRACES program. These profiles are complemented by extensive hydrodynamic measurements to identify the main water masses along the transect. Preliminary results indicate relatively fresh subsurface water with a negative N* (N-to-P-ratio) and elevated nitrate δ15N of entering the Canadian Archipelago from the west. This N-depleted water mass with elevated nitrate δ15N can be traced as far east as 60°W (Davis Strait), where it is underlain by more saline Atlantic water with a lower 15N/14N ratio. The data presented here will be discussed in the context of N-cycling processes and geochemical modifications within those waters as they move through the Canadian Archipelago and the Labrador Sea into the North Atlantic.

COUPLED TERRESTRIAL-AQUATIC CLIMATE IMPACTS ON THE WATERSHED OF THE HIGH ARCTIC’S GREAT LAKE (LAKE HAZEN, NUNAVUT)
Lehn herr, Igor (1), V. St. Louis (2), S. Schiff (3), M. Sharp (4), J. Smol (5), D. Muir (6), A. Gardner (7), C. Tarnocai (8), K. St. Pierre (2), N. Michelutti (5), C. Emmerton (9), C. Mortimer (4), C. Talbot (10) and J. Wiklund (6)
(1) Geography, University of Toronto-Mississauga (Mississauga Rd, Canada);
(2) Biological Sciences, University of Alberta (Edmonton, Canada);
(3) Earth and Environmental Sciences, University of Waterloo (Waterloo, Canada);
(4) Earth and Atmospheric Sciences, University of Alberta (Edmonton, Canada);
(5) Biology, Queen’s University (Kingston, Canada);
(6) Aquatic Contaminants Research Division, Environment and Climate Change Canada (Burlington, Canada);
(7) Jet Propulsion Laboratory, California Institute of Technology (Pasadena, United States);
(8) Agriculture and Agri-food Canada (Ottawa, Canada); (9) IISD-Experimental Lakes Area (Winnipeg, Canada); (10) Environment and Climate Change Canada (Burlington, Canada)

Lake Hazen, located within Quttinirpaaq National Park on northern Ellesmere Island (Nunavut, Canada), is the largest lake by volume north of the Arctic Circle and the High Arctic’s only true Great Lake. Lake Hazen has a maximum depth of 267 m, a surface area of 540 km2 and a 8400 km2 watershed that is ~1/3 glaciated. The climate of the Lake Hazen watershed has experienced a recent strong warming trend with surface air temperatures increasing ~0.21 °C yr-1 from 2000-2012. During this period, modeled glacier mass-balance values showed a distinct shift from net annual
mass gain of ~0.3 Gt to a net annual mass loss of up to 1.4 Gt beginning in 2007-2008. Recent warming of soils (0.14 °C yr-1) and deepening of the active layer in the Lake Hazen watershed have also occurred. Rising temperatures had important consequences for summer lake ice cover: the mean summer-time ice-free area on the lake increased by an average of 3 km² yr-1 from 2000 to 2012, and full ice-off on Lake Hazen became more frequent, from 60% of the years between 1985-95 to 88% of the years between 2006-12. The ~250 year sediment record obtained from the floor of Lake Hazen showed that, in the past 15 years, changes in diatom community assemblages, sedimentation rates, geological inputs from the catchment, water column mixing, and fluxes of organic carbon and contaminants are historically unprecedented and consistent with the observed trends of rising surface air temperatures, increasing glacial melt and runoff, and decreasing summer lake ice cover in this watershed. These changes have important implications for in-lake processes that pertain to ecosystem productivity, and the cycling of carbon, nutrients and contaminants. We demonstrate that even more resilient ecosystems such as very large lakes are exhibiting regime shifts due to climate change and entering new ecological states.

COMPARATIVE LIMNOLOGY OF LAKES AND PONDS IN THE LAKE HAZEN WATERSHED DURING ICE-COVERED AND ICE-FREE SEASONS: WHAT ARE THE IMPLICATIONS OF CLIMATE CHANGE FOR THE CARBON AND NUTRIENT CYCLES IN FRESHWATER ECOSYSTEMS?

Lehnherr, Igor (1), V. St. Louis (2), S. Schiff (3), J. Venkiteswaran (4), K. St. Pierre (2), C. Emmerton (5), P. Aukes (3) and V. Wisniewski (1)

(1) Geography, University of Toronto-Mississauga (Mississauga Rd, Canada);
(2) Biological Sciences, University of Alberta (Edmonton, Canada);
(3) Earth and Environmental Sciences, University of Waterloo (Waterloo, Canada);
(4) Geography, Wilfrid Laurier University (Waterloo, Canada);
(5) IISD-Experimental Lakes Area (Winnipeg, Canada)

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. The limnological characteristics of these freshwater ecosystems, including nutrient concentrations, thermal stratification/mixing regimes, and redox conditions play a critical role in controlling key biogeochemical processes such as ecosystem productivity and the net exchange of greenhouse gases with the atmosphere. Climate change is predicted to result in warmer temperatures, increased precipitation and permafrost melting, and decreased ice-cover 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. By comparing the conditions and processes that dominate under ice-covered vs. ice-free conditions, we can begin to predict how major processes such as primary productivity, ecosystem respiration, and the exchange of greenhouse gases will be altered, on an annual basis, as conditions shift towards a longer ice-free season. We sampled two lakes, shallow Skeleton Lake (4 m) and deep Lake Hazen (267 m), during both open-water and ice-covered seasons, as well as a series of wetland ponds during the open water season, on northern Ellesmere Island (82° N, Nunavut, Canada). We will present surface water measurements and depth profiles obtained for a suite of limnological and biogeochemical parameters, including concentrations of nutrients and dissolved gases (O2, CO2, CH4, N2O) as well as stable-isotope ratios of dissolved oxygen (δ18O-DO) and dissolved inorganic carbon (δ13C-DIC). Using these data we will show how the contrasting conditions (with respect to light and redox conditions, mixing and stratification regime, etc.) during spring (ice-on) and summer (ice-free) result in difference in how carbon and nutrients are cycled in these ecosystems, highlighting how, on an annual scale, these biogeochemical cycles are likely to change as the ice-free season continues to increase in length.

LARGESCALE ECOLOGICAL MONITORING OF TOP CARNIVORES IN THE TUNDRA ECOSYSTEM OF NUNAVUT

L'Hérault, Vincent (1), N. Lecomte (2), G. Szor (3), M. Awan (4) and D. Berteaux (5)

(1) ARCTIConnexion (Rimouski, Canada);
(2) Université de Moncton (Moncton, Canada);
(3) Gouvernement du Québec (Chibougameau, Canada);
(4) Government of Nunavut (Igloolik, Canada);
Wildlife monitoring is instrumental to detect changes in species abundance and distribution, population dynamic and ecological interactions between species of the Arctic ecosystems. Gaining knowledge on these wildlife parameters is particularly important under the general perspective of anthropogenic changes that are currently taking place in the Arctic. Mammalian predators such as the wolverine, wolf and grizzly bear, constitute one of the least known components of the tundra ecosystem, yet they play a considerable role in structuring the abundance of other Arctic species and bear a very important significance for Nunavut communities. Our study addresses a multi-year and large-scale ecological monitoring of these three top tundra predators to better understand their role in the functioning of the Arctic terrestrial ecosystem. From 2009 to 2013, a carcass collection program from subsistence harvesting across mainland Nunavut embodied the collaboration between the Hunters and Trappers Organizations, the Community Conservation Offices, the Government of Nunavut, and academia. From this collaboration, we gathered 791 carcasses for whose we investigated individual diet using stomach contents and various tissues (fur, liver, muscle) for Stable Isotopes. Observations and knowledge from local hunters were recorded on each animal. Nunavut hunters returned 287 carcasses of wolves (2011-2013), 375 wolverines (2010-2013), and 128 grizzly bears (2009-2013) across the 13 communities involved in the program. Kugluktuk, Baker Lake, and Arviat were the 3 communities for which we had the highest return rates of carcasses for all 3 species. Upinngaaqhaaq (March-May) was the season for which we had the highest return rates for the 3 species. Caribou contributed up to 90%, 75%, and 40% of wolves, wolverines, and grizzly bears’ diet, respectively. The proportion of caribou prey in wolverines and wolves’ diet was higher in the winter/spring compared to the summer (e.g. wolves harvested in the Arviat area averaged 75% vs 25% in spring and summer, respectively). Small tundra herbivores contributed up to 40% of the wolverines and wolves diet in summer, and up to 60% in grizzly bears’ diet during Upinngaaqhaaq. Muskoxen contributed up to 50%, 30% and 20% of wolves, wolverines, and grizzly bears’ diet, respectively (in Northwestern Nunavut). We documented, for the first time, a high proportion of marine sources in the diet of many wolverines (>60 individuals had marine-like signature in their diet) as in wolves, although weaker than for wolverines. This study has not explicitly studied the linkages between the anthropogenic stressors and the large carnivores, but we did record observations from hunters and elders suggesting a high potential of resilience (e.g. to industrial development). Some local observations increasingly report wolves in very poor conditions, changes in grizzly bear abundance, the use of marine preys by wolverines as our approach measured, changes in caribou distribution, increased muskoxen abundance. Altogether, these observations suggest that multiple stressors are at-play in the population of the largest terrestrial carnivores of the tundra. Long-term ecological monitoring of large carnivores (health indicators, reproduction capacity, and diet) is a possible avenue to be able to grasp the amplitude of the anthropogenic impacts over the next decades.

**HYDROCHEMISTRY AND CRITICAL LOADS OF ACIDITY FOR LAKES IN THE CANADIAN ARCTIC: POTENTIAL IMPACTS OF SHIP-SOURCE EMISSIONS**

Liang, Tanner and J. Aherne

Environmental and Life Sciences, Trent University, 1600 West Bank Drive, Peterborough, Ontario, K9J 7B8, Canada (Peterborough, Canada)

Increased accessibility of the northwest passage owing to climate change is expected to increase resource development and transportation within the Canadian Arctic. Increased ship-source emissions of sulphur dioxide (SO2) may have potential acidification effects on Arctic lakes and ponds, especially those located on acid-sensitive geology, i.e., Baffin Island. The critical loads approach provides an estimate of the maximum amount of acidic deposition that will not pose a significant harmful effect on a specified indicator organism, e.g., Arctic Char (Salvelinus alpinus). The objective of this study was to assess the hydrochemical characteristics of lakes and ponds in the Canadian Arctic, and to determine critical loads of acidity for surface waters. Hydrochemical data for >1500 lakes and ponds from across the Canadian Arctic were gathered from the literature and compiled into a unified database. Furthermore, during summer 2015 and 2016 lakes and ponds (n = 80) were sampled on Southern Baffin owing to its acid-sensitive geology (Pre-Cambrian Shield) and proximity to major shipping routes (Hudson Strait and the Northwest Passage). In addition, lakes...
and ponds from eastern Northwest Territories (n=9), Prince Charles Island (n=4), Coats Island (n=10) were also sampled to fill data gaps. Critical loads were estimated with the steady-state water chemistry model using observed water chemistry and a critical chemical limit to protect the specified indicator organism. Modelled sulphur and nitrogen deposition scenarios with and without marine-source emissions were used to calculated exceedance (i.e., where acidic deposition is in excess of the critical load) and the risk of negative impacts during the years 2010 and 2030.

HIGH-RESOLUTION HYDROLOGICAL MODELLING OF THE LOWER NELSON RIVER BASIN, MANITOBA, CANADA

Lilhare, Rajtantra (1), S. J. Déry (2), T. A. Stadnyk (3) and K. Koenig (4)

(1) Natural Resources and Environmental Studies (NRES), University of Northern British Columbia, Prince George, British Columbia, Canada (Prince George, Canada);
(2) Environmental Science and Engineering Program, University of Northern British Columbia, Prince George, British Columbia, Canada (Prince George, Canada);
(3) Department of Civil Engineering, University of Manitoba, Winnipeg, Manitoba, Canada (Winnipeg, Canada);
(4) Manitoba Hydro, Winnipeg, Manitoba, Canada (Winnipeg, Canada)

Numerical modelling plays a vital role in investigating potential hydrological impacts of climate change. This study describes the application of the Variable Infiltration Capacity (VIC) model at 0.10° spatial resolution to the Lower Nelson River Basin (LNRB) of Manitoba, Canada. The VIC model is forced by climate datasets that include daily precipitation, maximum and minimum air temperature from the Canadian Precipitation Analysis and the thin-plate smoothing splines (ANUSPLIN), and wind speed extracted from the North American Regional Reanalysis (NARR) for the period of 1979-2009. The model forcing parameters (precipitation and air temperature) are first evaluated as some previous studies have revealed a bias in ANUSPLIN gridded precipitation over northwestern Canada. Comparison of ANUSPLIN gridded datasets (precipitation and air temperature) against the observed data from meteorological stations shows that average daily precipitation attains a statistically-significant (p-value < 0.05) degree of correlation \( r = 0.88-0.99 \) and low Root Mean Square Error (RMSE = 0.30-0.54 mm) for all selected stations. The ANUSPLIN mean annual precipitation shows statistically significant correlation (p-value < 0.05) and low RMSE for most of the stations, while two others are negatively correlated, \( r= -0.22 \) (p-value= 0.38) and non-significant \( r= 0.35 \) (p-value= 0.22) with RMSE of 135.24 mm and 135.88 mm, respectively. Moreover, the ANUSPLIN average daily and mean annual air temperature are significantly correlated (p-value < 0.05) and consistent with the observed datasets. In the present VIC model calibration and evaluation process, we have selected unregulated sections of few tributaries of the Nelson River on the basis of observed data availability. The model calibration against the monthly observed discharge datasets from the Water Survey of Canada shows satisfactory results and achieved Nash-Sutcliffe Efficiency (NSE) scores of 0.68-0.81, Kling-Gupta Efficiency (KGE) values of 0.69-0.77 and \( r \) of 0.83-0.91 (p-value < 0.05). Furthermore, for the evaluation period these parameters show acceptable ranges with NSE (0.41-0.74), KGE (0.40-0.65) and \( r \) (0.70-0.96, p-value < 0.05). It is anticipated that the present setup of the high-resolution VIC model will provide the necessary support and useful insights into climate change impacts on the surface water hydrology of the LNRB. Future work in this regard includes a well calibrated and validated VIC model at various headwater rivers in LNRB and the understanding of climate change and flow regulation impacts on the LNRB.

TEAMING MARINE WILDLIFE SURVEYS WITH LOCAL INUVIALUIT COMMUNITIES

Lim, Rangyn (1) and F. K. Wiese (2)

(1) Stantec Consulting Ltd. (Burnaby, Canada); (2) Stantec Consulting Services inc. (Anchorage, United States)

Arctic marine mammal species are known indicators of ecosystem health and change. Studying distribution and population trends of marine mammal species is a challenge in the Arctic where logistical costs and constraints limit the accessibility of remote and offshore areas. Partnering with local communities and taking advantage of vessels of opportunity can make significant steps to overcome these challenges and help collect supplementary baseline data. Opportunistic
wildlife data collection programs took place during the summer months of 2008, 2009 and more recently, in 2015 and 2016. These data collection programs have teamed biologists together with local Inuvialuit wildlife observers, creating opportunities of shared knowledge exchange and integration between local communities and scientists. Data in 2008 and 2009 were collected as part of wildlife mitigation and monitoring surveys for seismic programs in the offshore oil and gas lease areas in the Canadian Beaufort Sea; as such they provide insight of temporal variability during a 9 week window of observations for a fairly confined geographical area. By contrast, surveys in 2015 and 2016 were conducted for ArcticNet taking advantage of the scientific research cruises that lasted up to three weeks but covered a large area throughout the Beaufort Sea. This latter dataset subsequently allows for an analysis of spatial variability during a fairly confined time window. In this presentation, we show the information collected through both strategies, highlight their complimentary nature, and illustrate how using data that have comparable standardized methods of collection can help supplement baseline studies in locations where data availability is otherwise limited. All four programs were conducted by a team of trained biologists and Inuvialuit marine wildlife observers, and followed protocol based on published literature, regulatory requirements and best practice methods. The extensive knowledge from local residents and hunters while conducting the surveys, has proven instrumental, and has complimented the programs by expanding and increasing the scientific understanding of Arctic ecology. Continuing engagement and training programs are fundamental in facilitating local community participation and encouraging mutual knowledge exchange. Data from these programs support marine mammal baseline studies and bridge the knowledge gap between scientists and Inuvialuit communities.

MODELING STUDY ON HUDSON BAY USING THE NEMO ICE-OCEAN MODEL

Liu, Zhuo, J. Lukovich and D. Barber
CEOS, University of Manitoba (Winnipeg, Canada)

NEMO (Nucleus for European Modelling of the Ocean) is a state-of-the-art modeling framework for oceanographic research, operational oceanography seasonal forecasts and climate studies, which includes an ocean model (OPA) coupled with a sea-ice model (LIM). It contains both global and regional configurations. In this study, we use a regional configuration that encompasses the entire Arctic Ocean and part of North Atlantic Ocean. Two open boundaries are located in Bering Strait and 25°N in Atlantic Ocean. The average horizontal resolution is 13km in Hudson Bay. We use NEMO for the modeling component of BaySYS, a project which seeks to understand and differentiate between how changes in climate variability and regulation will affect (or have affected) processes related to freshwater-marine coupling in the Hudson Bay system. A NEMO hindcasting experiment on Hudson Bay as well as the Arctic Ocean driven by historical CORE v2 from 1979-1996 has been conducted. This experiment incorporates Hydrological Predictions for the Environment (HYPE) modeled historical runoff. The tidal forcings of M2, K1, S2, O1, N2 are also included. Preliminary analysis of model results will be presented.

INUIT KNOWLEDGE OF CARIBOU ON AND NEAR KING WILLIAM ISLAND, NUNAVUT

Ljubicic, Gita (1), S. Okpakok (2), S. Robertson (3) and R. Mearns (4)
(1) Carleton University (Ottawa, Canada);
(2) Independent Interpreter/Translator (Gjoa Haven, Canada);
(3) Faculty of Native Studies, University of Alberta (Edmonton, Canada);
(4) Qikiqtani Inuit Association (and Carleton University) (Iqaluit, Canada)

Caribou are the lifeline of the land in most Inuit communities, and have been central to the seasonal hunting, survival, and culture of Inuit families for generations. This is certainly the case in Gjoa Haven, Nunavut, located on King William Island (KWI). Caribou health and implications for local diets, livelihoods, and cultural practices were identified as local priorities during planning workshops. In learning about the relationships between caribou, community, and well-being over the last five years, we have facilitated 3 land camps, 39 interviews including 31 that incorporated participatory mapping, and 5 verification workshops. To date KWI has been essentially overlooked in caribou research, and is shown as blank or as having uncertain status in the majority of herd ranges maps. In this poster we share Inuit knowledge of caribou on the island as expressed by Elders and
hunters in Gjoa Haven, including: 1) local approaches to naming and distinguishing caribou in the region; 2) long-term caribou cycles on KWI; and, 3) seasonal caribou migrations on and off the island. Given the lack of caribou research on KWI, and the significance of local observations and long-term experience in decision-making, Inuit knowledge of caribou can make important contributions to co-management efforts.

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

Loria, Ainsleigh, A. Burt and G. Stern

Centre for Earth Observation Science - University of Manitoba (Winnipeg, Canada)

The objective of this study is to gain perspective on select Arctic shrimp species living along the coast and in off-shore waters in the Beaufort Sea. In combination with oceanographic and biogeochemical data (δ13C and δ15N isotope signatures), total mercury (THg), methyl mercury (MeHg), polycyclic aromatic hydrocarbon (PAH) concentrations, and food web structure amongst decapod species was investigated. Eualus gaimardii (Eg), Sclerocrangon boreas (Sb), and S. ferox (Sf) were the crustacean species chosen for analysis as part of this comparison. Samples were collected during Leg 2 of the Arctic Net 2014 Amundsen expedition, as well as the BREA 2012 and 2013 Frosty expeditions in the Beaufort Sea. Shrimp tail muscle was analyzed for δ13C and δ15N stable isotope signatures, THg, and MeHg. A preliminary investigation of the data revealed that mean δ13C signatures for coastal shrimp were slightly higher than the off-shore shrimp (coastal and off-shore means were -20.4±0.1 and -19.6±0.1, p=0.0001 by the t-test) and that the δ15N signatures ranged from 14.7±1.0 in Eg to 16.1±0.9 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, it is not surprising that the δ15N is enriched in the Sf species. Higher tropic level feeding of the Sf species is also reflected by the THg and MeHg results, where mean concentrations for Sf were 4 times higher than in Eg (mean THg and MeHg concentrations in Sf were 2.0±1.1 and 2.3±1.0 ug/g versus 0.5±0.4 and 0.3±0.2 ug/g, respectively in Eg). The Hg analyses also showed glaring significant differences between the coastal and off-shore Sf species (p=0.002 by the t-test). In addition, two Eg whole body bulk samples were analyzed for PAHs. High levels of PAHs were not expected, due to the fact that shrimp are epi-benthic species and that PAHs are readily metabolized. The results of the analysis confirmed this prediction, as undetectable amounts of PAHs were found in these samples. The potential of adding fatty acid (FA) analysis to this data set is currently being evaluated. FA analysis could support the stable isotope data, to help us gain a better understanding of benthic food ecology with respect to bioaccumulation and biomagnification of mercury in the food web.

IMPACT OF THE RECENT INCREASE IN SHRUB COVER ON ABUNDANCE AND PRODUCTIVITY OF BERRIES AT UMIUJAQ (NUVAVIK).

Lussier, Isabelle (1), Esther Lévesque (1), Stéphane Boudreau (2)

(1) UQTR / CEN (Trois-Rivières, Canada); (2) U Laval / CEN (Québec, Canada)

In the context of current global warming, the Arctic vegetation near the treeline his changing, the erect shrub layer has increased and now dominates environments once opened. Such changes alter the composition, structure and dynamics of plant communities. On one hand, competition for light, water and nutrients can become stronger and reduce the growth and reproduction of less competitive species such as berry-producing species. Near the community of Umiujaq (Nunavik), shrub cover had significantly increase (> 20%) between 1994 and. These change sometimes affect residents picking habits. A decrease in productivity of berries could have significant impacts on northern people for whom berry picking is an important activity as well as on animal species who feed on them such as black bear, ptarmigan and Canada goose. On the other hand, environmental changes underway that promote shrub growth could also favor berry-producing species. So, the goal of this study was to quantify the impact of erect shrub increase on the productivity of three main berry producing species present near this community: Vaccinium vitis-idaea L., Vaccinium uliginosum L. and Empetrum nigrum L. We evaluated 388 sites selected by stratified random sampling covering the diversity of the landscape in Umiujaq in august 2015. The frequency, cover, productivity (g/m2) and ripening of berry producing species had been
compared in four conditions: under shrub, inner and outer margin, and in open areas. Dwarf birch, shrub the most present in the landscape, seems to affect berry productivity across the landscape. The presence of erect shrubs affects (reduce) more Vaccinium uliginosum L. and Empetrum nigrum L. than Vaccinium vitis-idea abundance and productivity. Berry species were present in almost 95% of sampled sites. Shrubs generally have negative effects on the four variables studied. However, the three species respond differently to the presence of erect shrubs. Vaccinium vitis-idea is the only one with higher productivity and greater cover in the inner margin (p <0.05). This global response is greatly influenced by the environments dominated by lichen where growth and productivity of V. vitis-idea is stimulated under shrubs.

**ON MODELED SEA ICE DYNAMICS IN HUDSON BAY**

Lukovich, Jennifer (1), X. Hu (2), G. Liu (1), D. G. Barber (1) and P. G. Myers (2)

(1) Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada);  
(2) Department of Earth and Atmospheric Sciences, University of Alberta (Edmonton, Canada)

In this study we examine sea ice dynamics in Hudson Bay in winter using output from NEMO ice-ocean model simulations. Investigated in particular is ice drift from the Arctic and Northern Hemisphere Atlantic (ANHA) University of Alberta NEMO simulations at ¼ and 1/12 degree grid spacing with CMC GDPS (CGRF) atmospheric forcing, in addition to a CEOS NEMO simulation at ¼ degree grid spacing with the incorporation of tides, to discern the implications of model spatial resolution and tidal forcing on sea ice circulation. Explored also as a contribution to the BaySys project are the impacts of regulation on sea ice dynamics in Hudson Bay via composites of high- and low-flow years determined from August river discharge anomalies from 2002 – 2012. Results from this analysis can be used to improve our understanding of freshwater-marine coupling from the perspective of near shore and offshore sea ice dynamical processes. Central also to this study is the determination of an optimal configuration for NEMO from the perspective of sea ice dynamics to ensure effective use of this tool to inform decisions related to regulation, shipping, and ecologically-sensitive regions in the Hudson Bay complex, and as a foundation for a long-term observational-modeling framework resulting from BaySys and its objectives.

**HUDSON BAY - PROJECTED FRESHWATER EXPORTS UNDER FUTURE CLIMATE**

MacDonald, Matthew (1), T. Stadnyk (1), S. Déry (2), M. Braun (3) and K. Koenig (4)

(1) University of Manitoba (Winnipeg, Canada);  
(2) University of Northern British Columbia (Prince George, Canada);  
(3) Ouranos Consortium (Montreal, Canada);  
(4) Manitoba Hydro (Winnipeg, Canada)

Projecting future freshwater discharge to the Hudson Bay Complex (HBC: Hudson Bay, James Bay, Foxe Basin, Hudson Strait and Ungava Bay) is critical for understanding potential changes to sea ice coverage, contaminant, and nutrient cycling. Anticipated changes to the HBC freshwater regime are characterized for 2021-2070 relative to the baseline period (1981-2010). Existing flow regulation practices are held constant. Both annual and seasonal regimes are discussed. A regional implementation of the Arctic-HYPE continental scale hydrological model is used for discharge projections. Historical calibration is performed over a split-sample period from 1971-2005 to span the range of climatic conditions. Nineteen members of the CMIP5 climate modeling experiment are used for meteorological forcing for discharge projections. Output from the climate models span the range of projected changes to precipitation and temperature over the region. Mean annual temperature is projected to increase by 1.2°C to 5.7°C from the baseline period to 2041-2070, and mean annual precipitation is projected to increase by 3% to 18%. The ensemble mean of discharge projections shows a general increase in mean annual discharge to the HBC during 2021-2070 compared to the baseline. Statistically significant increases in projected freshwater exports are greatest into Foxe Basin, Hudson Strait and Ungava Bay. Annual freshwater exports in the vicinity of the Hudson Plains (west of James Bay and southwest of Hudson Bay) are projected to decrease from the baseline period. The ensemble mean of seasonal discharge projections shows statistically significant increases in winter, spring and fall freshwater exports to the HBC, but little change to summer discharge. These results have implications for both marine ecosystem functioning and transportation routes within the HBC.
**MARINE ARCTIC INDICATOR ASSESSMENT FOR THE TARIUM Niryutait Marine Protected Area in the Inuvialuit Settlement Region**

MacMillan, Kate (1,2), C. Hoover (1,2), J. Peyton (1) and L. Loseto (1,2)

(1) University of Manitoba, Department of Environment & Geography;
(2) Freshwater Institute, Fisheries and Oceans Canada, Central and Arctic (Winnipeg, Canada)

Indicators are a useful tool to capture and monitor changes in the marine system, and are commonly used in marine protected area (MPA) management. However, in practice there is a lack of cohesion between data being collected for indicators that are used to monitor changes in MPAs and management targets. The aim of the proposed research will be to summarize and evaluate indicators currently being used for monitoring in the Beaufort Sea portion of the Inuvialuit Settlement Region (ISR), and assess their effectiveness in meeting the Tarium Niryutait (TN) MPA management plan. The TN MPA is the first Arctic MPA, it was established in 2010 to conserve and protect beluga whales and other marine species, their habitats and their supporting ecosystem. Quantitative data analysis will be performed on existing indicator datasets to highlight the overall state of indicators in the ISR, and the quality of data associated with them. A selection of indicators will then be used in evaluating the success of the TN MPA based on the management objectives. This analysis will also identify indicator monitoring gaps for both the ISR marine region and the TN MPA. Results will support additional Arctic and Canadian marine management areas, by developing an assessment process for the effectiveness of MPA management to determine if they are currently meeting the goals and objectives of their associated management plans. As Canada has committed to expanding MPA coverage to 10% by 2020, it is necessary to determine if MPAs are an effective tool for marine management. This research is part of ArcticNet Project “Knowledge Co-Production for the Identification and Selection of Ecological, Social, and Economic Indicators for the Beaufort Sea.”

**COMMUNITY STRUCTURE OF MACROFAUNA IN THE OFFSHORE CANADIAN BEAUFORT SEA: INFORMATION TO SUPPORT REGIONAL-SCALE MARINE SPATIAL PLANNING**

MacPhee, Shannon (1), L. de Montety (2), A. Majewski (1), J. Reist (1) and P. Archambault (2)

(1) Fisheries and Oceans Canada (Winnipeg, Canada);
(2) Université du Québec à Rimouski (Rimouski, Canada)

Marine spatial planning is required to manage pressures associated with climate change, resource development and increased marine traffic in the Canadian Beaufort Sea. Information is required regarding the spatial variability in benthic species assemblages and the factors that structure them, for example, in designing networks of marine protected areas and establishing reference conditions for assessing anthropogenic activities anticipated to have regionalscale effects. Benthic macrofauna have been widely applied as ecological indicators in many marine regions of the world because they are relatively sessile, long-lived, and respond to environmental gradients and stressors in a predictable manner. Recently, significant progress has been made toward reporting Arctic macrofaunal biodiversity baselines across large spatial scales (e.g., pan-Arctic, Canadian Arctic) and at local-scales within the Beaufort Sea in regards to specific geographic features (e.g., Beaufort Shelf, polynyas and areas of upwelling, oil gas lease blocks). Systematic, regional-scale surveys, however, remain a gap. Benthic ecosystem components were sampled across a broad depth range (20 – 1500m) from the transboundary region of the Yukon-Alaska border into Amundsen Gulf. Multivariate analyses of these novel survey data characterize spatial variability in macrobenthic community structure. Relationships between species assemblages and environmental drivers including depth, bottom type (e.g., granulometry), water mass characteristics (e.g., temperature, salinity) and benthic food proxies (e.g., %organic matter, benthic chlorophyll concentration) were examined. This regional-scale approach, based on a systematic transect-based survey design covers a significant portion of the Canadian Beaufort Sea, thus expands existing biodiversity baselines to deeper sites beyond the continental shelf break. This work has direct application to developing predictive models, habitat maps and biotic indicators for and conservation planning.
WORKING TOGETHER TO COLLECT MARINE BASELINE DATA IN WAGER BAY, UKKUSIKSALIK NATIONAL PARK

Mahy, Maryse and C. Vis
Parks Canada Agency (Iqaluit, Canada)

Since 2014, Parks Canada and partners have been working on a project to collect marine baseline data in Ukkusiksalik National Park, a relatively new park in Nunavut. The project will provide key information to guide the planning and management of future potential increases in tourism and other activities in Wager Bay, the marine ecosystem of the park. The project includes western science and Inuit knowledge components. The field work for the western science component of the project took place in August 2016 and was the result of partnerships between Parks Canada and the Government of Nunavut (GN) and the Canadian Hydrographic Service. Through the GN and its research vessel the M.V. Nuliajuk, the project was able to draw on a wide range of expertise from researchers based at the University of Manitoba, Memorial University in Newfoundland and the Université du Québec à Rimouski. The Inuit knowledge component of the project started in fall 2015; it has involved workshops with the Ukkusiksalik National Park Inuit Knowledge Working Group based in Naujaat (Repulse Bay) and other knowledge holders. Data has been collected and in some instances continues to be collected on bathymetry, tides, water quality, contaminants, seabed habitats, benthic invertebrates, boat safety and marine mammals. Analysis and results from the project will contribute to increasing our knowledge of this large marine ecosystem, will inform management of the area and may foster future research work.

MARINE FISH COMMUNITY STRUCTURE AND HABITAT ASSOCIATIONS IN THE WESTERN CANADIAN ARCTIC

Majewski, Andrew, S. Atchison, J. Eert, S. MacPhee and J. Reist
Fisheries and Oceans Canada (Winnipeg, Canada)

Marine fishes in the Canadian Beaufort Sea have complex interactions with habitats and prey, and occupy a pivotal position in the food web by transferring energy between lower- and upper-trophic levels, and also within and among habitats (e.g., benthic-pelagic coupling). The distributions, habitat associations, and community structure of most Beaufort Sea marine fishes, however, are unknown thus precluding effective regulatory management of emerging offshore industries in the region (e.g., hydrocarbon development, shipping, and fisheries). The present study delineates the community structure and habitat associations of offshore marine fishes in the Canadian Beaufort Sea to depths of 1000 m. The fish community was strongly depth-structured and assemblages were closely associated with vertical water mass distributions. This community analysis provides a framework to structure studies examining biological linkages (i.e., fish movements and trophic interactions) among offshore habitats, and assessments of fish stock structure. Understanding regional-scale habitat associations will also provide context to identify potentially unique habitats and fish community characteristics indicative of ecologically and biologically significant areas. Planned follow-on research will expand this work to areas of the southern Canadian Archipelago that are unstudied in this context. Information gained will support a comprehensive regional environmental assessment for the Beaufort Sea, from which the effects of anticipated development will be gauged. New data will also support current conservation initiatives in the Central Arctic Ocean through the development of new knowledge on ecological linkages of the Canada Basin to neighboring shelf systems.

HIGH RESOLUTION SPATIAL VARIABILITY OF SNOW DEPTH AND WATER EQUIVALENT ACROSS A PATCHY TUNDRA, FOREST AND SHRUB LANDSCAPE.

Mann, Philip, P. Marsh and B. Walker
Wilfrid Laurier University (Waterloo, Canada)

In high-latitude regions, where snow is the primary type of precipitation and there is a lack of extensive tall 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, either on less slopes or in shrub or tree patches, contribute a large percentage of total snow retained on the arctic tundra for the small percentage of area they occupy. 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, photogrammetric data by using an unmanned aerial system (UAS) and a variety of distributed snow density methods to calculate the percentage of total snow water equivalent (SWE) stored on the landscape. Understanding the role of blowing snow is required for testing blowing snow models to predict snow distribution at high resolution, and in order to estimate changes in snow cover as a warming climate changes the distribution of shrub and tree patches across the tundra.

FOODBORNE PATHOGENS IN CLAMS IN IQALUIT, NUNAVUT

Manore, Anna (1), K. Shapiro (2), J. Sargeant (3), J. S. Weese (4), A. Cunsolo (5), A. Bunce (6), J. Shirley (7) and E Sudlovenick (8)

(1) Department of Population Medicine, University of Guelph (Guelph, Canada);
(2) Department of Pathobiology, Microbiology, and Immunology, University of California, Davis, School of Veterinary Medicine (Davis, United States);
(3) Department of Population Medicine, Ontario Veterinary College, University of Guelph and Centre for Public Health and Zoonoses, University of Guelph (Guelph, Canada);
(4) Centre for Public Health and Zoonoses, University of Guelph (Guelph, Canada);
(5) Labrador Institute of Memorial University (Happy Valley-Goose Bay, Canada);
(6) Department of Population Medicine, Ontario Veterinary College, University of Guelph (Guelph, Canada);
(7) Nunavut Research Institute, Nunavut Arctic College (Iqaluit, Canada);
(8) Department of Integrative Biology, College of Biological Science, University of Guelph (Guelph, Canada)

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 and protective factors for enteric illness in the Canadian North that might differ from those in southern communities include differences in country food consumption. Recent work has revealed high rates of laboratory confirmed Cryptosporidium and Giardia in the stools of enteric illness patients in the Qikiqtani region of Nunavut, with molecular analyses suggesting a potential animal or foodborne source of these pathogens. Locally harvested country foods provide nutrition and a sense of cultural continuity in Inuit communities. Clams are a commonly consumed and easily accessible country food, and can potentially take up the cysts or oocysts of Cryptosporidium and Giardia from their environment. GOALS: The goal is to better understand clams as a potential source of Cryptosporidiosis and Giardiasis in Iqaluit, Nunavut, using clams collected from local harvesters. The objectives are to estimate the prevalence, identify risk factors, and genetically characterize Cryptosporidium and Giardia in clams from around Iqaluit for source attribution analysis.

METHODS: An EcoHealth approach guided the research process, including principles of community participation, transdisciplinarity, systems thinking, social equity, sustainability, and knowledge-to-action. Clams were collected from local harvesters in the Fall of 2016. Hemolymph (circulatory fluid) and digestive glands were removed from the sampled clams, and will be tested for Cryptosporidium and Giardia using molecular methods. Prevalence of Cryptosporidium and Giardia will be estimated from these data, and multivariable logistic regression will be used to identify potential risk factors for positive test results. OUTCOMES: To date, 398 clams have been collected from local harvesters, and have been processed in preparation for molecular testing. Methods and preliminary results will be presented. 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 Iqaluit, Nunavut, as well as other Indigenous communities in Northern Canada.
INTEGRATING HIGH RESOLUTION FIELD OBSERVATIONS AND MODELLING IN ORDER TO IMPROVE OUR UNDERSTANDING OF HYDROLOGICAL CHANGE

Marsh, Philip (1), P. Mann (1), B. Walker (1), A. Toure (1), E. Wilcox (1), O. Sonnentag (2) and C. Derksen (3)

(1) Wilfrid Laurier University (Waterloo, Canada); (2) University de Montreal (Montreal, Canada); (3) Environment and Climate Change Canada (Downsview, Canada)

The arctic climate is changing at an unprecedented rate, transforming all aspects of the arctic environment, including vegetation, snow and the active layer. Understanding the integrated impacts of these changes on lake levels and streamflow is essential to understanding the future implications of a changing climate on the arctic environment and arctic communities. Here we will describe a series of integrated field observations at the Trail Valley Creek research watershed south of Tuktoyaktuk, NWT, in the western Canadian Arctic. This paper will focus on describing novel observation methods to characterize the arctic environment. These include the use of unmanned aerial systems, cosmic ray sensors, and eddy covariance systems for example. These data sets will be used to test the high resolution hydrologic models required to understand past, and future, changes in hydrology.

CASCADING OFF DAVIS STRAIT SEEN FROM NEMO MODEL RESULTS

Marson, Juliana (1), P. Myers (1), B. Petrie (2), K. Azetsu-Scott (2) and C. Lee (3)

(1) University of Alberta (Edmonton, Canada); (2) Department of Fisheries and Oceans (Dartmouth, Canada); (3) University of Washington (Seattle, United States)

Cascading occurs when dense waters form and accumulate on the continental shelf, eventually sliding down the slope and reaching intermediate and deep layers of the ocean. It is an important process for ventilating the deep ocean and capturing carbon from the atmosphere. Although cascading has been observed in several different locations – especially in high latitudes - an event on the western Greenland shelf has never been reported. We use the results from a 2002–2014 NEMO simulation to show that cascading could happen sporadically at Davis Strait. Each event starts around February and persists until the end of May. Between 2007 and 2013 no event was detected because the freshwater content in Davis Strait increased significantly, preventing the shelf water reaching a density which would allow it to sink. The water that cascades from this part of west Greenland shelf goes, mostly, to the deep Baffin Bay, although not at a rate to be a primary source of Baffin Bay Deep Water. The simulation’s temperature and salinity interannual variability in Davis Strait agrees reasonably with observations (CTD profiles and moorings), showing that this phenomenon has the potential to occur in this location.

MODELLING GREENLAND ICEBERGS: EVALUATING THEIR FRESHWATER CONTRIBUTION TO THE NORTH ATLANTIC

Marson, Juliana and P. Myers

University of Alberta (Edmonton, Canada)

The Atlantic Meridional Overturning Circulation (AMOC) is well known for carrying heat from low to high latitudes, moderating local temperatures. Numerical studies have examined the AMOC’s variability under the influence of freshwater input to subduction and deep convections sites. However, an important source of freshwater has often been overlooked or misrepresented: icebergs. While liquid runoff decreases the ocean salinity near the coast, icebergs are a gradual and remote source of freshwater – a difference that affects sea ice cover, temperature, and salinity distribution in ocean models. Icebergs originated from the Greenland ice sheet, in particular, can affect the subduction process in Labrador Sea by decreasing surface water density. Our study aims to evaluate the contribution of icebergs to freshwater input in the North Atlantic and to subduction variability in the Labrador Sea. To do that, we will use an interactive iceberg module coupled with the Nucleus for European Modelling of the Ocean (NEMO v3.4), which will calve icebergs from Greenland according to rates established by Bamber et al. (2012). Details on the distribution and trajectory of icebergs within the model may also be of use for understanding potential navigation threats, as shipping increases in northern waters.
CLIMATE CHANGE KNOWLEDGE MOBILIZATION FOR DECISION-MAKERS IN NUNAVUT: CASE STUDIES

Martos, Zoe

Government of Nunavut, Climate Change Secretariat (Iqaluit, Canada)

Nunavut is experiencing significant climate change impacts, requiring action from decision-makers across disciplines. Climate change is a complex system, requiring an interdisciplinary approach in order to affect meaningful change. Knowledge mobilization (KMb) is critical in bridging the information to action gap, ensuring that decision makers have the best possible understanding of climate change issues to make informed decisions. To address the complexity of this system, the Government of Nunavut Climate Change Secretariat (CCS) has developed a variety of programs. These initiatives address improving knowledge and affecting action through two-way exchange processes, heavily focusing on relationship building and engagement activities. Underpinning the continuum of knowledge mobilization is the CCS’s role as a knowledge broker, working across a wide variety of partners and disciplines. Essentially, the process of KMb is to share the right information with the appropriate audience in a meaningful way. A main outcome of CCS activities is to increase capacity of decision-makers, inform action, and influence behaviour change. The CCS considers a broad approach to targeting decision-makers, focusing on an array of Nunavummiut including policy-makers, youth, elders, and hunters. Each of these groups has invaluable information to share, contributing significantly to decision-making processes within communities. Similarly, the climate change knowledge base draws on complementary knowledge sources; both scientific information and traditional knowledge are critical to KMb practices in Nunavut. From planning to implementation, the CCS identifies and addresses adaptation and mitigation strategies that align with the needs and priorities of Nunavummiut. Thus, the CCS has created strategies for developing and delivering climate change programs in Nunavut. These strategies use knowledge mobilization techniques, communication theory, and are grounded in evidence-based best practices. Through examining case studies of current CCS programs, climate change KMb best practices are outlined in a practical manner. Using these examples, the CCS has identified lessons learned for effectively working between information producers and end users of climate change information in Nunavut. By facilitating the knowledge to action process, CCS ensures decision-making approaches are informed and relevant to Nunavut. The vision is to create more resilient and sustainable communities through mobilizing climate change knowledge.

ENTERIC PATHOGENS IN SURFACE WATER IN IQALUIT, NUNAVUT


(1) University of Guelph (Guelph, Canada);
(2) Nunavut Research Institute (Iqaluit, Canada);
(3) Public Health Agency of Canada (Saint-Hyacinthe, Canada);
(4) Memorial University (Happy Valley-Goose Bay, Canada)

Waterborne disease is a global public health priority, exacerbated by climate change, shifting population dynamics, and infrastructure limitations. Endemic levels and outbreaks of enteric illness transmitted by contaminated water contribute to considerable morbidity, mortality, and economic costs in Canada. One of the highest incidences of self-reported enteric illness reported in the global literature is in Iqaluit, Nunavut. To understand potential waterborne disease transmission in Iqaluit, this project estimated the prevalence, identified risk factors, and examined molecular source attribution for Giardia and Cryptosporidium parasites in untreated surface water that community members collect for drinking. Water quality data were collected weekly from June to September, 2016, from two streams commonly used as sources of untreated drinking water. Targeted samples were collected and processed in Iqaluit using the IDEXX Filta-Max® system for pathogen isolation, and IDEXX Colilert® system for quantification of indicator bacteria (total coliforms and E. coli). Samples were tested weekly to provide information about the presence of these pathogens, and positive samples will be genetically characterized to provide information about the molecular epidemiology of these pathogens. Environmental risk factors were analyzed to identify potential associations between positive samples, weather conditions, and other water quality parameters (i.e. water temperature, pH, turbidity, and conductivity). Preliminary results include 2.4% of samples testing
positive for Cryptosporidium and 12.2% of samples testing positive for Giardia (n=41). These results suggest that rates of Cryptosporidium and Giardia in surface water are lower in Iqaluit compared to Southern Canadian regions. The research team will work with Northern partners to develop a culturally acceptable and effective knowledge translation strategy to share our results with the community. This study increases our understanding of enteric illness in Iqaluit and helps redirect our focus to other enteric illness risk factors in the community.

SPRING PROGRESSION OF SPECTRAL LIGHT TRANSMISSION THROUGH LANDFAST SEA ICE DURING THE MELT SEASON IN AN ARCTIC FJORD ON BAFFIN BAY

Matthes, Lisa (1), C. J. Mundy (1), S. Lambert Girard (2), R. Hodgson (3), G. Verin (2), M. Babin (2) and J. Ehn (4)

(1) Centre of Earth Observation Science, University of Manitoba (Winnipeg, Canada);
(2) Takuvik Joint International Laboratory, Université Laval (Quebec, Canada);
(3) Department of Fisheries and Ocean (Winnipeg, Canada);
(4) Centre of Earth Observation Science, University of Manitoba (Winnipeg, Canada)

Arctic sea ice is trending towards melting earlier and forming later, which is leading to an overall thinner and more transparent ice cover. During late spring, the increase in light transmittance through the ice cover is amplified with the melt of snow and the appearance of shallow melt ponds of great coverage that significantly decrease the surface albedo. The increase in light transmission typically occurs over a few days with important physical and biological implications. For example, it has the potential to inhibit and/or terminate ice algae growth while it enhances primary productivity below the sea ice cover. The increase in light transmittance increases as a function of melting sea ice surface and bottom structures remains understudied. Therefore, over a period from 6 June to 2 July, 2016, during the GreenEdge Campaign in Baffin Bay, we deployed a remotely operated vehicle (ROV) equipped with hyperspectral radiometers to investigate spatial and temporal changes in the spectral light conditions below melting landfast sea ice. Horizontal transects of ~130 m length, at a depth of 2 and 4 m, and vertical profiles, to a depth of 50 m, were performed beneath the ice cover with changing quantities of snow, ice, melt ponds and ice algae. We relate these changes to the melt progression of surface characteristics (i.e., spectral albedo, snow height, melt pond depth and ice thickness) that were measured at a near by site. Preliminary results show an overall increase in light availability in the upper water column, whereby a dependency of spectral transmittance on different surface structures as well as the presence of algae became more pronounced with progressing ice melt.

LONGITUDINAL STABLE ISOTOPE-BASED DATASETS REVEAL UNEXPECTEDLY HIGH INDIVIDUAL VARIATION IN BELUGA LIFE HISTORY AND FORAGING ECOLOGY

Matthews, Cory and S. Ferguson

Fisheries and Oceans Canada (Winnipeg, Canada)

An animal’s foraging ecology can vary over a range of temporal scales, reflecting ontogenetic shifts in diet and distribution, as well as long-term shifts in prey availability. Obtaining individual-based, longitudinal diet information through direct observation, however, is logistically challenging for marine mammals that pursue and consume prey underwater, and are often widely distributed. Isotopic profiling along continuously growing tissues like teeth, which archive dietary inputs at the time of growth in their stable isotope composition, allows for chronological dietary reconstructions over multi-year timespans. Here, we report on key findings from several longitudinal diet studies of eastern Canadian Arctic beluga whales (Delphinapterus leucas) derived from serial isotopic measurements of annual growth layer groups (GLGs) in tooth dentine. Individual long-term isotope profiles indicated ontogenetic diet shifts consistent with timing of weaning and sexual maturation, while population chronologies constructed by stitching together individual profiles by calendar year indicated long-term, population-specific trends that could reflect changes in food web structure. A surprising degree of individual variability in weaning age and foraging ecology (likely both prey consumed and foraging habitat) existed within beluga populations. For example, beluga calves were weaned at 1 to 3 years of age, and sexually mature male belugas forage
consistently at different trophic levels, and likely at different depths than females. Such individual variation in beluga life history and foraging ecology is relevant because individual whales may be affected differentially by changes in their ecosystem. We recommend that individual variation be incorporated into models of beluga population dynamics and Arctic marine food web structure.

**FISHING WITH OUR HANDS: VISUALIZING COMMERCIAL AND TRADITIONAL ACTIVITIES IN PANGNIRTUNG’S CHAR FISHERY**

Mauro, Ian (1) and N. Baird (2)

(1) University of Winnipeg (Winnipeg, Canada);
(2) Master’s Student, University of Manitoba (Winnipeg, Canada)

Since the time of Nanook of the North, visual representations of Arctic communities have often been skewed to reflect southern desires to see Indigenous peoples engaged in “authentic” and “traditional” activities. Resulting stereotypes have dangerously reinforced a perspective that Inuit cannot practice subsistence lifestyles while also being engaged in the cash economy. However, Inuit have consistently struck a balance between these “two worlds”, and a successful example of how subsistence and commercial activities fit together is the fishery in Pangnirtung, Nunavut. Using a participatory video approach, this project documented local perspectives and visual representations of how the fishery dynamically supports both economic development and traditional livelihoods. In summer 2016, our team travelled and filmed two separate fishing expeditions in and around Cumberland Sound, one commercial and one subsistence, yet both times we ended up “fishing with our hands”. Regardless of whether fishers are monetizing their catch, our analysis of interviews, visuals and experiential learning shows that the equipment, techniques and associated knowledge remains similar and is small-scale, locally-focused, and inherently sustainable. This multi-media presentation will take you on the land, allowing you to hear from community members, and see for yourself Pangnirtung’s char fishery and its ecological and cultural richnss.

**VOICES FROM THE FIELD: THE PROMISE AND PERILS OF COMMUNITY-BASED RESEARCH**

Mauro, Ian (1) and N. Baird (2)

(1) University of Winnipeg (Winnipeg, Canada);
(2) Master’s Student, University of Manitoba (Winnipeg, Canada)

Recently in the Arctic, there has been a surge of interest in community-based research (CBR) approaches, which emphasize collaboration with local individuals and institutions in an effort to make results more informed and impactful. To assess the state of community-based research taking place in northern Canada, we interviewed scientists, students as well as representatives from northern organizations at the ArcticNet 2014 Annual Scientific Meeting (ASM) to better understand the benefits and risks of this type of scholarship, and strategies to enhance its efficacy as a methodology and positive impacts moving forward. We interviewed a diversity of academics using CBR – inclusive of experts in the social, health and natural sciences – and asked them to reflect on their experiences. Inuit and other northerners also shared their observations, either having been in active research collaborations, or simply as witness to the community-based scholarship taking place in their regions. These interviews demonstrated that while CBR is a promising approach, it is not without its perils, and to avoid it simply becoming a “buzzword” research must be highly engaged, guided by and respectful of locals, and deliver results that create real world benefits for communities. Based on the interviews collected, we developed an educational video, which will be released as part of our presentation and is designed to assist the next generation of researchers and community members in the Arctic and beyond.

**IS ERYSIPELOTHRIX RHUSIOPATHIAE, A ZOONOTIC BACTERIUM AND RECENT CAUSE OF MORTALITY IN MUSKOXEN, NEW TO THE ARCTIC?**

Erysipelothrix rhusiopathiae, a bacterium frequently observed in pigs and poultry, was isolated from muskoxen (Ovibos moschatus) for the first time on Banks and Victoria Island (Canadian Arctic) during a series of acute mortality events between 2010 and 2012. In addition to being a conservation concern, the zoonotic potential of the pathogen raises the issue about food safety for community members handling and consuming muskoxen. In order to better understand the epidemiology of the bacterium and to document its historical and current occurrence, we initiated a serological survey using archived and newly collected samples from several muskox populations ranging from Greenland to Alaska. We obtained serum from over 900 muskoxen sampled during monitoring or research projects between 1976 and 2015. Animals originated from Alaska (n>500), Canada (n>350) and Greenland (n=20). Blood was collected in blood tubes or filter-paper strips, and serum was obtained through centrifugation or elution and tested for anti- E. rhusiopathiae antibodies using an indirect Enzyme-linked Immunoassay (ELISA) developed in our lab. Preliminary data (n=330) indicate exposure in various Alaskan herds from 1976 to present with a seroprevalence around 20%. In contrast, data from Banks Island in Canada (n=161), where we have a time series from 1991/92, 2001, 2008 and 2012 demonstrate low to no seropositivity in 1991/92, but increasing seropositivity from 2001 and all sampling time periods thereafter. High seroprevalence in fall 2012 aligns with a large mortality event observed in the previous summer in this region. Results across all sampled herds, regions and time periods as well as spatial and temporal patterns will be presented in detail. Further insights into the dynamics and impact of E. rhusiopathiae infection on muskox populations and potential public health significance will be discussed.
CONNECTING INUIT KNOWLEDGE WITH SEA-ICE RESEARCH TO BETTER UNDERSTAND CONDITIONS FOR SEA-ICE FREEZE-UP AND BREAK-UP IN CAMBRIDGE BAY, NUNAVUT

McLean, Mercedes, R. Dewey, M. Hoeberechts and M. Otokiak

Ocean Networks Canada (Victoria, Canada)

Ocean Networks Canada (ONC), an initiative of the University of Victoria, develops, operates, and maintains cabled ocean observatory systems. Technologies developed on the world-leading NEPTUNE and VENUS observatories have been adapted for small coastal installations called “Community Observatories,” which enable community members to directly monitor conditions in the local ocean environment. In 2012, ONC installed the first Arctic Community Observatory in Cambridge Bay, Nunavut, providing year-round, continuous undersea monitoring of the northern environment. Its purpose is to offer science-based support for a greater understanding and protection of the fragile arctic marine ecosystems for scientists, community members, students, and policy-makers alike. In addition to collecting scientific data from the Cambridge Bay Community Observatory, ONC is working with the community to learn more about sea-ice and the conditions for sea-ice freeze-up and break-up through the POLAR Knowledge Canada funded Safe Passage Project. To characterize and predict the freeze-up and break-up of sea-ice, ONC will be using local observations, measurements and models. The project examines the importance of sea-ice for winter transportation, as a habitat for marine mammals and as a platform for hunting. Long-term data on changes to dates of ice freeze-up and break-up are important indicators of climate change on Earth. ONC is working closely with community members to incorporate Inuit knowledge and current observations of sea-ice and snowfall with scientific models as part of a youth-led initiative in Cambridge Bay, NU. ONC’s Arctic Youth Science Ambassador is leading a program to gather knowledge and observations of sea-ice from knowledge holders, elders and community members to contribute to the understanding of local conditions and how baselines may be shifting. As part of this program, measurements of snowfall and snow depth will be collected by students at Kiilinik High School to quantify environmental conditions. These measurements are incorporated into scientific models which predict future or past environmental conditions. This program will provide opportunities for Inuit students, who are underrepresented in science, to be directly engaged in local research as well learning more about the interdisciplinary field of ocean science. This project also offers an opportunity to foster and encourage knowledge sharing between generations, passing on valuable Inuit knowledge, culture and language from one generation to the next. In August 2016, ONC hosted a community information session, visited local schools, and met with a variety of government organizations and community members in Cambridge Bay to discuss the development of this project. The research for this project is being conducted collaboratively by scientists at research institutions and local experts, youth, and educators in Cambridge Bay. The study goals and results will be shared and co-developed with community members, scientists and community leadership.

APPLICATION OF TERRESTRIAL ECOSYSTEM MONITORING UNDER THE CAFF CIRCUMPOLAR BIODIVERSITY MONITORING PROGRAM: DESIGNING AND IMPLEMENTING TERRESTRIAL MONITORING TO ESTABLISH THE CANADIAN HIGH ARCTIC RESEARCH STATION AS A FLAGSHIP ARCTIC ENVIRONMENTAL MONITORING SITE

McLennan, Donald (1), J. Wagner (1), M. Doyle (2), D. Kehler (3), T. Christensen (4) and T. Barry (5)

(1) Polar Knowledge Canada (Winnipeg, Canada);
(2) INAC (Ottawa, Canada);
(3) Parks Canada (Halifax, Canada);
(4) U Arhuus (Copenhagen, Denmark);
(5) CAFF (Akureyri, Iceland)

The Canadian High Arctic Research Station (CHARS) is scheduled for completion in July 2017 and is the northern science component of Polar Knowledge Canada (POLAR). A mandated goal for POLAR is to establish the adjacent Experimental and Reference Area (ERA) as an Arctic Flagship monitoring site that will track change in Arctic terrestrial, freshwater and marine ecosystems, within a social-ecological context. Situated in the community of Cambridge Bay on Victoria Island in the Kitikmeot Region of Nunavut, CHARS provides the opportunity to draw on the Indigenous Knowledge of local residents to help design and conduct the monitoring, and to operate 12 months a year. Monitoring at CHARS will be linked to networks nationally and...
internationally, and is being designed so that change in key indicators can be understood in terms of drivers and processes, modeled and scaled up regionally, and used to predict important changes in critical indicators. As a partner in the Circumpolar Biodiversity Monitoring Program (CBMP) and INTERACT, the monitoring design for terrestrial ecosystems follows approaches outlined by the CBMP Terrestrial Expert Monitoring Group, who have listed key monitoring questions and identified a list of important Focal Ecosystem Components (FECs). To link drivers to FECs we are proposing a multi-scaled approach: 1) a local-scale, Intensive Monitoring Area to establish replicated, long term monitoring plots and transects that track change in abiotic factors such as snow depth and condition, active layer depth, soil temperature, soil moisture, and soil solution chemistry that are spatially and temporally linked to changes in Focal Ecosystem Components such as microbiological activity, CO2/CH4 net ecosystem flux, vegetation relative frequency, species composition, growth and foliar nutrient concentration, arthropod abundance, lemming abundance and health, and shorebird/songbird abundance and productivity. 2) These intensive observations are supported by sub-watershed and watershed scale measures that will monitor, during the growing season, lemming winter nest abundance, songbird, shorebird and waterfowl staging and nesting, and other observations; in the winter we will monitor muskoxen, caribou, Arctic hare, wolf and Arctic fox using tracks and DNA analysis of fresh scat, as well as pathogens and parasites. 3) Ground measures will provide calibration-validation data to support models linked to data from aerial overflights and satellite remote sensing approaches to reach out to sub-regional and regional scales. Feedback is being sought at this time on project design, implementation and scope.

ISOTOPIC NICHES OF COASTAL FISHES IN THE CANADIAN BEAUFORT SEA, DARNLEY BAY

McNicholl, Darcy (1), J. Reist (1), M. Power (2) and A. Majewski (1)

(1) Fisheries and Oceans Canada (Winnipeg, Canada); (2) University of Waterloo (Waterloo, Canada)

Climate change is expected to drive shifts in abundance and distribution of coastal fishes and induce competition as prey availability becomes limiting with increasing temperature. Stable isotopes δ13C and δ15N were used as a proxy to establish dietary niches among nine species collected during a nearshore (<40 m depth) survey in Darnley Bay, NT in 2014 and 2015. The coastal region of the Beaufort Sea supports both anadromous (e.g., Arctic Cisco, Broad Whitefish and Arctic Char), and marine species, which are associated with benthic (e.g., Greenland Cod, Fourhorn Sculpin, Shorthorn Sculpin and Starry Flounder) or pelagic habitats (e.g., Capelin and Pacific Herring). Preliminary analysis of data suggests the range of δ13C and δ15N indicate different habitat associations and vary in the extent of overlap in isotopic bivariate space. Among these co-occurring species Fourhorn Sculpin exhibited the largest niche (δ13C range: -23.01 to -15.70; δ15N range 9.95 to 16.91) and displayed the greatest overlap with co-occurring benthic species such as Shorthorn Sculpin (δ13C range: -21.63 to -17.73; δ15N range: 13.14 to 17.55) and Starry Flounder (δ13C range: -22.14 to -16.85; δ15N range: 11.82 to 15.44). Substantive overlap was observed among anadromous fishes such as Arctic Char (δ13C range: -25.03 to -21.73; δ15N range: 13.97 to 15.78) and Arctic Cisco (δ13C range: -24.12 to -20.89; δ15N range: 12.85 to 14.87) with pelagic species such as Capelin (δ13C range: -23.81 to -21.65; δ15N range: 13.85 to 15.44) and Pacific Herring (δ13C range: -22.75 to -21.69; δ15N range: 13.50 to 15.27). These results suggest that co-occurring fishes found in Darnley Bay are able to occupy a variety of dietary niches. The extent of overlap among these species is expected to change in response to warming temperatures and availability of prey. Therefore, future habitat use of these species may increase the potential for competition and shifts in distribution in response to a changing environment. The use of stable isotopes as an indicator for environmental change will provide a greater understanding of ecosystem function in the Darnley Bay proposed marine protected area as this dynamic ecosystem continues to change.

PUBLIC PARTICIPATION IN COMMUNITY PLANNING AND DECISION-MAKING AROUND PUBLIC HEALTH ISSUES: CASE STUDY OF THE COMMUNITY-LED FOOD ASSESSMENT PROCESS IN NUNATSIAVUT AND NUNAVUT

McTavish, Kristeen (1), C. Furgal (1), S. Hill (1) and NiKigijavut Nunatsiavutinni Project Team (2)

(1) Trent University (Peterborough, Canada); (2) Food First NL (St. John’s, Canada)
Food insecurity is a persistent problem in Canada. From 2008 to 2012, the proportion of households that reported experiences of food insecurity increased from 11.3% to 12.7%. The 2007-2008 Inuit Health Survey drew particular attention to the seriousness of this issue for Inuit regions in Canada, where these rates ranged from 44.2% in Nunatsiavut to 70.2% in Nunavut. Communities in these regions face unique challenges in addressing food insecurity, such as extreme weather conditions which impact food transportation and changes in wildlife availability and accessibility which impact access to country food. With the recognition that emergency food programs such as food banks do not address root causes of food insecurity and are therefore failing to meaningfully address the problem, increased attention is being focused on augmenting community participation in designing community-based solutions. Many have argued that greater community participation in planning and decision-making leads to more locally applicable, sustainable and appropriate responses. Using 3 case studies, this claim was explored in the context of community food assessments and intervention planning processes in two Inuit regions in Canada’s North. Through extensive document review and interviews with key stakeholders involved in the project, this project examined the experiences of Community-Led Food Assessments conducted in Nunatsiavut and Nunavut to: 1) explore the role of public participation in effective and sustainable community decision making related to food, and to 2) to identify factors that facilitate and/or inhibit public participation in planning and decision-making in community food security intervention planning. This study offers recommendations of circumstances of public participation that can enhance social planning processes and lead to better decision making around community food security.

USE OF TRANSECT STUDIES AND MOORINGS TO ASSESS SEASONAL PRODUCTIVITY IN A SUB-ARCTIC FJORD ADJACENT TO THE GREENLAND ICE SHEET

Meire, Lorenz (1), J. Mortensen (2), T. Cox (3) and S. Rysgaard (4)

(1) Arctic Research Centre, Aarhus University (Aarhus, Denmark);
(2) Greenland Institute of natural Resources (Nuuk, Denmark);
(3) ECOBE, Antwerp University (Antwerp, Belgium);
(4) Center for Earth Observation Science, CHR Faculty of Environment, Earth, and Resources, University of Manitoba, Winnipeg, Manitoba, Canada. (Winnipeg, Canada)

The Greenland Ice Sheet is melting at an unprecedented rate, and as a result, fjords and continental shelves around Greenland are exposed to an increasing freshwater runoff. Yet the impact of high meltwater input on the biogeochemistry remains largely unquantified. To resolve the effect on Greenland’s fjord, an extensive sampling program was set up in Godthåbsfjord (SW Greenland) comprising regular transect measurements from the outer fjord to the glaciers and the deployment of moorings. During monthly samplings, discrete measurements of primary productivity using 14C incubation experiments were collected alongside hydrographic measurements. This data provides unique insights on spatial variability in the system but still only provides a snapshot of the productivity due to its poor temporal resolution. Therefore additionally we investigated the use of high frequency oxygen data of moorings to estimate productivity. By validating these results with 14C primary production measurements, the possibility to get continuous estimates of primary production from moorings is assessed.

HYDROCARBON BIODEGRADATION BY ARCTIC SEA-ICE AND UNDER-ICE MICROBIAL COMMUNITIES DURING MICROCO Sm EXPERIMENTS, NORTHWEST PASSAGE (NUNAVUT, CANADA)

Michel, Christine (1), M.-È. Garneau (2), G. Meisterhans (1), N. Fortin (3), T. King (1), C. Greer (3) and K. Lee (4)

(1) Fisheries and Oceans Canada (Winnipeg, Canada);
(2) Environment Canada (Quebec, Canada);
(3) National Research Council (Montreal, Canada);
(4) Australian Resources Research Centre (Kensington, Australia)

The opening of new sea routes, in combination with opportunities for hydrocarbon exploration, increases the likelihood of oil spills in the Arctic Ocean. Bioremediation of hydrocarbons is a promising mitigation strategy but challenges remain, particularly due to low microbial metabolic rates in cold, ice-
covered seas. This study investigated the oil degradation potential of ice-associated and under-ice microbial communities in the Northwest Passage (Nunavut, Canada). Microcosm incubations were run for 15 days at 1.7°C with and without oil to determine the effects of hydrocarbon exposure on microbial abundance, diversity and activity, and to estimate component-specific hydrocarbon loss. Diversity was assessed with automated ribosomal intergenic spacer analysis and ion torrent 16S rRNA gene sequencing. Bacterial activity was estimated by 3H-leucine uptake rates. Under-ice and sea-ice microbial communities degraded 94% and 48% of the initial hydrocarbons, respectively. Hydrocarbon exposure changed the composition of both sea-ice and sub-ice communities. The contribution of Epsilonproteobacteria increased and that of Alphaproteobacteria and Bacteroidetes decreased in under-ice microcosms, whereas Bacteroidetes (mainly Polaribacter) dominated in sea-ice microcosms. Sequencing data showed a decline in diversity and increases in Colwellia and Moritella in hydrocarbon-exposed communities. The low concentration of dissolved organic matter in under-ice seawater likely explains the higher hydrocarbon degradation compared to that in sea ice, where abundant and labile is present.

**ISAAFFIK ARCTIC GATEWAY**

**Mikkelsen, Peter Schmidt**

Arctic Research Centre, Aarhus University (Aarhus, Denmark)

ISAAFFIK is the Greenlandic word for gateway. ISAAFFIK is also the name of a new independent and public website (www.isaaffik.org). ISAAFFIK is a facility, a network, but not an authority. The content of the website is maintained decentrally by a number of ISAAFFIK partners and contributors. The purpose of ISAAFFIK is to inspire and facilitate cooperation, synergies and creativity among universities and knowledge centers in areas of arctic research, education, consultancy and logistics. Involvement and participation of users – researchers, coordinators and more – is key to the growing success of ISAAFFIK. Everyone engaged with arctic research, education, consultancy and logistics is eligible to become a member and hold an ISAAFFIK account. As registered user with a personal profile at ISAAFFIK members can announce expeditions, events, activities, participate in informal discussions, and more. This website is a valuable tool for planning expeditions, coordinating fieldwork, and sharing resources. This presentation will describe the functionality and benefits of this site to current and future users. The ISAAFFIK Secretariat, hosted at Arctic Research Centre (ARC), Aarhus University, is responsible for on-going operations, updates and future development of ISAAFFIK. ARC is a founding partner of the Arctic Science Partnership (ASP asp-net.org). whose mandate is to bring together the world’s leading Arctic scientists in collaborative and joint research initiatives.

**PROMISING PRACTICES IN THE ASSESSMENT OF LANGUAGE AND LITERACY IN INUIT COMMUNITIES**

**Miller, Tess (2), J. Palluq-Cloutier (1), C. Chenier (3) and S. Tulloch (2)**

(1) Inuit Uqausinginnik Taiguusiliuqtiiit (Iqaluit, Canada);
(2) University of Prince Edward Island (Winnipeg, Canada);
(3) Ilitaqsiniq - Nunavut Literacy Council (Ottawa, Canada)

This presentation discusses preliminary results for one facet of the ArcticNet-funded project Foundations for Student Persistence and Success in Inuit Nunangat. This project asks, “How are students progressing in Inuit schools, what are they achieving, and how is this achievement being assessed?” In the National Committee on Inuit Education’s National Strategy (2011), Mary Simon, then Chair, wrote of a vision for Inuit schools and communities that would “graduate bilingual Inuit children with the skills and knowledge to contribute with pride and confidence to the 21st century”. However, one of the persistent challenges in reaching this goal, and knowing when it has been achieved, is the dearth of Inuit-specific measures and indicators of learning success, including effective indicators of Inuktitut proficiency. In this presentation, we will explore Inuit-specific measures of language and literacy that are being developed by Inuit for Inuit (including language assessment tools developed by Inuit Uqausinginnik Taiguusiliuqtiiit and the Inuit Circumpolar Council). We will also explore other relevant mainstream measures of language and literacy proficiency. We will discuss the importance of critically evaluating the assessment tools being used in Inuit communities, in order to fully embrace culturally and
linguistically-responsive schooling, lay a foundation for further learning, and appropriately evaluate the learning and achievement that is occurring in Inuit schools.

**RADAR INSTRUMENTATION AND METHODS FOR LONG TERM GLACIER AND ICE-ISLAND MONITORING**

Mingo, Laurent (1), A. Crawford (2), D. Mueller (2) and G. Flowers (3)

(1) Blue System Integration Ltd. (Vancouver, Canada);  
(2) Water and Ice Research Laboratory (WIRL), Carleton University (Ottawa, Canada);  
(3) Glaciology Research Group, Simon Fraser University (Burnaby, Canada)

Ongoing field monitoring of glacier changes in polar locations requires significant logistical efforts, and incurs large costs associated with deployment, site visits, maintenance, and manual operation of field instruments. Simple automated instruments like weather stations, have been commonly used for a long time, however this is not the case for more complex instrumentation systems such as ice penetrating radar (IPR) technology. One use of IPR that is being investigated is its application as a stationary instrument measuring temporal changes over weeks to months in the cryosphere. In the case of terrestrial ice, we looked at glacier changes in glacio-hydraulic conditions, which may give insights for instance about the mechanisms of glacial outburst floods. In the case of floating glacier ice, and more specifically ice-islands, understanding how these extensive floating ice masses break up into large iceberg-size drifting objects is important since they pose a hazard in the Canadian Arctic, as far as the southern reaches of Newfoundland. Here we present the results of three field seasons using a newly designed automated stationary ice penetrating radar (sIPR) system and demonstrate how it can be used successfully. In its first implementation, the system was installed during two summer seasons in a sub-arctic environment on the Kaskawulsh Glacier in the Saint-Elias Mountains, Yukon. In this proof-of-concept study, the goal was to detect temporal changes in the subglacial and englacial environment associated with the sudden drainage of a glacier-dammed lake. As hypothesized, the drainage event produced a signature in the radar signal following the only observed event during the monitoring window. After these first automated trials, a second implementation of the sIPR was deployed on an ice island (PII-2012-A-1-f) that originated from the Petermann Glacier (NW Greenland). This deployment, conducted in October 2015, is part of the ice island deterioration modeling efforts of the Water and Ice Research Lab at Carleton University (WIRL). The primary objective was to obtain on-going ice-thickness measurements over the long term using satellite telemetry to retrieve radar and system data. In this presentation, we focus on the system design and its capabilities in dealing with the complexity of sIPR equipment operating in an Arctic environment with little to no access to the device. We present the two data sets collected with the system on terrestrial glaciers, and the third one showing a full year of data collected on PII-2012-A-1-f, to illustrate how measurements produced by the sIPR can be used. We discuss how satellite telemetry is optimized to deal successfully with large data sets from a complex instrument as well as how the data can be used to look at not only ice depth information but also englacial properties. Finally the latest technical advances being implemented on the sIPR are discussed.

**THE EXCHANGE OF INORGANIC CARBON ON THE CANADIAN BEAUFORT SHELF**

Mol, Jacoba (1), H. Thomas (1), P. Myers (2) and X. Hu (2)

(1) Dalhousie University (Halifax, Canada);  
(2) University of Alberta (Edmonton, Canada)

The Mackenzie Shelf in the southeastern Beaufort Sea is an area that has experienced large changes in the past several decades as warming, sea-ice loss, and increased river discharge have altered carbon cycling. Upwelling and downwelling events are common on the shelf, caused by strong, fluctuating along-shore winds and resulting cross-shelf Ekman transport. Downwelling has the ability to carry inorganic carbon and other remineralization products off the shelf and into the deep basin for possible long-term storage in the world oceans. Upwelling carries water high in dissolved inorganic carbon (DIC) and nutrients from the Pacific-origin upper halocline layer (UHL) onto the shelf. Profiles of DIC and total alkalinity (TA) taken in August and September of 2014 are used to investigate the cycling of inorganic carbon on the Mackenzie Shelf. The along-shore and cross-shelf transport of inorganic carbon is quantified using velocity fields from model output of the Arctic and Northern Hemisphere Atlantic (ANHA) Simulation.
A strong upwelling event prior to sampling on the Mackenzie Shelf is analyzed and the resulting influence on the carbonate system, including the saturation state of aragonite and pH levels on the shelf, is investigated. TA and δ18O are used to examine water mass distributions in the study area and analyze the influence of Pacific Water, Mackenzie River freshwater, and sea-ice melt on carbon dynamics and air-sea fluxes of CO2 in the surface mixed layer. The sources of DIC to the shelf and deep basin, including the remineralization of organic matter, brine formation, and air-sea gas exchange are further considered using the stable isotopes of carbon (δ13C-DIC) as an independent tracer of biological activity. Understanding carbon transfer in this seasonally dynamic environment is key in order to quantify the importance of Arctic shelf regions to the global carbon cycle and to provide a basis for understanding how its role will respond to the aforementioned changes in the regional marine system.

IMPORTANCE OF EXCHANGES BETWEEN ECOSYSTEMS IN THE FUNCTIONING OF FOOD WEBS: A META-ANALYTIC APPROACH

Montagano, Laurent (1), N. Lecomte (1), S. Leroux (2) and M.-A. Giroux (1)

(1) Université de Moncton (Moncton, Canada);
(2) Memorial University of Newfoundland (St-John’s, Canada)

At the heart of our study lies the concept of ecological subsidies, which encompass any resource, in the form of nutriments, detritus or prey, that transits from one habitat to a consumer or a producer in another habitat. This donor-controlled input of energy (i.e. whose quantity is invariable to consumption rate) modifies the productivity of the recipient and can potentially cause a sequence of cascading effects in the food web. A wide variety of these effects have been studied across several systems in the past 20 years. Here we determine the general effect that subsidies exert on responses exhibited by individuals, populations, and communities using a meta-analysis. This will allow us to examine how specific parameters such as latitude, the type of effect (direct or indirect) and the type of subsidy (nutriments, detritus or prey) can influence responses to subsidies. Such a model of subsidies impacts on entire systems can be applied to sensitive biomes such as the Arctic. This approach could be used to better understand the current changes occurring in tundra ecosystems, which are simultaneously facing surges in subsidies from the South (e.g. increasing population of geese) and a fast-paced climate warming.

RELATIONSHIPS BETWEEN ORGANIC CONTAMINANTS AND METABOLOMICS PROFILES IN MUSCLE AND LIVER OF POLAR BEARS FROM TWO SUBPOPULATIONS IN HUDSON BAY, CANADA

Morris, Adam (1), R. Letcher (2), M. Dyck (3), B. Chandramouli (4) and J. Cosgrove (4)

(1) Carleton University (Ottawa, Canada);
(2) Environment and Climate Change Canada (Ottawa, Canada);
(3) Nunavut Department of the Environment (Igoolik, Canada);
(4) AXYS Analytical (Sidney, Canada)

Metabolomics analysis can be used to produce profiles of endogenous, low molecular weight metabolites associated with a range of physiological processes in cells, tissues or whole organisms. Metabolite profiles can be assessed using partial least squares discriminant analysis (PLS-DA) in combination with an analysis of variable importance on projection (VIP). These procedures have been effective in identifying metabolites as potential biomarkers of exposure to contaminants including perfluorooctane sulfonic acid (PFOS) and bisphenol A (in fish), polychlorinated dibenzodioxins (in rodents), and polybrominated diphenyl ethers (PBDEs; in rats), among others. In nature, organisms are exposed to complex mixtures of organic contaminants with widely variable modes of action and physiological responses, the effects of which are difficult to assess holistically. Polar bears (Ursus maritimus) are the apex predator of the Arctic sea-ice associated food web, and are exposed to legacy and current use organic contaminants that have known or suspected endocrine disrupting effects. Here, a semi-targeted metabolomics platform (216 metabolites) was used to generate profiles in the muscle and liver of male polar bears from the southern and western Hudson Bay subpopulations (SHB and WHB respectively). These were compared with profiles of organic contaminants in order to identify covarying components that might be useful in assessing the physiological effects of the contaminant mixture on the bears. The PLS-DA models in muscle and liver were validated and subjected to permutation
testing before VIP analysis. In liver comparisons of metabolites alone, a two component model explained 31% of the total variance of the data. VIP analysis showed that the majority of metabolites that covaried significantly and influenced the discrimination of the scores of the bears from SHB and WHB were related to lipid metabolism (acylcarnitines associated with $\beta$-oxidation), and membrane lipid synthesis/catabolism (phosphatidylcholines, lysophosphatidylcholines sphingomyelins). When contaminants were added to the model, VIP identified components included acylcarnitines and their intermediates, membrane lipids, gamma aminobutyric acid (GABA), and an ursid-specific bile salt, along with PBDE congeners (BDE99 and -100), a perfluorinated substance (perfluoro-4-ethylcyclohexane sulfonic acid; PFEtCHxS) and several organochlorine (OC) compounds. Concentrations of metabolites identified by VIP were all greater in WHB bears, which also had elevated concentrations of OC pesticides, while the remaining VIP-identified contaminants were typically greater in SHB bears. In muscle, a two component model explained 29% of the variance, with VIP identifying a range of metabolites primarily associated with carbohydrate metabolism, lipid metabolism, and protein synthesis. When contaminants were added to the model, VIP analysis showed some similarity to liver in terms of contaminants identified (PFEtCHxS, BDE99); however OC pesticides had a greater statistical influence on the discrimination of the profiles in muscle over liver. Fewer membrane lipids were identified by the VIP than in liver, while hexoses, biogenic amines, acylcarnitines, fatty acids and some amino acids in muscle covaried significantly with the contaminant concentrations, with the metabolites generally being greater in WHB bears over SHB. The utility of these results for assessing the effects of contaminant mixtures on polar bears will be discussed.

**DECOUPLING OF OTOLITH AND SOMATIC GROWTH DURING MIGRATION OF A NORTHERN SALMONID**

Morrison, Christie (1), K. Howland (2), K. Tierney (1) and C. Gallagher (2)

(1) University of Alberta (Edmonton, Canada); (2) Fisheries and Oceans Canada (Winnipeg, Canada)

Northern form Dolly Varden char (Salvelinus malma malma) are migratory salmonids that inhabit the western arctic. They have been listed as special concern under COSEWIC due to their limited distribution, population declines, and concerns over their ability to tolerate climate change. Due to their importance as a cultural and subsistence fish to Inuvialuit and Gwich’in First Nations, research is currently being undertaken to reconstruct early life histories of Dolly Varden using otoliths (ear bones). We examined the otolith size – fish size relationship in three populations of Dolly Varden in order to confirm the assumption of constant proportionality in otolith and fish growth prior to back-calculating size-at-age. Results indicate a decoupling of otolith and somatic growth during first seaward migration, thus leading to an overestimation of size-at-age in the juvenile ontogenetic stage. During first migration, fish are dramatically increasing in body size over a short summer feeding period. We hypothesized that during this period of rapid increase in somatic growth, material is being deposited onto the otolith at a slower rate, thus leading to the subsequent decoupling. This is the first evidence of otolith and somatic decoupling during migration for a migratory salmonid. A modified ontogenetic stage-specific back-calculation equation that accounts for the decoupling of otolith and somatic growth will be developed in order to accurately estimate size-at-age for Dolly Varden during early ontogenetic stages.

**SIMULATED CARIBOU BROWSING LIMITS THE EFFECT OF NUTRIENT ADDITION ON THE GROWTH OF BETULA GLANDULOSA, AN EXPANDING SHRUB SPECIES IN NUNAVIK, CANADA**

Morrissette-Boileau, Clara, S. Boudreau, J.-P. Tremblay and S. D. Côté

Caribou Ungava, Université Laval (Québec, Canada)

Warmer summer temperatures and enhanced soil fertility associated with recent climate change are hypothesized to be the main drivers of the generalized shrub expansion observed at the circumpolar scale in the last decades. In Nunavik, evidence from aerial photography, field observations and dendrochronological analyses indicate that Betula glandulosa Michx. is the dominant species driving shrub expansion. Caribou (Rangifer tarandus) reduces the abundance of forage through selective browsing, suggesting that they can have a negative impact on shrub growth and may limit shrub expansion. To discriminate the impacts of climate
change and caribou herbivory on B. glandulosa, we conducted a five-year experiment near Deception Bay, Nunavik, Canada, in which we simulated moderate and intense caribou browsing, warmer temperatures (using hexagonal open-top chambers) during the growing season and fertilisation that consisted of increased nitrogen availability in the form of urea. We fitted linear mixed-effects models to assess the effect of fertilisation, temperature and browsing on total aboveground and leaf dry biomass and on annual radial growth during the five years of the experiment. We found no effect of treatments on leaf biomass. Warming had a negative impact on total biomass accumulation in fertilised plots, possibly linked to negative ecological effects of open-top chambers increasing temperature extremes and lowering relative humidity. The fertilisation treatment increased radial growth 3 years out of 5, suggesting that B. glandulosa growth is at least partially limited by nitrogen in tundra ecosystems. Thereby, fertilisation may only favour B. glandulosa growth when other conditions limiting growth are met. Simulated browsing had a negative cumulative effect on radial growth since the effect of browsing increased with cumulated browsing throughout the years and under high intensity. Browsed birches likely allocated their resources to leaf regrowth in response to removal of part of their photosynthetic apparatus and this allocation in leaf biomass was made at the expense of radial growth. This is consistent with the observation that leaf biomass did not vary with the intensity of simulated browsing. Our results have implications for understanding and predicting potential shrub responses to future scenarios of climate change and herbivory regime. Our study demonstrated that simulating the effects of climate change can increase shrub growth, but herbivory was the main driver of growth as we observed in ring width increment. Our results also suggest that caribou population sizes should be included when predicting tundra vegetation changes in the Arctic, at least in areas with high herbivore density.

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

Mortenson, Eric (1), H. Hayashida (1), N. Steiner (2), A. Monahan (1) and T. Sou (3)

(1) University of Victoria (Victoria, Canada); (2) Department of Fisheries and Oceans; Environment Canada; University of Victoria (Victoria, Canada); (3) Institute of Ocean Sciences (Sidney, Canada)

Traditionally, models of seasonally ice-covered ocean have treated the ice cover as an inert barrier to the air-sea exchange of gases. However, recent field research indicates that chemical and biological processes in the sea ice contribute to the carbon transport within and below the ice. We have developed a coupled sea ice and pelagic ecosystem in a 1D model that simulates carbon exchange in the seasonally ice-covered marine Arctic. Carbon sinks and sources due to pelagic and sympagic biological production, and sea-ice carbon fluxes due to ice growth and melt have been included, as well as ikaite precipitation (within the ice) and dissolution (in the water column). The model has been set up for a location near Resolute Bay in the Canadian Arctic Archipelago. Sensitivity analyses focusing on the relative importance of the ice algal bloom, DIC-rich brine rejection during ice growth, and low-DIC meltwater release during ice melt, provide insight into the impacts of these processes on the air-sea exchange of carbon during the ice-free season. These carbon fluxes are presently being implemented in a 3D regional coupled ice-ocean biogeochemical model for the Arctic, and preliminary results from the 3D regional model will be presented as well.

RECENT WARMING OVER CANADA’S HIGH ARCTIC GLACIERS: GLACIER SURFACE TEMPERATURES AND ALBEDO CHANGE FOR THE QUEEN ELIZABETH ISLANDS (2000-2015)

Mortimer, Colleen (1), M. Sharp (1) and B. Wouters (2)

(1) Department of Earth and Atmospheric Sciences, University of Alberta (Edmonton, Canada); (2) Institute of Marine and Atmospheric Research, Utrecht University (Utrecht, Netherlands)

The Queen Elizabeth Islands, Arctic Canada, contain ~14% of the global glacier area, and rates of glacier mass loss from the region have increased since at least 2003. Inter-annual variations and longer term trends in annual glacier mass balance in this region are largely attributable to variations in summer melt. Net shortwave radiation is the largest source of melt energy in the QEI and is modulated by changes in glacier surface albedo. Mean summer glacier surface temperatures (GST), determined from NASA’s Moderate Resolution Imaging Spectroradiometer are
a proxy for the duration and intensity of summer melt. Between 2000 and 2015, they increased at an average rate of 0.06 ± 0.04°C, for a total of nearly 1°C. Over a similar time period (2001-15), the mean summer surface albedo (MODIS shortwave broadband black-sky albedo (BSA) of glaciers south of 80°N) decreased by 0.057. Most of the surface warming occurred between 2005 and 2012, when mean summer near-surface (2 m) and upper air (700 hPa) temperatures were 1.0 – 1.2°C higher than the 1948-2015 mean. There is a strong correlation between glacier surface temperatures and 700 hPa air temperature ($r >0.8$, $p <0.001$), suggesting that the period 2005-2012, when mean summer GSTs were anomalously high, was likely the warmest period in the region since at least 1948. 2003-2015 GSTs are strongly correlated ($r = -0.82$; $p < 0.01$) with the annual mass change record from the Gravity Recovery and Climate Experiment during 2003/04-2014/15, derived by differencing the annual summer minima in the time series of regional mass anomalies, confirming that variations in QEI annual balance are strongly influenced by variations in summer air temperature. In addition, the mean summer shortwave black-sky albedo of glacier surfaces is negatively correlated with the surface temperature during the 2001-15 period, indicating that warming-induced albedo decline accelerates melting and mass loss and enhances further surface warming.

ONE FOR ALL AND ALL FOR ONE, OR HOW CORRELATED BEHAVIOURS IMPACT ABundance ESTIMATES IN WILDLIFE SURVEYS

Mosnier, Arnaud, T. Doniol-Valcroze and M. Hammill
Fisheries and Oceans Canada (Mont-Joli, Canada)

Estimates of abundance from wildlife surveys often underestimate true numbers because not all animals are visible at one time and not all visible animals are detected. Atlantic Walrus (Odobenus rosmarus) are harvested by the Inuit for subsistence, cultural and economic reasons. They are also listed in Appendix III under the Convention on International trade in Endangered Species (CITES), meaning that a permit is required for the export and sell of walrus products. In any survey of wildlife, the objective is to produce an estimate that is as close as possible to the true population size. An estimate that is too high (positive bias), may allow harvests that are too high for the population to withstand. An estimate that is too low (negative bias) may restrict harvests too much meaning that hunters cannot meet their subsistence needs. Bias is difficult to quantify, but hopefully the true population size lies within the 95% confidence interval. Normally, the narrower these 95% confidence intervals, the greater the confidence that we have in our estimates. Walrus are challenging to count because the proportion of animals hauled out at any one time is highly variable, sometimes changing from a few individuals to several hundred of them in a short period of time. Most previous approaches to adjust for this availability bias have assumed that animals are acting independently of each other. However, social interactions and common responses to environmental cues can result in many animals showing similar responses at the same time, meaning that the assumptions in standard estimators are not respected. Consequently, traditional estimators may be biased and underestimate survey uncertainty i.e. suggesting that the surveys are more precise than they actually are. This ‘coordinated’ behaviour among individuals may affect the suitability of current methods to estimate the proportion of animals hauled out across the survey range, as well methods used to estimate survey uncertainty. This uncertainty will impact the provision of harvest advice and can impact the assessment of populations’ status within the context of the committee on Species of endangered Wildlife in Canada (COSEWIC). Testing this in a field program is time consuming and expensive. However, with the increased power of small laptop computers, the impacts of coordinated behaviour between individuals can be examined within a simulation environment. In this study, results from simple simulations that included correlation in haulout behaviour between individuals were compared with data from published research. This theoretical framework was then used to test several methods generally applied to estimate abundance of walrus populations. Results show that mean count corrected by the average proportion of time hauled-out is an unbiased estimator while accounting for the extra variance linked to correlation among individuals. Two other estimators, known as Minimum Counted Population and Bounded Counts were both likely to underestimate the true population size, and the associated uncertainty. The use of valid tools accounting for animal behaviour is crucial to estimate population abundance of species such as walrus, ensuring a better knowledge of their status and more efficient management practices.
TRENDS OF MERCURY AND OTHER ELEMENTS IN ARCTIC CHAR IN EAST AND WEST LAKE, CAPE BOUNTY ARCTIC WATERSHED OBSERVATORY, MELVILLE ISLAND, NUNAVUT

Muir, Derek (1), X. Wang (2), A. Cabrerizo-Pastor (2), J. Kirk (2), D. Iqaluk (3), S. Lamoureux (4), K. Roberts (4) and M. Lafrenière (4)

(1) University of Guelph (Guelph, Canada); (2) Environment & Climate Change Canada (Burlington, Canada); (3) Nunavut (Resolute, Canada); (4) Department of Geography and Planning, Queen’s University (Kingston, Canada)

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 2007-12 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 2007-2008 while the East catchment experienced relatively minor disturbances. These alterations to runoff patterns, erosion and permafrost degradation are also driving changes in biogeochemical cycling. We are investigating whether these changes are also seen in bioaccumulation of mercury (Hg) and other elements, as well as persistent organic pollutants, in arctic char and the food webs of West and East Lakes. We hypothesize that increased erosional inputs into West Lake will result in increasing Hg concentrations in landlocked arctic char (Salvelinus alpinus) and other bioaccumulative elements such as cesium (Cs) and rubidium (Rb). To investigate this, arctic char have been collected annually at the end of July, from 2008 to 2016, and analysed for a suite of 34 elements using ICP-MS, and Hg using USEPA Method 7473 (thermal decomposition/amalgamation and AA detection). Carbon (C) and nitrogen (N) stable isotope analysis showed that char have significantly more depleted δ13C in East vs West Lake (mean ± SD; -27.26±0.82 ‰ (N=96) vs -24.72±1.10 ‰ (N=101)) indicative of greater terrestrial carbon inputs to West Lake. Also δ15N is significantly lower in West Lake char (10.1±0.99 ‰ vs 11.2±0.51‰) suggesting differences in food sources. The combined results from 2008 to 2016 collections show that the West Lake adult char have significantly higher concentrations of Hg, Cs and Rb in muscle (geomeans 152, 3.6 and 1760 ng/g wet weight, respectively) compared to East Lake (87.0, 2.1 and 890 ng/g) and this difference is even greater if results are adjusted for δ15N or length using analysis of covariance. Condition factors (g*100/cm3) for char in West Lake have declined since 2008 and over the period 2011-2016 have been significantly lower (0.60±0.11) than those in East Lake (0.67±0.08) indicating they are thinner than fish of the same length in East Lake. This may be due to difficulty feeding in West Lake’s turbid waters. Hg concentrations have declined in East Lake char over the period 2008 to 2016 (averaging -5.3%/yr) while increasing (4.6%/yr) in West Lake from 2009-2016. Cs and Rb in char muscle have also increased significantly in West Lake since 2009 while showing no change in East Lake. The higher concentrations and increasing Hg, Cs and Rb, in West Lake char are consistent with higher inputs into West Lake resulting from extensive permafrost disturbance in the West watershed.

SEA ICE NUTRIENT MEASUREMENTS: THE ROLE OF ICE ALGAL INTRACELLULAR NUTRIENTS

Mundy, C.J. (1), J.-É. Tremblay (2) and M. Gosselin (3)

(1) CEOS, University of Manitoba (Winnipeg, Canada); (2) Université Laval (Quebec, Canada); (3) ISMER (Rimouski, Canada)

Nutrient availability is a main factor influencing maximum production, taxonomic composition, and termination of the spring ice algae bloom in ice-covered seas. However, measuring nutrients available to ice algae is not a straightforward task and a lack of a standard method for sea ice researchers has plagued the field. In particular, there has been a common assumption that as ice core samples melt, nutrients remain conservative and therefore, their concentrations in ice melt would be a function of salinity. However, positive relationships between nutrient concentrations and algal biomass in ice melt samples led studies dating back to the early 90s to hypothesize that algae maintain an intracellular nutrient pool that is released upon melting an ice core due to osmotic stress. As part of a process-based landfast ice study near Resolute Bay, Nunavut called the Arctic - Ice Covered Ecosystem (Arctic-ICE) project, we collected a bottom-ice dataset during the 2012 spring ice algal bloom to test this hypothesis. Using chlorophyll a concentration (chl)
to standardize data, our analysis compares the bulk ice melt method to intracellular measurements from an ice-scrape sample (i.e., little osmotic stress) of nitrate+nitrite, silicic acid and phosphate concentrations. Significant positive relationships of each nutrient (bulk ice) versus chl highlighted non-conservative mixing during core processing. With a focus on nitrogen as the main limiting factor, intracellular concentrations of nitrate+nitrite ranged between 5.5 and 38.1 μmol mg chl-1 and varied as a function of snow depth (light access) and bloom period (bloom versus post bloom). Surprisingly, when standardized to bottom-ice chlorophyll a concentration, intracellular measurements fell along a 1:1 line with that of bulk ice melt measurements. These results demonstrate that ice algae exhibit luxury uptake of nutrients when available in their environment and that intracellular nutrient measurements should be made when possible during ice algal studies. The ability of ice algae to store up a nutrient reserve during the early bloom also highlights a critical biological process that stands to shift our understanding of nutrient dynamics in sea ice.

A NOVEL SOURCE OF OXYGENATED VOLATILE ORGANIC COMPOUNDS IN THE SUMMER TIME MARINE ARCTIC BOUNDARY LAYER

Mungall, Emma (1), J. Abbatt (1), J. Wentzell (2), A. Lee (3), J. Thomas (4), M. Blais (5), M. Gosselin (5), L. Miller (6) and J. Liggio (2)

(1) University of Toronto (Toronto, Canada);
(2) Environment Canada (Toronto, Canada);
(3) National University of Singapore (Singapore, Singapore);
(4) LATMOS-IPSL (Paris, France);
(5) Université de Québec à Rimouski (Rimouski, Canada);
(6) Fisheries and Oceans Canada (Sidney, Canada)

An understanding of the natural sources of organic vapors which can lead to the formation of secondary organic aerosol is necessary for the modeling and prediction for global climate. Natural sources of oxygenated organic volatile compounds (OVOCs) are particularly poorly understood in marine environments. Few observations of marine OVOCs exist, but those that do suggest that a missing, unknown source is needed to explain observed levels. We present here shipboard observations of OVOCs made by an acetate HR-ToF-CIMS during the NETCARE 2014 Amundsen campaign. These observations are consistent with a novel source of OVOCs to the marine boundary layer: chemistry at the sea surface microlayer. Correlations between measurements of organic matter in the ocean and in the atmosphere made in the waters of Nares Strait (north of 80) point to a marine source for the measured OVOCs. Correlations between the diurnal cycle of the OVOC measurements and the diurnal cycles of solar radiation and sea surface temperature point to a photo-mediated surface source. This newly identified source should be sought out in other likely areas in order to quantify its global impact on OVOC and SOA burdens in the atmosphere.

HUDSON BAY WATERSHED: RECENT INCREASES IN FISH MERCURY CONCENTRATIONS FROM HISTORICALLY IMPOUNDED RESERVOIRS OF NORTHERN MANITOBA

Munson, Kathleen, G. Stern and F. Wang

University of Manitoba (Winnipeg, Canada)

Impoundment of reservoirs for hydroregulation has been shown to significantly increase fish total mercury concentrations within a decade following large-scale flooding. Total mercury concentrations in fish have been linked to the size of the area flooded during impoundment, during which increased decomposition of terrestrial organic matter drives the formation of methylmercury, the form of mercury that biomagnifies in aquatic food webs. In northern Manitoba, the Churchill River Diversion needed to maximize hydropower production through generating stations along the Nelson River, resulted in elevated total mercury fish concentrations in lake whitefish (Coregonus clupeaformis), walleye (Esox lucius), and northern pike (Sander vitreus) reaching maxima between 2 and 14 years post-flooding. The most recent analysis of fish data in 2002 suggested that fish total mercury concentrations were approaching background levels prior to impoundment within 23 years of flooding. Extending the historical data analysis to include the past decade, we have observed increases since 2005 in fish from a variety of northern lakes, with some averages for walleye and northern pike exceeding the Canadian consumption limit of 0.5 µg g-1. These increases indicate deviations from the expected recovery of these lakes to pre-impoundment fish mercury levels. We
examine temporal changes in northern Manitoba climate as well as geochemical controls on methylation in flooded reservoirs to determine potential drivers of the recent increases in fish mercury.

LAND-USE PLANNING IN THE NUNAVIK MARINE REGION WITH REGARD TO THE HUDSON BAY REGION

Naseer, Mishal

Nunavik Marine Region Planning Commission

Hudson Bay is part of a region of complex jurisdictional overlap in the Canadian North. The activities and policies enacted as part of the Nunavik Inuit Land Claims Agreement (NILCA) therefore affect the communities of Nunavik (Northern Quebec) along the Hudson Bay Coast. Specifically with activities undertaken on behalf of the land-use planning process in the Nunavik Marine Region (NMR), the development of policies and guidelines have to take into account not only local impacts but cumulative and downstream effects as well on the management of the land and marine resources of the Hudson Bay Region. The Nunavik Marine Region Planning Commission (NMRPC) on behalf of its mandate (NILCA Article 6) undertook a Use & Occupancy Mapping Study (UOM) that was completed earlier this year and is currently developing a Conservation Atlas that will help inform the land-use planning process specifically the Protected Areas development process. It is therefore critical that various stakeholders from the Hudson Bay region work with the communities and the policymakers in helping define priorities that can help inform the land-use planning process. This report is a part of a preliminary approach in developing methods of engagement in ensuring best practices are maintained during the land-use planning process for the NMR and that a strong network of communication, cross-regional planning, and a collaborative approach is sustained.

INVESTIGATING THE COMPLEX PERMITTIVITY OF OIL-CONTAMINATED SEA ICE

Neusitzer, Thomas, N. Firoozy, T. Tiede, D. Desmond, P. Mojabi, D. Barber, M. Lemes and G. Stern

University of Manitoba (Winnipeg, Canada)

Climate change in the Arctic has begun to affect the environmental dynamics in the region, the most visible of which is the reduction of the Arctic sea ice cover (Comiso et al, Geophys. Research Lett., 35(1), 2008). As a result of the loss of sea ice, the Arctic Ocean is becoming increasingly accessible to humanity. This rise in accessibility increases the potential for Arctic endeavours such as marine shipping, oil and gas development, and tourism. Each of these activities carries the inherent risk of chemical contamination of the environment in the form of oil spills. Due to the presence of sea ice, existing detection methods for open water oil spills will likely be ineffective if applied in the Arctic, and as such, it is critical that appropriate remote sensing methods be developed to allow for the detection of crude oil spills beneath the sea ice. It has been speculated that the presence of crude oil will affect the thermal characteristics as well as the salinity of sea ice, both of which are critical to the determination of the complex permittivity of the ice. Since active microwave remote sensing is already employed as an important characterization tool for the study of Arctic sea ice (D.G. Barber, Phys. in Canada, 61(5), 227-233, 2005), it follows naturally that the variations of the thermal and electrical properties of the sea ice would be visible in the data collected from various microwave sensing methods. It has been demonstrated that the complex permittivity profile of sea ice can be recovered from the normalized radar cross-section (NRCS) of the sea ice (Firoozy et al, IEEE Geosci. Remote Sens. Lett., 12(1), 209-213, 2015), therefore analysis of NRCS data for oil-contaminated sea ice shows promise for under-ice oil spill detection applications. This research investigates the effects of crude oil spilled in the water column beneath sea ice on the complex permittivity profile of the ice in an effort to develop capabilities for microwave remote detection of under-ice oil spills. Herein, we present preliminary results and observations from an oil-in-ice mesocosm experiment conducted from January 16 to March 1, 2016 at the University of Manitoba Sea-ice Environmental Research Facility from the viewpoint of microwave remote sensing. Throughout the experiment the temperature profile of the ice was measured in-situ, and physical sampling of the ice was conducted to determine brine and oil content within the ice. In addition, we explore the application of existing dielectric mixture models for the oil-contaminated case, as well as potential modifications needed to model the complex permittivity of oil-contaminated sea ice.
APPLYING CURRENT ETHICAL FRAMEWORKS WHEN CONDUCTING RESEARCH IN THE ARCTIC

Newell, Sarah and N. Doubleday
McMaster University (Hamilton, Canada)

Introduction: Research involving Indigenous peoples in the past has not always been conducted in an ethical way. This concept is a foundation for the chapter of the Tri-Council Policy Statement (TCPS2) dedicated to conducting research involving Indigenous peoples. The publishing of the final report of the Truth and Reconciliation Commission of Canada (TRC) in December 2015 drives this point home. It is apparent from the TRC report that action must be taken to end the extreme inequalities in health and other outcomes that are a result of this history. However, careful consideration must be taken regarding the type of action to be taken when it comes to policy and research. Objective/Research question: As someone new to Arctic research, it is important to consider this context when developing a research proposal. My objective is to conduct community-based participatory research regarding how climate change and other factors influence fishing communities with regards to food security, cultural continuity, and community health and well-being. Using community-based research methods, my research question was developed in collaboration with community members. Methods: Using community-based participatory research (CBPR) methods meet many of the suggestions set out by the TCPS2 and the TRC Report. As a researcher unfamiliar with any Arctic communities this made finding a community willing to collaborate with me challenging but interesting experience. Given the community-based nature of my research, the exact methods and research question are developed with the community members through a community consultation. Discussion: To date my efforts in developing this research project have been both challenging and rewarding. After several months of contacting various organizations and cold calling communities it was rewarding to finally have a community who has agreed to work with me. Another important challenge I faced was explaining to faculty within my program that it is essential to have a community consultation when developing my research question. In addition, I have to defend the idea that I will likely not complete my PhD within the 4 year timeline the institution has set out for all PhD programs. Despite these challenges, having communities be involved in the design of research is an important part of conducting ethical research in the Arctic and I am eager to continue learning the skills required to conduct community-based research. Conclusions: Conducting ethical research in the Arctic requires careful consideration of each step within the context of our troubled history. However, community-based can lead to better research projects which will have a more positive impact on communities over the long term. ArcticNet is an important part of promoting ethical research in the Arctic.

MARINE MICROBIAL HYDROCARBON DEGRADATION IN THE KITIKMEOT REGION: ARE THE MICROBIAL RESPONSES AND COMMUNITIES THE SAME AS ELSEWHERE IN THE ARCTIC?

Noël, Amy and C. Hubert
University of Calgary (Calgary, Canada)

Reduced ice cover has led to an increase in shipping in the Canadian Arctic and a subsequent risk of marine hydrocarbon spills. The Kitikmeot region and Northwest Passage are important areas to consider for potential hydrocarbon spill mitigation because they form the east-west corridor (shortening some shipping routes by as much as 30%) and host a number of coastal communities. Microbial hydrocarbon biodegradation is a significant contributor to hydrocarbon contaminant removal in marine environments. Cold-adapted hydrocarbon biodegradation has been documented in marine conditions; however, factors influencing distribution and activity of these microbial communities remain relatively unknown. This study examined microbial degradation rates in the Kitikmeot region compared to other areas of the Canadian Arctic in light of its unique oceanography and anthropogenic activity. Further, shifts in microbial communities exposed to hydrocarbon contaminants were measured. To assess differences in hydrocarbon biodegradation rates and microbial community shifts, cold temperature fuel spills were simulated in experiments using local marine sediments (Cambridge Bay) that were compared with sediments from the Beaufort Sea and Baffin Bay. Simulations used realistic contaminants (diesel, bunker fuel and crude oil) and were incubated under oxic and anoxic (i.e. benthic, sulfate-reducing) conditions. Preliminary findings suggest that sediment-associated hydrocarbon biodegradation in the Kitikmeot region...
is comparable, and potentially faster, than the other Arctic locations. Whereas aerobic incubations showed similar metabolic response rates when amended with diesel, bunker fuel, and crude oil in all sites, anaerobic sulfate-reducing metabolism was the most rapid in the sediment from the Kitikmeot region; sulfate reduction was observed after 56 days as compared to Baffin Bay sediments that were incubated for over 500 days before sulfate reduction was observed. Microbial genomic surveys targeting 16S rRNA genes before and after contaminant exposure showed enrichment of Gammaproteobacteria in aerobic conditions and Deltaproteobacteria in anaerobic sulfate-reducing conditions. These results suggest that the Kitikmeot region harbors aerobic and anaerobic cold-adapted hydrocarbon-degrading bacterial communities that may be able to remediate contaminants in the event of a spill. Further analysis will reveal whether microbial key players responsible for biodegradation of hydrocarbons in the Kitikmeot region are unique or highly similar to in other regions of the Arctic.

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

Nuesslein, Shirin (1), C. Furgal (2), M. Gamberg (3), J. Shirley (4), J. Carpenter (5) and J. F. Provencher (6)

(1) Nasivvik Centre for Inuit Health and Changing Environments, MA Program in Sustainability Studies at Trent University (Peterborough, Canada);
(2) Nasivvik Centre for Inuit Health and Changing Environments, Trent University (Peterborough, Ontario, K9J 7B8, Canada);
(3) Gamberg Consulting (Whitehorse, Yukon, Y1A 2J2, Canada);
(4) Nunavut Research Institute, Nunavut Arctic College (Iqaluit, Nunavut, X0A 0H0, Canada);
(5) Environmental Technology Program, Nunavut Arctic College (Iqaluit, Nunavut, X0A 0H0, Canada);
(6) Acadia University (Wolfville, Nova Scotia, B4P 2R6, Canada)

Students in Nunavut Arctic College’s (NAC) Environmental Technology Program (ETP), are being trained to help identify, understand, and address many environmental challenges confronting the North. They are often tasked with being critical knowledge translators, working among communities of scientists, resource users, industry and government. It is therefore critical that they have the appropriate skills and tools to engage with these issues, and to understand and communicate about them with a variety of northern audiences. To date, online courses, workshops, in-class presentations and on the land science camps have been conducted in Arctic communities to build local capacity to understand and take action on critical environmental issues such as the presence of environmental contaminants in the Arctic food chain. However, few of these training efforts have been documented and shared for others to learn from and even fewer have been evaluated to assess their impact on participant or student learning. For the past 10 years, a group of educators, scientists, hunters, community representatives and decision makers have come together to deliver the environmental contaminants training workshop to students of the ETP program at NAC in Iqaluit, NU. This one week workshop combines lectures, interactive labs, and group discussions to introduce and teach ETP students about contaminant sources and pathways, wildlife tissue sampling, contaminants monitoring programs and communicating about contaminants research to a variety of audiences. Bringing together science and Inuit Qaujimajatuqangit, the training modules draw upon scientists to introduce students to the lab environment and local experts to teach students traditional knowledge and skills pertaining to these topics. Through interactive sessions with researchers, hunters, community members and decision makers, students learn a variety of techniques to assess, manage and communicate about the potential risks posed by environmental contaminants in country foods. In 2015, a systematic assessment was conducted for the first time since the inception of the workshop. An evaluation framework focusing on 6 recognized learning outcomes (depth and breadth of knowledge, knowledge of methodologies, application of knowledge, communication skills, limits of knowledge and understanding, and professional capacity and autonomy) was adapted and applied. Integrated analysis of student surveys, student and instructor interviews, review of curriculum materials and classroom observation indicated that 3 of 8 workshop objectives were fully achieved, and 5 partially achieved. The workshop successfully enhanced students’ awareness of key contaminant and contaminant research issues and fostered the development of dissection skills among students. The workshop proved less successful in enhancing students’ ability to communicate about
contaminants, and in understanding how health risks are assessed and know how to integrate LEK and science on this topic. Evaluation results were carefully considered in the design and adaptation of the 2016 iteration of the workshop, which was also evaluated. This project represents the first systematic effort to evaluate the effectiveness of an Arctic environmental training initiative, and is showing the practical value of front line trainer evaluation in regards to improving program delivery and assessing short and long-term success of such efforts.

IS SUMMER SEA SURFACE TEMPERATURE OVER THE ARCTIC OCEAN CONNECTED TO WINTER AIR TEMPERATURE OVER NORTH AMERICA?

Ogi, Masayo (1), S. Rysgaard (1), D. Barber (1), T. Nakamura (2) and B. Taguchi (3)

(1) University of Manitoba (Winnipeg, Canada);
(2) National Institute of Polar Research (Tokyo, Japan);
(3) Japan Agency for Marine-Earth Science and Technology (Yokohama, Japan)

Focusing on the extremely cold winter of 2013/2014 over North America, we use both reanalysis datasets and an atmospheric general circulation model (AGCM) to examine the relationship between changes in the Arctic Ocean during the summer and atmospheric circulations over North America during the subsequent winter. In the reanalysis datasets, air temperatures over North America were extremely cold during the winter of 2013/2014, while summer sea surface temperatures (SST) over the Barents Sea in 2013 were anomalously warm. This relationship is not limited to 2013-2014; we find that the interannual variability of SST over the Barents Sea is significantly correlated with the atmospheric circulations and air temperatures over North America during the winter. Also, positive SST anomalies over the Barents Sea during summer persist through autumn and winter. These results indicate that variations in Barents SST have a memory longer than a season, and hence are important for the interseasonal link from summer to winter, which is likely related to the atmosphere and temperature anomalies in the following winter. AGCM experiments driven by the observed SST and sea ice concentration successfully reproduced the warmer temperature over the Barents Sea from summer to winter. The winter large-scale atmospheric anomalies in the experiments were similar to observed atmospheric anomalies in the winter of 2013/2014. Finally, both our observational analysis and the model experiments suggest that the summer-autumn Barents SST, rather than Arctic sea ice anomalies, may hold a key to predict the winter atmospheric circulation and the winter air temperature over North America.

DIETARY OVERLAP BETWEEN RINGED AND HARP SEALS IN CUMBERLAND SOUND, NUNAVUT

Ogloff, Wesley (1), G. Davoren (1) and S. Ferguson (2)

(1) University of Manitoba (Winnipeg, Canada);
(2) DFO (Winnipeg, Canada)

As the ocean climate continues to warm, northward range expansions of subarctic species and increasing abundances in Arctic regions are predicted. A greater understanding of the impacts of these expansions on ecosystem structure and function will be essential for proper management of subsistence and commercially harvested species. In the Cumberland Sound region, harp seals have become more abundant in recent years, and Inuit knowledge suggests that ringed seal populations have been declining with increasing harp seal populations since 2000. Other changes in the region include reports of unusually abundant subarctic forage fish species, namely capelin, by locals. To assess the potential for competition between ringed and harp seals, we examined their dietary overlap. Stomach contents were analysed for both ringed (n=44) and harp seals (n=13) hunted during Inuit subsistence hunts from 2008-2015, along with stable isotope analysis of muscle and liver tissue. Although stomach contents of both seal species included varying frequencies of invertebrates (e.g., amphipods, euphausiids, mysids), fish was more frequently observed in harp (77%) than in ringed (38%) seal stomachs. This coincided with higher percentage-by-mass of fish in harp (69%) than in ringed (28%) seal stomachs. Of the fish consumed, capelin represented a lower percentage of the content in ringed seal (8%) than in ringed (38%) seal stomachs. This coincided with higher percentage-by-mass of fish in harp (69%) than in ringed (28%) seal stomachs. Of the fish consumed, capelin represented a lower percentage of the content in ringed seal (8%) than in harp seal (29%) stomachs. Although dietary overlap appears to be high, resource use differed between species. This information can better inform management of seal populations in the face of changing conditions that may exacerbate the pressures acting upon these populations. This is particularly important in areas in which ringed seals are the primary subsistence food of Northern communities.
UNDERSTANDING EDUCATIONAL ACHIEVEMENT IN INUIT NUNANGAT: AN ANALYSIS OF THE ABORIGINAL PEOPLES SURVEY

O’Gorman, Melanie

University of Winnipeg (Winnipeg, Canada)

Educational attainment in Inuit regions is significantly lower than that in the rest of Canada. For example, in 2012, 58 percent of Inuit aged 18-44 had not completed high school, compared to 11 percent of the non-Aboriginal population in the same age group. Attendance is also an issue in many Northern communities. For example, in 2012 a quarter of students who dropped out of school reported missing school often (Statistics Canada (2013)). Such statistics indicate a need for research on factors that are supporting Inuit students to stay in and excel in school. In January 2016, the Amaujaq National Centre for Inuit Education, along with the ArcticNet Centre of Excellence, issued a call for research proposals to identify such factors. Our team of researchers applied for and received funding under this call for the project Foundations for Student Persistence and Success in Inuit Nunangat. Our team of researchers is now addressing the following questions: 1. What is contributing to Inuit students’ persistence in or withdrawal from school, particularly at grade transitions? 2. How are students progressing in Inuit schools, what are they achieving, and how is this achievement being assessed (including mainstream and Inuit-specific indicators of success)? This research will draw upon a great deal of high quality academic research on Inuit education. These studies indicate ways in which student success can be fostered by, for example, increasing Inuit leadership and staff in schools (Walton O’Leary, 2015), developing strong community partnerships (Tompkins, 1998) or developing support materials to help promote Indigenous learning in the classroom (McGregor, 2012). This literature is however largely qualitative. To guide educational policy and programming, research must identify factors that are quantitatively important in influencing educational outcomes. The present paper identifies factors associated with Inuit educational attainment and academic achievement in Canada using the 2012 Aboriginal Peoples Survey (APS). This is a large, post-censal survey focused in particular on education and employment outcomes of First Nations, Métis and Inuit individuals in Canada. This analysis allows for the identification of factors associated with academic success and retention such as gender, language of instruction, school climate, school-family communications and peer effects. In order to determine the extent to which these independent variables can explain differences in educational achievement across the North, I undertake Oaxaca-Blinder decompositions. These decompositions provide insight into which variables are most highly associated with missing days of school, academic performance and high school graduation, and therefore point to important policies/areas of programming for improving such indicators for northern policy makers and educators.

TWENTY YEARS OF PLANT SUCCESION IN THE HIGH ARCTIC

O’Kane, Katriina and G. Henry

University of British Colombia (Vancouver, Canada)

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 restrictions on plant growth. In 1995, a study on plant succession was conducted in the forelands of Twin Glacier, on Ellesmere Island, Nunavut. Assuming the foreland represented a chronosequence, time was substituted for space in making inferences about the patterns displayed by succession. By assessing vegetation cover and diversity, the study found that succession at the site followed a directional-replacement model, transitioning through four main stages over 44 years. Twenty years later, we re-conduct the same study, applying identical surveying methods. How has succession proceeded during this time? Was the original study correct in assuming the foreland represented a chronosequence, or are other environmental variables more significant? These are the questions that will be answered by this poster.

WILDLIFE RESEARCH AND MONITORING IN NUNAVUT

Orman, Lynda

Government of Nunavut, Department of Environment (Igloolik, Canada)

The Government of Nunavut Department of Environment (GN DOE), Wildlife Management Division has a legislated mandate for the management
of terrestrial wildlife species in Nunavut, including on-going responsibility for the co-management of Nunavut wildlife within the principles of conservation outlined in the Nunavut Land Claims Agreement. One of the primary goals of the DOE is to achieve a balanced approach to wildlife management that uses both science and Inuit Qaujimajatuqangit (IQ). The objectives of the Wildlife Management Division are to: provide up-to-date information and research about wildlife from various sources; develop wildlife management plans with co-management partners to manage wildlife populations and to fulfill the national and international obligations of Nunavut with regard to wildlife management; provide support and resources to co-management partners and harvesters; and ensure legislative and regulatory compliance through education and enforcement. The Wildlife Research Section of the Wildlife Management Division, DOE, with input from co-management partners, leads wildlife research in Nunavut including population assessment, wildlife health, harvest monitoring and habitat studies of polar bear, caribou, muskox, grizzly bear and wolverine in Nunavut. Many of the wildlife populations in Nunavut have ranges that extend into neighboring provinces and territories. Within the Arctic ecosystem, caribou is an important species comprising much of the tundra biodiversity. Caribou and other wildlife, as a resource, provide food, support social and cultural activities, and drive local economies in Nunavut. An overview of the GN DOE wildlife research program and some of the recent results are reviewed. We have little understanding of the rapid consequences of climate warming on the keystone Arctic species and ecosystem. In the changing Arctic, in order to address information gaps in ecosystems and wildlife on the remote tundra where logistics are financially challenging, we need increased investment in research and monitoring through cooperative programs involving academia, communities, multiple levels of government and some private partners. Key words: Polar bears, caribou, muskox, wolverine, Inuit Qaujimajatuqangit, IQ, Nunavut, wildlife research, wildlife management, Nunavut Land Claims Agreement, Government of Nunavut.

ADAPTATION ACTIONS FOR A CHANGING ARCTIC (AACA) – PERSPECTIVES FROM THE BERING-CHUKCHI-BEAUFORT (BCB) REGIONAL ASSESSMENT

Outridge, Peter (1), L. Hinzman (2) and S. Klepikof (3)

(1) Geological Survey of Canada (Ottawa, Canada); (2) University of Alaska Fairbanks (Fairbanks, United States); (3) Arctic and Antarctic Research Institute (St. Petersburg, Russia)

Following a directive from the Arctic Council in 2011, multinational teams of researchers and community members have been assessing the challenges and opportunities associated with all forms of change in the Arctic environment and in communities that are being affected by climate warming. The goal is to provide decision-makers and leaders at all levels, from communities to regional governments, with adaptation strategies to better deal with the complex and interacting problems and stressors occurring across many human and environmental systems. Three Arctic regions are being assessed, two of them in the western and eastern Canadian Arctic; ArcticNET IRISes have played a major role in both. Here, a summary for policy-makers for the Bering-Chukchi-Beaufort Region will be presented, focusing on the adaptations that residents, industries and governments have begun to plan and implement in recent decades. Further, it considers the environmental and socio-economic changes to which inhabitants in the region will be adapting in future, and provides a number of suggestions intended to help inform decision makers about how they might help their communities better adapt in future.

IMPACTS OF RIVER HEAT FLUX ON THE DECLING BEAUFORT SEA ICE

Park, Hotaek

JAMSTEC (Yokosuka, Japan)

Increases in surface air temperatures in the Arctic are exceptionally fast during the recent decades. The warming temperature resulted in changes in the Arctic freshwater system, such as increases in river discharge, changes in river-ice phenology, and warming of river water temperature. The combination of the increased river discharge and warming water temperature can result in warmer river heat flux flowing into Arctic
Ocean, consequently enhancing sea ice melting. However, few studies have provided quantitative assessments for influences of river heat flux on the Arctic sea ice. A land surface model (CHANGE) coupled with models of river discharge, ice-cover, and water temperature through channel network was applied to the Arctic river basins over the period 1979–2013 in order to explore influences of the river processes on sea ice. The analysis targeted to the upper terrestrial rivers of Beaufort sea basin. The simulation indicated increasing trends in river discharge and water temperatures in the Beaufort river basin, and thus warming trend in river heat flux. The heat fluxes were significantly correlated with sea surface temperature and sea ice concentration in the nearshore seas, especially in the spring season when sea ice begins to melt. This provides an insight about influence of the terrestrial freshwater on the declining Arctic sea ice.

APPLICATION OF A FORMAL SAFETY ASSESSMENT IN ARCTIC MARITIME TRANSPORTATION

Parsons, James (1), V. Kuzmin (2) and E. Clouter (3)

(1) Marine Institute/Memorial University (St. John’s, Canada);
(2) Admiral Makarov State University of Maritime and Inland Shipping (Saint-Petersburg, Russia);
(3) Marine Institute/Memorial University (St. John’s, Canada)

Global attention towards the Arctic is increasing, especially in the exploitation of its waters and hence in maritime transportation. Some of the main drivers of this increase include a decline in the coverage and thickness of multi-year ice, longer open water periods during the Arctic summer, increase in demand for renewable and non-renewable resources in the area, improvements in technology, potential gains in business efficiency via shorter shipping routes, and population growth of native and non-native people requiring greater consumer choice and more services. Regardless of the global growth in interest, the Arctic remains a very challenging environment in which to safely and effectively operate as it is a remote, isolated, geographically vast, sparsely populated, environmentally sensitive, climatically harsh, poorly charted and meagerly serviced region with extensive periods of total darkness and waters that are ice covered or ice-infested. The Arctic presents many hazards and risks to maritime transportation and thus effective risk management is a vital component of safe and successful business operations. To help drive the need for risk management, the International Maritime Organization (IMO), through its International Safety Management (ISM) Code, requires ship owners to establish safeguards against all identified risk. To expand on the work of the IMO in the area of risk management, a Formal Safety Assessment (FSA) concept has been developed and credited with prompting numerous initiatives and regulatory changes. The goal of the FSA is to predetermine need so that measures can be established in an attempt to prevent tragedy. The FSA methodology has several of the characteristics common to many risk management approaches and is a five step process with feedback loops. The steps include hazard identification, risk assessment, risk control options (RCOs), cost-benefit assessment (CBA), and decision-making recommendations. While the FSA methodology is not without its critics, it is felt that with appropriate application tailored to numerous challenges, it is a suitable risk management tool for use in Arctic maritime transportation. The Canadian Transportation Safety Board (TSB) database was utilized to gain insight on the circumstances surrounding the 157 reported marine occurrences in Canadian waters north of 60°N between the years 2000 and 2014. In comparing Canadian Arctic shipping statistics with those of other Arctic nations, it was found that the biggest risk to vessels sailing in Arctic ice covered water was related to vessel damage as a result of contact with ice or grounding.

ARCTICIDEA: NUNAVUT BROADBAND AND DIGITAL ENTREPRENEURIALISM

Pasch, Timothy (1), M. Trahant (1) and D. Bjerklie (2)

(1) University of North Dakota (Grand Forks, United States);
(2) TIME Magazine (New York, United States)

The importance of training in information technology, job creation in digital industries, and participation in markets for digital products is widely recognized as essential in modern economies. And yet a digital divide remains a significant limiting factor in many regions, including much of the circumpolar Arctic. The extraordinary vulnerability of many Arctic communities and the increasing urgency to preserve
and document indigenous knowledge in an era of rapid environmental, social and economic change, are tightly linked to the challenges of building long-term community capacity, including human elements of digital cyberinfrastructure. This paper discusses Arctic digital entrepreneurialism as economic opportunity in Nunavut with a focus on reviewing existing broadband infrastructure, discussing challenges and possibilities for enhancing connectivity and access, and elucidating community-focused digital training and education concept models. Collaborative opportunities within and between communities in the circumpolar North are explored along with proposing specific economically-viable innovations in community-driven digital projects embedding geographic and cultural knowledge.

**INUIT TRADITIONAL ECOLOGICAL KNOWLEDGE (TEK), SUBSISTENCE HUNTING AND ADAPTATION TO CLIMATE CHANGE IN THE CANADIAN ARCTIC**

Pearce, Tristan (1), J. Ford (2), A. Cunsolo (3) and B. Smit (4)

(1) University of the Sunshine Coast (Sippy Downs, Australia);
(2) McGill University (Montreal, Canada);
(3) Labrador Institute (Happy Valley-Goose Bay, Canada);
(4) University of Guelph (Guelph, Canada)

This paper examines the role of Inuit traditional ecological knowledge (TEK) in adaptation to climate change in the Canadian Arctic. It focuses on Inuit relationships with the Arctic environment, including hunting knowledge and land skills, and examines their roles in adaptation to biophysical changes that affect subsistence hunting. In several instances, TEK underpins competency in subsistence and adaptations to changing conditions, which includes flexibility with regard to seasonal cycles of hunting and resource use, hazard avoidance through detailed knowledge of the environment and understanding of ecosystem processes, and emergency preparedness, e.g., knowing what supplies to take when traveling and how to respond in emergency situations. Despite the documented importance of TEK in adaptation and in maintaining a level of competency in subsistence, the relationships between TEK and adaptation to climate change are not well defined in the scholarly literature. This paper aims to conceptualize the relationships between TEK and adaptation to climate change by drawing on case study research with Inuit in the Canadian Arctic. TEK is considered an element of adaptive capacity (or resilience) that is expressed as adaptation if TEK is drawn upon to adapt to changing conditions. This capacity depends on the development, accumulation, and transmission of TEK within and among generations.

**PUTTING ARCTIC RESEARCH INTO PRACTICE: EVIDENCE-BASED DECISION-MAKING IN A NORTHERN CONTEXT**

Perrin, Alison (1) and Colleen Healey (2)

(1) Yukon Research Centre, Yukon College (Whitehorse, Canada);
(2) Government of Nunavut, Climate Change Section (Iqaluit, Canada)

Regional and Indigenous governance in Canada’s North have been evolving rapidly over the past twenty years within a complex physical and political landscape and in many ways are pioneering new forms of governance. With the Nunavut Land Claims Agreement, Labrador Inuit Land Claims Agreement, Nunavik Inuit Land Claim Agreement, Yukon self-government agreements with 11 of 14 First Nations, and NWT’s Comprehensive Land Claims Agreements, northern regions are arguably leading the way in Indigenous self-governance in Canada. Northern territories are also taking on more decision-making power with devolution in Yukon and most recently in the Northwest Territories. The northern context includes rapid landscape change due to the impacts of climate change and economic and resource development. Within the social context, the North is experiencing the impacts of development and environmental change on culture, health, and northern ways of life. At the same time, northern governments are taking on these challenges with a human and financial deficit, and with a public service that can experience high turn over. Yet northern organizations and governments are using innovation and northern ingenuity to overcome capacity challenges, and technology and the knowledge economy are making inroads in northern economies. Within this context northern governments and policy organizations are focusing more on integrating research into their work and making evidence-based decision-making a priority in the policy landscape. They are using innovative programs and partnerships to build their capacity. Research is part of the growing northern
economy, building knowledge and also bringing money and opportunities to northern communities. Yet not all research has the same impact, and there are still barriers to bridging the science-policy gap in the North. There can be a disconnect between the information and capacity needs of the North, and researcher priorities, and finding the balance between fundamental and applied research is a challenge for those working in the North. What does this look like in practice? This presentation will explore the barriers to bridging the science-policy gap, but also examine examples of how northern organizations including the governments of Nunavut, Northwest Territories and Yukon are partnering with research groups and academic institutions to answer their research questions and train their workforce. These partnerships are being built in a way that not only improves the flow of information from academic institutions to government decision-makers, but also allows governments to share their information needs with researchers to inform the development of research programs.

THE CUMULATIVE IMPACTS OF HUMAN INFRASTRUCTURES ON SUMMER HABITAT USE OF MIGRATORY CARIBOU

Plante, Sabrina (1), C. Dussault (2) and S. D. Côté (1)

(1) Université Laval, Caribou Ungava (Québec, Canada);
(2) Gouvernement du Québec, Ministère des Forêts, de la Faune et des Parcs (Québec, Canada)

Human disturbances have been suggested to be one of the main factors explaining caribou and reindeer (Rangifer tarandus) declines across boreal and arctic regions. The number of mining exploration projects has increased in the last decades in northern Quebec and Labrador. With the increasing threat of human disturbances in northern ecosystems, it is crucial to assess their potential cumulative impacts on wildlife. We investigated the summer habitat selection of migratory caribou of the Rivière-aux-Feuilles (RAF) and Rivière-George (RG) herds in northern Québec and Labrador (Canada) using long-term satellite monitoring. Using resource selection functions, we evaluated the effects of environmental variables (habitat type, forage productivity-NDVI) and human disturbances (active and abandoned mines, mining explorations, roads, buildings and other types of infrastructures) on the relative probability of occurrence of caribou. We also evaluated their cumulative impacts by determining whether habitat selection responses to disturbances depended on the local disturbance density. We found that caribou strongly avoided mines when in operation, but not when abandoned or during the exploration phase, suggesting that the intensity of disturbance activities may modulate caribou responses. Surprisingly, caribou selected for proximity to roads. Caribou responses to disturbances also increased with increasing disturbance density. Caribou avoided naturally disturbed areas such as old and recent burns, and selected areas with higher vegetation productivity. Our results suggest that caribou are sensitive to natural and human disturbances and that their probability of occurrence depends on the intensity of disturbances and their local density. Mining activities in northern ecosystems and future developments are likely to decrease the availability of functional habitat for caribou.

FTIR IMAGING ANALYSIS OF CELL CONTENT IN SEA-ICE DIATOM TAXA DURING A SPRING BLOOM IN THE LOWER NORTHWEST PASSAGE OF THE CANADIAN ARCTIC

Pogorzelec, Nicole (1), C. J. Mundy (1), C. Findlay (2), K. Campbell (1), A. Diaz (1), J. Ehn (1), S. Rysgaard (1) and K. Gough (2)

(1) CEOS, University of Manitoba (Winnipeg, Canada);
(2) Department of Chemistry, University of Manitoba (Winnipeg, Canada)

During their vernal bloom, ice algae respond to variable light and nutrient availability by changing their production of cellular lipids and proteins. Fourier transform Infrared (FTIR) spectrochemical imaging was used to quantify relative amounts of saturated lipids and proteins within algal cells from high and low light conditions, i.e. thin and thick snow cover, respectively. Samples were collected within the lower Northwest Passage, near Cambridge Bay, Nunavut, Canada during the 2014 ICE-CAMPS field campaign. Diatom taxa analyzed included Nitzschia frigida, Attheya spp., and pennate ribbon colonies. Saturated lipid content and lipid to protein ratios were significantly greater under thin snow covers relative to those under thick; cell protein content remained relatively stable throughout the study under both snow covers. Nitzschia frigida exhibited the greatest and most rapid increase in averaged cellular saturated lipid content and lipid to protein ratios. Results were interpreted relative to a
parallel-related study wherein under ice nutrients were concluded to be a major, but co-limiting factor with light limitation over a diel period during the study. The increase in lipids and particularly, lipid to protein ratio, highlighted the transitioning allocation of carbon from protein to lipid algal biomass through the spring bloom progression, as algae experienced greater light availability under nutrient limiting conditions.

OBSERVATIONS ON THE PAST DYNAMICS OF SALIX ARCTICA DWARF SHRUB ON SUBXERIC SITES – A CASE STUDY FOR RETROSPECTING MONITORING

Ponomarenko, Serguei and D. McLennan

Canadian High Arctic Research Station (Ottawa, Canada)

While the general recent trend is growing shrubiness within the Arctic, the particular local situations can be more complicated. Salix arctica is a good model shrub since it has a circumpolar range as well as a broad ecological range allowing it to grow from wetlands to dry summits. This presentation deals with the population dynamics on the driest end sites within a 50 km² landscape plot on the northern side of Greiner Lake, Victoria Island, Nunavut, Canada. Data collected within 15 subxeric sites (summits of the hills) demonstrates that there is a significant change in sizes of the present-day growing shrubs and dead shrub branches that can be found on the sites. The present day shrubs achieve diameter of 8 mm, whereas dead branches are 2-3 times larger in diameter. An initial dendochronological analysis revealed that dead branches represent really old shrubs. A specimen of dead branch measuring 12 mm in diameter yielded 106 years of age and apparently the shrub itself was older. Dendrochronology of the current branch measuring 7 mm in diameter yielded 15 years of age. The data support the observation that the old-growth shrubs died somewhere around three decade ago or more since germination of the seedlings on these sites is a rare event. (A long search allowed finding a single seedling measuring 1.5 cm of height and having 4 years of age.) The current population consists of relatively young shrubs. The diameter increments in the young shrub are almost 4 times higher than in the historical specimen. Most probably, that the mortality of old-growth shrubs was a result of a single even or a single combination of unfavorable weather events that occur quite rarely. This might have been a combination of a high wind winter that eroded snow from the summits and a following dry summer. This type of observations and data enable to extend the current monitoring efforts retrospectively and better understand relationship between the vegetation dynamics and climate change.

GEOMORPHIC CONTROLS ON THE SPATIAL DISTRIBUTION OF SUBSURFACE FLOW CONTRIBUTIONS TO SURFACE WATERS AND THE NESTED INFLUENCES OF GEOMORPHIC AND HYDROMETEOROLOGICAL DRIVERS OF THE HYDROLOGICAL AND THERMAL REGIME OF THE NIAQUUNGUUT (APEX) RIVER, IQLALUIT, NU.

Pouliot, Louis Gabriel (1), J. Franssen (1), G. Chiasson-Poirier (1), T. Tremblay (2), S. Lamoureux (3) and M. Lafrenière (3)

(1) Université de Montréal (Boucherville, Canada); (2) Canada-Nunavut Geoscience Office (Iqaluit, Canada); (3) Queen’s University (Kingston, Canada)

Groundwater inputs to surface waters are vitally important to the functioning of freshwater ecosystems. Unfortunately, groundwater discharge patterns are difficult to assess at broad spatial scales and consequently the patterns and rates of groundwater discharge to surface waters are rarely known. An improved understanding of the hydrogeomorphic characteristics of hillslope and riparian areas may help to advance our ability to predict the spatial occurrence of groundwater inputs to surface waters. We conducted high-resolution profiling of groundwater natural tracers (temperature and specific conductivity) along river and lake margins to locate zones of discrete groundwater discharge. During the summer baseflow period, three surveys were conducted at each of two headwater streams, two lakes and two river segments in the Niaqunnguut River watershed near Iqaluit, Nunavut. Three distinct potential zones of groundwater discharge were identified, a positive vertical hydraulic gradient confirmed the groundwater inputs and each of these sites has been characterized in terms of deposit delineation, surface and frost table topography and vertical hydraulic gradient measurements. Local groundwater discharge and mixing patterns are major drivers of broader scale thermal dynamics. Therefore, river discharge and temperature measurements have been taken at various
locations chosen in order to characterize the longitudinal gradients and mixing dynamics in the watershed. Preliminary results seem to indicate that surface and frost table topography, along with the hydraulic conductivity of surficial deposits, are major and nested controls on the spatial distribution of groundwater inputs to surface waters. Modelling groundwater discharge patterns must therefore minimally include these components. Furthermore, water emanating from boulder fields seems to have a thermal and chemical signature similar to groundwater. Considering the large spatial extent of boulder fields within the watershed, this type of geomorphic unit may exert an important influence on the storage and routing of water in this watershed and thus on the hydrological and thermal regime of the Niaqunnguut River.

A COMPARISON OF FLUCTUATING ASYMMETRY USING WHISKERPRINT SOFTWARE AS A MARKER OF ENVIRONMENTAL STRESS IN CAPTIVE-BORN POLAR BEARS VERSUS WILD POLAR BEARS OF THE WESTERN HUDSON BAY POPULATION

Pound, Luke (1), M. Hamlin (2), C. Silver (3), J. Rogers (4), D. Labun (5), J. Larkin (6), J. Roth (7) and J. Waterman (7)

(1) The Park School of Baltimore (Baltimore, United States);
(2) Kelvin High School (Winnipeg, Canada);
(3) Johns Hopkins University (Baltimore, United States);
(4) The Park School of Baltimore (Baltimore, United States);
(5) Kelvin High School (Winnipeg, Canada);
(6) Parks Canada (Churchill, Canada); (7) University of Manitoba (Winnipeg, Canada)

The developmental stability of an organism can be reflected in its ability to produce an “ideal” form under a particular set of conditions. As its stability decreases, the likelihood of deviation from the norm increases. The movement away from bilateral symmetry can be caused by a variety of stresses, genomic or epigenetic. 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. 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. 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. Recent studies have shown that whisker spot patterns from polar bears in the Western Hudson Bay Lowlands population are not symmetrical on each side of the face. However, the origin of this asymmetry is unknown. Since we are limited in our ability to acquire and monitor the whisker spot patterns of bears born and maturing in the wild, this study compared the fluctuating asymmetry of polar bears born in captivity or put into captivity before reaching reproductive maturity, where they are well-provisioned, to those in Western Hudson Bay, where ice and food scarcity are increasing annually. This research had three main objectives: 1) test the ability of the WhiskerPrint software to identify the degree of fluctuating asymmetry in wild polar bears where both right and left sides of the face are recorded, 2) acquire monthly photographs from partner zoos for whisker spot analysis on developing bears, and 3) compare the fluctuating asymmetry of captive, developing polar bears to those from the Western Hudson Bay population. Asymmetry in individual wild bears was measured by comparing the whisker spot patterns from one side of the bears’ face to the other. From databases of both wild (n = 39) and captive bears (n = 5), we examined the degree of asymmetry in individual bears and compared the mean degree of asymmetry of wild bears to asymmetry of captive bears. We found the WhiskerPrint software program is a reliable method of identifying fluctuating asymmetry in wild bears, as the whisker pattern from one side of the face shows no significant concordance with the opposite side of its face in that the two sides of the face are as different as two different bears. Preliminary results comparing the degree of fluctuating asymmetry in wild versus captive bears suggest there is no statistically significant difference in adult populations. Future work includes increasing the sample size of bears born in captivity and analyses of whisker spot patterns during early development.
CURRENT USE PESTICIDE (CUP) AND LEGACY ORGANOCHLORINE PESTICIDE (OCP) DYNAMICS AT THE OCEAN-SEA ICE-ATMOSPHERE (OSA) INTERFACE IN RESOLUTE PASSAGE, CANADIAN ARCTIC, DURING WINTER-SUMMER TRANSITION.

Pucko, Monika (1), G. Stern (1), L. Jantunen (1), T. Bidleman (2), R. Macdonald (3), D. Barber (1), N.-X. Geilfus (1), S. Rysgaard (1) and A. Burt (1)

(1) University of Manitoba (Winnipeg, Canada); (2) Umeå University (Umea, Sweden); (3) Institute of Ocean Sciences (Victoria, Canada)

We present the first detailed analysis of processes by which various current use pesticides (CUPs) and legacy organochlorine pesticides (OCPs) are concentrated in melt ponds that form on Arctic sea ice in the summer, when surface snow is melting and ice eventually breaks up. Four CUPs (dacthal, chlorpyrifos, trifluralin, and pentachloronitrobenzene) and one OCP (α-hexachlorocyclohexane) were detected in ponds in Resolute Passage, Canadian Arctic, in 2012. Melt-pond concentrations changed over time as a function of gas exchange, precipitation, and dilution with melting sea ice. Observed spikes in melt-pond concentrations for all detected pesticides were associated with precipitation events. Dacthal reached the highest concentration of all CUPs in ponds (95 ± 71 pg L⁻¹), a value exceeding measured concentrations in the under-ice (0 m) and 5 m seawater by >10 and >16 times, respectively. Drainage of dacthal-enriched pond water to the ocean during ice break-up provides an important ice-mediated annual delivery route, adding ~30 % of inventory in the summer Mixed Layer (ML; 10 m) in the Resolute Passage, and a concentrating mechanism with potential implications for exposures to organisms such as ice algae, and phytoplankton.

FAMILY AND COMMUNITY LEADERSHIP IN BILINGUAL EDUCATION: A CASE STUDY

Qanatsiaq-Anoee, Nunia (1), S. Tulloch (2), A. McAuley (3), F. Walton (3), K. Wheatley (3) and M. Sandiford (4)

(1) Government of Nunavut (Arviat, Canada); (2) University of Winnipeg (Winnipeg, Canada); (3) University of Prince Edward Island (Charlottetown, Canada); (4) Beachwalker Films (Charlottetown, Canada)

Inuit conceptualizations of effective bilingual education encompass much more than school-based learning. In this presentation, we present results from a case study in Arviat, Nunavut, a community recognized for achieving and maintaining high levels of bilingualism. Teachers, Elders, parents, and District Education Authority (DEA) members interviewed for this project emphasized that the community’s thriving bilingualism is linked to the prioritization of Inuktitut learning and uses across the lifetime, and across community domains. While school-based learning is important, too are opportunities and motivation to practice Inuktitut in homes and with family. Examples include exposure to various genres of Inuktitut, including environmental print, songs, stories, and books. In addition, community-based leadership in language teaching and learning, including local radio, Inuktitut churches, and community events also emerged as a factor to support reaching and maintaining proficiency in oral and written Inuktitut. These activities are contextualized within community attitudes and practices that question the hegemony of English and deliberately make space for Inuktitut as Inuit’s first language.

BIO-OPTICAL CHARACTERIZATION OF THE UNDER-ICE LIGHT FIELD IN BAFFIN BAY, NEAR QIKIQTARJUAQ, NUNAVUT

Quiring, Christine (1), J. Ehn (1), S. McDonald (1), N. Pogorzelec (1) and C. J. Mundy (2)

(1) University of Manitoba (Winnipeg, Canada); (2) University of Manitoba (Winnipeg, Canada)

The spectral distribution and shape of the under-ice light field are not well understood at present. This lack of understanding has implications for parameterizations of solar radiation absorption in sea ice and the water column, and consequently on rates of heating and melting, light-limited primary productivity. As a part of the Green-Edge 2015 Campaign, a comprehensive examination of the marine ecosystem under landfast sea ice cover was carried out from mid-April through to mid-June (prior to melt onset) in Baffin Bay, near Qikiqtarjuaq, Nunavut. We focused on investigating the spectral variability (horizontal and vertical) in the under-ice light field during the pre-melt season. This spectral dataset was used in conjunction with spectral albedo observations and total chlorophyll-a concentrations to characterize the depth dependence and variability of optical properties of the
landfast ice cover. Largely basing our model off of the Beer-Lambert law, we ran various functional linear regression models where optical depth (τ) was our functional predictor variable to scalar responses, snow depth (Z_s), ice thickness (Z_I) and total chlorophyll-a concentration (C_(chl-a)), in order to predict spectral transmittance. The present dataset considers 34 spectra, with total chlorophyll-a concentrations spanning three orders of magnitude (22.47 - 1029.12 mg m3) in the bottommost 0-3 cm of sea ice under high and low snow cover. Preliminary results show the shape of C_(chl-a)and Z_s coefficients were consistent with theory, and we had sufficient evidence to conclude they influence optical depth through our wavelength range of photosynthetically active radiation (PAR; 400-700 nm). However, there was insufficient evidence to conclude the effect of the Z_I coefficient on our model, which could be due to multicollinearity. Further analysis of the data is planned and the poster will discuss our results in a format that addresses three main interests: (1) the spectral optical depth of Arctic sea ice under high and low snow cover prior to the onset of Arctic sea ice melt; (2) the difference between functional regression derived downwelling attenuation coefficients and calculated direct downwelling attenuation coefficient of bottom ice algae in the bottommost (0-3 cm) portion of sea ice; and (3) the link between attenuation, an apparent optical property, to absorption and scattering, inherent optical properties, through Kirk’s 1984 empirical formula.

PREDICTING OCCURRENCES OF RETROGRESSIVE THAW SLUMPS AND THEIR IMPLICATIONS ON THE NEAR SHORE CARBON BUDGET ALONG THE YUKON COAST, CANADA

Ramage, Justine-Lucille (1), A. M. Konopczak (1), H. Lantuit (1), A. Morgenstern (1), U. Herzschuh (1) and N. Couture (2)

(1) Alfred Wegener Institute for Polar and Marine Research (Berlin, Germany);
(2) NRCan’s Geological Survey of Canada (Ottawa, Canada)

Permafrost degradation processes such as thermokarst and thermo-erosion create highly dynamic landforms that reshape Arctic landscapes. Retrogressive thaw slumps (RTSs) are among the most active landforms in the Arctic. RTSs lead to the displacement of large volumes of sediments and are a major source of instability for biomass, hydrology and carbon storage in permafrost terrains. Studies have shown that in various Arctic areas, the number of RTSs has increased tremendously over the past decades. The processes initiating RTSs are well defined; however, little research has been done on regional scale to reveal the major terrain controls on their development. There is a clear need to shed light on the heterogeneous distribution of RTSs in the Arctic. Our research provides new insights into the dynamics of coastal RTSs. It highlights the main geomorphic factors causing RTSs along a 235 km coastal segment of the Yukon Coastal Plain, Canada.

FIRST INVENTORY OF BIODIVERSITY AND PRODUCTIVITY OF CAMBRIDGE BAY LAKES, VICTORIA ISLAND, HIGH-ARCTIC CANADA

Rautio, Milla (1), C. Lovejoy (2), M. Power (3), J. Wagner (4) and D. McLennan (4)

(1) Université du Québec à Chicoutimi (Chicoutimi, Canada);
(2) Université Laval (Quebec, Canada);
Several of the most extreme habitats on Earth are in the Arctic, with vertebrate species and peoples that have adapted through biological and cultural evolution to its unique conditions. The Arctic is also home to numerous invertebrates and microbes that make up lower food webs, but whose community structure, biomass, biodiversity and production is little known. The species composition and productivity of the freshwater lower food web will affect the ecosystem functions and services, including the health of fish populations that provide food for northern peoples. These smaller species are also indicators of the transfer and fate of valuable compounds such as lipids and their fatty acids in the ecosystem. As part of the initial steps in addressing the knowledge shortfall of freshwater invertebrates and microbes in Cambridge Bay (Kitikmeot region) lakes, a sampling campaign of > 20 lakes, including the majestic Greiner Lake, was carried out in summers of 2014-2016, with the aim to provide a baseline description of the ecological variability of water quality, microbial diversity, phyto- and zooplankton community composition, and indices of carbon fluxes and ecosystem health. The sampling also contributed to the Circumpolar Biodiversity Monitoring Program (CBMP) and its freshwater monitoring protocol, with the aim to provide high quality and comparable information on the environments and biodiversity over the pan-Arctic. All of the Kitikmeot region lakes sampled were highly transparent and light penetrated to the bottom allowing photosynthesis even at depths greater than 10 m. The bottom sediments of these lakes were covered with highly productive benthic algae, often forming a layer of organic material that was several mm thick. In contrast, the taxonomically varied phytoplankton community productivity and biomass in the water column was low. The number of species and the biomass of zooplankton were high, especially in small lakes that are too shallow for fish, which are the main predators of zooplankton. In deeper lakes with fish, zooplankton numbers were lower. We estimated the nutritional quality of aquatic foods based on their lipid and fatty acid composition. Zooplankton had the highest percentage of lipids per unit mass, followed by seston, benthos, terrestrial vegetation and soils. The percentage of polyunsaturated fatty acids (PUFA) was, however, highest in the catchment vegetation and soils, suggesting the catchment area may provide important valuable compounds that support net aquatic production. The lipid quantity and quality of aquatic animals, including different taxa of zooplankton, benthic invertebrates, mysids and sticklebacks, which are putative diet sources for Arctic Char, lake trout and other valuable fish were compared in more detail. Copepod zooplankton, mysids and benthic invertebrates contained the highest amount of lipids but the PUFA content the mysids would make them the best fish food, followed by sticklebacks and benthic invertebrates. These first results provide new insight into the functioning and productivity of Arctic lakes as related to the use of lakes by Northerners. Ongoing work will contribute to understanding the implications of these smaller species in the provision of ecosystem services, including drinking water quality and sustaining fish production.

ON THE GREEN EDGE: GLIDER OBSERVATIONS FROM THE BAFFIN BAY MARGINAL ICE ZONE

Rehm, Eric, G. Becu and M. Babin
Takuvik / Université Laval (Québec, Canada)

AUV operations in ice-covered environments require rapid and effective data fusion strategies for mission planning and updates, platform survival, intercalibration with ship casts, and adaptation of mission sampling schemes to changing physical and biogeochemical processes. Using specific details of the summer 2016 study of the phytoplankton spring bloom along the receding ice edge in Baffin Bay, we show how combining ice velocity and ocean current forecasts from a coupled atmosphere-ice-ocean model with a variety satellite remote sensing products including ocean color, true color, and cross-polarized SAR imagery, as well as passive microwave estimates of the location of the ice edge allow us to plan and adapt missions and achieve quality observations with our glider-based bio-optical sensors. We will show the first-ever bio-optical data from glider-based transects from open water briefly into and under the marginal ice zone and back, demonstrating the important biogeochemical fluxes in this region.
**VARIATIONS IN COMPONENTS OF THE GREATER SNOW GOOSE REPRODUCTIVE SUCCESS OVER A 25-YEAR PERIOD.**

Resendiz, Cynthia and G. Gauthier  
Laval University (Quebec, Canada)

Migratory species breeding in seasonal environments have a narrow time window to breed, and typically females nesting early in the season achieve the highest reproductive success. In greater snow geese (Chen caerulescens atlantica), timing of breeding remains unchanged despite a warming trend at their breeding site, creating a trophic mismatch between hatching of goslings and the date of peak food abundance. This study uses data on the reproductive parameters of snow geese collected at the Bylot Island colony, Nunavut, from 1991 to 2015 to assess temporal variation in components of reproductive success in relation to timing of breeding. More specifically, our aim was to determine if the seasonal decline in several components of reproductive success reported in the early years of the study changed over time. Total clutch laid (TCL, n= 6336), egg success (n=3680), hatchability (n=3561) and pre-fledging survival (n=1320) were analyzed using linear regression. Daily nest survival was estimated using logistic regression (n=8265), and post-fledging survival with a multi-event capture-recapture model of marked goslings (n=73221). We tested the effect of study year, relative laying or hatching date (expressed as deviation from the annual laying or hatching median values) and the interaction between relative date and year on each of the components. Three out of six components have changed over time. Changes in the relationship between TCL or egg success and laying date were curvilinear over time. Early nests show a decrease in clutch size over time followed by an increase in recent years whereas late nests show the opposite pattern. Nesting success of early and late nests was much lower than those initiated near the mean at the beginning of the study but this curvilinear relationship has flattened in recent years because of an increase in nesting success of early and late nests. Nests close to the mean of the population showed no change for any of the components. Relationships between hatchability or pre-fledging survival and laying date did not change over time. This study highlights the importance of direct and indirect consequences of increasingly warm temperatures found during the breeding season. The changes found in TCL, egg success and nesting success reflect the effects of a rapidly shifting environment on the unresponsive breeding phenology of snow geese. Reproductive success components described here will be used to determine the temporal trend of the overall reproductive success of the species in relation to timing of breeding, which is likely also affected by the observed changes in its components.

**THE INFLUENCE OF SURFACE CHARACTERISTICS ON THE SURFACE OFFSET IN LAC DE GRAS REGION, NWT**

Riddick, Julia and S. Gruber  
Carleton University (Ottawa, Canada)

Understanding and monitoring permafrost is essential as we look to expand infrastructure in northern Canada under a changing climate. Conventional methods of measuring permafrost ground temperature are often impractical due to vast areas of northern Canada being remote and inaccessible. Drilling into permafrost is costly and disruptive. Air and near-surface ground temperatures are comparatively inexpensive and low impact measurements yet still provide valuable insight into the state of the ground thermal regime. This project is based on the concept of the surface-offset, which is when variation in surface characteristics and materials affect energy transfer between atmospheric and subsurface temperature, the net difference between the two is the surface offset. This concept will be used to predict near-surface ground temperatures by measuring air temperature and several key ground surface characteristics, such as slope, aspect, leaf-area index, vegetation type and height. The study takes place in the Lac de Gras region of the Northwest Territories, which is representative of many of the different surfaces of the sub-arctic tundra. 43 sites were instrumented in 2015. These 43 sites capture the regional variation of the sub-arctic tundra. They are installed on hilltops, hill slopes, valleys, as well as various permafrost and glacial landforms. The boreholes were drilled at the centre of each plot and four temperature loggers were installed at a depth of 10 cm within a 10 m radius of the borehole. The four temperature sensors installed in each plot capture local variability of the surface features. Additionally, six air temperature and relative humidity loggers were installed proximally in the region. This study will facilitate prediction of near-surface ground temperatures based on surface characteristics and air temperatures. This is also important when it comes to understanding the influence of vegetation change, such as shrubification, on the ground thermal regime.
These preliminary results are based on the first year of temperature data acquired since installation of monitoring equipment in the summer of 2015.

MODELLING FRESHWATER DYNAMICS IN THE HUDSON BAY COMPLEX USING THE ANHA4 CONFIGURATION

Ridenour, Natasha (1), X. Hu (1), P. G. Myers (1) and D. Barber (2)

(1) University of Alberta (Edmonton, Canada); (2) University of Manitoba (Winnipeg, Canada)

The Hudson Bay Complex (HBC) is the drainage basin for many rivers in Canada, receiving almost 900 km$^3$ of river discharge per year. Modification of river discharge has been the result of hydroelectric regulation and development. To understand the impacts and future of regulation in this region, the numerical ocean model, NEMO, run with the ANHA4 configuration, is used to model freshwater dynamics associated with river discharge and sea ice melt. The present work establishes the freshwater budget and exchange in each subregion of the HBC. It is shown that the freshwater budget is mainly a balance between the incoming river runoff and freshwater advected out of the region. Quantitative estimates of regional eddy and Ekman transport of freshwater are also presented. As a contribution to the BaySys project, the impact of regulation on sea ice dynamics in Hudson Bay via composites of high- and low-flow years, will also be determined from August river discharge anomalies from 2002 – 2012. Future work includes modelling freshwater eddies in the Hudson Strait outflow, in addition to understanding the role of the Hudson Strait inflow.

SUSTAINABLE HOUSING IN NORTHERN CANADA: LEARNING FROM NUNAVIK AND NUNATSIAVUT

Riedlsperger, Rudy (1), M. Riva (2) and T. Bell (3)

(1) Memorial University of Newfoundland (St. John’s, Canada); (2) McGill University (Montreal, Canada); (3) Memorial University (St. John’s, Canada)

Communities in Northern Canada face various sustainability challenges, among the most pressing of which are housing related stresses. As the demand for housing outstrips supply, local and regional governments have limited capacity to build, maintain, or repair residential infrastructure to the extent necessary. Making additional (social) housing available, for example through new construction and through improving the life span of infrastructure, can be an important measure to provide some immediate relieve to these pressures. There is indication, however, that in order to resolve the housing crisis in the Canadian North, the provision of housing alone may be insufficient if their design follows southern practices. In our presentation we will focus on the communities of Nain, Nunatsiavut, and Quaqtaq, Nunavik, which provide two case studies that explore culturally appropriate and energy efficient approaches to sustainable housing designed by Inuit, for Inuit, as a means to alleviate some of the negative consequences of inadequate housing. In both cases, model houses are being implemented that aim to address the physical and sociocultural concerns outlined above. While the planning and implementation processes differ between the two communities, both have Inuit co-design as a primary principle. Our presentation inquires whether Inuit co-designed housing has discernible effects on the well-being of residents. In other words, does Inuit co-designed housing work, and is it worth replicating? We will also discuss how Inuit co-designed housing is being implemented in Nunavik and Nunatsiavut. This is important in order to better understand how Inuit co-designed housing may be replicated in other parts of the Canadian North. Addressing these questions may help to a) increase our understanding on the impacts of Inuit co-designed housing on community health and well-being and b) guide actors when attempting to replicate/implement Inuit co-designed housing in other parts of the Canadian North.

DELAYED SPRING SEA-ICE BREAK-UP LEADS TO A LOWER EFFECTIVE NUMBER OF BREEDERS IN RINGED SEALS

Ritchie, Kyle (1), S. Ferguson (1,2), J. Roth (1), L. Johnson (3) B. Young (2) and S. Petersen (3)

(1) University of Manitoba; (2) Department of Fisheries and Oceans; (3) Assiniboine Park Zoo, University of Manitoba

Ringed seals have a circumpolar distribution and use subnivean lairs on sea ice to rear young in spring. Earlier or later break-up of sea ice may compromise the protection from predation and the harsh environment effects of open water.
that these lairs provide, which may increase juvenile mortality and cause population decline. In Hudson Bay the date of spring break-up has advanced by 5.5 days per decade over the past three decades. This phenomenon has been related to declines in polar bear survival and body condition in Hudson Bay. Ringed seal census population size estimates have previously been obtained in Western Hudson Bay with aerial surveys. Here we use a genetic approach to investigate the relationship between sea-ice conditions and abundance of ringed seals. The genetic parameter, effective number of breeders (Nb), is related to adult census population size and can be used to infer trends in abundance in ringed seal populations. From genetic samples collected in Western Hudson Bay, we used sibship assignment to estimate the effective number of breeders annually from 1984 to 2012. We then assessed trends in the effective number of breeders over time in relation to the ordinal date of spring break-up. The effective number of breeders appeared to fluctuate over time in a 5 or 6 year interval, similar to that seen in the date of spring break-up, but the overall trend neither increased nor decreased. The effective number of breeders was negatively related to the ordinal date of spring break-up when a 5-year lag was applied. In years when break-up occurred later, polar bears were likely able to forage on sea ice longer, where they typically have greater hunting efficiency than during the ice-free season, especially on naïve juvenile seals. Increased juvenile mortality of ringed seals may cause a reduction in the effective number of breeders 5 years later, as that cohort reaches maturity. The current trend towards earlier ice break-up may reduce ringed seal mortality caused by polar bears. However, if sea-ice break-up continues to advance, it may compromise the survival of neonate ringed seals that cannot thermoregulate as effectively as adults and may be exposed to increased hunting pressure by polar bears if seals start to whelp on shore.

COMMUNITIES ARE COMPLEX ARRANGEMENTS OF PHYSICAL, SOCIAL, MATERIAL, HISTORICAL, CULTURAL AND SYMBOLIC QUALITIES BROUGHT TOGETHER THROUGH HUMAN ACTION TO CREATE ENVIRONMENTS THAT ARE SUPPORTIVE OF COLLECTIVE LIVING, HEALTH AND WELL-BEING. THE HEALTH OF COMMUNITIES IS THUS VERY COMPLEX AND MULTIFACETED YET IN EVERYDAY LIFE THE CONCEPT OF COMMUNITY IS SIMPLE. COMMUNITIES ARE WHERE WE LIVE, AND HOW WE LIVE TOGETHER. IN 2012, A WORKSHOP WAS HELD IN KUJJUJUAQ WHERE ONE OF THE OBJECTIVES WAS TO DEFINE PRIORITIES FOR THE FOLLOW-UP OF THE NUNAVIK HEALTH SURVEY. DISCUSSIONS DURING THE WORKSHOP POINTED TO THE CONSIDERATION OF COMMUNITIES WITHIN THE NEXT HEALTH SURVEY, AS A WAY TO MOVE AWAY FROM A SOLE FOCUS ON INDIVIDUALS, WITH A VIEW OF IDENTIFYING CONDITIONS OF COMMUNITIES AS PROTECTIVE FACTORS FOR HEALTH AND WELL-BEING IN NUNAVIK. IN RESPONSE, A ‘COMMUNITY COMPONENT’ WILL BE ADDED TO THE UPCOMING QANUILIRPITAQ 2017 NUNAVIK INUIT HEALTH SURVEY (HEREAFTER Q2017), WITH THE OBJECTIVE OF DESCRIBING COMMUNITY CONDITIONS THAT ARE RELEVANT FOR THE HEALTH OF NUNAVIMMIUT FROM A LIVED INUIT PERSPECTIVE SO THAT COMMUNITY-LEVEL STRENGTHS AND CHALLENGES MAY BE ADDRESSED EFFECTIVELY AND PEOPLE MAY LIVE WELL TOGETHER NOW AND IN THE FUTURE. THE COMMUNITY COMPONENT WILL PROVIDE A GENERAL UNDERSTANDING OF THE PROCESSES, DYNAMICS, AND PARTICULARITIES OF HEALTH AND WELL-BEING IN THE 14 NUNAVIK COMMUNITIES, WHICH CAN BE DESCRIBED AND COMPARED OVER TIME. THIS PRESENTATION HAS FOR OBJECTIVES TO: 1) PRESENT THE RATIONALE FOR INTEGRATING INFORMATION ABOUT COMMUNITY-LEVEL CONDITIONS AS PART OF POPULATION HEALTH SURVEYS; 2) DESCRIBE METHODOLOGIES EMPLOYED FOR THE DEFINITION, DEVELOPMENT AND INTEGRATION OF COMMUNITY-LEVEL CONDITIONS IN Q2017; AND 3) PRESENT PRELIMINARY RESULTS OF WORKSHOPS CONDUCTED IN TWO COMMUNITIES IN NUNAVIK TO DEVELOP INDICATORS OF COMMUNITY CONDITIONS PERTINENT TO THE HEALTH AND WELL-BEING OF PEOPLE IN NUNAVIK COMMUNITIES.

DEVELOPING CULTURALLY RELEVANT INDICATORS OF COMMUNITY CONDITIONS TO BE INCLUDED IN POPULATION HEALTH SURVEYS IN THE ARCTIC

Riva, Mylene (1), C. Fletcher (2) and M.-C. Lyonnais (3)

(1) McGill University (Montreal, Canada); (2) Professeur, Université Laval (Quebec, Canada); (3) Université Laval (Québec, Canada)

OUR HOUSE IS BURNING AND WE ARE LOOKING ELSEWHERE: CLIMATE CHANGE VS BIODIVERSITY LOSS COVERAGE IN THE MEDIA

Since the mid-20th century, climate change and biodiversity loss have been identified as major consequences of anthropological pressures and both have already transgressed safe limits. Given their significance for human health and well-being and their large-scale effects, international cooperation is crucial to address these issues. Intergovernmental initiatives merging the scientific community and stakeholders were therefore created from the late 80s. For instance, the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) produce synthesis based on the primary scientific literature which are addressed to policy-makers. The success of such international initiatives relies on different actors, who all play a vital role in the prioritization and implementation of solutions to these global issues. Scientists communicate their findings through peer-reviewed scientific journals, the media popularize scientific research to inform the public on environmental issues and politicians implement legislations. The ways in which information is framed and expertise is communicated by the media is therefore crucial for political decisions and for the integrated management of environmental issues. Here we present a comparative study of scientific literature and press articles addressing climate change and biodiversity loss. Specifically, we focused on two main hypotheses: i) scientific production and media coverage of both issues should follow the same long-term trends and ii) short-term media coverage should mirror specific events such as major international agreements/summit, or environmental catastrophic events. To do so, we compiled information from international databases to extract the number of published scientific and mass media articles between 1990 and 2015. We found that media coverage of climate change was hundred times greater compared to biodiversity loss. This result could not be explained by differential scientific output between the two issues. Moreover, we noticed that media coverage of climate change was often related to specific events such as the 21st Convention of Parties (COP21), whereas no such trends was found in the case of biodiversity loss. We suggest that the complexity and often local-scale impact of biodiversity issues, as well as the lag between the actual loss of species or interactions between species and the consequences for human well-being could in part explained the lower media coverage of issues related to biodiversity threat compared to that of climate change. We wish to emphasize the need for scientists in the field of biodiversity to better communicate their findings to the mass media and to efficiently transfer their knowledge to stakeholders.

SPATIAL VARIABILITY OF SEA ICE DRAFTS IN THE CONTINENTAL MARGIN OF THE CANADIAN BEAUFORT SEA FROM A DENSE ARRAY OF MOORED UPWARD LOOKING SONAR INSTRUMENTS

Ross, Ed (1), D. B. Fissel (1) and H. Melling (2)

(1) ASL Environmental Sciences Inc. (Victoria, Canada);
(2) Fisheries and Oceans Canada, Institute of Ocean Sciences (Sidney, Canada)

An array of 9-10 upward looking sonar (ULS) operating from subsurface moorings provided accurate (±0.1 m), measurements of sea ice draft (proportional to thickness) and velocity during two full years: 2009-2011. The moorings were placed in water between 50 and 1010 m depth on the shelf and continental slope of the Canadian Beaufort Sea thereby spanning several topographic regimes between the middle slope and the middle shelf. The separation of moorings ranged between 4 and more than 100 km. The temporal variability of the sea ice draft was examined from a seasonal perspective, related to the annual cycle of ice development and decay, using a weekly (5-day) time interval, related to forcing by passing weather systems and on a sub-hourly scale that resolves sea ice keels and hummocky ice. The annual cycle of ice formation and break-up was coherent across all locations, but more so in 2009-2010 than in 2010-2011. The moorings were placed in water between 50 and 1010 m depth on the shelf and continental slope of the Canadian Beaufort Sea thereby spanning several topographic regimes between the middle slope and the middle shelf. The separation of moorings ranged between 4 and more than 100 km. The temporal variability of the sea ice draft was examined from a seasonal perspective, related to the annual cycle of ice development and decay, using a weekly (5-day) time interval, related to forcing by passing weather systems and on a sub-hourly scale that resolves sea ice keels and hummocky ice. The annual cycle of ice formation and break-up was coherent across all locations, but more so in 2009-2010 than in 2010-2011. In 2009 freeze-up began in late October at all locations. In 2010 freeze-up occurred in mid-October on the shelf and upper slope
but in late October further offshore. A weather event may be implicated in the later consolidation of ice cover further offshore. Ice break-up occurred at all locations except the mid-shelf near the end of May in 2010. In 2011, however, break-up occurred between mid-May to late June depending on location; that over moorings on the outer shelf and upper slope began in mid-May but was interrupted by an ice incursion in early June. Mean ice draft reached 1.5-2 m at all sites by mid-February in 2009-2010. The 5-day mean ice draft was highest at the mid-shelf and lowest over the slope at this time. In 2010-2011, 5-day mean values of ice draft between freeze-up and mid-February varied appreciably around the expected smooth seasonal increase in draft, reflecting strong and variable forcing by weather events during this time. During ice growth through to February, synoptic forcing caused deviations from the longer-term growth pattern with higher variability; some locations experienced reductions in ice draft for several weeks during early winter, December to January. The maximum values of 5-day mean ice draft were lower in the 2010-11 winter than in the preceding winter. Extended periods of zero ice motion offshore in winter are a feature of the ice regime of the eastern Beaufort Sea. These are linked to coastline geometry, high ice concentration and weather patterns. Their prevalence during the two winters of study was similar, with no-motion events occurring even in early winter at mid-shelf locations but later further offshore. The zero motion events were most common in both areas in February and March. These results are consistent with earlier studies.

INVESTIGATION OF MIXING WITHIN THE TIDAL STRAITS OF THE KITIKMEOT MARINE REGION: EXPLORATORY RESULTS FROM UNDERWAY CTD AND ADCP MEASUREMENTS

Rotermund, Lina (1), W. Williams (2), S. Danielson (3), K. Brown (4), E. Carmack (2), B. Bluhm (5), C. Clarke (2), A. Schimnowski (6) and O. Schimnowski (7)

(1) University of Victoria (Victoria, Canada);
(2) Fisheries and Oceans Canada, Institute of Ocean Sciences (Sidney, Canada);
(3) University of Alaska Fairbanks (Fairbanks, United States);
(4) Woods Hole Oceanographic Institution (Woods Hole, United States);
(5) The Arctic University of Norway (Tromso, Norway);
(6) Arctic Research Foundation (Winnipeg, Canada);
(7) Polar Knowledge Canada (Ottawa, Canada)

During August and September 2016, our team of oceanographers explored vast areas of the Kitikmeot Marine Region in the southern Canadian Arctic Archipelago from the Arctic Research Foundation’s RV Martin Bergmann. Particular areas we covered were Bathurst Inlet, Dease Strait, Finlayson Islands, Simpson Strait, Rae Strait and Chantry Inlet within the greater areas of Coronation Gulf and Queen Maud Gulf. These gulf's receive significant annual freshwater input, which results in strong stratification that limits vertical mixing and thus also limits upward mixing of dissolved nutrients and hence primary productivity. However, in certain narrow channels there is evidence of early ice melt and we hypothesize that this is a result of vertical mixing of subsurface heat caused by amplified tidal currents over the sill. This upward mixing should also lead to higher productivity near the strait, which has major implications for the regional ecosystem. A variety of oceanographic instruments were deployed to study the physics, geochemistry and biology of the straits. Here we report the preliminary findings of two of those instruments – the underway CTD and underway ADCP. We use profiles of salinity, temperature, density and currents to help to quantify the structure and mixing in these tidal straits.

ICE CAP SURFACE ELEVATION CHANGES DERIVED FROM ICESAT AND TANDEM-X ELEVATION DATA: EXAMPLE DEVON ICE CAP

Roth, Achim, B. Wessel, M. Huber and A. Wendleder

DLR - German Remote Sensing Data Center (Wessling, Germany)

Surface elevation information of glaciers and ice caps is an important Essential Climate Variable (ECV) in particular for ice sheet mass balances. Due to their remote location and immense extension this information is hard to be gained. Selective ground measurements, airborne campaigns and spaceborne mission are the alternatives. In this presentation we will focus on two spaceborne missions suited for this purpose: ICESat and TanDEM-X. ICESat was launched in 2003 and provided multi-year elevation data measured by the GLAS instrument (Geoscience Laser Altimeter System) until 2009. The footprint of the laser sensor itself has
about 70m in diameter, spaced at 170m intervals in along track. Across track the points are spaced at about 30km at the equator getting denser towards higher latitudes (e.g. about 5km at 80° latitude). The height accuracy is better then one meter depending on the land cover and the relief. Contrary to ICESat, which is an optical laser altimeter, the TanDEM-X DEM is generated by applying SAR interferometry. TanDEM-X and its twin satellite TerraSAR-X fly in a close orbit formation and form a single-pass synthetic aperture radar (SAR) interferometer. Within the TanDEM-X mission a global digital elevation model was generated with 12.5 m posting, 10 m absolute and 2-4 m relative height accuracy (depending on the terrain slope).

In order to achieve those specifications at least two acquisitions of the same area on ground with different imaging geometries were necessary. Areas with strong relief were mapped even four times. The corresponding SAR input data were acquired between December 2010 and January 2015. Laser altimeter provide the height of the surface (first return) while the microwave radiation of SAR systems penetrates the surface to some degree before being reflected. This is in particular true for snow and ice covered areas. This effect has to be considered when multi-source data are used for the determination of surface height variations. In the proposed presentation the imaging and height determination techniques shall be presented. The ICESat products are well established. A special focus will be given to the processing of the newly released TanDEM-X DEM. It is believed that this DEM will widely be used for ice mass balances as those data are globally available. It is therefore important to understand how this elevation information is derived. Both, penetration and processing strategy affect the individual elevation values. The processing strategy is given, however corrections for the penetration depth can be modelled and applied. The Devon Ice Cap serves as example to demonstrate effects and possible improvements.

**CHANGING ARCTIC FOX AND RED FOX POPULATION DYNAMICS AS LEMMING CYCLES DAMPEN AT THE ARCTIC’S EDGE**

Roth, James and J. Verstege

University of Manitoba (Winnipeg, Canada)

Climate change has been implicated in dampened lemming cycles and expansion of mammalian predator ranges in the Arctic, both of which could strongly affect tundra predators and disrupt Arctic food webs. We examined the dynamics of Arctic fox (Vulpes lagopus) and red fox (Vulpes vulpes) populations and their response to changing prey availability near Churchill, Manitoba, where tundra meets boreal forest and the ranges of these foxes overlap. Provincial harvest records indicate Arctic and red fox populations historically fluctuated in synchrony, and fox den surveys in the 1990s indicated reproductive success of both species was highly correlated with fluctuating lemming numbers. Recent mark-recapture estimates, however, suggest lemming populations are consistently low and no longer fluctuating. While Arctic foxes previously dominated the harvest, recently Arctic fox numbers are declining relative to red fox numbers, and their populations are becoming decoupled, as breeding success of Arctic and red foxes has been unrelated in recent years. Red foxes have also been observed more commonly on the tundra in late winter using dens historically occupied by Arctic foxes. Whether red foxes usurp Arctic foxes from these dens or merely use unoccupied dens on the landscape is unclear. However, the use of tundra dens prior to the arrival of migratory birds and caribou, in an area where lemming numbers have dampened that is close to the Hudson Bay coast, suggests access to sea ice could be attracting red foxes to this area. These observations suggest red foxes may be responding favorably to the warming climate and Arctic foxes are responding negatively due to both top-down (incursion of red foxes) and bottom-up (lemming declines) influences. The food web consequences of this displacement, and potential implications for reproductive success of Arctic-nesting birds and population dynamics of small mammals, remain to be seen.

**DEVELOPMENT OF A CLIMATE-RESILIENT FUNCTIONAL PLAN FOR DEMPSTER HIGHWAY**

Roy, Louis-Philippe (1), F. Calmels (2), B. Horton (2), S. MacDougall (3) and M. Taillefer (2)

(1) Yukon College (Whitehorse, Canada);
(2) Northern ClimateExchange / Yukon College (Whitehorse, Canada);
(3) Yukon Highways and Public Works, Transportation and Engineering Branch (TEB) (Whitehorse, Canada)

The Dempster Highway is the only road connection to the western Arctic, and when the Inuvik-
Tuktoyaktuk Highway is built, it will be part of the infrastructure linking southern Canada with the Arctic Ocean. Extensive reconstruction of the highway has been completed on the NWT side of the territorial border in response to degradation of the road surface and embankment. Recognizing the need to ensure year-round availability of the Dempster Highway in the context of increasing traffic and a changing climate, Yukon Government Department of Highways and Public Works (HPW) has initiated a project to create a functional plan. This project will go beyond the typical functional plan process by integrating climate change and geohazards research, industry expertise, and adaptation strategies into the planning process. Research and analysis required to assess climate and geohazard vulnerability will be carried out by the Northern Climate ExChange, part of the Yukon Research Centre at Yukon College. To do so, the field assessment will focus on the foot of the embankment and the field area adjacent to the embankment. Work will be performed on both sides of the road using a combination of drilling, instrumentation of boreholes, and geophysics (specifically, Electrical Resistivity Tomography). Project and study objectives include development of a function plan that considers climate change and incorporates climate resiliency into short, medium and long term planning and cost estimates. The final plan will incorporate industry-identified innovation opportunities and stimulate partnerships between industry, research, and Highways and Public Works (HPW) with the goal of building practical adaptation strategies. Products of this project will include a state of the highway report, a report summarizing climate and geohazard-related vulnerabilities for the highway corridor, a functional plan that incorporates climate change, and an industry innovation workshop.

ISOTOPIC COMPOSITION OF SEDIMENTARY FE AS TRACER OF ARCTIC OCEAN BIOGEOCHEMICAL PATHWAYS

Royer-Lavallée, Alexandre (1), A. Poirier (2), C. Gobeil (1),

(1) INRS-ETE (Québec, Canada); (2) GEOTOP-UQÀM (Montréal, Canada)

Iron is both an essential micronutrient for primary production in the ocean and a key redox element providing insights on organic matter metabolism at the sea floor. We have determined the profiles of the concentration and isotopic composition of total Fe (FeT) and of Fe extracted with a HCl solution (1N), hereafter identified as reactive Fe (FeR), in seven sediment cores collected within the Arctic Ocean at locations spanning shallow to deep-water (51-3250 m). We assume that a diluted HCl solution removes a very minor portion of Fe from silicate minerals but solubilizes quantitatively Fe oxihydroxides and Fe monosulfide. Concentration and isotopic composition of pyrite-Fe (FePy), defined as the residual Fe left over after having successively extracted the sediments with HCl and HF, were also determined in the same cores. Results show strong differences between the overall average isotopic composition ($\delta^{56}$Fe) of FeT (+0.18±0.11; n=44) and those of FeR (−0.13±0.26; n=41) and FePy (−0.82±0.47; n=18). Moreover, the $\delta^{56}$Fe values of FeR are significantly higher in shelf sediments (0.00±0.15; n=17) than in basin sediments (−0.28±0.10; n=12), while both concentrations and inventories of highly reactive Fe (FeHR), defined as FeR plus FePy, are significantly lower in shelf than in basin sediments. From these observations we will discuss and argue in this presentation (i) that authigenic phases of Fe (oxihydroxides, monosulfide, disulfide) produced as a consequence of dissimilatory iron and sulfate reductions during the early stages of diagenesis in the Arctic Ocean have a light isotopic composition relative to that of FeT, (ii) that the efflux of isotopically light Fe remobilized from shelf sediments is eventually exported towards the Arctic Ocean interior and deposited in basin sediments, and (iii) that sea-level fluctuations during glacial-interglacial cycles play a critical role on the large-scale distribution of Fe in the Arctic Ocean.

SEASONAL AND MULTI-YEAR SURFACE DISPLACEMENTS MEASURED BY DINSAR IN A HIGH ARCTIC PERMAFROST ENVIRONMENT

Rudy, Ashley (1), S. Lamoureux (1), P. Treitz (1), N. Short (2) and B. Brisco (2)

(1) Queen’s University (Kingston, Canada); (2) Natural Resources Canada (Ottawa, Canada)

Arctic landscapes are in a period of transition as warming temperatures lead to thawing and degradation of permafrost terrain. Gentle continuous subsidence is expected as the active layer settles due to top-down thawing as the summer season progresses. Localized or irregular subsidence occurs in areas with high ground ice content or where active layer thaw penetrates the uppermost permafrost leading to the formation
of thermokarst terrain. Knowledge of the relative magnitude of displacement, as well as the temporal and spatial variability of that displacement, is valuable information for risk assessment for the planning and engineering of northern communities as well as the overall assessment of environmental and ecological stability. The purpose of this study is to determine the magnitude and patterns of land surface change in a continuous permafrost environment using Differential Interferometric Synthetic Aperture Radar (DInSAR).

Synthetic aperture radar interferometry (InSAR) is a technique capable of measuring ground surface displacements resulting from thawing permafrost at centimetre precision. InSAR techniques measure small changes in the phase of a ground target’s returned signal based on SAR image pairs collected over the same area but at different times. Ground displacements are generated by differentiating the phase component of the two-coregistered SAR images after the removal of the topographic effect. High-resolution InSAR pairs from RADARSAT-2 (ultrafine beam mode U4, 4 m spatial resolution) were acquired during the thaw season (June to September) at Cape Bounty, Melville Island, NU. Repeat pass DInSAR processing was carried out using GAMMA software and a high-resolution digital elevation model (1 m). Surface displacements were derived using stacked InSAR pairs for 48 days from July to September in both 2013 and 2015. A 2013-2015 displacement stack was also derived using a total of 6 pairs (3 each from 2013 and 2015) covering a period of 792 days. The displacement patterns derived from DInSAR offer geomorphological insight into subsurface processes in permafrost environments. Areas of interest were selected to examine local patterns of DInSAR displacement in combination with field measurements from 2013 to 2015. DInSAR measurements of displacement were consistent with field observations of permafrost degradation and the geomorphic context. For example, increased areas of subsidence were observed in areas subject to thermokarst in the scars of recent active layer detachments. The DInSAR results for this permafrost environment are promising. Many measured DInSAR values are close to the margin of error (i.e., 1 cm) and therefore do not indicate significant change; however, displacement measurements are consistent with field observations, geomorphological processes and meteorological conditions. While our dataset is limited to two years of data representing a three year time period, the displacements derived from DInSAR provide insight into permafrost change in a High Arctic environment and show promise for measuring seasonal ice aggradation and degradation, helping target more detailed geophysical investigations. Based on these results, DInSAR analyses show great potential as an innovative and cost-effective method for assessing environmental change in remote permafrost regions.

PERMAFROST COMICS: BRIDGING THE GAP BETWEEN SCIENCE AND SOCIETY


(1) Queen’s University (Kingston, Canada);
(2) Université de Montréal, Université Laval (Montréal, Canada);
(3) Centre d’études nordiques (CEN) Université Laval (Quebec, Canada);
(4) Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (Potsdam, Germany);
(5) Centro de Estudos Geográficos/IGOT Univ. de Lisboa (Lisboa, Portugal);
(6) Université de Montreal, Centre d’études nordiques (CEN) Université Laval (Montreal, Canada);
(7) Stockholm University (Stockholm, Sweden);
(8) Purdue University (West Lafayette, United States);
(9) Universität Hamburg (Hamburg, Germany)

Here we present the first results of an entertaining and easily understandable scientific-based comic on the impacts of climate change in permafrost areas. Education and outreach is a fundamental component of scientific research activities. Especially for Arctic science, the involvement of local communities and the diffusion of scientific knowledge in schools is now an essential task on every researcher’s to-do list. The International Permafrost Association (IPA) Action Groups “A Frozen-Ground Cartoon” and “Permafrost and Culture” aim at filling the gap between indigenous knowledge, complex scientific results and outreach to the general public. It is possible to change global thinking, especially in relation to environmental friendly policy and industry, but only if awareness to the sensitive Arctic regions can be brought to the general public and to political decision makers. This can be hard to achieve, as scientific publications and knowledge are difficult to access for the general public. Permafrost comics explain the impact of climate change in permafrost areas, its effects on local communities,
wildlife and changing landscape. We provide handouts with simple scientific background information that can be used by school teachers as educational material. The comics are part of a larger outreach and education project including posters and a short Frostbyte video. Everything will be freely available on the IPA website for download. For more information: https://www.researchgate.net/project/A-Frozen-Ground-Cartoon-Explaining-international-permafrost-research-using-comic-strips http://ipa.arcticportal.org/activities/action-groups

**Biodiversity of the Canadian Arctic Vascular Plant Flora: New Floristic Discoveries Represent Critical Baseline Biodiversity Data**

Saarela, Jeffery, L. Gillespie, P. Sokoloff and R. Bull

Canadian Museum of Nature (Ottawa, Canada)

Exploration of the vascular plant flora of the Canadian Arctic has been ongoing for almost two hundred years, yet substantial gaps remain in our floristic understanding of this large, rapidly changing and difficult-to-access region. Detailed information on the diversity and distribution of Arctic plants is urgently needed to understand the potential impacts of climate change on the region’s flora. Since 2008 we have been conducting detailed floristic surveys in botanically-understudied regions of the Canadian Arctic. The comprehensive baseline data of our >8000 new collections, all housed permanently in the National Herbarium of Canada at the Canadian Museum of Nature, and other herbaria in Canada and internationally, adds important knowledge to our understanding of Arctic plant biodiversity, which may inform future terrestrial monitoring efforts by identifying areas that contain rare species or unique habitats, for example. Many of our collections represent first records for specific areas, others represent the second or third collections of poorly-known species at the edge of their ranges in the Canadian Arctic, and many fill in gaps in the known distributions of Arctic species. We will summarize our floristic work to date, with a focus on as-yet unpublished noteworthy discoveries from Victoria Island, Cape Dorset and Malik islands, Baffin Island and mainland Nunavut.

**The Critical Role of Natural History Collections in Documenting Biodiversity of the Arctic in the Past, Present and Future**

Saarela, Jeffery

Canadian Museum of Nature (Ottawa, Canada)

Changes in the diversity, distribution and ecology of species in the Arctic are predicted and/or already being documented in response to global change. Baseline biodiversity data from the past and present can provide critical points of reference in time and space for measuring change. Core components of biodiversity data are specimens in natural history collections. Natural history specimens are data themselves, documenting the distribution of species in time and space; they serve as vouchers for datasets, allowing future workers to go back to original material to confirm or revise identifications; and they are also sources of new data (morphology, anatomy, toxicology, genetic information, etc.). Biological specimens from the Arctic are a diverse, valuable and irreplaceable component of the polar information spectrum, yet Arctic specimens were collected more frequently in the past than they are today. Core functions of museums are the collection, long-term preservation, stewardship and curation of specimens, and facilitating access to these specimens, both physically and digitally. 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). Arctic research programs on biodiversity should document field observations with specimens whenever possible, and should engage with natural history museums to ensure these specimens are properly preserved and accessible to future generations of researchers. Reciprocally, natural history museums should be more involved in Arctic science discussions to raise awareness and increase usage of their rich collections-based resources, and should actively engage with researchers who require a permanent repository for their Arctic field collections.
PARTICIPATION, CONTEXTUAL RELEVANCE AND IMPACT: DEVELOPING AN EVALUATION FRAMEWORK FOR INUIT HEALTH PROGRAMS AND A WHITEBOARD VIDEO FOR HEALTH PROMOTION

Saini, Manpreet (1), I. Shiwk (2), S. Roche (1), A.Papadopoulos (1), M. Wood (3), Rigolet Inuit Community Government - (2), Nunatsiavut Government - (3), Indigenous Health Adaptation to Climate Change Research Team - (4) and S. Harper (1)

(1) University of Guelph (Guelph, Canada);
(2) Rigolet Inuit Community Government (Rigolet, Canada);
(3) Nunatsiavut Government (Happy Valley-Goose Bay, Canada);
(4) Indigenous Health Adaptation to Climate Change Research Team (Montreal, Canada)

In recent years there has been a strong focus on the contextual relevance of public health approaches. Broadly created public health programs may not be as effective when applied to specific culturally distinct communities. For instance, Inuit culture is orally and visually oriented, and these key characteristics of Inuit culture can, and should be, used to 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 desired objectives and to inform future initiatives for improved impact. The objectives of this project were to (1) co-develop a whiteboard video with Inuit youth, (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 and focus group discussions were conducted with 31 Rigolet community members and 3 regional government employees to discuss the critical components of an effective evaluation framework and their perspectives on participation in the evaluation of public health programs. The interviews and group discussions were transcribed and analyzed using thematic analysis. The key themes, subthemes and codes from these discussions were then applied to create a framework for evaluation of Inuit health programs. Member checking and peer debriefing were techniques used to ensure the themes were reflective of participants’ perceptions. Key components identified for the framework included: (1) engaging community members to foster participation in completing evaluations, (2) working collectively with community members for the development of an evaluation plan, (3) capturing relevant evaluation information in a participant-tailored manner, and (4) focusing on examining long term, lasting impacts through evaluation. The framework was employed in the evaluation of the collaboratively developed whiteboard video, which was used to share health information about acute gastrointestinal illness (AGI). The video was completed in August 2016, and debuted in the community at an open house. Preliminary results suggest the whiteboard video is a contextually relevant and impactful tool to use to share health information. Additionally, the components of the framework worked well to generate an applicable evaluation strategy for the whiteboard video. In conclusion, participation in the development and evaluation of culturally relevant public health interventions may play a significant role in their uptake and impact.

UNRAVELING THE INTRICATE DYNAMICS OF PLANKTONIC ARCTIC MARINE FOOD WEBS.

Saint-Béat, Blanche (1), F. Maps (1) and M. Babin (2)

(1) Takuvik Joint International Laboratory, Université Laval (Canada) – Centre National de la Recherche Scientifique (France), (Quebec, Canada);
(2) Takuvik Joint International Laboratory, Université Laval (Canada) – Centre National de la Recherche Scientifique (France) (Quebec, Canada)

The accelerating pace at which the Arctic environment is submitted jeopardizes its marine ecosystems. Now more than ever, we need to develop a holistic view of the structure and functioning of these ecosystems in order to define their ecological state. Ecological Network Analysis (ENA) indices reveal emergent ecosystem properties that are not accessible with simple in situ observation. They are powerful tools to assess the various states of an ecosystem, such as its level of resistance and resilience to perturbation, the redundancies in its trophic pathways, etc. ENA provide a functional fingerprinting of ecosystem under different environmental conditions, and they allow the detection of potential regime shifts. The calculation of these indices needs the knowledge of every food web flow value. Despite the recent increasing in in situ measurements from Arctic areas, several flow values remain unknown. Linear inverse modeling (LIM) allows to estimate missing flow values from already existing
field flow measurements and thus to reconstitute ecosystem food webs. A higher quantity of in situ data integrated to the LIM ensures a better estimation of missing flows. But what about the kind of flows integrated to the model? The aim of this study was to determine to what kind of flows the LIM approach is sensitive. We updated an exiting food web model of the Amundsen Gulf. We did a sensitivity analysis to assess the impact of each flow integrated to the model on the estimation of the others flows. We ran thirty-five models integrating different set of flow information. The impact of flow on the quality of estimation was analyzed at two distinct levels: 1) flow magnitude and 2) ENA indices. The error calculation of both the flow value and ENA indices between the reference run and each of the thirty-five degraded runs allowed to determine the most impacting flow on the food web reconstruction. The estimation of missing flow values remained relatively robust to the kind of flow integrated to the model. The differences observed between the reference run and the degraded runs remain for almost every flow within the standard variation of the reference model and did not impact the ENA indices. As consequence, the ecological interpretation of the ecosystem state remained the same whatever the run considered, except for one. The removing of the information on the flow from bacteria to dissolved organic carbon led to a higher cumulated error on flow values, impacting ENA indices. The food web construction and ecological interpretation seemed sensitive to this flow.

SPATIO-TEMPORAL EVALUATION OF CONTEMPORARY AND HISTORIC SHORELINE CHANGES IN RESPONSE TO THE EFFECTS OF CLIMATE VARIABILITY ALONG SOUTHWESTERN BANKS ISLAND – A QUANTITATIVE ANALYSIS OF VULNERABILITY

Sankar, Ravi Darwin, M. Murray and P. Wells

University of Calgary, Arctic Institute of North America (CALGARY, Canada)

Arctic communities are increasingly susceptible to the effects of climate change. Increased storminess (storm intensity and frequency) coupled with rising sea-level, elevated air and sea-surface temperatures and decreased sea-ice extent all act as catalysts to accelerate coastal erosion. As a result, development and use of innovative geospatial methodologies are necessary to provide updated assessments of coastal evolution that facilitate the implementation of plausible adaptation initiatives. This investigation quantified rates of shoreline change along a 35 km segment of Southwestern Banks Island, Northwest Territories, Canada. Thirty years of shoreline position data (from 1982-2015) were obtained from Landsat multi-spectral satellite imagery. The data was incorporated into ArcGIS 9.3 and the Analyzing Moving Boundaries Using R (AMBUR) technique was used to determine and evaluate rates of change over the long-term and short-term time periods. Results show that the 35 km stretch of Arctic coastline along Southwestern Banks Island retreated at an average rate of -0.58 meters per year over the duration of the study period. Further, the analysis revealed a dominant erosional signal across a significant portion of the study-area with approximately 71% of the shoreline retreating landward. A localized segment of shoreline in close vicinity to Sachs harbor was also analyzed over the period 1998-2012. Data shows acceleration of erosion in this area over the short-term, with average retreat rates of 1.15 meters/year. Erosional hotspots (zones) exist to the west of Martha Point Spit and immediately east of the populated zone. Shoreline retreat along these areas, and by extension the coastline along Southwestern Banks Island, appear to be directly related to decreases in sea-ice extent that facilitate elevated wave amplitudes with storm passage. The Coastal Vulnerability Index (CVI) metric was employed to highlight the effects of storm intensity and increasing sea-level along the coast of Southwestern Banks Island. The maps and data illustrate that a large segment of the study area is highly vulnerable to the effects of climate change as this region is characterized by unlithified bluffs of low elevation. With warming conditions predicted to increase in this region, coastal managers should prepare for -0.20 m/yr of retreat in the immediate vicinity of Sachs Harbor and approximately -0.52 m/yr of shoreline erosion along the entire length of coastline evaluated.

ZOOONOTIC PARASITES IN DOGS IN IQALUIT, NUNAVUT

D. Julien (1), Sargeant, Jan (1), S. Weese (1), A. Cunsolo (2), A. Bunce (1), J. Shirley (3), E. Sudlovenick (4), R. Guy (5) and Sherilee Harper (1)

(1) Ontario Veterinary College (Guelph, Canada);
(2) Labrador Institute of Memorial University (Happy
BACKGROUND: Residents in the Canadian North have the highest rates of self-reported acute gastrointestinal illness in the literature. However, the specific pathogens associated with infectious gastrointestinal illness and the sources of these pathogens are not entirely known and likely differ from more southern environments. Recent publications have reported Cryptosporidium spp., and Giardia spp., in the feces of patients with gastrointestinal illness in Iqaluit, Nunavut. These pathogens can potentially be transmitted between animals and humans, or vice versa. Given the importance of dogs in many Northern communities, it is important to understand this potential source of transmission. OBJECTIVE: This project is a component of a larger community-based surveillance project to investigate the potential sources of Cryptosporidium and Giardia in animals and the environment in Iqaluit, Nunavut. The objectives of this study are to determine the prevalence of Cryptosporidium and Giardia in dogs and to examine molecular source attribution. METHODS: A pilot study of sled dogs was conducted in July 2016. Then, in September 2016, environmental stool samples were collected from sled dogs (sampled daily for three days), dogs housed temporarily at the Iqaluit Humane Society, and from stool samples identified during transect walks of randomly selected areas of Iqaluit and the surrounding area. Samples were tested for the presence/absence of Cryptosporidium and Giardia using sucrose wet mounts and commercially available rapid ELISA test kits. DNA-based methods will be used on samples positive for Cryptosporidium and/or Giardia to facilitate an assessment of the zoonotic potential and to compare between other potential parasite sources identified in the other studies within this project. RESULTS: There were 60 samples collected during the July pilot test, and 394 samples collected during the September sampling period. The laboratory work is ongoing and results will be presented in this poster. This ArcticNet-funded study involved close collaboration with Northern organizations such as the Nunavut Research Institute, Department of Health, and Iqaluit Public Health. The results of this study are intended to increase our understanding of the source of enteric illness in humans and to help inform public health messaging in Nunavut, as well as other Indigenous communities in Northern Canada.

INUIT-IDENTIFIED PATHWAYS FOR GOOD WELLBEING: AN EXPLORATION OF THE LAND’S ROLE AS A DETERMINANT AND SOURCE OF WELLNESS IN NUNATSIAVUT, LABRADOR


(1) University of Guelph (Guelph, Canada);
(2) Labrador Institute, Memorial University (Happy Valley-Goose Bay, Canada);
(3) University of Guelph (Guelph, Canada);
(4) Nunatsiavut Government, Department of Health and Social Development (Happy Valley-Goose Bay, Canada);
(5) McGill University (Montreal, Canada);
(6) The Inuit Mental Health and Adaptation to Climate Change team IMHACC (Rigolet, Canada);
(7) The Rigolet Inuit Community Government (RICG) (Rigolet, Canada)

Inuit across the Circumpolar North are experiencing dramatic and rapid environmental changes, compounded by social, cultural, and economic shifts. Despite these challenges, Inuit in Canada are actively working to maintain their culture and traditions while advancing both individual and collective wellbeing, with many communities calling for and implementing land-based programming. Indeed, understanding the context-specific, interconnected nature of Inuit relationships with the land is essential when developing and implementing policy and programs that aim to enhance Inuit wellbeing in culturally-appropriate ways. Understanding the essential relationship between the land and health, the five communities of Nunatsiavut, Labrador, Canada worked together on a multi-year community-based project. One of the goals of this research was to explore pathways that Inuit in this region use to support good wellbeing by: (1) characterizing conceptualizations of wellbeing and its underlying components from the perspectives of Inuit living in Nunatsiavut; (2) describing pathways through which Inuit in this region achieve and maintain good wellbeing; and (3) comparing and contrasting...
protective factors for wellbeing at both individual and community levels across Nunatsiavut. Over 100 in-depth interviews were conducted by Local Inuit Research Coordinators with community members and healthcare professionals throughout Nunatsiavut. An iterative, constant-comparative qualitative analysis was then conducted, allowing for cross-community themes to be developed. Interviewees shared that the land was an underlying determinant for all dimensions of wellbeing, emphasizing its roles as “healer,” “teacher,” “connector,” and “kin.” Further, the land shaped and reinforced pathways for cultural revitalization, building supportive relationships, and generating a stronger sense of community – all of which contribute to good wellbeing in Nunatsiavut. Overall, this case study provides a foundation from which to move forward and address challenges to Inuit wellbeing in the context of changing environments. It underscores the importance of including Inuit perspectives and values that aim to enhance wellbeing in relevant and meaningful ways in the North. Demonstrating how Inuit in Nunatsiavut are actively creating and pursuing pathways for wellbeing will help to guide future health research, programming, provision, and response that places Inuit voices, culture, ways of knowing, and conceptualizations of health and wellbeing at the centre of decision-making and action.

DEVELOPING VALUES-BASED ENVIRONMENT AND HEALTH METRICS FOR SURVEILLANCE WITH INUIT IN RIGOLET, NUNATSIAVUT, LABRADOR


(1) University of Guelph (Guelph, Canada);
(2) Labrador Institute, Memorial University (Happy Valley-Goose Bay, Canada);
(3) University of Guelph (Guelph, Canada);
(4) Rigolet, Nunatsiavut (Rigolet, Canada);
(5) Nunatsiavut Government, Department of Health and Social Development (Happy Valley-Goose Bay, Canada);
(6) The Rigolet Inuit Community Government (RICG) (Rigolet, Canada)

Inuit communities across the Circumpolar North are dealing with various environmental issues as a result of climate change and resource extraction that have both direct and indirect impacts on health and wellbeing. For Inuit, health impacts of environmental change are complex, interconnected, and vary between regional and local contexts. Indeed, there are many ways in which Inuit communities are already adapting and building resilience to these environmental stresses to promote and sustain good wellbeing. In order to conduct research and inform policy that is centered on Inuit values, needs, and priorities, it is important to first build a thorough understanding of the intrinsic connections between environmental change and resulting impacts on wellbeing from the perspectives of Inuit themselves. The goal of this research project is to identify and characterize environment and health surveillance metrics that are of value to Inuit in Rigolet, Nunatsiavut, Labrador. Within this goal, the main objectives are to: (1) Describe the environment and health metrics that are important to Inuit in Rigolet; (2) Explore the underlying values that affect the relative importance of these environment and health metrics; and (3) Compare and synthesize perspectives of community members as well as local and regional government stakeholders on how to incorporate values-based metrics into a successful, sustainable health and environment monitoring program. In-depth, semi-structured interviews were conducted with Inuit in Rigolet (n=30) and regional government stakeholders in Happy Valley-Goose Bay (n=11) to explore what environment and health metrics are important to the community, as well as why these metrics are important to monitor. Additionally, focus group discussions were conducted with local and regional government representatives (n=3 focus groups, totaling 15 individuals) to discuss how these environment and health metrics can be used to inform health policy and programming in Nunatsiavut. Two Community Open Houses were held in Rigolet to engage members of the community in planning and developing a monitoring program that is based on values-based environment and health metrics. When discussing adaptive strategies for environmental change, all interviewees emphasized the importance of the connections between environment and health, and felt that synergies between Indigenous and scientific knowledge systems should be identified in order to benefit both community and environmental wellbeing in Rigolet. This research demonstrates the utility of qualitative methods to conduct research on environment-health metrics rooted in Inuit values for contextually-sensitive monitoring and response. Furthermore, using community-based, community-led approaches for environment-health monitoring in the
North can help influence and enhance guidelines for sustainable strategies that enhance Inuit health and resilience. Building from this foundation, we will work together with the community of Rigolet to develop and implement future health research and policy in this community that are aligned with their specific goals and priorities and that can subsequently be scaled up with other Inuit communities in Nunatsiavut and indeed throughout the Circumpolar North.

THE ENUK PROGRAM: PARTICIPATORY, COMMUNITY-LED ENVIRONMENT AND HEALTH SURVEILLANCE WITH INUIT IN RIGOLET, NUNATSIAVUT, CANADA

Sawatzky, Alexandra (1), A. Cunsolo (2), D. Gillis (3), A. Bunce (4), O. Cook (3), I. Shiwak, C. Flowers (5), J. Shiwak (6), J. Ford (4), C. Furgal (7), V. Edge (8), The Rigolet Inuit Community Government RICG (9) and S. Harper (3)

(1) University of Guelph (Guelph, Canada); (2) Labrador Institute, Memorial University (Happy Valley-Goose Bay, Canada); (3) University of Guelph (Guelph, Canada); (4) McGill University (Nanaimo, Canada); (5) Rigolet, Nunatsiavut (Rigolet, Canada); (6) Rigolet Inuit Community Government (Rigolet, Canada); (7) Trent University (Peterborough, Canada); (8) Public Health Agency of Canada (Guelph, Canada); (9) The Rigolet Inuit Community Government (RICG) (Rigolet, Canada)

Impacts of environmental changes in the Canadian North present major challenges for human health, with the most acute impacts experienced among Inuit populations reliant on the environment for sustenance and livelihoods. It is anticipated that these environmental stressors will likely lead to increased negative impacts on physical and mental health issues. Research has uncovered many associations between environment and health outcomes; however, detecting cumulative environment-health outcomes and responding to them is a serious challenge. The need for comprehensive, integrated, sustainable, and locally-appropriate surveillance systems is becoming a major priority across the North. Indeed, government stakeholders, industry, health practitioners, and academics alike have called for community-led approaches to surveillance strategies that are responsive and integrate environmental and socio-economic factors, and provide management tools for decision-makers and communities. In order to respond to this call for community-led approaches for environment and health surveillance systems, the Rigolet Inuit Community Government, the Nunatsiavut Department of Health and Social Development, and a team of Inuit and non-Inuit researchers have been working with the community of Rigolet, Nunatsiavut to develop and implement the eNuk program: an Inuit-designed and developed participatory environment and health surveillance system that will track, analyze, and respond to health impacts of climate change, resource development, and socio-cultural and socio-economic shifts using a locally-designed iPod App. Central to the methods of this research is the active engagement of all stakeholders to co-develop the overall project design. Key methods include: (1) Focus group discussions and consultations with community members and government stakeholders characterize needs, goals, and priorities for the surveillance system; (2) The participatory development of an iPod App with Inuit in Rigolet to collect important and timely environment and health data; (3) Active monitoring, using the iPod App, with 30% of the households in the community to gather in-depth written, oral, audio, photographic, and video documentation of a variety of environmental and health indicators. Initial focus group discussions and consultations with community members and other stakeholders have led to the identification of environment and health metrics that matter to Inuit in Nunatsiavut. This information is being used to develop and pilot a comprehensive surveillance system in Rigolet. Subsequently, information gathered will be used to support the development of locally-appropriate programming and policy in the region, including an environment-health survey tool, based on near real-time data gathered through the active monitoring program. The findings from this research may provide the foundation to support a culturally-safe, locally-relevant environment-health surveillance program with Inuit in Rigolet, which has the potential to strengthen resilience to environmental change within this community, while directing future adaptation responses in the region and across the North.

PASSIVE ACOUSTIC MONITORING OF BELUGA HABITAT USE IN THE MACKENZIE ESTUARY

Scharffenberg, Kevin (1), D. Whalen (2), S. MacPhee (3), G. Davoren (4) and L. Loseto (5)
Beaufort Sea beluga whales (Delphinapterus leucas) form some of the world’s largest summering aggregations in the Mackenzie Estuary. Belugas first enter the area when the landfast ice barrier across the estuary breaks up, after which they are frequently seen in the shallow, muddy waters of Beluga Bay, Shallow Bay, and Kugmallit Bay. The timing and location of beluga presence in the estuary is well documented; however, the function of the estuary for beluga, as well as drivers for temporal and spatial patterns of occurrence, are not fully understood. Recent research summarized aerial survey data from 1977-1985 and 1992 to identify seven ‘hot spots’ within the estuary where belugas were more likely to congregate year after year. The identification of these hot spots provides a starting point to more closely examine beluga habitat use. The objective of this study is to define beluga habitat use in Kugmallit Bay by using vocalization data as a means to indicate presence, alongside environmental and oceanographic data to assess how beluga occurrence and movement is influenced by environmental parameters. The viability of passive acoustic monitoring as a tool to determine localized presence or absence of belugas in the estuary has previously been demonstrated. As such, monitoring is being done through the deployment of passive acoustic sensors (hydrophones) in areas of Kugmallit Bay that have been previously identified as hotspots.

Deployment of hydrophones occurred from June to August in 2015 and 2016, with plans to deploy again in 2017. Oceanographic data collection consists of a number of passive instruments co-located with each hydrophone. A total of 5 instrumented seabed moorings were placed ~5 km apart in areas where whales have been previously observed or could contain unique temporal oceanographic variations in the study region. The configuration of each mooring varied, but included hydrophones to measure noise in the water column (whales, anthropogenic and waves), CTDs (conductivity, temperature and depth), and pressure sensors (waves and tidal levels). In addition, an ADCP (current profiler), optical backscatter (turbidity), and a pH sensor were deployed alongside the hydrophone at selected locations. Lastly, a weather station was installed to record and broadcast wind climatology on a near real-time basis. By combining beluga presence/absence with environmental data at a fine temporal scale, we hope to identify the drivers behind beluga movement within the estuary, and better understand the function of the estuary itself. With improved knowledge we will be able to better assess the impacts of climate change, evaluate industrial proposals, and formulate management plans which protect these important biological resources. This research is part of ArcticNet Project “Knowledge Co-Production for the Identification and Selection of Ecological, Social, and Economic Indicators for the Beaufort Sea.”
the need for ice tracking. The acquisition program was aimed at the following research objectives: (a) improving the utility of SAR for discriminating sea ice types during all seasons including summer; and (b) improving the utility of SAR for discriminating proxy variables of importance for understanding ocean-atmosphere-sea ice interactions during spring and summer periods, like sea ice melt pond fraction and ice melting state. A pre-melt (April) aerial survey of ice thickness and roughness over Victoria Strait and M’Clintock Channel, along with collection of coincident SAR images, facilitated the establishment of baseline ice conditions. A coincident summer (late June) aerial survey, coupled with the collection of imagery from high-resolution World-View 2 optical satellite, enabled the assessment of melt pond coverage and ice melting state (e.g. drained ice). Field observations of sea ice geophysical parameters over the spring and summer periods were made at a control site located on smooth, landfast first-year sea ice in Dease Strait, adjacent to Cambridge Bay, NU. Preliminary results from this project are presented here, with emphasis on: (a) evaluating sea ice type and melting state characterizations using compact polarimetric (CP) backscatter parameters simulated from Radarsat-2 images; and (b) assessing the utility of low frequency Alos-2 SAR as a standalone or complementary source of sea ice information. Emphasis on CP parameters is grounded in the need to prepare for the advanced SAR capabilities of the pending Radarsat Constellation Mission (RCM) in 2018. RCM is a Canadian led mission that will provide advanced image parameters over wide swaths, and significantly increase the SAR revisit frequency over the Kitikmeot Region, compared to Radarsat-2.

TURBULENT DISSIPATION RATES, MIXING, AND HEAT FLUXES IN THE CANADIAN ARCTIC FROM GLIDER-BASED MICROSTRUCTURE MEASUREMENTS

Scheifele, Benjamin (1), S. Waterman (1) and J. Carpenter (2)

(1) UBC (Vancouver, Canada);
(2) Helmholtz-Zentrum Geesthacht (Geesthacht, Canada)

Understanding mixing rates 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 340 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 $\varepsilon$ and $\chi$, the dissipation rates of turbulent kinetic energy and thermal variance. Dissipation rates vary across four orders of magnitude but are generally very low: consequently, mixing tends to be inhibited by the strong stratification.

BIODIVERSITY, DISTRIBUTION AND BIOMASS OF ZOOPLANKTON AND FISH IN HUDSON BAY

Schembri, Sarah and L. Fortier

Université Laval (Quebec City, Canada)

Changes in ice cover and freshwater availability in Hudson Bay are expected to impact both the pelagic and the coastal ecosystems. Although information about the abundance and distribution of species in this subarctic sea are limited, studies indicate that shifts in fish species composition are occurring. As part of the BaySys project, the overarching aim of this study is to improve our knowledge of Hudson Bay marine ecosystem and of how external pressures such as climate change and changes in seasonal freshwater cycles are affecting it. To this end data from direct sampling and acoustic surveys carried out on the CCGS Amundsen will be used. Data from the 2005 and 2010 expeditions will be compared with available literature on the fish and zooplankton of the Hudson Bay. The data time series will be extended during the BaySys cruise in June/July 2017. Trends in biodiversity, distribution and abundance of fish and zooplankton, especially species that are key to the food web such as arctic cod and Calanus copepods, will be examined. Initial data exploration
shows that although still the most abundant fish in Hudson Bay, the occurrence of capelin has decreased between 2005 and 2010. A decline in abundance of arctic cod was also observed. Meanwhile the numbers of arctic shanny caught in the nets have increased. Thus far, these observations corroborate with analysis of seabird’s diets in the region. Further investigation will attempt to answer these questions; • Is the role of the arctic cod within the sub-arctic marine ecosystem of the Hudson Bay the same key role as that in the Arctic? • If numbers of arctic cod are decreasing, which species will fill the role of forage species in this ecosystem? • Will alterations in the seasonal variation of freshwater input affect the biodiversity, distribution and biomass of fish and zooplankton in the Hudson Bay? • Will the new conditions be more favourable for invasive species such as the rainbow smelt to expand their habitat?

LAKE HAZEN WATERSHED IN THE HIGH ARCTIC: USING TRITIUM AND NATURAL ABUNDANCE STABLE ISOTOPES OF SULFATE TO PARTITION CHANGING INPUTS FROM GLACIAL RIVERS.

Schiff, Sherry (1), P. Aukes (2), P. Dainard (2), M. English (3), R. Elgood (2), X. Zheng (2), V. St. Louis (4), I. Lehnherr (5) and K. St.Pierre (4)

(1) University of waterloo (waterloo, Canada);
(2) Department of Earth & Environmental Sciences, University of Waterloo, Waterloo ON, N2L 3G1 (waterloo, Canada);
(3) Department of Geography & Environmental Studies, Wilfrid Laurier University, Waterloo ON N2L 3C5 (waterloo, Canada);
(4) Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada T6G 2E9 (Edmonton, Canada);
(5) Department of Geography, University of Toronto-Mississauga, Mississauga, Ontario, Canada L5L 1C6 (Mississauga, Canada)

Effects of global warming on the nearshore marine environment in the arctic is currently a topic of intensive research. Nutrient loading from the terrestrial system and the coupling between land and nearshore environment is changing but few terrestrial systems are amenable for study, especially in the high arctic. Lake Hazen is a large, inland lake in Quttinirpaaq National Park, Nunavutat at the northern end of Ellesmere Island with terrestrial inputs from both glacial fed rivers and streams fed by active layer and permafrost thawing. The lake maximum depth is 265 m and the whole lake water residence time in the past was nominally 89 years. Recent work has shown that Lake Hazen and its watershed have undergone rapid change within the past 5 years and spurred a new intensive research effort on the lake and watershed. Lake Hazen is now consistently ice-free for part of the summer and both glacier ablation and lake sedimentation rates have increased dramatically. Further, the lake is no longer at steady state with respect to hydrologic or chemical inputs. Quantifying annual inputs from various parts of the catchments to construct mass budgets is logistically difficult in the far north. Here we explore the use of natural abundance stable isotopes of sulfate (both 18O-SO42- and 34S-SO42- ) and tritium (3H) to examine contributions from various watersheds to Lake Hazen. In 2015 and 2016, we sampled lakes, ponds, seeps, streams, subsurface water and glacial rivers in the arctic spring to late summer in the Lake Hazen watershed. Stable isotopes of SO42- differ between the various glacially fed rivers and from the small but highly chemically concentrated non-glacial seeps and small streams. Values cover a wide range but outside the range reported in textbooks. Oxidation of sedimentary elemental sulfur is an important contributor to SO42- isotope systematics in the terrestrial watershed and oxidation of reduced sulfur. Surprisingly, there is little correspondence with the expected marine sulfate values despite the dominance of sedimentary bedrock of Cambrian to Paleogene age. Reconstruction of inputs to the lake using 3H measured in the major glacial river inflows also confirms that the lake water residence time has decreased recently by about a factor of four. Both the wide isotopic range in SO42- sources and 3H offer potential tools to separate contributions from the various glacial fed rivers and the changes in the water residence time of Lake Hazen.

TOWARDS A SUSTAINABLE FISHERY FOR NUNAVUMMIUT: THE INTEGRATION OF TRADITIONAL KNOWLEDGE WITH WESTERN SCIENCE

Schott, Stephan (1), J. Qitsualik (2), P. Van Coeverden de groot (3), V. Walker (3) and S. Lougheed (3)

(1) Carleton University (Ottawa, Canada);
(2) Gjoa Haven Hunter and Trapper Organization (Gjoa Haven, Canada);
(3) Queen’s University (Kingston, Canada)
The paper examines the process and sequence of integrating traditional knowledge with Western science in the context of a multidisciplinary research project in the Kitikmeot region of Nunavut. We discuss research steps and methodologies, and evaluate experiences from a week long traditional knowledge workshop and a follow-up validation workshop in Gjoa Haven, Nunavut. The objective of the research study is to strengthen food security, to determine a baseline for fish stock, fish migration and contamination levels, and to explore the potential for commercial fisheries in close collaboration with the local Hunter and Trapper Organization of Gjoa Haven and the community. The paper reports on experiences and lessons learned from the consultation process, group mapping of ecological knowledge and commercial potential, individual land use mapping, a discussion of experiences from commercial fishing activities in the past, a discussion of sampling methods and a validation workshop. We approach knowledge mobilization through an iterative engagement and research process. We address how to improve the uptake and acceptance of Western science evidence and the use of visual presentation tools in an interactive online atlas that will be used to disseminate and discuss research findings throughout the research process. We conclude with implications for research methods in natural and social sciences, and lessons learned for collaborative research.

LONG TERM TRENDS IN DIET OF FEMALE POLAR BEARS IN WESTERN HUDSON BAY

Sciullo, Luana (1), G.W. Thiemann (1) and N.J. Lunn (2)

(1) York University (Toronto, Canada);
(2) Environment and Climate Change Canada (Edmonton, Canada)

Foraging behaviour of polar bears (Ursus maritimus) is dependent on predictable sea ice patterns and learned predator-prey interactions. In western Hudson Bay, spring hyperphagia is followed by summer ice melt, forcing bears onto shore where most fast for 3-4 months, and up to 8 months for pregnant females. Changes in the timing of sea-ice breakup and freeze-up negatively influence polar bear body condition, and are hypothesized to alter foraging strategies. The objective of this study was to examine potential responses of female polar bears to shifting environmental conditions by identifying inter-annual changes in diet composition across age and reproductive status. We sampled a total of 403 adult (5+ years old), subadult (2-4 years old), independent and dependent yearling (1 year old) and dependent cub-of-the-year (COY) females captured in the fall between 2004-2014 and assessed diet composition using quantitative fatty acid signature analysis. Across all years, ringed seal (Pusa hispida) was the dominant prey species consumed. Solitary adult females and females supporting yearlings consumed significantly more bearded seal (Erignathus barbatus) than either subadults or females supporting COY, suggesting that females with COY and younger inexperienced bears are avoiding foraging areas preferred by male bears (e.g., offshore pack ice). A high dietary diversity of subadults and females supporting COY suggest these groups may be actively scavenging on a broad range of prey types. Diet composition across all females fluctuated over the ten year period, with bears consuming more harbour seal (Phoca vitulina) and less ringed seal. Year significantly predicted polar bear diet composition, but sea ice breakup date did not; suggesting that inter-annual variability in diet of female polar bears may be a consequence of multiple interacting environmental variables affecting predictable predator-prey interactions.

THE CLIMATE CHANGE ADAPTATION LANDSCAPE IN NUNAVIK, QUEBEC.

Shah, Cheenar (1), J. Ford (1), J. Labbé (1), S. Bleau (2) and R. Siron (2)

(1) McGill University (Montreal, Canada);
(2) Ouranos (Montreal, Canada)

Evidence that the climate of northern Canada is changing is overwhelming and we can expect rapid warming and associated impacts this century. Adaptation will be unavoidable. This inevitability has resulted in increased interest on adaptation in climate policy in recent years, including in Nunavik. Scholarship on adaptation, however, remains in its infancy. Thus while we have increasing knowledge of what needs to be done to adapt, we have very limited understanding of how or if adaptation is taking place or if communities are ready to adapt. These are important gaps, particularly given the limited window for action on adaptation and speed of climate change. Reflecting this gap in understanding, we systematically reviewed publically available information on government and private sector driven adaptation in Nunavik, cataloguing...
all climate change adaptation initiatives. Our aim
was to create an adaptation baseline for reporting,
monitoring, and evaluating change over time. The
number of discrete adaptation initiatives found (n=203)
show that adaptation is on Nunavik’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 and lacks
implementation. Key trends highlight that permafrost
and vegetation change, extreme weather events and
climate variability, 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, provincial 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 certain communities, such as
Salluit and Umiujaq, emerging as leaders.

WOLVERINES (GULO GULO) AS AN
INDICATOR SPECIES FOR TRICHINELLOSIS
IN NORTHWEST TERRITORIES, CANADA.

Sharma, Rajnish (1), B. Wagner (1), B. Elkin (2),
R. Mulders (2), M. Branigan (3), J. Pongracz (3), A.
Gajadhar (4) and E. Jenkins (1)

(1) Department of Veterinary Microbiology, Western
College of Veterinary Medicine, University of
Saskatchewan, 52 Campus Drive, Saskatoon,
Saskatchewan, Canada, S7N 5B4 (Saskatoon, Canada);
(2) Environment and Natural Resources, Government
of the Northwest Territories, 600, 5102-50th Avenue,
Yellowknife, NT, Canada, X1A 3S8 (Yellowknife,
Canada);
(3) Environment and Natural Resources, Government
of the Northwest Territories, P.O. Box 2749, Shell Lake,
Inuvik, NT, Canada, X0E 0T0 (Inuvik, Canada);
(4) Parasitix Lab Services, Innovation Place, Saskatoon,
SK, Canada (Saskatoon, Canada)

Trichinelloasis is an important parasitic zoonosis
caued by nematodes of the Trichinella genus. Although
eradicated from commercially raised pigs in Canada,
Trichinella is still prevalent in Canadian wildlife and
cases are sporadically reported in people consuming
meat from harvested walrus and bears. Wolverines
(Gulo gulo) are an economically important species
in northern Canada because of their valuable fur.
Due to their high level trophic position, predatory
and scavenging lifestyle, wolverines could play the
role of “bioaccumulators” of foodborne parasites
such as Trichinella spp. The objective of the present
study was to estimate the prevalence and determine
the genotypes of Trichinella in wolverines from the
Northwest Territories (NWT). Muscle samples (tongue
and diaphragms) were collected from 131 wolverine
carcasses trapped for fur from five different regions of
the NWT. Muscle samples were artificially digested
using pepsin-HCl to detect, count, and recover
Trichinella larvae. Larvae were identified to species
level using a multiplex Polymerase Chain Reaction
(PCR). Overall, 81 wolverines were positive for
Trichinella spp., a prevalence of 62%. The average
number of larvae per gram (LPG) was 11.9 (range: 0.1
– 83.7). Significantly higher prevalence was observed in
adult wolverines (90%, 36/40) versus juveniles (41.7%,
25/60) (p<0.001, chi square test), suggesting that chance
of exposure to Trichinella infection increases with age.
Prevalence did not differ significantly between female
(50%, 20/40) and male (68.3%, 41/60) wolverines
(p=0.066, chi square test). Among the five regions
studied, the highest prevalence (80%) was observed
in Sahtu followed by North Slave (72.2%), Inuvialuit
(64.5%), South Slave (56%) and Dehcho (36%). Out of
78 positive samples genotyped, Trichinella T6 was the
predominant genotype (39.7%) followed by T. nativa
(34.6%) and T. pseudospiralis (1.3%). Mixed infections
(both T6 and T. nativa) were detected in 24.4% samples.
This high prevalence, intensity, and diversity suggest
that wolverines may be considered a useful indicator
species for Trichinella occurrence in the Northwest
Territories.

TOXOPLASMA GONDII IN BELUGA WHALES
(DELPHINAPTERUS LEUCAS) FROM
BEAUFORT SEA (INUWIALUIT SETTLEMENT
REGION, NORTHWEST TERRITORIES).

Sharma, Rajnish (1), L. Loseto (2), S. Ostertag (2), S.
Lair (3), E. Couture (3), N. Bachand (1), B. Al-Adhami
(4), A. Gajadhar (5) and E. Jenkins (1)

(1) Department of Veterinary Microbiology, Western
College of Veterinary Medicine, University of
Saskatchewan, 52 Campus Drive, Saskatoon,
Saskatchewan, Canada, S7N 5B4 (Saskatoon, Canada);
Toxoplasma gondii is a protozoan parasite which can infect most warm blooded terrestrial and marine vertebrates. In arctic regions, the main hosts (domestic and wild cats) for this parasite are largely absent above the treeline. Despite this, wildlife and people in communities in the North show exposure to this parasite. Handling, skinning, and consumption of wildlife are among the risk factors identified for exposure to T. gondii in the North. Beluga whales (Delphinapterus leucas) are an important species for communities in the Inuvialuit Settlement Region (ISR), both culturally and as a food resource. Therefore, it is important to know the status of toxoplasmosis in beluga whales from the ISR. Thirty-eight belugas were harvested by subsistence hunters from Hendrickson Island and East Whitefish during the years 2014 and 2015. We assayed sera for antibodies against T. gondii by Modified Agglutination Test (MAT) and an Enzyme Linked Immunosorbent Assay (ELISA). For detection of parasite in tissues (brains and hearts) of 16 beluga whales, we used a sequence specific magnetic capture DNA extraction technique followed by conventional as well as real time PCR targeting a 529 bp repeat element of T. gondii. Antibodies to T. gondii were detected in 97.3% (37/38) and 65.7% (25/38) of the sampled population by MAT and ELISA respectively; however, false positives on these tests are possible in marine mammal samples due to high levels of lipids. None of the tissue samples were positive for Toxoplasma however, false negatives are possible even with these highly sensitive techniques. Therefore, our results do not justify changing messaging about public health risks and benefits associated with consumption of locally harvested wildlife. Further investigation of the presence and significance of T. gondii in beluga whales is needed.
HUDSON BAY WATERSHED: HOW MERCURY CYCLING IN FRESHWATER SYSTEMS IS AFFECTED BY RIVER REGULATION

Singer, James, K. Munson and F. Wang
University of Manitoba (Winnipeg, Canada)

Mercury cycling in the Hudson Bay watershed in northern Manitoba and Quebec is impacted by hydroelectric regulation. Total mercury (THg) concentrations in fish are known to increase within 10 years of reservoir impoundment. Increases are thought to be temporary however, with recovery to pre-impoundment concentrations occurring within a few decades, although recovery can take longer in some cases. In this study, we aim to quantify the contribution of hydroelectric regulation on the production of mercury within an ecosystem with rapidly changing climate. We have identified 4 key lakes, 2 regulated and 2 non-regulated, in the Churchill River Diversion and the Nelson River systems that are within the Hudson Bay watershed as field sites for determining the extent to which reservoir mercury cycling is impacted long-term by hydroelectric regulation. Previous studies show mercury methylation can take place in sediments by bacteria including sulfate reducing bacteria who reduce sulfate to sulfide. Preliminary studies of water column sulphide, THg, and methylated mercury concentrations in our field sites suggest that methylation in the systems in question is linked to sulphide production. Ongoing studies will examine the quantitative relationship between sulphide production, organic matter remineralization and mercury methylation.

IMPACT OF SHRUB COVER ON LEAF LITTER DECOMPOSITION AND MICROCLIMATE IN SOUTHERN ARCTIC TUNDRA

Skaarup, Electra
Carleton University (Ottawa, Canada)

Warming of the Arctic has recently been associated with increasing shrub abundance in some tundra ecosystems. This shift in vegetation has the potential to modify a range of ecosystem processes including the carbon cycle. In my study, I have used the leaf litterbag technique to investigate how decomposition dynamics vary in Southern Arctic tundra with different shrub covers. This method can be used to determine whether winter conditions (e.g. freeze-thaw events, thermal insulation by deep snowpack) influence decomposition processes. In summer, greater shading, cooler soils and more moisture may also impact decomposition rates. Successfully identifying the important microclimate differences that most impact litter mass loss will add to the bigger picture of understanding how a warming climate influences carbon and nutrient cycling. The study was carried out at Daring Lake in Canada’s Northwest Territories, 300 km NE of Yellowknife and roughly 70 km north of the treeline. In August 2015, 600 litterbags with birch shrub leaf litter were set out on the surface and 10 cm below the surface at 5 replicated plots in 3 locations representing different birch shrub coverage. At each location, we instrumented 1 plot with soil thermocouples to continuously monitor soil temperatures throughout the winter. Other microclimate characteristics were measured manually in the summer and included: soil temperature, soil moisture, thaw depth and Leaf Area Index. A subsample of litterbags were collected in early spring (May 2016) and summer (August 2016) to assess relative mass and nutrient loss. Additionally, lab analyses are currently being conducted to quantify mass loss in controlled temperature and moisture conditions (to simulate autumn mass loss as a potential contributor to winter mass loss) and also to quantify DOC production via a leaching study. Preliminary results suggest that the majority of mass loss occurred during the cold season (including late August 2015 – early Spring 2016) rather than during summer 2016. Further analysis will reveal how microclimate characteristics vary between sites with different levels of shrub coverage and interact to influence the observed mass loss rates.

CARBON DIOXIDE AND METHANE FLUXES AT ILLISARVIK 2016

Skeeter, Wesley
University of British Columbia (Vancouver, Canada)

Methane and carbon dioxide fluxes were measured using eddy covariance at Illisarvik basin, an experimental drained lake on Richards Island, NWT in the summer of 2016. Vegetation at the site was diverse but generally characterized by patches of low willows (<1 m), grasses, sedges and bare ground. Measurements occurred between July 10th and August 7th and covered the peak growing season through early senescence. Meteorological conditions were highly variable during
the study while soil water content gradually decreased and active layer depth increased slightly. Methane fluxes were generally weak and positive, followed no clear diurnal pattern, and varied considerably by wind direction. The areas of sedge had the highest emissions while the drier grasses and bare patches had lower emission or acted as weak sinks. Carbon dioxide fluxes were moderate and negative with less dependence upon wind direction. Carbon dioxide uptake offset methane emissions making the site a moderate carbon sink for over the period studied.

A 10 YEAR REFLECTION ON INDIGENOUS CO-MANAGEMENT IMPLEMENTATION IN NUNATSIAVUT.

Snook, Jamie

Torngat Secretariat (Happy Valley - Goose Bay, Canada)

Indigenous co-management in Canada is a relatively new model in the devolution of governance power from state control to a continuum of shared control, where Federal, Provincial, and Indigenous Government appointees manage wildlife, plants, and fisheries. The 2005, Labrador Inuit Land Claim Agreement (LILCA) established the Torngat Joint Fisheries Board and the Torngat Wildlife and Plants Co-management Board. These Boards were the first tripartite-funded boards established in Canada, with funding to both boards shared equally among the Governments of Nunatsiavut, Newfoundland and Labrador, and Canada. There are approximately 2600 Inuit living in Nunatsiavut, Labrador, representing 4% of the Canadian Inuit population. Residents are spread throughout five remote coastal communities: Nain, Hopedale, Postville, Makkovik and Rigolet. Today, Inuit actively harvest species such as caribou, moose, polar bear, migratory birds, salmon, char, shrimp, and crab, and rely on the land for all aspects of cultural continuity, health, and wellness. In recent years, Nunatsiavutimnit have experienced challenges to these connections from climate change, development, socio-economic shifts, and resource extraction, with resulting impacts to loss of habitat, and changes to animal population levels. In 2010 the organization supported an action research project involved semi-directed interviews with past and present board members. The data revealed four major themes: frustrations from system delays and administrative tasks; challenges from a system in transition; enthusiasm from board members to act on recommendations and related activities; and the presence of quality board dialogues and the influence these dialogues have on board member actions. The primary lessons learned from this research included the importance of patience and quality work from board members and staff, and the common understanding that co-management and the business of making ministerial recommendations are a process versus a one-time event that happened when the land claim was signed. 2015 marked the 10-year anniversary of the LILCA, and this presentation will provide an update on the impact of implementing the 2010 action research recommendations, and what this means for co-management strategies and processes in Nunatsiavut. The Boards have also since completed a Strategic Plan with a vision of “healthy ecosystems and communities with shared stewardship of wildlife, plants, and fisheries”. Building from this 2010 research, and the resulting implementation of recommendations, new research is underway that will examine the pathways through which co-management governance structures and approaches may impact health outcomes for individuals, communities, populations, and ecosystems due to the oversight of harvesting levels and management of traditional Inuit activities. This research is important and timely. Given the new Nation-to-Nation relationships that are currently being negotiated at the Federal level with Indigenous Nations in the country, this research has the potential to contribute to this conversation and to the continued development and strengthening of co-management structures in this country, as well as to Inuit wellbeing.

TRANSDISCIPLINARY RESEARCH OF TORNGAT MOUNTAINS CARIBOU

Snook, Jamie

Torngat Secretariat (Happy Valley - Goose Bay, Canada)

The Torngat Wildlife and Plants Co-Management Board (TWPCB) was established as part of the 2005 Labrador Inuit Land Claims Agreement (LILCA). In 2009 community members in Nain, Nunatsiavut and board members of the TWPCB identified concerns with the Torngat Mountains Caribou Herd (TMCH). These concerns were being expressed at a time when the adjacent George River Caribou Herd were experiencing historic and precipitous declines, and were prioritized for research funding and attention. Managing the TMCH is complex and multiple levels of
government have jurisdictional authority. The TWPCB collaborates with multiple stakeholders including the Nunatsiavut Government, the Government of Newfoundland and Labrador, Government of Quebec, academia, as well as others, on data collection, data analysis, and information dissemination. The TWPCB convened a TMCH stakeholder workshop in 2010 and has coordinated a transdisciplinary research program ever since. Since 2009, the TWPCB’s work related to the Torngat Mountains Caribou Herd has spanned several disciplines: scientific and Inuit knowledge research, inter-jurisdictional management and public engagement and awareness. Meetings, workshops, conference calls, and partnerships have all contributed to strengthening the relationships between stakeholders concerned about the relatively small, montane herd. Notably, a telemetry program was initiated in 2011, followed by the first systematic collection of Inuit knowledge in 2013 (Wilson et al., 2014) and the first aerial census of the herd in 2014 (Couturier et al., 2015). The continuation of the telemetry program is ongoing, and the development of a spring photo classification methodology is in progress. Additionally, the TWPCB has worked with Caribou Ungava and researcher Édouard Bélanger to study TMCH habitat selection, future population trends, and space use relationship between TMCH and the neighbouring George River migratory caribou herd (GRCH). Results from this research indicated that the overlap between the two herds has declined substantially in the past 25 years and that this decline was negatively correlated with the GRCH abundance. Habitat selection by the TMCH differs greatly between seasons at both a coarse and fine spatial scale. At a coarse scale, vegetation cover and elevation are key features of seasonal habitat selection whereas vegetation cover and topographical features are important components of seasonal habitat selection at a finer scale.

FACTORS IMPACTING INUIT STUDENT PERSISTENCE AND TRANSITIONS

Snow, Kathy (1), S. Tulloch (2), M. O’Gorman (2), K. Tilleczek (3) and J. Lane (4)

(1) Cape Breton University (Sydney, Canada);  
(2) University of Winnipeg (Winnipeg, Canada);  
(3) University of Prince Edward Island (Charlottetown, Canada);  
(4) Department of Education & Economic Development, Nunatsiavut Government (Hopedale, Canada)

The National Committee on Inuit Education has clearly identified the need to gather evidence and data to inform educational policies and decision-making across the Inuit regions. In 2016 our team responded to the call “Future Directions in Research in Inuit Education” and partnered with Inuit Tapiriit Kanatami’s Amaujaq National Centre for Inuit Education to begin to identifying the factors that contribute to successful transitions and graduation from high school. Specifically this research addresses two interrelated questions, following priorities articulated by the Amaujaq National Centre for Inuit Education: 1. What is contributing to Inuit students’ persistence in or withdrawal from school, particularly at grade transitions? 2. How are students progressing in Inuit schools, what are they achieving, and how is this achievement being assessed? This presentation will share the preliminary results of the analysis of one of the qualitative approaches to examining these questions. Factors that contribute to successful transitions both through public school and into undergraduate study will be shared through the stories of the young people who can provide a reflective voice on their experiences with education. This collaborative program of research is anchored in Indigenous methodologies that prioritize relationship, dialogue, and respect (Kovach, 2009; Tuhiwai Smith, 1999). The approach to data collection will involve narrative sharing through walking interviews with Inuit post-secondary students. Students stories of persistence and transition will be examined in the context of current literature related to student transitions.

ADDRESSING COMMUNITY RESEARCH PRIORITIES THROUGH YOUTH ENGAGEMENT AND CAPACITY BUILDING

Solomon, Eric (1), S. Elverum (2) and N. Carter (3)

(1) Vancouver Aquarium Marine Science Centre (Vancouver, Canada);  
(2) Ikaarvik: Barriers to Bridges (Pond Inlet, Canada);  
(3) Department of Geography Environment, Society, and Policy Group, University of Ottawa (Ottawa, Canada)

Ikaarvik: Barriers to Bridges is dedicated to creating stronger connections between Arctic communities and science. Ikaarvik has developed a community-directed research methodology that addresses local research priorities in the North by empowering youth to be the bridge between their
communities and Arctic science. This approach begins with youth and community workshops to identify local research priorities. Next, the youth are trained in participatory research techniques (e.g., interviewing, mapping exercises, field note taking, etc.). These young community researchers partner with a scientific researcher to identify research questions and develop a research program to address one or more of the community’s priorities. The youth then co-facilitate community meetings to collect data and/or collect field data, depending on the nature of the research. They work with the researcher throughout the project, including interpretation of results and communication of results to the broader community. In the fall of 2015, Ikaarvik conducted youth and community workshops in four Nunavut communities (Kugluktuk, Gjoa Haven, Pond Inlet and Cambridge Bay). During these workshops, the community of Pond Inlet identified changing sea ice conditions and increases in shipping activity as two priority issues. To further address these issues, two community-directed research projects were developed. In the spring of 2016, Ikaarvik partnered with SmartICE and conducted youth and community workshops in Pond Inlet to identify the characteristics and patterns of traditional sea ice use, the nature and location of sea ice hazards, the patterns and timing of ice freeze-up, break-up, and extreme events, and the nature and format of desired sea ice information. This allowed SmartICE to develop a sea ice monitoring, measuring and mapping program to meet the specific needs of the community. Subsequently, an Ikaarvik youth participant and mentor was trained and hired to coordinate the program for the community. In March of 2016, we partnered with the Arctic Marine Activities Integration Synthesis Project (AMaIS) to conduct youth and community workshops to identify areas that are sensitive ecologically and socio-culturally (e.g., locations of polar bear and seal denning, areas where significant hunting activity occurs, etc.) and that could be impacted by increases in shipping activity in the region. After training in participatory research techniques the youth worked with Dr. Natalie Carter to refine research questions and methodology. The youth then co-facilitated a community workshop with Elders, Hamlet and HTO representatives and others to collect interview and mapping data on potentially sensitive areas around the community. These youth community researchers took significant ownership of and great pride in the data collection workshops and have continued to work closely with SmartICE and AMaIS on the validation, interpretation and reporting of the results

and implementation of sea ice monitoring around the community. The net result is science that is relevant to Canada’s Arctic communities, more robust incorporation of IQ in the research, and youth with the personal and professional capacity to work with scientific researchers on projects that meet their communities’ priorities.

MEASURING CO2 AND CH4 WETLAND FLUXES USING THREE PROMISING TECHNIQUES - LESSONS LEARNED

Soloway, Ashley (1,2), T Papakyriakou (1,2), S. Luque (1,2), C. Rattray (2), P. Badiou (3), B. Page (3) and B. Gill (2,4)

(1) Centre for Earth Observation Science, University of Manitoba, Winnipeg, MB;
(2) Department of Environment & Geography, University of Manitoba, Winnipeg, MB;
(3) Institute for Wetland and Waterfowl Research, Ducks Unlimited Canada, Stonewall, MB;
(4) Manitoba Hydro, Winnipeg, MB

Quantifying greenhouse gas emissions from freshwater bodies can be challenging but is essential for developing inland and coastal carbon budgets. Measurement methods must align with the appropriate scale, precision and emission pathways. Three measurement techniques, eddy covariance, flux gradient, and flux gradient using long open path lasers are explored in an upper mid latitude, large restored prairie marsh complex. Measurement footprints, plus CO2 and CH4 fluxes are calculated and compared for each of the three measurement techniques. Aquatic concentrations of CO2 and CH4 were collected to provide insight into the local wetland carbon cycling processes. Lessons learned about the measurement methodologies and their potential application for freshwater GHG quantification, including northern wetlands, anthropogenic impoundments and coastal areas are discussed.

TWO YEARS OF YOUTH-DRIVEN ARCTIC RESEARCH IN MITTIMATALIK: WHAT CAN THE LEARNING-BY-DOING APPROACH TEACH US?

Inuit youth have the potential to succeed in pursuing careers in Arctic research, but are lacking opportunities to develop their research capacity. During the last two years (2014-16), we developed a youth-driven research project offering an opportunity to a group of five young Inuit from Mittimatalik (Pond Inlet), Nunavut. The project involved researching and developing skills and competencies on a pressing community priority focusing on water quality, human health and adaptation in the context of climate change. We have been encouraged by community members, especially Elders, to address this priority issue based on observations of environmental changes and many residents complaining of gastro-intestinal problems. In order to offer meaningful and long-lasting training experience to the team of young researchers, we explored novel approaches to the concept of training; approaches that depart from traditional school-driven ones (concepts and theory first), to an approach sensitive to and consistent with Inuit experiential approaches to learning (observation and experience first). The need for hands-on, experiential learning opportunities has been stated consistently by Inuit Elders and others in Arctic communities as it is critical to inunnguiniq; the making of a capable person. Project leader (Tim Anaviapik-Soucie) worked full-time, during 2014-16, running research activities that included training a research team of assistants, coordination of the field work, lab work and interactions with community leaders, elders and residents of Mittimatalik. The project leader and his team received guidance, training, and continuous support from a team of research mentors at ARCTIConnexion, Dalhousie University, Université du Québec à Rimouski, University of Guelph, and the Nunavut Research Institute. Research training took place in Arctic community settings and in southern partner academic institutions. Data logs, questionnaires and video interviews were performed with team members and mentors to record the project’s progress. The project leader and local researchers have made significant progress in: 1) developing a better understanding of the backgrounds, concepts and environments associated with Arctic research; 2) reframing the position of Inuit Knowledge and Scientific knowledge in Arctic research settings; 3) developing specific skills and competencies for the running of a scientific agenda; 4) building personal skills that promote self-esteem and self-empowerment, and; 5) communicating the concepts, experiences and outputs of their research at local and national scales. Certain elements are key to the progresses made by students: 1) community and academic support contributed to a balanced reconciliation of Indigenous knowledge and scientific knowledge; 2) mentors’ day-to-day support of the trainees maintained motivation and engagement in the research; 3) an emphasis on field work (hands-on) approach enabled the trainees to learn in an experiential way, and; 4) community-based work allowed the trainees to work close to their family members and support networks. We have made substantial progresses in building capacity in northern communities by showing that Inuit youth have the capacity to drive a research agenda. This project can serve in providing insights to research and programs interested in developing new ways to do arctic research, build capacity, and to respect Inuit education and ‘informal’, ‘life-learning’ processes and Indigenous knowledge.

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

Spiers, Kent
University of Calgary (Cochrane, Canada)

The goal of this study is to critically evaluate Community Based Monitoring (CBM) programs in order to understand the features that best address the needs of communities within the context of scientific research concerning the nature of Arctic ecosystem change. CBM involves the systematic collection of quantifiable data such as, the measurement of sea ice thickness to assess stability for travel. It may also focus on the collection of largely qualitative Indigenous, local or traditional knowledge, (TK) or a combination of approaches. CBM programs promote community empowerment and capacity building through local participation in research that affects social and biological wellbeing within communities. Five research questions will address my goals: 1. Do existing CBMs
satisfy the desire for community empowerment through involvement in proposing, planning and undertaking research? 2. Are community members able to interpret and use CBM data and the results of analysis to meet local needs? 3. What other groups are using CBM data and for what purposes? 4. How effective is the management and distribution of CBM data? 5. What are the most effective methods for integrating Western science and TK? Are these effective for all potential data users or does there need to be “tailor-made” solutions for different stakeholders? My research will provide an assessment of CBM methods that work toward ensuring best practices for data gathering of high quality, which in turn will benefit Arctic social and biophysical integrity. Initially my research will compile a comprehensive catalogue of all CBM programs implemented in the Arctic. From there I will use a mixed methods research design to collect qualitative and quantitative data in order to assess program functionality. Participants will include CBM program developers and data users drawn from a wide range of stakeholder groups (academic, Indigenous and other Northern residents, private sector and agency representatives). Stakeholders within the region of the Inuit Circumpolar Council in Alaska, hamlet of Pond Inlet, Nunavut and on Fogo Island, Newfoundland have been consulted and have consented to be participants in the study. Through the development of an established research agreement with stakeholders we will generate a framework of best practices that can be employed to improve existing programs and those currently in development. Establishing measurable and agreed-upon indicators of success (CBM metrics) is necessary for program effectiveness. Appropriate indicators to evaluate success of CBM programs will be identified through engagement with stakeholder groups. Since a CBM program is meant to address multiple and often divergent needs for information, stakeholder engagement is critical. Programs that have been established for a minimum of three years will be the initial focus of this research and include both CBM programs that are directed toward the collection of TK data (largely qualitative) often from interviews, and those in which environmental data (largely quantitative) are collected often using some form of scientific instrumentation. By including a range of circumpolar sources my research offers the potential to explore multiple perspectives from which potential policies for best practices in Arctic research can be compiled.

HUDDSON BAY: CHANGING RIVER DISCHARGE IN NORTHERN CANADA

Stadnyk, Tricia (1), S. Dery (2), M. MacDonald (1) and B. Gauli-Sharma (2)

(1) University of Manitoba (Winnipeg, Canada); (2) University of Northern British Columbia (Prince George, Canada)

This presentation will summarize an analysis of the observed interannual variability and interdecadal trends in river discharge across northern Canada for 1964–2013. The 42 rivers chosen for this study span a combined gauged area of 5.26 × 106 km². These are selected based on data availability and quality, gauged area, and record length. Statistical analyses show that interannual variability in river discharge is greatest for the Eastern Arctic Ocean (coefficient of variation CV = 16%) due to the Caniapiscau River diversion into the La Grande Rivière system for enhanced hydropower production. Variability is lowest for the study area as a whole (CV = 7%). A trend analysis based on the Mann-Kendall Test (MKT) reveals no significant (p > 0.05) trend in annual discharge from 1964-2013 to the Bering Sea, Western Arctic Ocean, Western Hudson and James Bay, and Labrador Sea; for northern Canada as a whole, however, a statistically-significant (p < 0.05) decline of 102.8 km³ (25 year)-¹ in discharge occurs over the first half of the study period followed by a statistically-significant (p < 0.05) increase of 208.8 km³ (25 year)-¹ in the latter half period. Increasing (decreasing) trends in river discharge to Eastern Hudson and James Bay (Eastern Arctic Ocean) are largely explained by the Caniapiscau diversion to the La Grande Rivière system. Strong regional variations in seasonal trends of river discharge are observed, with overall winter (summer) flows increasing (decreasing, with the exception of the most recent decade) partly due to flow regulation and storage for enhanced hydropower production along Hudson and James Bay, the Eastern Arctic Ocean and Labrador Sea. Flow regulation also suppresses the natural variability of river discharge, particularly during cold seasons. The talk will end with a discussion of the implications of our finding and plans for future work.
SOURCES AND TRANSPORT OF SEDIMENT AND ORGANIC MATTER IN THE LOWER NELSON RIVER SYSTEM, MANITOBA

Stainton, Tassia (1), G. McCullough (2), D. Lobb (3), M. Goharrokhi (3), B. Brooks (3), E. Petticrew (4), P. Owens (4) and Z.Z. Kuzyk (3)

(1) University of Manitoba (Winnipeg, Canada);
(2) Centre for Earth Observation Science (CEOS), University of Manitoba, Winnipeg MB R3T 2N2 (Winnipeg, Canada);
(3) Soil Science and Centre for Earth Observation Science (CEOS), University of Manitoba, Winnipeg MB R3T 2N2 (Winnipeg, Canada);
(4) Department of Geography, University of Northern British Columbia, 3333 University Way, Prince George, BC V2N 4Z9 (Prince George, Canada)

Rivers are important transporters of sediment and terrestrial organic carbon from the continental land mass to the world’s coastal zones. The quantities of material transported and the nature of the materials undergoing transport are conditioned by fundamental controls (geomorphic and tectonic influences within drainage basins, geography (location and climate) and geology) but also by human activities. Deforestation, agriculture, mining, water diversion, and flooding tend to enhance soil erosion and thus increase sediment transport while at the same time channel bank hardening and development of hydroelectric reservoirs decrease sediment transport. These same activities can affect the storage and release of organic carbon, both the total quantities exported and the elemental, isotopic and molecular composition of the organic matter mobilized within drainage basins. The Nelson River is a major river of Canada and the single largest river discharging to Hudson Bay. The Lower Nelson River drainage basin lies to the southwest of Hudson Bay in a region that is dominated by boreal forest and peat bogs. The basin is warming rapidly and considered greatly at risk of rapid permafrost thaw. Alone, at present, the Nelson River contributes an estimated 40% of the total terrestrial organic carbon delivered to Hudson Bay. However, the river has an extensive history of hydrological alteration for hydroelectric power development. Thus, the transport of sediment and organic carbon by the Lower Nelson River has likely already undergone significant modification from pre-industrial times, partly through reservoir construction and diversions, and partly through warming/thawing, with possibly greater changes still to come. In this study, we are analyzing historical data and collecting samples from the Lower Nelson and Burntwood (Churchill Diversion) River systems and tributaries in order to gain insight into the main sources of sediment and organic carbon and the extent of transport of these materials downstream towards Hudson Bay. The first phase of field work was conducted in August 2016, when instream sediment samples, river bank and land surface soil samples were collected. Various properties of the sediment and organic carbon are being explored to characterize source materials and develop a means to trace their influence downstream. Ultimately, we will use tracer data, together with mixing models, to assess the contributions of major sources at various points within the system. In a second phase of field work, we will obtain sediment cores within which we can seek evidence of change.

The results of the study represent a contribution to the BaySys project, which, in collaboration with Manitoba Hydro, is investigating the relative impacts of hydroelectric activity and climate change on the freshwater-marine coupling in Hudson Bay.

INVESTIGATING THE VARIABILITY OF THE SMITH SOUND ICE ARCH ASSOCIATED WITH THE NORTH WATER POLYNYA

Stark, Heather and D. Barber

Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada)

The formation of the North Water Polynya in northern Baffin Bay (an area of open water surrounded by a sea-ice covered ocean) was examined to determine the spatial and temporal variability of the Smith Sound ice arch (a feature that prevents ice from drifting into the polynya). Using a passive microwave sea ice dataset from 1979-2015 to examine formation and breakup of the ice arch, multiple years were classified as atypical, with the polynya forming earlier, the ice arch not forming at Smith Sound, or the ice arch not forming at all. Secondly, we investigate the atmospheric forcing influencing the consolidation of the ice arch. Using NCEP re-analysis data and the Hans Island weather station we examine the factors that contributed to the typical NOW formation year of 2010-2011 and the atypical year of 2009-2010. Analysis of wind speed and direction identified a significant southerly wind event in 2009-2010 that could have displaced the ice pack and prevented the consolidation of the ice arch. We also present discussion on the ice pack of Nares Strait,
including the loss of multiyear sea ice and the frequency of icebergs and ice islands, and how this change could influence the consolidation of the ice arch.

**MODELING THE PHYSIOLOGICAL CONSTRAINTS OF KEY ARCTIC MARINE SPECIES: A BOTTOM UP, FIELD BASED APPROACH TO ECOSYSTEM MODELLING**

Steiner, Nadja (1) and Helen Drost (2)

(1) Fisheries and Oceans Canada (Sidney, Canada); (2) UBC (Vancouver, Canada)

This presentation will describe our fledgling study on the impacts of Climate Change on marine species in the Western Arctic. We will investigate if key species, such as ice algae, copepods (e.g. Calanus hyperboreus), Arctic cod and sub-Arctic migrating species (such as chum salmon (e.g. Oncorhynchus keta) are vulnerable to climate change stressors and, if they are vulnerable, how that may impact the Arctic food web. We know that Arctic sea ice ecosystems are being exposed to a rapidly changing environment due to climate warming. Both the quality and quantity of summer sea ice has significantly decreased. We will investigate the potential change in the abundance of phytoplankton that live within the bottom ice (ice algae) and in the upper ocean, which in turn can impact zooplankton and fish species composition and abundance. Such fundamental changes at the base of the food web can ultimately lead to changes in Arctic subsistence and commercial fisheries. Marine species have pH and temperature limits that, if exceeded, can influence migration and survival. This investigation will combine the foundational Arctic sea-ice ecosystem modelling by Steiner et al. (2016) and Mortenson et al. (2016) with marine species distribution and abundance modelling (Cheung et al. 2009, Suprenand et al., 2016). We will focus on specific regions within the Canadian Arctic and will be adding the physiological limits to multiple stressors (including ocean acidification and increasing water temperature) of selected Arctic and sub-Arctic marine species. The development of this modelling approach is an iterative process that will be applied over the course of two years. All model components are in the early stage of development and will be refined based on input from interested parties. This investigation will contribute to the knowledge base for management decisions by: • Identifying current and potential impacts and vulnerable areas/species (including gaps in knowledge on resilience and adaptive capacity of species and ecosystems) • Establishing baseline conditions in the Arctic Ocean: with particular focus on the Kitikmeot region • Identifying potential changes in those conditions as they influence primary production and patterns of distribution and abundance of plankton, fish, invertebrates and marine mammals • The proposed research also contributes to Science support for implementation of the ecosystem approach to fisheries and can thus explore the potential effects of oceanographic conditions and ecosystem process on the spatial dynamics and movements of straddling and highly migratory stocks • Assessing socio-economic impact via economic models and current fishery-economic activities. Field research and long term monitoring is cost prohibitive. Our modelling experiments will highlight key gaps in data and provide a “priority list” of Arctic and migratory marine species that warrant immediate study. This list was developed in consultation with the Inuvialuit Game Council and we plan to meet with Nunavut government representatives and other interested parties to ensure that key marine species are included in the analysis.

**IN VITRO METABOLISM, STRUCTURE-ACTIVITY RELATIONSHIPS (SARS), FATE AND BIOACCUMULATION OF ORGANOPHOSPHATE ESTERS (OPES) IN POLAR BEARS (URSUS MARITIMUS) AND THEIR RINGED SEAL (PUSA HISPIDA) PREY**

Strobel, Adelle (1), R.J. Letcher (2), C. Sonne (3) and R. Dietz (3)

(1) Carleton University (Ottawa, Canada); (2) 2. Ecotoxicology and Wildlife Health Division, Environment and Climate Change Canada, National Wildlife Research Centre, Carleton University, Ottawa, ON, K1A 0H3 AND Carleton University, Ottawa, ON, K1S 5B6 (Ontario, Canada); (3) Department of Bioscience, Arctic Research Centre, Aarhus University, Roskilde, Denmark (Roskilde, Denmark)

The Arctic is subject to environmental contamination as a sink for anthropogenic chemicals and substances, where many are classified as persistent organic pollutants (POPs). POPs enter the Arctic ecosystem via long-range oceanic and atmospheric transport and may subsequently persist in the environment depending on their physical-chemical properties. Thus, Arctic wildlife and other biota are
exposed to both legacy and novel contaminants; however, comparatively there is lesser information on the toxicology and fate (e.g. metabolism and biotransformation) of POPs. Production of some brominated flame retardants (BFRs), e.g. PBDEs and hexabromocyclododecane, have been restricted due to their environmental persistence and bioaccumulation. Organophosphate esters (OPEs) are alternative FRs to restricted BFRs such as PBDEs. Several OPEs have recently been detected in Arctic biota, including in the fat of Hudson’s Bay polar bears. The present study will provide much needed data on the toxicokinetics of a subset of OPEs in polar bears and ringed seals collected from the East Greenland area of Scoresby Sound. Previously, OPE degradation and metabolite formation have been demonstrated in in vitro (liver microsomal) metabolism studies using the herring gull as a Great Lakes wildlife model, and using ultra-high performance liquid chromatography triple quadrupole mass spectrometry (UPLC-MS/MS) for OP triester and OP diester metabolite quantification. For further study, OPEs of environmental relevance have been identified under the mandates of the Environment and Climate Change Canada’s, Chemical Management Plan. Preliminary in vitro metabolism data from this study strongly suggests that the OP triester metabolic rates are rapid in East Greenland polar bears and comparable to rates that where recently reported in Great Lakes herring gulls. This work is being conducted to determine the role of molecular structure on the comparative rate of metabolism of OP triesters in polar bears and their ringed seal prey. Comparisons between polar bears and ringed seals will allow for estimates of trophic transfer and biomagnification between polar bears (the apex predator of the Arctic food web) and their primary dietary item (blubber of ringed seals). This research will provide toxicokinetic data on priority OPEs in Arctic marine predators. This information can then be applied to current regulatory decision-making through risk assessments and food web modeling.

**ARCTIC CHARR (SALVELINUS ALPINUS) GENETIC POPULATION STRUCTURE: A FUTURE WITH SUSTAINABLE FISHERIES IN POND INLET**

Sudlovenick, Enooyaq (1), M. Ferguson (1) and Z. Martin (2)

(1) University of Guelph (Iqaluit, Canada); (2) Department of Fisheries and Oceans (Iqaluit, Canada)

**BACKGROUND:** Pond Inlet is a community on the northeast coast of Baffin Island with a population of about 1500. With high food prices, people from the community rely heavily on traditional hunting practices including fishing, for food. Near Pond Inlet, there are a number of lakes with rivers that empty into Eclipse Sound and all of these are assumed to contribute Arctic charr to a mixed fishery that takes place in summer and fall in the open ocean. With a commercial fishery being proposed in Eclipse Sound, it now important to know the freshwater origin of fish captured in the ocean and if there is interbreeding between fish from different natal lakes. This would occur if fish returned to different natal areas for breeding after ocean residency. **GOALS:** Collect 50 individual samples from each of the 7 lakes that are connected to Eclipse Sound to determine if there is significant genetic differentiation among fish from the lakes. If the fish in each lake have different frequencies of alleles at microsatellite loci, we can determine the contribution of each population to the mixed fishery. The lack of significant population differentiation among lakes would indicate that the populations can be managed as a single stock and reduce the possibility of overfishing a specific population subcomponent. **METHODS:** A community-based approach was used throughout the entire process, including community consultations, community-based advertising, and collaboration with the local Hunter’s and Trappers Organization (HTO), the Nunavut Wildlife Management Board (NWMB), and Department of Fisheries and Oceans. All samples were collected by local fishermen and hunters who were already fishing for sustenance. All samples were paid for at a pre-determined price. All samples will be sent to the University of Guelph to be genotyped at 10 microsatellite loci and results will be relayed to the community of Pond Inlet. **PROGRESS:** To date, local fishermen have collected 160 samples over two winters. The pre-study community consultation has been conducted and received positively by the community as well as welcomed with support from the HTO. The NWMB funded study has potential to provide the community with the skills and knowledge required to establish a permanent community-based Arctic charr monitoring program.
CRCM5 DYNAMICAL DOWNSCALING OVER THE CORDEX ARCTIC DOMAIN WITH EMPIRICAL CORRECTION OF CGCM-SIMULATED SEA-SURFACE CONDITIONS

Takhsha, Maryam, O. Nikiéma, P. Lucas-Picher, R. Laprise, L. Hernández-Díaz and K. Winger
UQAM (Montreal, Canada)

As part of the CORDEX project, the fifth-generation Canadian Regional Climate Model (CRCM5) is used to simulate the Arctic climate for the historical period driven by reanalyses and for the RCP8.5 scenario driven by the MPI-ESM-LR CGCM output. In our study, we have investigated the effect of large-scale spectral nudging (SN) on the regional climate simulations. Analysis shows that SN has little impact on Arctic region’s simulations of CRCM5.

We have also conducted another experiment in which the CGCM-simulated sea-surface temperatures (SST) are empirically corrected and used as ocean boundary conditions for an Atmosphere-only GCM simulation (AGCM), which in turn provides the atmospheric lateral boundary conditions to drive the RCM simulation. This is what we call the 3-step approach of dynamical downscaling (CGCM-AGCM-RCM). This approach has shown to considerably improve the historical simulations in Africa and it is now being assessed over the Arctic. Future projection using this method will be compared with the results obtained with the traditional 2-step dynamical downscaling to assess the impact of correcting systematic biases of SST upon future-climate projections.

WHAT HAPPENS WITH PERMAFROST ORGANIC MATTER BETWEEN THAW AND TRANSPORT INTO THE OCEAN? – A CASE STUDY FROM THE YUKON COAST IN THE WESTERN CANADIAN ARCTIC

Tanski, George (1), S. Rutter (1), H. Lantuit (1), C. Knoblauch (2), B. Radosavljevic (1), J. Ramage (1), J. Strauss (1) and M. Fritz (1)

(1) Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI) (Potsdam, Germany);
(2) University of Hamburg, Institute of Soil Science (Hamburg, Germany)

The Arctic is more than any other region on Earth affected by climate change. Increasing air and water temperatures as well as longer open water seasons and wave action will in particular affect ice-rich permafrost coasts that will thaw and erode at a greater pace. Consequently, organic matter (OM) that is stored in permafrost will be mobilized and potentially released as greenhouse gases to the atmosphere and transported into the nearshore zone of the ocean, where it can affect marine chemistry and ecosystems. However, little is known about the degradation mechanisms of OM, before finally entering the ocean. Along the coasts of the western Canadian Arctic, retrogressive thaw slumps (RTS), i.e., disturbed landforms caused by thawing permafrost and melting of massive ice underlying the surface, are ubiquitous and act as zones, where permafrost OM is transformed upon thaw and transported together with organic material from the tundra into the ocean. In this study we investigated the degradation processes of OM within a RTS system. A representative RTS called “Slump-D” on Herschel Island (Yukon Territory, Canada) was divided in an undisturbed, disturbed and nearshore zone, and sampled systematically along transects. All samples have been analyzed for total and dissolved organic carbon and nitrogen (TOC, DOC, TN, DN) and compared between the three zones. Degradation processes were inferred from C/N-ratios (TOC/TN and DOC/DN), δ13C concentrations (δ13C-TOC and δ13C-DOC), ammonium (NH4), nitrite (NO2) and nitrate (NO3), as well as biomarkers (n-alkanes, n-fatty acids and n-alcohols). Our results show that organic carbon decreases substantially in the disturbed zone. C/N-ratios and δ13C concentrations generally do not reflect degradation processes and possibly indicate the dilution with melted massive ice. However, high ammonium concentrations in mudpools, i.e., just thawed material and tundra detachments, and low DOC/DN-ratios in thaw streams draining the RTS reflect substantial OM metabolization processes right upon thaw in the disturbed zone. Thaw streams also transport OM quickly and with only little time for processing OM into the nearshore zone. A substantial amount of mobilized material is directly buried in the nearshore zone, indicated by C/N-ratios in marine sediment samples reflecting a terrestrial origin. We show that before entering the nearshore zone of the ocean, OM mobilized upon thermokarst formation is subject to degradation and dilution processes, thus both processes are challenging to entangle. We conclude that permafrost coasts and RTS represent hotspots for degradation at the land-ocean-interface and influence the biochemical composition of OM substantially before entering
marine systems, where it can have profound effects on ecosystems and chemistry.

**CHALLENGES IN MAPPING TRADITIONAL INUIT KNOWLEDGE**

Taylor, D. R. Fraser

Department of Geography, Carleton University (Ottawa, Canada)

This paper will discuss some of the challenges of mapping traditional Inuit knowledge. It is based on many years of collaboration with Inuit communities and organizations which have resulted in the creation of a number of cybercartographic atlases the contents of which are community driven. The paper will consider the following interrelated points: • The dynamic nature of traditional knowledge • The importance of storytelling in an oral society • Legal and ethical issues of intellectual property, data ownership and control. The need for new licensing schemas for Inuit knowledge • Different aspects of metadata. Inuit elders as “living metadata” • Mapping as a form of data preservation • The choice of mapping techniques to effectively present Inuit traditional knowledge. Cybercartography and the Nunaliit data management framework • Some examples e.g. the Atlas of Arctic Bay

**BENEATH THE SURFACE: INUIT MINERS AT RANKIN INLET, 1957-1962**

Tester, Frank (1), Arn Keeling (2)

(1) University of British Columbia (Vancouver, Canada);
(2) Executive Producer (St. John’s Nfld, Canada)

Between 1957 and 1962, Inuit miners worked underground at what is now Rankin Inlet, Nunavut Territory in the first mine to operate in the Canadian eastern Arctic. From living in tents and igloos, trapping foxes and hunting caribou, Inuit made the transition from the oldest form of social, cultural and economic organization on the planet - a hunting/gathering culture, to a industrial one in a matter of weeks. This has to be one of the most dramatic change experiences for any Aboriginal population in recorded history. This film uses archival footage and extensive interviews with Inuit - men and women - who came to live and work in what was a company town in the late 1950s, early 1960s. The film examines their experience using their own words and information gleaned from archival records dealing with events unfolding primarily in the Kivalliq region at the time. The film deals with the aftermath - what happened to Inuit miners and their families when the mine suddenly closed in October of 1962. The experience of women living in the 512 wood-frame houses and segregated ‘Eskimo village’ receives some attention from the wife of a former miner. Inuit who were present in the community after the mine closed were interviewed by an Inuk reporter in 1970. Their observations on the impact of the mine on social conditions, wildlife and the political development of Inuit are part of the examination of this history. The film ends with a brief summary of the current status of mining in the territory and its significance for the Inuit population of Nunavut. Much of the film is in Inuktitut with English subtitles. (55:20 minutes)

**THE ROLE OF POLICY IN ARCTIC FOOD (IN) SECURITY: AN EXPLORATORY CASE STUDY OF NUNAVIK**

Thackeray, Lindsay (1,3) and C. Furgal (1,2,3)

(1) Sustainability Studies Program, Trent University, Peterborough, ON
(2) Indigenous Environmental Studies and Sciences Program, Trent University, Peterborough, ON
(3) Health, Environment and Indigenous Communities Research Group, Trent University, Peterborough, ON

The concept of policy is diverse and multi-layered. Food and food-related policies can be extremely diverse in nature, and can be represented in a variety of ways. Food is a complex and integrated phenomenon, transecting many sectors of society including health, environment, and economy. It is often argued that the ‘Western’ political administrative framework is inherently incompatible with governing complex and cross-cutting issues in society, such as food. As a result, policy gaps and deficiencies in these fields may contribute to a variety of problems, most notably conflicting efforts or a lack of attention and adequate support for a particular issue. In the case of food, this can mean potentially heightened levels of food insecurity among a population. This project explores the relationship between policy and the status of food insecurity in the Arctic through an examination of the case of Nunavik, Québec. Nunavik, like other
Inuit regions is one where food insecurity is very prevalent. Many of Canada’s northern and remote Indigenous communities tend to have much higher rates of food insecurity than the Canadian population as whole. Communities in Nunavik also utilize a mixed food system comprised of both store-bought or ‘market’ foods and harvested, gathered, shared and otherwise accessed ‘country’ foods, adding a further dimension to the already complex policy aspects of this issue. This project is being conducted through a document review and a series of semi-structured interviews. First, documents describing the regional policy landscape in Nunavik were identified, gathered and reviewed to better understand the current policy context of food in the region and to identify any policy challenges. A series of semi-directed interviews are then to take place exploring the potential association between identified policy challenges and the levels of food insecurity in the region. Interviews participants will be recruited from within the Food Security Working Group of Nunavik, a multi-stakeholder interdepartmental working group recently established. Patterns in data regarding key barriers and facilitators to interdepartmental and organizational cooperation on food policy and perspectives on the association between food and food-related policy and regional food insecurity are being examined. This research is contributing to the discussion surrounding the need for a more centralized and integrated food policy in Nunavik and Canada linking relevant policy domains. It is using the issue of food insecurity to explore the consequences of policy challenges in the existing policy landscape. While connections have been drawn between policy challenges and food insecurity in Canada, the topic has not been explored in detail in an Arctic context to date. It is expected that this research will ultimately help in identifying policy strategies through which to help address the high levels of household food insecurity among Canada’s northern and remote Indigenous communities in the future.

SPATIAL AND TEMPORAL VARIABILITY OF SEA SURFACE SALINITY FROM REMOTE SENSING IN HUDSON BAY.

Thériault, Nathalie, J. Ehn, J. Landy, L. Candlish, D. Babb and D. Barber
University of Manitoba, CEOS (Winnipeg, Canada)

Sea surface salinity (SSS) measurements were compared in summer months over the Hudson Bay complex (HBC) from both satellites “Soil Moisture and Ocean Salinity” (SMOS from the European Space Agency’s, ESA) and Aquarius/SAC-D (from the National Aeronautical Space Agency’s, NASA). Salinity plays an important role in Hudson Bay by shaping the ocean current and by controlling the density and the stratification of the water column. Each year, the salinity of Hudson Bay is affected by the considerable freshwater inputs to the surface layer from both rivers and sea ice melt. Sea ice concentration in Hudson Bay varies from a complete coverage during winter months to completely ice free during summer. In summer, the high input of freshwater from both sources leads to a stronger stratification and a thinner surface layer. Past observations in Hudson Bay are limited to ship cruises and moorings, with restricted temporal and spatial coverage. This can be improved with two recent satellite missions: SMOS products created by the Barcelona Expert Center (weekly at a resolution of 25 km from 2011-2013) and Aquarius data (weekly at a resolution of 1 deg from 2011-2014). However, the remote sensing measurements must first be validated against in situ data in cold water areas. The Argo float is a worldwide array of free drifting profiling floats that give information on the salinity and temperature of the water column. Unfortunately there are no floats in Hudson Bay, but there are some in the surrounding areas of the Complex. This presentation will show the spatial and temporal variability of the SSS observed by the 2 satellites over the HBC, with comparison between satellites and Argo floats where available. This study is part of a collaborative project, named BAYSYS, which aims to investigate the effect of hydroelectric regulation of freshwater runoff to the Hudson Bay system. Results from this study showed that the spatially averaged SSS over the Bay is 30 psu, with the highest temporal variability in central Hudson Bay, varying up to 1.8 psu from year to year. A spatial asymmetry was observed, with south-central Hudson Bay being 4 psu lower than the North-West area.

INUIT QAUJIMAQTUANGIT OF ARCTIC CHAR NEAR IQALUKTUUQ (EKALLUK) RIVER: INNOVATION AND THE UNEXPECTED WHEN BRINGING TOGETHER ELDERS, FISHERS, YOUTH, BIOLOGISTS AND SEA-RUN ARCTIC CHAR

Thorpe, Natasha (1), M. Avalak (2), T. Ogina (2), J.-S. Moore (3) and P. Saravanja (4)
In the Kitikmeot region, Arctic char populations have long determined Inuit survival, subsistence, and identity as well as, more recently, provided for the largest commercial Arctic char fishery in Canada. While extensive Inuit Qaujimajatuqangit (IQ) related to Arctic char exists for this area, there have been few efforts to document these understandings and interweave them with local fisheries management or to collaborate with ongoing local scientific fisheries research. Since 2013, the Oceans Tracking Network (OTN) and Department of Fisheries and Oceans (DFO) have been carrying out a study targeting sea-run Arctic char, exploring questions related to straying of individual fish, mixing of stocks, habitat use, and timing of migration events in the Cambridge Bay area. As this scientific study advanced and collaborative relationships developed between some of the commercial fishers and members of the Ekaluktutiak (Iqauktuuttiaq) Hunters and Trappers Organization (EHTO), the EHTO voiced an interest in carrying out their own study to document IQ of Arctic char. Through a partnership with Trailmark Systems, the EHTO in 2015 began to document IQ of Arctic char to contribute important insights through a research project aimed at supporting Elder-youth initiatives and fostering capacity-building in IQ research and video-documentary making. Building on the work of the OTN and DFO study, the EHTO based their efforts on semi-directed interviews and IQ database development during the spring of 2016; an Elder-youth camp held at Iqaluktuuq River in August 2016; and production of several video-documentaries throughout the fall. In 2017, the EHTO hopes to expand their efforts to include tracking of fisheries activities through the use of rugged handheld devices. Northern scientists and community members alike can struggle to partake in a meaningful, productive and respectful dialogue of resource management; however, fisheries research can provide a hands-on setting where sharing, learning, and relationship-building can occur between Elders, youth and fisheries biologists. This presentation by Elder Mary Avalak, IQ researcher and video-documentary producer Trisha Ogina; and Natasha Thorpe of Trailmark Systems will discuss the successes and challenges in carrying out integrated IQ research both in the community and on-the-land. Unexpected events in the field and surprising research outcomes will be highlighted in the context of this participatory and adaptive community-driven initiative.

A TEMPERATE INTERTIDAL KEY SPECIES IN THE ARCTIC – HOW A NON-ARCTIC SPECIES SURVIVE AND PERFORM IN A CHANGING ARCTIC

Thyrring, Jakob (1), M. Blicher (2), R. Tremblay (3) and M. Sejr (1)

(1) Arctic Research Centre, Aarhus University (Aarhus, Denmark);
(2) Greenland Climate Research Centre, Greenland Institute of Natural Resources, Greenland (Nuuk, Greenland, Denmark);
(3) Institut des sciences de la mer, Université du Québec à Rimouski (Rimouski, Canada)

The Arctic is experiencing accelerated warming. Increasing temperature is known to affect species distribution and abundance but knowledge about the impacts on Arctic marine biogeography remains limited. Blue mussels (genus Mytilus) constitute a key ecological role in the littoral zone, and they are expected to be sensitive to climate changes. To study this, we used a time-for-space approach along a latitudinal climate gradient from the subarctic to High Arctic in West Greenland. We studied abundance, growth patterns and age structure at 73 sites located at five locations ranging from 64 to 77°N, as well as the variation in cold tolerance between seasons and latitudes. Abundance declined >95% with increasing latitude from an average of 23.67 to 0.71 individuals 0.0625 m-2 from Nuuk to Upernavik at the mid-intertidal level. Sub-zero air temperatures and exposure time was of central importance for the distribution in Greenland forcing mussels to find refuge in microhabitats, such as crevices and macroalgae in the lower part of the intertidal. Adult blue mussels were able to significantly adjust their cold tolerance by up to 1°C on both seasonal and latitudinal scales. Despite a latitudinal decline in the observed maximum individual age, the estimated annual mortality rates of adults showed little variation between localities. However, the abundance 1-year-old recruits significantly declined with latitude, indicating that the observed geographical patterns in abundance are controlled at the earliest life-stages. Thus, blue mussels abundance and age structure can be regarded as a sensitive first indicator for climate impacts in the Arctic.
as physiological plasticity did not confound patterns. In conclusion, if air temperatures continue to increase, blue mussels may increase their abundance and vertical distribution in the intertidal Greenland. Because blue mussels are key species future changes in distribution may have wide-ranging effects on the intertidal community in Greenland.

CHALLENGES OF IMPLEMENTING A SURFACE CONTACTING MICROWAVE SENSOR IN THE ARCTIC

Tiede, Tyler, P. Mojabi and D. Barber
University of Manitoba (Winnipeg, Canada)

Active microwave non-destructive measurements provide an effective means to monitor and characterize different properties of first year ice and young ice. However, the harsh conditions in the Arctic pose practical problems with implementation. The focus of this paper is on the challenges that we have faced during the design and testing of a surface contacting microwave sensor built in-house. The purpose of this device is to collect reflected power measurements at multiple frequencies that are used to reconstruct the time-series dielectric properties of snow-covered sea ice [Tiede et al., IEEE APS/URSI, 2016]. The active sensor developed was a dielectric filled open-ended waveguide that sits flush against the snow-covered sea ice surface. Most antennas are designed and optimized to radiate into free space, and in the far-field zone. When in the presence of snow and ice, modifications and optimization to standard designs must be performed in order to couple the antenna with this new media; ideally, the near-field zone of the antenna needs to be considered since interrogation occurs mostly in this zone. The sensor was designed to operate at frequencies between 2 and 5 GHz. This frequency range was originally speculated to provide sufficient penetration depth and resolution. At the simulation stage of this antenna, the snow and ice layers were modelled as isotropic lossy dielectrics, which can be considered as a modelling error. After fabrication, the antenna’s radiation pattern was measured utilizing our compact antenna test and spherical near field ranges. Although these free space measurements demonstrated that the sensor was accurately built, they do not give a true representation of the antenna performance when illuminating into snow and ice layers. Next, time series data were collected using artificially grown sea ice at the University of Manitoba’s Sea Ice Environmental Research Facility. A vector network analyzer (VNA) was used to collect the measurements from the sensor connected via a coaxial cable. However, this equipment is intended to operate at room temperature and also must remain undisturbed once calibrated. The VNA was placed inside a custom made insulated box in order to operate at the appropriate temperature. An air-filled coaxial cable was used in order to operate at the necessary temperatures. Calibration of the VNA posed challenging due to the calibration kit’s operating temperature being between 20-24°C. These components could not be shielded from below freezing temperatures. The decision was made to calibrate the system inside and then move the setup to the measurement site. Only the magnitude of the power measurements was deemed useful due to the phase being highly affected by the movement after calibration. Additionally, we observed a thin saline water layer formed between the antenna and ice which significantly reduced the originally predicted penetration depth. We believe the high thermal conductivity of the antenna’s brass and copper acted as a heat sink which caused melting of the surrounding ice. The overall performance of the antenna and recommendations for future design and measurement procedures will be presented.

"WE’VE SPENT MORE MONEY ON SCIENCE THAN ANY PROJECT IN THE HISTORY OF THE WORLD": HARD ROCK MINING AND RESOURCE MATERIALITY IN BRISTOL BAY, AK

Tollefson, Jonathan and B. Panikkar
University of Vermont (Burlington, United States)

This research explores the social, historical, ethical, and political constitution of resource materialities in Bristol Bay, Alaska, surrounding the permitting process of the Pebble Mine starting in the early 2000s. To speak of land, politics, environment, and development in contemporary Alaska is to open a black box of institutional, legal, social, and historical complexity, characterized by disputes over legal authority, rights of nature, risk and benefit, preservation of local economies, sustainable development, and environmental justice. The first section of this research examines ideologies of land as a site of ownership and profit as they were historically constructed in relation to mineral resource development in the region, moving from Alaska’s purchase in the late 1800s, to statehood
in 1959, to the passage of the Alaska Native Claims Settlement Act (ANCSA), the National Environmental Policy Act (NEPA), and the Alaska National Interest Lands Conservation Act (ANILCA) over the following decades. Part two narrows its focus to the Pebble Mine permitting process to examine contemporary conflicts and commonalities between mineral wealth and salmon as representative resources of the Bristol Bay region, with a focus on the State of Alaska’s 2005 Bristol Bay Area Plan revision. Part three addresses subsistence land imaginaries as they emerged in the Pebble permitting debates and through the 2013 Citizens’ Alternative Bristol Bay Area Plan, as well as the importance of subsistence as a counter-discourse to state-centered land-as-profit frameworks.

EXPLORING THE IMPORTANCE OF MUSKOXEN: PERSPECTIVES FROM IKALUKTUIAK, VICTORIA ISLAND, NUNAVUT

Tomaselli, Matilde (1), C. Gerlach (2), S. Kutz (3), S. Checkley (1) and the community of Ikaluktutiak (4)

(1) Department of Ecosystem and Public Health, Faculty of Veterinary Medicine, University of Calgary (Calgary, Canada);
(2) Department of Anthropology and Archeology, Faculty of Arts, University of Calgary. (Calgary, Canada);
(3) Department of Ecosystem and Public Health, Faculty of Veterinary Medicine, University of Calgary;
(4) Ikaluktutiak (Cambridge Bay), Canada

Understanding the human-wildlife relationship, including how humans value wildlife, is critical to consider when implementing wildlife oriented activities, being these management, conservation and/or monitoring. As part of a study focused on the development of a participatory muskox health surveillance system in the Arctic community of Ikaluktutiak (Cambridge Bay) on Victoria Island, Nunavut, Canada, we explored community perspectives on the importance of muskoxen. This study was also focused on understanding the impact at the individual and community level of local decline of muskoxen in the Ikaluktutiak area. We interviewed individually 30 community members, using semi-structured interviews. We recruited participants through the purposeful sampling and snowball techniques, and we defined the sample size by the thematic saturation approach. The interviews were recorded and information transcribed to allow thorough thematic content analysis. Once information was interpreted, we validated the findings by presenting back the results to participants in feedback sessions, in which 26 of the 30 interviewees participated. Participants identified 4 major themes to describe muskox importance both at the individual and community level, and defined it as nutritional, socio-cultural, economic and environmental importance. Additional sub-themes emerged when exploring each domain, providing a richer description of participants’ values and attitudes toward muskoxen. Local decline of muskoxen was perceived by participants to have significant and multiple impacts on the local economy, food security, as well as socio-cultural dimensions. This work provides valuable insights about the Ikaluktutiak community point of view. It also further justifies the importance of implementing a surveillance system to monitor muskox population health and trends for sound management and conservation actions. Finally, it provides information on participatory bottom-up methods and approaches useful to foster dialogue with community members and resource users in a co-management fashion.

ENHANCING WILDLIFE RESEARCH AND CO-MANAGEMENT IN THE KITIKMEOT REGION: A PARTICIPATORY STUDY ON VICTORIA ISLAND MUSKOXEN

Tomaselli, Matilde (1), C. Gerlach (2), S. Kutz (3), S. Checkley (1) and the community of Ikaluktutiak (4)

(1) Department of Ecosystem and Public Health, Faculty of Veterinary Medicine, University of Calgary (Calgary, Canada);
(2) Department of Anthropology and Archeology, Faculty of Arts, University of Calgary. (Calgary, Canada);
(3) Department of Ecosystem and Public Health, Faculty of Veterinary Medicine, University of Calgary;
(4) Ikaluktutiak (Cambridge Bay), Canada

In a rapidly changing Arctic, monitoring wildlife population health, including status and trends, is a
critical for wildlife management. However, in such a vast and remote environment, undertaking long term and regular wildlife monitoring activities is a difficult endeavor. This often results in the inability to detect changes in the status of wildlife populations in the early stages, and consequently being incapable of acting promptly with suitable management actions. However, people who live year round in the Arctic and make extensive use of local resources have a vast and holistic knowledge about the natural environment and its wildlife. They can, therefore, significantly contribute to understand wildlife population health status and early detect its changes. The question then becomes ‘how can we robustly gather this knowledge so that it can be useful for management decisions?’ Community based participatory methods can offer a solution. As part of a broader study focused on the development of a participatory muskox health surveillance system in the community of Ikaluktutiak, on Victoria island, Nunavut (Canada), we gathered Inuit and local knowledge to understand trends and status of local muskoxen. We implemented this research in three phases, which aimed at collecting qualitative and quantitative data on the local muskox population. Semi-structured individual interviews (phase 1), followed by group interviews (phase 2), were implemented with a total of 38 participants. To increase data accuracy and reliability, we implemented purposeful sampling, thematic saturation, and triangulation techniques. Finally, we presented the results back to participants to validate data analysis and interpretation (phase 3; n=31). Novel epidemiological observations on muskoxen were elucidated through the interviews. These included information on historic and contemporary population trends, morbidity and mortality data, relative prevalence of endemic and emergent diseases, and spatiotemporal patterns of mortality outbreaks. In addition, this work provides a methodological framework for the collection of data on wildlife populations relevant for management and conservation decisions. The flexibility and ease of implementation render these methods portable to other settings and species. We envision that such a study, if applied in a community network fashion, could largely help in understanding the status of wildlife populations across their range and inform future research priorities. Finally, and equally importantly, these methods largely promote the inclusion of Indigenous people in the research process, contributing to its democratization and facilitating the co-management process.

**DISTRIBUTED SNOW SIMULATIONS FOR QUANTIFICATION OF SNOW ACCUMULATION ACROSS AN ARCTIC SHRUB-TUNDRA LANDSCAPE**

Toure, Ally (1), P. Marsh (1), G. Liston (2), C. Dersksen (3), P. Mann (1), B. Walker (1) and E. Wilcox (1)

(1) Wilfrid Laurier University (Waterloo, Canada); (2) Cooperative Institute for Research in the Atmosphere (Fort Collins, United States); (3) Environment Canada (Waterloo, Canada)

Arctic regions have been warming at a rate at least two times faster than the global average, resulting in a profound transformation of the landscape and regional ecosystems. In particular, climate change affects the seasonal cycle of water availability and phase, which in turn affects the plants, wildlife, and human populations. The Arctic snow duration has shortened by 3 to 5 days / decade and this trend is predicted to continue. Understanding the impacts of changing snow cover is required in understanding many aspects of the terrestrial arctic ecosystem as well as the streamflow, the permafrost, the lake levels and the vegetation. Arctic warming has led to an increase in shrubs and the greening in turn is likely to affect future snow cover distribution. Across the Arctic, interactions between wind, vegetation, topography and snowfall produce an uneven spatial distribution of snow over distances of tens of centimeters to hundreds of meters known as snowdrifts. These large patches of snow can produce a proglacial-like runoff pattern due to delay in snowmelt in the spring. Therefore, knowing the location and magnitude of drifts is key for understanding runoff in these regions. In this study, we used a high-resolution snow model (~1 m) with snow transportation capabilities to locate and estimate snow depth and snow water equivalent (SWE) as a function of topography, vegetation and land use. Snow accumulation and melt across natural terrain heterogeneity, patches of tundra, shrubs, and forest environments are evaluated against ground-based and Light Detection and Ranging (LiDAR) observations acquired during the snow season of 2012/2013.

**HIGHER BLUBBER CORTISOL IN THREATENED BELUGA WHALES OF THE CANADIAN ARCTIC**

Trana, Marci (1), J. Roth (2), G. Tomy (3), G. Anderson (2) and S. Ferguson (4)
Changes in Arctic sea ice associated with increasing temperatures will likely affect ice-associated species such as odontocetes (e.g. Beluga whale [Delphinapterus leucas]). These species are often observed near sea ice, and forage in close association with sea ice. Beluga whales migrate each fall/winter with the ice edge, using the ice for refuge from predators and consuming prey species that depend on ice for survival (capelin and cod). If sea ice continues to decline, beluga whale populations may experience changes in prey availability and increased predator access. Cortisol, a hormone related to stress, reflects changes in the physiology of an organism. If stress hormone levels rise extensively, an organism’s vital functions may degrade, leading to eventual death. Increased stress hormones measured from several individuals within a population could indicate potential population-level declines, providing managers an opportunity to mitigate effects before population losses. While a few studies have measured stress levels of free ranging individual whales in response to disturbance, no population-level study has examined long-term temporal changes in chronic stress at a broad spatial scale in the Arctic, where climate change is exaggerated. We measured blubber cortisol, a metabolically proximal tissue that is less likely to reflect capture stress, in archived samples collected from 1981 through 2010 from four beluga whale populations in the Canadian Arctic that differ in conservation status (i.e. healthy, special concern or threatened) and other population characteristics (migration distance, historical commercial harvest rate and predation pressure). Higher cortisol concentrations occurred in the population under highest concern (0.61 ± 0.07 ng/g) compared to three populations with lower conservation risk status (0.32 ± 0.08, 0.36 ± 0.27, 0.44 ± 0.04 ng/g). Blubber cortisol concentrations were unaffected by sex or age, but the relative importance of year sampled in our model selection suggests changes over time may be occurring in some populations. The increased cortisol concentration of the threatened population supports blubber cortisol as an indicator of population status. We suggest cortisol measurements from blubber be added to methods for the assessment of population health, particularly when samples can be collected via biopsy dart.

HIGH-RESOLUTION SWATH BATHYMETRY AND ACOUSTIC STRATIGRAPHY OF GRAND LAKE (LABRADOR)

Trottier, Annie-Pier and P. Lajeunesse

Université Laval (Québec, Canada)

High resolution multibeam bathymetric data and acoustic subbottom profiles were collected during the summer of 2016 in Grand Lake (Labrador) in order to reconstruct the history of sedimentation since deglaciation in this lake basin that is one of the deepest in eastern North America. The newly acquired dataset in this 54 km long and 3 km wide fjord-like lake reveals a complex geomorphology characterized by 1) steep sidewalls incised by a dense dendritic network of gullies; 2) a deep (240 m) flat bottom floor made of closely-spaced high amplitudes reflections and affected by a large-scale mass-movement; 3) erosion terraces that indicate an ancient lower lake level; and 4) a large delta at the mouth of Naskaupi River showing series of crescent shaped bedforms (CSB) on its frontal slope and prodelta, that suggest the occurrence of sediment density-flows. The geomorphology observed on the high-resolution swath bathymetry suggest that modern sedimentary processes in Grand Lake are mainly related to slope dynamics, which were probably initiated during a past lower lake level. In opposition to observations in many other fjord, no moraine or sill are observed in Grand Lake, suggesting a rapid ice retreat without any ice margin stabilization in the former fjord, except at its southern end. The lake geomorphology was therefore poorly influenced by the last ice retreat, but rather by postglacial deep water sedimentary processes.

TOTAL RESOURCE UTILIZATION HABITATS FOR NORTHERN COMMUNITIES

Tsantrizos, Peter (1) and N. Curry (2)

(1) Terragon Environmental Technologies, Inc. (Montreal, Canada);
(2) Terragon Environmental Technologies (Montreal, Canada)
In many Northern communities, the cost of water and other utilities is high, and the uncontrolled discharge and disposal of waste has the potential to endanger the surrounding environment. Sustainable waste management practices present a challenge as many communities are isolated and located in harsh environments. A novel waste management strategy that places community sustainability, well-being, and autonomy at the forefront is required. Terragon has developed a concept called the Total Resource Utilization (TRU) Habitat which employs the use of its innovative Micro Auto Gasification System (MAGSTM) and Wastewater Electrochemical Treatment Technologies (WETTTM) to convert a community’s solid waste streams, used oils, and wastewater streams into “community resources” – clean heating energy, clean water, sterilized biochar, and the potential for autonomous greenhouses that can be used for food production. In addition, Terragon is working with several educational institutions to develop a “Guardian Program” that will provide training and hands-on opportunities for youth in the North to learn about and maintain various new green technologies that will assist with self-sufficiency, off-grid sustainability, and environmental protection.

THE AKUTTUJUUK FRAMEWORK FOR BILINGUAL EDUCATION IN INUIT NUNANGAT

Tulloch, Shelley (1), C. Lee (2), A. McAuley (3) and Fiona Walton (3)

(1) University of Winnipeg (Winnipeg, Canada);
(2) OISE/UT (Pangnirtung, Canada);
(3) University of Prince Edward Island (Charlottetown, Canada)

With the negotiation of land claims and self-government agreements across Inuit Nunangat, each Inuit region has a mandate to promote and preserve the Inuit language, and to develop schools that support and teach Inuit ways of knowing, being, and doing. In this presentation, we present a framework for effective education that supports Inuit to develop proficiency in an Inuit language and a national language, and to develop other capacities and aptitudes that Inuit associate with being a capable person. The framework synthesizes findings from a literature review of promising practices in effective bilingual education alongside examples from each of the Inuit regions. It conceptualizes effective bilingual education as part of a well-resourced and effectively led education system, in which learning in and about two or more languages supports academic success and reinforces a positive sense of identity. Effective bilingual education requires demonstrated sensitivity and responsiveness to particular sociopolitical and linguistic contexts, and is an integrated component of broader efforts toward self-determination, as well as language and culture reclamation.

CLIMATE CHANGE IS ASSOCIATED WITH INCREASING RATES OF UNINTENTIONAL INJURY IN ALASKA: EVIDENCE AND IMPLICATIONS

D. Driscoll (1) and Van Wyck, Rebecca (2)

(1) Institute for Circumpolar Health Studies (Anchorage, United States);
(2) Institute for Circumpolar Health Studies at the University of Alaska Anchorage (Anchorage, United States)

Climate records in Alaska indicate that the average temperature in north and northwest portions of the state have warmed 7° Fahrenheit since the 1950s. This has resulted in the degradation of permafrost, loss of sea ice, and warming and acidification of seawater. These changes to the environment have also amplified the number and intensity of extreme weather events. In this presentation we present primary data from two year-long rounds of community-based surveillance of the health effects of climate change in Alaska. Unintentional injuries were nearly three-times more likely during months in which the unusual or unseasonable environmental conditions occurred (OR = 2.8 95% CI 1.6 – 4.9) and nearly five-times more likely in months when community members changed travel plans due to those unseasonable environmental conditions (OR = 4.5 95% CI 2.9 – 6.9). We present statistical evidence of associations between unseasonable environmental conditions in northern regions of Alaska and incidence of injury based on secondary data from NOAA, the Alaska Trauma Registry, and community health aides. Finally, we present formative primary data collected in GIS-assisted semi-structured interviews on the contextual factors associated with unintentional injuries suffered during travel by residents of rural and remote communities in northern Alaska. These factors include environmental covariates, as well as behavioral covariates, such as the location and manner in which
these travel-related injuries take place. We conclude with a discussion of the implications of increased extreme weather and hazardous travel conditions on population health in rural and remote communities in north and northwest Alaska.

METHYLmercury hOtSPoRTS AND CYCling IN TERrestRIal AND aQUATIC COMpartMents OF A HIGH aRCTIC SUB-CATCHMENT

Varty, Stephanie (1), I. Lehnherr (2), J. Kirk (3) and K. St. Pierre (4)

(1) University of Toronto (Mississauga, Canada);
(2) University of Toronto Mississauga (Mississauga, Canada);
(3) Environment and Climate Change Canada, Aquatic Contaminants Research Division (Burlington, Canada);
(4) University of Alberta (Edmonton, Canada)

Methylmercury (MeHg), is a toxin which bioaccumulates and biomagnifies through food webs and which is produced from inorganic Hg via a process called methylation2. Concentrations of MeHg can be elevated in certain freshwater fish and this is a potential health concern for the health of northern Aboriginal peoples who consume these fish as part of a traditional diet. Furthermore, climate change is likely to alter the fate of MeHg in Arctic ecosystems, such that it is important to gain an understanding of the spatial and seasonal variations in the sources of MeHg, including production hotspots. This research is aimed at determining where production (methylation) and degradation (demethylation) of MeHg occurs in a terrestrial soil-wetland-lake continuum system in the High Arctic to determine where MeHg hotspots are occurring on the Arctic landscape. In addition, this research will aid in developing an understanding how MeHg cycling differs between ice-on and ice-off seasons in aforementioned system. To address these objectives a series of field based experiments and spatial surveys to quantify Hg methylation and MeHg demethylation were conducted in the Skeleton Lake sub-catchment in the Lake Hazen Region of Ellesmere Island, Nunuvat. This sub-catchment allows us to track MeHg concentrations and production along a continuum from permafrost seeps through a lake (Skeleton Lake), downstream ponds, wetland stream (Skeleton Creek), sedge meadow and finally at the inflow of Skeleton Creek into Lake Hazen and thus to better understand how MeHg is processed as it is transported downstream from terrestrial ecosystems to receiving aquatic ecosystems. Sampling and experiments were conducted during the summer ice-free growing season of 2016. Hg methylation and MeHg demethylation were quantified using enriched stable isotope tracers in 1) Skeleton Lake water column; 2) Skeleton Lake sediments; 3) downstream pond sediments; and 4) wetland soils both along the stream and in the sedge meadow. A spatial survey was also conducted along the entire length of the wetland stream and meadow to quantify Hg and MeHg in wetland soils. Hg and MeHg concentrations were also quantified weekly at various sites along the continuum. Preliminary data suggests that while MeHg is produced in the lake and pond sites along the continuum, wetland soils act as a sink for MeHg reducing its export into Lake Hazen and thus decreasing exposure to this contaminant in the Lake Hazen Arctic Char (Salvelinus alpinus) population. Additional measurements of methylation/demethylation rates will be conducted in spring 2017 in the Skeleton Lake water column when lake waters are anoxic (thus providing ideal conditions to support the activity of anaerobic methylating microorganisms), and in the snowpack to determine whether the high MeHg concentrations sometimes observed in snowpacks are the result of in-situ methylation. This research will provide a better understanding as to where MeHg is produced and decomposed on the Arctic landscape and how climate change (through changes in snow and lake ice-cover, redox conditions in lake waters, etc.) may alter biogeochemical processes relevant to contaminant cycling in the High Arctic, an issue of both environmental and human health concern.

MICRObes deGRADIng HYDROCARBONS AT LOW TEMPERATURES: UNTANGLING MICRObial COMMUNITY ASSEMBLY AND SUCCESSION

Vergeynst, Leendert (1), P. Lassen (2), T. Dalsgaard (1), K.U. Kjeldsen (3) and S. Rysgaard (4)

(1) Arctic Research Centre, Aarhus University (Aarhus, Denmark);
(2) Department of Environmental Science and Environmental chemistry & toxicology, Aarhus University (Aarhus, Denmark);
(3) Section for Microbiology & Center for Geomicrobiology, Department of Bioscience, Aarhus University (Aarhus, Denmark);
The Arctic is in political and scientific focus due to growing economic interests in the possibilities for establishing shorter shipping routes and for offshore extraction of oil and gas. This will inevitably lead to oil spills in the marine Arctic, where the harsh environmental conditions and remoteness complicate clean-up efforts. A very likely strategy to remediate oil spills in remote Arctic regions is therefore natural degradation by specialized indigenous bacteria. However, few studies have investigated how low temperatures shape the assembly and succession of hydrocarbon-degrading microbial communities. In this comprehensive study, microcosms with 100mL seawater sampled in Aarhus Bay, Denmark, were incubated with 100µL marine diesel for up to 3, 5 and 9 months at 15, 4 and 0°C, respectively. For each temperature, series of 7 triplicate microcosms were setup and triplicates were periodically sacrificed for analysis of residual hydrocarbons, total bacterial carbon content and community profiling by Illumina sequencing of bacterial 16S rRNA. The microbial community mineralized (CO2 production) hydrocarbons at all temperatures and produced on average 20 µmol CO2 per day at 15°C, which was 2.4 and 15-times faster than at 4°C and 0°C, respectively. Most genera were enriched at all 3 temperatures, however, at faster rates at 15°C than at 4°C and 0°C. Cluster-based analysis of the microbial community composition revealed that a similar succession of bacterial genera took place in all treatments, but at slower rates at lower temperatures. At 4 and 0°C, the succession was about 2.4 and 15-times slower as compared to at 15°C. Clustering of the whole community into correlated sub-communities showed the succession of that at least 4 consortia of bacterial genera. These consortia were characterized by typical growth patterns, which consisted of an exponential growth phase, followed by a stationary phase and subsequently decay. For example, Colwellia spp. had doubling times of about 0.7, 2.3 and 8.2 days at 15, 4 and 0°C, respectively and reached in approximately 10, 20 and 100 days a stationary phase with equally high abundances at all temperatures. Similarly, Cycloclasticus spp., a genus known as PAH degraders, had doubling times of 0.4, 1.2 and 17.4 days during the exponential phase and reached a stationary phase with equal abundances in about 15, 30 and 150 days at 15, 4 and 0°C, respectively. The community patterns will be related to the observed hydrocarbon degradation patterns. In conclusion, our results imply that the slower microbial community succession at lower temperature should be taken into account when studying the effect of temperature on the microbial community structure. Comparing microbial communities at different temperatures without taking into account difference in succession rates may underestimate the contribution of certain genera. For example, in the case the community structure of 4°C and 15°C would be compared at day 20, Colwellia spp. would appear to be highly abundant at 4°C, but already past the maximal abundance at 15°C.

EXPLORING THE MICROBIOME OF TWO CARNIVOROUS SPONGE GENERA (CHONDOROCLADIA, CLADORHIZA) FROM BAFFIN BAY
Verhoeven, Joost and S. Dufour
Memorial University of Newfoundland (St. John’s, Canada)

The Cladorhizidae is a unique family of marine sponges that exhibit carnivory: rather than suspension-feeding, they use specialized structures to capture small mesoplanktonic prey, which they subsequently digest. Preliminary studies have postulated a central functional role of sponge-associated bacteria for prey digestion and assimilation, indicating that sponge carnivory might be a symbiotic process. Carnivorous sponges of the genera Chondrocladia and Cladorhiza are common components of the epibenthic macrofauna at shelf depths in Baffin Bay. On leg 2A of the 2015 Amundsen cruise along the east coast of Baffin Island, carnivorous sponges were observed in 3 of 4 ROV dives, and samples obtained from Navy Board Inlet, Qikiqtarjuaq and Cape Dyer. We used Illumina-based high-throughput sequencing of the 16S rRNA gene to investigate the bacterial community structure (microbiome) of Chondrocladia sp. (N=3, collected at Qikiqtarjuaq and Cape Dyer) and Cladorhiza sp. (N=2, collected at Navy Board Inlet and Qikiqtarjuaq) with the goal of better understanding the biology and trophic ecology of these carnivorous sponges. Specimens were sectioned and bacterial community composition was examined in separate anatomical regions that have predicted involvement in prey capture (sphere), support (primary and secondary axis) and benthic substrate attachment (root, base axis). Preliminary analysis shows that the microbiome of Chondrocladia is more diverse.
In Chondrocladia, multiple bacterial families were present in higher abundances (Flavobacteriaceae, Rhodobacteraceae, Halieaceae and Colwelliaceae), whilst in Cladorhiza, all anatomical regions were dominated solely by Flavobacteriaceae. Variations in bacterial families were consistently seen within Chondrocladia individuals, with specific families present at higher abundances in particular anatomical regions, suggesting a functional role for these bacteria within host biology. Comparable results were obtained during a previous study investigating bacterial communities in Chondrocladia from the Gulf of Maine suggesting a conserved and possibly geographically stable Chondrocladia microbiome. This study highlights both the stability and flexibility of the carnivorous sponge microbiome, and points to the importance of particular bacterial groups to sponge function within Chondrocladia. Bacterial communities within Chondrocladia appeared more diverse and stable than in Cladorhiza; differences between these genera could indicate divergent trophic strategies. This work contributes to our continued exploration and understanding of the ecological roles of carnivorous sponges in the Arctic.

LIVING ON THE EDGE: WHAT ENCOURAGES LEMMINGS TO OVERWINTER ON THE DENS OF ARCTIC FOXES?

Verstege, Jacqueline and J. Roth

University of Manitoba (Winnipeg, Canada)

Predators may impact prey through mechanisms other than predation. Through small-scale disturbances and nutrient enhancement from excrement and prey remains on dens, Arctic foxes (Vulpes lagopus) act as ecosystem engineers, promoting growth of nutrient-demanding species on their dens, like tall shrubs and grasses atypical on tundra. Alterations to vegetation cover on dens facilitated by Arctic fox have instigated changes in the distribution of lemmings, their primary prey. Approximately 70% of fox dens contain collared lemming (Dicrostonyx spp.) winter nests, made of grass for insulation, but the proximate mechanism and ultimate cause that entice lemmings to live on fox dens, where predation risk is likely higher, is not known. Dens may provide important nesting material through greater biomass of grass and willows that comprise much of the collared lemming’s winter diet. Furthermore, insulative snow drifts are a limited resource for lemmings that live and potential breed beneath snow in winter. These thick insulative snow drifts accumulate leeward of raised vegetation and topography, yet much of tundra is covered with shallow wind-pack snow that provides little insulation. Consequently, if taller vegetation on fox dens promotes greater snow insulation and other potential benefits, then lemming activity, reflected in the number and distribution of winter nests, should increase on fox dens compared to surrounding areas. We examined the proximate mechanisms that entice lemmings to overwinter on fox dens by comparing different snowpack and vegetation characteristics known to influence lemming winter site selection. We also evaluated the ultimate benefit to lemmings living on fox dens by comparing winter reproduction on fox dens to surrounding tundra. We measured snowpack characteristics, fox activity (February 2016), and summer vegetation on fox dens, on control sites 200 m from dens, and at locations of previous lemming nests near Churchill, Manitoba. Lemming winter nests are abandoned in spring and never re-used, and can serve as an annual index of lemming activity. We collected lemming nests (June 2015 and 2016) to infer reproduction using the size distribution of feces within nests. Lemming activity was higher on fox dens with warmer subnivean temperatures. Snow thicknesses varied positively with vegetation height, suggesting vegetation height promotes accumulation of thick insulative snow drifts on fox dens, producing warmer subnivean temperatures. Furthermore, a greater proportion of lemming nests on fox dens showed evidence of reproduction compared to nests from transects. Thus, warmer subnivean temperatures on fox dens may provide a winter refuge supporting reproduction, potentially benefiting lemming demographies by providing additional high quality winter nesting sites. Our research illuminates another important ecological role of Arctic fox as ecosystem engineers by providing additional high quality winter habitat for lemmings.

SPANISH POLAR STRATEGY: A WINDOW CONNECTING BOTH POLAR REGIONS

Villegas, Marina

Spanish Research Agency. Ministry of Innovation and Competitivity. Spain

Spain promotes polar scientific research that respects regional legislation and fosters international
cooperation, out of the conviction that these extreme regions of the Earth – the Arctic and the Antarctic – must be used for peaceful ends and for the sustainable development of the region and of the world. Spain considers that scientific research findings are of vital importance to our knowledge of the environmental processes and risks that climate change can bring to our planet; to our ability to predict the impact of these variations on local Arctic populations; and to foresee the possible effects of these changes in our own latitudes. Besides hard-core scientific research, Spain also participates in multiple initiatives for data management; integrates Arctic observations and data sharing, based on its National Polar Data Centre, which represents the country at most of the Arctic information management international consortia such as Sustaining Arctic Observing Networks and the International Arctic Science Committee; participates actively in the harmonization of international databases; and establishes routines for their interconnection and interoperability. Spain is also interested in education and dissemination of Polar Region knowledge and works to develop initiatives that promote the conservation of the environment and way of life values for residents.

Although Spain has a long tradition of research in the Antarctic, our research in the Arctic is also promoted and we have several relevant research programs in the Arctic, including the Canadian Arctic. Our main aim of collaboration in terms of polar research may represent an excellent opportunity for both countries in sharing infrastructures and logistics for developing synergies and wider perspective scientific projects.

FORMATION AND VARIABILITY OF THE LOFOTEN BASIN VORTEX IN A HIGH-RESOLUTION OCEAN MODEL

Volkov, Denis (1), Arseny Kubryakov (2), Rick Lumpkin (3)

(1) University of Miami / NOAA - AOML (Miami, United States); (2) Institute of Earth Sciences, St. Petersburg State University (St. Petersburg, Russia); (3) NOAA Atlantic Oceanographic and Meteorological Laboratory (Miami, United States)

The Lofoten Basin of the Norwegian Sea is characterized by a local maximum of eddy kinetic energy and it is an important transit region for the warm and saline Atlantic waters on their way towards the Arctic Ocean. Eddies are generated by the Norwegian Atlantic Current and propagate anticlockwise around the center of the basin. In situ and satellite observations have discovered a rather small (with a radius of a few tens of km), but strong quasi-permanent anticyclonic vortex that resides in the center of the Lofoten Basin near 3°E, 69.8°N. The vortex is not stationary and drifts cyclonically within the area bounded by approximately the 3250 m isobath. The objective of our study was to understand how and why the vortex is formed and to investigate what processes support its stability and drive its variability. To achieve this objective, we conducted a number of numerical experiments, which provide an experimental evidence of the importance of eddies in the formation and stability of the vortex. An analysis of the barotropic vorticity budget of a high-resolution ocean model output shows that the advection of the relative vorticity gradient by eddies is the main mechanism that drives the variability of the Lofoten Vortex. The direct impact of wind/buoyancy forcing is found to be small to negligible.

RECRUIT AND RETAIN - MAKING IT WORK: ADDRESSING RECRUITMENT AND RETENTION CHALLENGES IN THE HEALTH SECTOR IN NORTHERN AND ARCTIC COMMUNITIES

Wakegijig, Jennifer (1), G. Healey (2), A. Macdonald (3), R. Strasser (1) and P. Moody-Corbett (1)

(1) Northern Ontario School of Medicine (Sudbury, Canada); (2) Qaujigiartiit Health Research Centre and Northern Ontario School of Medicine (Iqaluit, Canada); (3) Department of Health, Government of Nunavut (Iqaluit, Canada)

The Northern Ontario School of Medicine (NOSM), is the Canadian partner collaborating with partners in four Northern European countries (Iceland, Norway, Sweden and Scotland) on a European Union-funded initiative, “Making it Work” through the Northern Periphery and Arctic Programme, that aims to stabilize the public sector workforce in Northern and Arctic communities. Canada’s case study is taking place in Nunavut, and NOSM is working in partnership with Nunavut’s Department of Health, Nunavut Tunngavik Incorporated, and Qaujigiartiit Health Research Centre. Difficulty in recruiting and retaining a skilled workforce, in particular health professionals, is a common challenge for Northern rural and remote areas.
Making it Work will implement recruitment solutions in five case study sites across five countries, applying a common flexible model to a variety of public sectors (health, education, social work etc.). In each partner country, a locally-tailored approach to enhancing recruitment and retention of public sector workforce will be piloted and evaluated using a common evaluation framework, with common, comparable baseline and outcome indicators. The Nunavut project is focused on physician recruitment. A steering committee, which includes members from NOSM, Nunavut’s Department of Health, Nunavut Tunngavik Incorporated and Qaujigiartiit Health Research Centre, is providing guidance to the project, and sharing relevant data related to current recruitment practices and outcomes. This steering committee will determine which interventions are piloted and evaluated, based on an analysis of baseline information. The project concludes in January, 2019.

MAPPING SNOW DEPTH AND SNOWMELT USING UNMANNED AERIAL SYSTEMS IN ARCTIC-TUNDRA ENVIRONMENTS

Walker, Branden, P. Marsh, P. Mann and T. DeJong
Wilfrid Laurier University (Waterloo, Canada)

The hydrological cycle of Arctic-tundra is greatly impacted by the deposition and redistribution of snow during the winter months. The end-of-winter snowcover is characterised by significant small-scale (of the order of a few metres) spatial variations in snowcover depth, density, and thus snow water equivalent (SWE). The end-of-winter SWE distribution across these landscapes is shown to have significant hydrological influences during the spring snowmelt period, resulting in a spatially heterogeneous snowmelt, with significant controls on the timing and magnitude of snowmelt runoff. Traditional remote sensing techniques for quantifying snowcover depth and snow covered area during melt, are characterised by coarse spatio-temporal resolutions and therefore fail to capture small-scale snowcover conditions across small distances and over the duration of the snowmelt period. This study aims to capture small-scale spatial variations in end-of-winter snow depth and document the spring snowmelt changes in snow depth, snow covered area and basin water storage at unprecedented high-resolutions though the application of a fixed wing Unmanned Aerial Systems (UAS). Our multi-year study reveals a strong correlation between observed and measured snow depth at a catchment scale and demonstrates a successful application of UAS for measuring snow depth. The addition of in-situ hydrological data allows for high spatio-temporal quantification of end-of-winter SWE and snowmelt across our study basin, allowing for a detailed documentation of the complex and dynamic spring snowmelt runoff processes in these tundra ecosystems.

WHAT HAPPENS TO BOREAL FOREST SOIL COMMUNITIES AFTER FIRE?

Walker, Virginia (1), G. Palmer (2), M.-C. Leewis (3) and M. B. Leigh (3)
(1) Queen’s University (Kingston, Canada);
(2) Qubit Systems (Kingston, Canada);
(3) Institute of Arctic Biology, University of Alaska Fairbanks (Fairbanks, United States)

An increase in the number of wildfires has been attributed to climate change and its associated alteration of precipitation patterns and higher temperatures. In Alaska, 30% of the most devastating fire years have been in the last decade for over 75 years of records. As well, fires are larger than previously reported with the average area burned in the state projected to double in the next few decades. Fire is a natural part of the boreal forest ecosystem’s disturbance regime. Thus we hypothesized that although fires would have an immediate impact on soil communities, provided the burn was not extensive, these would recover within a few years. To test this hypothesis, a boreal forest overlying discontinuous permafrost and just south of Fairbanks, Alaska was selected. Adjacent sections of this site had been recently (2015) and more distantly (2009) burned and categorized as level three and four on a five-point wildfire scale. Within the vicinity, no chemical extinguishing agents were used. Both fires resulted in an uneven burn with ‘control’ sections exposed only to smoke. Perhaps not surprisingly, temperature, conductivity and pH were highest in the organic layers of the 2015 fire and these perturbations were correlated with the lowest mean soil respiration levels as measured by CO2 emission. However, even 7 years after fire with now verdant overlying vegetation, soil pH was still elevated and respiration depressed relative to control sites. Fatty acid assessment as well as initial bacterial 16S rRNA Illumina MiSeq sequence analysis both confirmed the significant distinctiveness of consortia
in the organic and mineral soils associated with fire, in comparison to control soil samples. Thus, even though the two fires were fragmented and not highly destructive, communities continued to be affected years after the events, prompting our suggestion that fires may have more lasting impact on the soil communities than we had previously appreciated.

THE SEA-ICE ENVIRONMENTAL RESEARCH FACILITY (SERF) AND RESEARCH HIGHLIGHTS (2015-2016)

Wang, Feiyue, D. Barber, S. Rysgaard and T. Papakyriakou
University of Manitoba (Winnipeg, Canada)

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 2015-2016, as well as the development of a new oil-in-sea-ice mesocosm (OSIM) as part of the Churchill Marine Observatory (CMO).

MESOCOSM-SCALE STUDIES OF SEA ICE PROPERTIES AND PROCESSES AT THE SEA-ICE ENVIRONMENTAL RESEARCH FACILITY (SERF): A FIVE-YEAR SYNOPSIS

Wang, Feiyue, N.-X. Geilfus, D. Barber, S. Rysgaard and T. Papakyriakou
University of Manitoba (Winnipeg, Canada)

Constructed in 2011, the Sea-ice Environmental Research Facility (SERF) at the University of Manitoba, Winnipeg, is the first outdoor, mesocosm scale experimental sea ice facility in Canada. Since its official opening on February 8, 2012, SERF has provided an unprecedented platform where process-oriented sea-ice studies are carried out under controlled or semi-controlled conditions. A series of experiments have been completed at SERF so far, shedding new lights on a variety of geophysical, chemical and geochemical properties and processes associated with different forms of sea ice under various conditions. Based on the first five years of operation, here we review the motivation and operation principle of SERF, highlight major discoveries from SEEF experiments so far, and provide a critical analysis of the pros and cons of mesocosm-scale studies of sea ice and their relevance to field and modeling studies.

MITIGATION OF OIL SPILLS IN ICE-COVERED ARCTIC WATERS

D. Barber, Wang, Feiyue, G. Stern and C.J. Mundy
University of Manitoba (Winnipeg, Canada)

With increasing accessibility, the Arctic is witnessing unprecedented opportunities for industrial and socio-economic development. Associated with the projected increase in maritime activities related to marine transportation and oil and gas exploration and production is the threat of a major Arctic oil spill. The exceptional vulnerability of Arctic ecosystems to oil spills makes it critical that such a spill be detected promptly and mitigated effectively to reduce its ecological and human health impact. In response to this critical need, a globally unique research facility, known as the Churchill Marine Observatory (CMO), is being developed in Churchill, Manitoba, adjacent to Canada’s only deep Arctic port, and is dedicated to the studies of detection, impact and mitigation of spills of oil and related contaminants in sea ice-covered waters.
The core infrastructure of the $32-million facility is comprised of 1) the Oil-in-Sea-Ice Mesocosm (OSIM) with two saltwater sub-pools, which is designed to simultaneously accommodate contaminated and control experiments on various scenarios of oil spills in sea ice, and 2) the Environmental Observatory (EO) system, which is a state-of-the-art monitoring system located in the Churchill estuary and along the main shipping channel across Hudson Bay and Strait to allow scaling process studies conducted in OSIM to Hudson Bay and the larger Arctic environment. Operational by the end of 2017, CMO will enable the development of detection and mitigation techniques and ecosystem impact studies from the molecular scale (e.g., petroleomics; genomics) to the regional and global scale (e.g., satellites). Several major national and international research programs have already been funded or proposed for the first three to five years of the CMO operation. Collaborative and partnership opportunities are available and welcome.

**METHYLATION AND DEMETHYLATION OF MERCURY IN THE CANADIAN ARCTIC SEAWATER**

Wang, Kang, K. Munson, D. Armstrong and F. Wang

Centre for Earth Observation Science, and Department of Environment and Geography, University of Manitoba (WINNIPEG, Canada)

Mercury (Hg) is a major contaminant in marine environment for its high toxicity and biomagnification in the food web, and the main culprit for both features is monomethylmercury (MMHg). This is of particular concern to the Northern people who consume MMHg-enriched marine mammals and fish as their traditional diet. Though uncertainties remain in the ultimate source of MMHg in marine organisms, recent studies indicate that its primary source is in situ methylation of inorganic Hg(II) in the water column. To study the mechanism of Hg methylation and demethylation in seawater, incubation experiments were carried out in marine waters from different sites of the Canadian Arctic. In the experiments, isotopically labeled Hg species (202Hg(II), MM198Hg)) were added to seawater with different treatments (filtered/unfiltered, sterilized/unsterilized), to assess the role of particles, biotic and abiotic processes in Hg methylation and demethylation. In waters from all sites, both methylation and demethylation were observed, but the demethylation rates were always much higher than methylation rates. No significant enhancement of methylation was found in the unfiltered waters compared to the filtered ones. The presence of methylation in sterilized waters supports the occurrence of abiotic methylation in the water column. Higher demethylaiton potential was found in incubation bottles filled with unfiltered seawater, suggesting that particulate matter might play an important role in MM demethylation. In contrary to the generally-held view that MMHg demethylation in seawater is driven by either photochemical or microbial processes, we found that sterilized waters had higher demethylation potential than unsterilized controls (both are incubated under dark). This indicates that abiotic demethylation might be important in seawater even in the absence of sunlight.

**MERCURY IN THE MARINE WATERS OF THE CANADIAN ARCTIC**

Wang, Kang (1), K. Munson (2) and F. Wang (2)

(1) University of Manitoba (WINNIPEG, Canada); (2) Centre for Earth Observation Science, and Department of Environment and Geography, University of Manitoba (WINNIPEG, Canada)

Mercury (Hg) is a contaminant of major concern in the Arctic marine ecosystem for its high toxicity and biomagnification in the food web. In upper trophic level species, Hg concentrations are sufficiently high to pose heath risks to both animals and the Northern people who consume these animals as part of traditional diet. The dominant form of Hg that is transferred within the food web is monomethylmercury (MMHg), which is built up from their prey and ultimately from seawater. Although sedimentary production and release of MMHg can occur, recent studies indicate that the primary source of MMHg to seawater is in situ conversion of inorganic Hg(II) to MMHg in the water column. We have recently reported enhanced methylmercury (MeHg, sum of MMHg and dimethylmercury) production in subsurface seawater of the Beaufort Sea and linked this MeHg production to local and recent organic matter remineralization. Here we report depth profiles of total Hg (HgT) and MeHg concentrations from the ArcticNet/GEOTRACES 2015 cruise. In the Canada Basin (CB) and Baffin Bay (BB), HgT shows a transient-type distribution, with elevated concentrations in the surface and deep waters, and lower concentrations in the upper and middle ocean. Whereas in the shallower Canadian Arctic Archipelago (CAA), HgT concentrations are more uniform with depth, probably due to the enhanced
terrestrial Hg input by river runoff and coastal erosion. The patterns of MeHg profiles in the CB and West CAA are different from those in the East CAA and BB. While MeHg in both regions exhibit surface minimum and subsurface peaks similar to those observed in the Beaufort Sea and other world oceans, the high concentrations gradually decreased at depth in the CB and West CAA, but persisted in the East CAA and BB to the bottom water. Positive correlations were found between MeHg and phosphate concentrations, providing further evidence for the hypothesis that MeHg in seawater originates from in situ methylation associated with organic matter remineralization. Different from previous studies is, however, the presence at many stations of a second sub-surface peak close to the depth of subsurface chlorophyll maximum. In addition, considerable concentrations of MeHg were also observed in a few stations in the surface water. These results suggest that there might be another MeHg source in surface seawaters, which is most likely related to biological activities, and/or that photodemethylation in the surface ocean might not occur as fast as we previously thought.

**CHARACTERIZING PERMAFROST LANDSCAPE FEATURES USING OBJECT-BASED CLASSIFICATION OF TERRASAR-X IMAGERY**

Wang, Lingxiao (1), P. Marzahn (1), M. Bernier (2) and R. Ludwig (1)

(1) Ludwig Maximilian University of Munich (Munich, Germany);
(2) Centre Eau Terre Environnement, Institut National de la Recherche Scientifique (INRS) (Québec, Canada)

Satellite-based monitoring strategies become increasingly important to understand the state and dynamics of permafrost landscapes at regional scales. This study presents an operational permafrost landscape features characterizing system based on TerraSAR-X radar imagery. Backscatter coefficients and interferometric coherence are sampled over different types of land cover between August 2013 and September 2014 in the discontinuous permafrost region of Umiujaq, Nunavik. The systematic approach includes three applications: 1) mapping the extent of permafrost-affected area and thermokarst ponds (TP); 2) detecting the ice regime on TP during winter 3) monitoring the general state of permafrost. Multitemporal SAR backscatter signals and seasonal coherence features analysis is conducted on individual training objects, i.e. permafrost landscape features. It is assumed that near-surface permafrost-affected areas are covered with short vegetation (lichen and herbaceous vegetation), showing moderately low coherence over time. The lower coherence of permafrost-affected areas can be explained with topographical dynamics in permafrost terrain. The thawing-freezing cycle in the active layer causes ground surface displacement (subsidence/uplift), thus induces lower coherence compared to permafrost-free areas with similar vegetation cover. There is also spatial coherence variation within permafrost-affected terrain, where areas of progressing degradation usually show denser vegetation cover and higher surface soil moisture, also reflected in image coherence. TPs are important permafrost landscape features. The depth of TP is difficult to determine from optical imagery, however it can be a useful indicator to estimate the state of thermokarst progression or drainage. When a pond is newly formed, it is normally shallow and results in grounded ice during the winter season. As the pond deepens in relation to permafrost degradation, i.e. with the thawing of underlying permafrost, its depth begins to exceed the maximum ice thickness and liquid water remains under the thick ice cover all winter, this creating floating ice. In return, ageing TPs will eventually drain, become shallower and shrink. In the monitoring system, first Level 1 object-based image analysis (OBIA) classifies the region into “Permafrost environment” and “Non permafrost environment”. This was followed by a Level 2 classification, defining the “Permafrost environment” class into 1) TP; 2) lichen (permafrost); 3) herbaceous vegetation (permafrost); 4) lichen (low possibility of permafrost); 5) herbaceous vegetation (low possibility of permafrost); 6) developed vegetation (low possibility of permafrost). A Level 3 classification considers the ice regime on the TP class in winter. Backscattering variation from two types of ice cover distinguishes TP into a) floating ice covered in winter and b) grounded ice covered. Level 4 applies an unsupervised classification to coherence features on permafrost-affected area to obtain a permafrost state map, which characterizes density and stability of permafrost features. The proposed permafrost monitoring system can delineate permafrost-affected areas and TPs in high accuracy, delivering permafrost state information in high spatial resolution over larger regions. The floating ice/grounded ice indicator is used to approximate the depth of TPs. This classification scheme can be applied in a multitemporal system
setup, to determine the evolutionary state of TPs and provide useful information to assess regional permafrost condition.

WIND-DRIVEN VARIABILITY IN SUBSURFACE WARM LAYERS OF THE CHUKCHI SHELF BREAK

Watanabe, Eiji, J. Onodera, M. Itoh, S. Nishino and T. Kikuchi (1)
JAMSTEC (Yokosuka, Japan)

Ocean heat transport is a possible important factor for recent sea ice decline, especially in the western Arctic Ocean. It has been indicated that vertical hydrographic profiles in the Canada Basin were characterized by three temperature maxima. The near-surface temperature maximum was the shallowest one arising from summer solar heat absorption and subsequent autumn Ekman downwelling. The subsurface temperature maximum reflected intrusion of Pacific summer water. The deepest maximum was located in the Atlantic layer. Substantial parts of upper ocean heat would eventually affect sea ice freezing/melting. However, spatial and temporal variabilities of these warm layers still remain uncertainties. In this study, a pan-Arctic sea-ocean modeling was performed to address wintertime transport of subsurface warm water. The horizontal grid size was approximately 5 km to resolve mesoscale eddies and narrow boundary currents. In the interannual experiments from 2001 to 2014, strong easterly winter winds in the southern part of the prevailed Beaufort High sometimes produced a westward shelf-break jet along the northern edge of Chukchi shelf. In this situation, lateral advection of shelf-origin water along jet streams is a key factor for subsurface warming around the Chukchi Borderland. Whereas a substantial part of subsurface heat in the shelf-break region was immediately released to atmosphere by wind-driven turbulent mixing, stronger stratification protected the warm layers against heat loss in some years.

A SHIFT IN FORAGING BEHAVIOUR OF BELUGA WHALES (DELPHINAPTERUS LEUCAS) FROM THE THREATENED CUMBERLAND SOUND POPULATION MAY REFLECT A CHANGING ARCTIC FOOD WEB

Watt, Cortney, S. Ferguson and J. Orr
Fisheries and Oceans Canada (Winnipeg, Canada)

Cumberland Sound, an inlet on Baffin Island, Nunavut is experiencing changes in sea ice cover, and a shift in the food web from one dominated primarily by Arctic cod to one dominated by capelin. The small (ca. 1000) population of beluga whales that inhabits Cumberland Sound year round is currently listed as threatened by the Committee on the Status of Wildlife in Canada (COSEWIC). Relatively little is known about the diet of these beluga whales, but we hypothesized that a change to a new dominant forage fish would affect their diet and dive behaviour. To test this, we (1) compared fatty acids in blubber samples collected from subsistence- hunted belugas in Cumberland Sound from the 1980s to 2010, and (2) analyzed satellite tag information from seven belugas tagged in 2006-2008. There was a change in the fatty acid profile of beluga blubber from the 1980s compared to the 1990s and 2000s. Specific fatty acids indicative of capelin increased over time, while those common to Arctic cod decreased, suggesting an increased consumption of capelin with a reduction in Arctic cod available in summer in more recent years. Dive behaviour in the 2000s suggested different foraging tactics across seasons. Since the change in the dominant forage fish, belugas use shallow short dives in summer, which may indicate foraging on capelin, while deeper longer dives were made in autumn and winter, possibly indicating foraging on deeper prey such as Arctic cod and Greenland halibut. In particular, the number of very deep dives (>500m) and dives of longer duration (15 minutes or more) in the autumn and winter may indicate foraging on deep dwelling Arctic cod or possibly on Greenland halibut, an important fish species for the emerging commercial fishery in the region. Overall, beluga diet seems to be reflecting changes in the Cumberland Sound food web, suggesting whales may be adjusting to their changing environment.
SCHOOLS ON BOARD - EXAMINING THE IMPACTS OF ARCTICNET’S OUTREACH PROGRAM ON PARTICIPATING STUDENTS AND TEACHERS

Watts, Michelle (1), L. Barber (2) and D. Barber (2)

(1) University of Manitoba-ArcticNet (Winnipeg, Canada);
(2) Centre for Earth Observation Science, University of Manitoba (Winnipeg, Canada)

Schools on Board is a national outreach program of ArcticNet, based out of the University of Manitoba. Developed in 2003, Schools on Board aims to bridge Arctic research with science education in high schools across Canada to increase awareness of issues related to climate change in Canada and to excite young Canadians about the challenges and career opportunities of Arctic systems research. At the core of the program, the Arctic Field Program “on board” the Canadian research icebreaker CCGS Amundsen, provides schools the unique opportunity to send students and teachers to the Arctic to participate in an educational experience that is completely integrated with the research activities of the ArcticNet science team. While on board participants engage in lectures and work with scientists on deck during sampling operations and in the labs. In addition, the community visit has become an integral part of the program and provides an opportunity for participants to interact with peers, elders and community leaders to discuss issues stemming from climate change in the Arctic. This poster presentation will focus on success stories of Schools on Board alumni and discuss the impacts on their lives. This poster will provide a ‘where are they at’ glimpse by highlighting a few participants and some of their current activities. A comprehensive assessment conducted in 2014-15 covering the 12-year life span of the program examined the impacts (short to long-term) of a ‘Schools on Board’ experience. Key results from this assessment will also be presented.

TRADITIONAL ECOLOGICAL KNOWLEDGE OF BELUGA WHALE (DELPHINAPTERUS LEUCAS) IN A CHANGING CLIMATE IN THE INUVIALUIT SETTLEMENT REGION (ISR), NWT.

Waugh, Devin (1), T. Pearce (2), S. Ostertag (3) and B. Bradshaw (1)

(1) University of Guelph (Guelph, Canada);
(2) University of the Sunshine Coast, University of Guelph (Sippy Downs, Australia);
(3) Fisheries and Oceans Canada (Winnipeg, Canada)

The Beluga Whale (Delphinapterus leucas) is an important species to the coastal Inuvialuit communities of the Western NWT. 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 knowledge is made more poignant by the rapid climatic and non-climatic changes that are occurring in the region. As key stakeholders in the outcomes of beluga management, Inuvialuit have indicated their desire to document their TEK of beluga. The ongoing research documented TEK about the ecology and behaviour of the beluga whale, hunting techniques, and subsistence preparation under changing climatic and non-climatic conditions through a case study in the Inuvialuit Settlement Region from June to August 2016. Ethnographic research methods were utilized for data gathering activities, including semi-directed interviews and participant observation. Three objectives will be addressed through the research, including: (1) characterizing the local Inuvialuit relationship with beluga, including ecological knowledge of the species, hunting techniques, and subsistence preparation (2) documenting change and stressors affecting Inuvialuit/beluga relationships, and (3) identifying challenges and opportunities for inclusion of TEK in beluga co-management regimes. This research is part of ArcticNet Project 1.8 “Knowledge Co-Production for the Identification and Selection of Ecological, Social, and Economic Indicators for the Beaufort Sea”.

211
SPATIAL VARIABILITY IN PERMAFROST CONDITIONS IN SUBARCTIC AND ARCTIC LABRADOR

Way, Robert and A. Lewkowicz

Department of Geography, Environment and Geomatics, University of Ottawa (Ottawa, Canada)

The Labrador Permafrost Project was initiated in 2013 with the goal increasing our understanding of permafrost and its dynamics across the Labrador region of northeastern Canada. The need for this project is based on a clear knowledge gap regarding the true extent and characteristics of permafrost within Labrador (no scientific publications on the topic in >20 years). Rapid regional warming has also occurred over the past several decades but without ground temperature monitoring apparatus there has been no empirical means of evaluating whether permafrost thermal conditions are actively changing. In the three years since the initiation of this project, considerable effort has been placed on mapping the current extent of permafrost and on installing monitoring stations to facilitate future work. Extensive local field investigations of permafrost occurrence and thickness have been undertaken with DC electrical resistivity tomography and other field methods in a variety of environments ranging from coastal palsa bogs near the community of Red Bay in southern Labrador to the Arctic cordilleran tundra landscape of the Torngat Mountains of northern Labrador. Ground temperature monitoring at three boreholes in southern Labrador indicates the presence of very warm permafrost that is unlikely to survive projected warming scenarios. Preliminary results also show differences in the dominant controls on permafrost presence/absence in coastal environments relative to continental areas. This contribution outlines progress to date on the establishment of the overall monitoring program, discussion of field observations of permafrost and ground temperatures and includes a first-order assessment of the spatial and temporal variability in permafrost conditions using spatial numerical modelling. These results should help inform policy-makers on the complex nature of permafrost in Labrador.

SHRUB AND PERMAFROST INTERACTIONS IN COASTAL LOW-ARCTIC MOUNTAINS

Way, Robert (1), L. Hermanutz (2), D. Whitaker (3), L. Charron (2), A. Lewkowicz (1) and C. Lapalme (1)

(1) Department of Geography, Environment and Geomatics, University of Ottawa (Ottawa, Canada); (2) Department of Biology, Memorial University of Newfoundland (St. John’s, Canada); (3) Western Newfoundland Field Unit, Parks Canada (Rocky Harbour, Canada)

Northern Labrador is rapidly greening, causing ecosystem level changes, potentially affecting Inuit land use and the ecological integrity of protected areas. Recent warming in northern Labrador has increased shrub cover in the Torngat Mountains National Park. Prior studies in northern environments have linked increased shrub height and density with increases in permafrost active layer depth due to greater snow trapping in the winter. The resulting degradation of the permafrost can cause ecosystem level changes such as variations in local hydrology with corresponding impacts on wildlife and vegetation. To date, no studies have directly examined the complex interactions between shrubs and permafrost in the eastern Canadian Arctic. This contribution describes recent efforts towards characterizing the relation between upright shrubs and permafrost at Kangalaksiorvik Lake in the northern subzone of the Torngat Mountains National Park. Permafrost investigations were undertaken with DC electrical resistivity tomography (ERT), topographic profiling, active layer probing, ground surface temperature monitoring and photography generated using an unmanned aerial vehicle. Along each ERT profile, shrub cover and height were characterized to elucidate how shrubs influence, and are influenced by near-surface ground temperatures. The resulting modelled resistivities from the ERT surveys were used to interpret ground thermal properties (i.e., frozen/unfrozen, cold/warm). Modelled resistivities at 4 depths (0.5, 1.6, 2.7, 4.95 m) are therefore used as a proxy for near-surface ground temperatures and are compared to co-located shrub characteristics using principal component and standard statistical analytical techniques. Field results indicate that Betula glandulosa and Salix argiocrapa were the dominant upright shrubs in our plots. We found that resistivities are correlated through the depth profile and that increased height and cover of these upright shrubs are associated with inferred warmer ground temperatures (i.e., lower resistivities). Modelled resistivities show a stronger negative correlation with shrub height on the south-facing slope compared to the north-facing slope, particularly for deeper layers. These results suggest that ground temperatures are more strongly influenced by vegetation cover on south-facing
(warmer) slopes than north-facing (colder) slopes. This suggests the response of permafrost and shrub growth to future warming at the landscape level will be heterogeneous. Future studies will explore the spatial characteristics of permafrost using ERT and vegetation data for a variety of sites in northern Labrador and will examine how warming may affect Inuit land use.

**INUIT CHILDBIRTH IN CANADA: AN EXPLORATION OF PLACE, CULTURE, AND HEALTH**

Weber, Laura Jane (1), C. Dewey (1), A. Cunsolo (2), S. Humphries (1), S. Harper (1)

(1) University of Guelph (Winterbourne, Canada); (2) Labrador Institute of Memorial University (Happy Valley-Goose Bay, Canada)

Inuit in Canada experience the highest infant mortality rate in the country, as well as significantly higher rates of preterm births, stillbirths, and maternal health issues, as compared to the non-Inuit population. These differences are attributed, in part, to the lack of availability and type of obstetrical care women receive. Most women are required to fly out of their communities for birth, and may have to remain in southern hospitals for weeks or months (referred to as obstetric evacuation, OE). A literature review was conducted to examine the range, extent, and nature of peer-reviewed literature about OE in Northern Canada. The literature documents women reporting feeling isolated, lacking prenatal support, experiencing language barriers, and receiving obstetrical care from a Western model that is incongruous with Indigenous teachings on holistic well-being. Fathers and older siblings find it challenging to connect emotionally with a newborn after missing the birth, and for communities, OE represents the loss of Inuit self-governance. Importantly, place-attachment – one’s psychological, emotional, and spiritual connection to the land, and to the kin- and community-based relationships that are sustained in a particular place – is central to the well-being of Indigenous peoples, and connected to all facets of health. As such, OE may have especially serious impacts on the overall health and well-being of an Inuit mother and child, but also that of her family and community. This poster will present an overview of what we know so far, as documented in the peer-reviewed literature, about the connections between place, culture, and health in relation to Inuit experiences of obstetric evacuation. It will propose future research directions and questions for researchers, practitioners, and policy-makers to consider.

**EXTENDING THE WEATHER RECORD FOR NORTHERN ELLISMERE ISLAND: NOTES FROM THE SECOND PEARY EXPEDITION TO REACH THE NORTH POLE, 1905-06**

Wells, Patricia (1), M. Murray (2), and R. Sankar (1)

(1) Arctic Institute of North America (Calgary, Canada); (2) Arctic Institute of North America, University of Calgary (Calgary AB, Canada)

The end of the 19th century saw the first Arctic observing stations, but it was not until close to the middle of the 20th century that northern weather facilities were firmly established to collect detailed records of Arctic weather and climate. This information has been invaluable for understanding the nature of shifting climate in the region. Historic records including sources such as ships logs, particularly those of whaling expeditions, offer the opportunity to extend the weather record further back in time. While these sources record summer conditions when travel was most frequent in the Arctic, the Northern Seas Project will contribute to understanding Arctic climate history by targeting historical accounts that extend into the winter months. In this talk we present the weather record for the winter of 1905-06 during which time Robert Peary’s ship the Roosevelt was jammed in ice off Cape Sheridan, northern Ellesmere Island. The log of Ross Marvin, an engineer onboard the ship, recorded temperature and barometric pressure, and made observations of wind direction and velocity. This rich source of weather describes a relatively cold winter in the region, and while it cannot demonstrate a trend, it contributes to an important and growing body of information on the history of Arctic climate.

**UN-MUZZLING SCIENCE: SCIENCE COMMUNICATION AND SCIENCE-TO-POLICY IN THE CANADIAN ARCTIC**

Wells, Talia

University of Calgary (Calgary, Canada)

In 2007, following the election of Canada’s conservative majority, journalists across Canada began
to address and question changes to the media relations protocol within some federal departments. Major news outlets ran stories on the “muzzling” of Canada’s federal scientists, citing particular instances where journalists were denied interviews with researchers and instead referred to Media Relations officers, often missing deadlines or provided with “approved lines” as opposed to formal interviews. In 2012 the focus moved North, as polar scientists gathered in Montreal for the International Polar Year Conference, Canada’s Northern scientists were spotlighted for their inability to speak with media. While the conference was designed to “contribute to the translation of new polar scientific findings into an evidence-based agenda for action that [would] influence global decisions, policies and outcomes over the coming years”, Canadian scientists were accompanied by Media Relations contacts and instructed not to speak with the media. Despite concerns surrounding the open and transparent communication of science in the Canadian media, institutional barriers have not been the only obstacle facing Northern scientists. Numerous scholars have addressed the difficulty, and in many cases inability, of scientists to communicate their research to a non-scientific audience. Through a series of semi-structured qualitative interviews with Northern scientists, this paper investigates the communication avenues, barriers and confidence of researchers. It examines the research audiences, policy considerations and issues surrounding policy applicability as identified by polar and circumpolar scientists.

**MONITORING WET SNOW AT HIGH ALPINE GLACIERS USING MULTI-POLARIZED TERRASAR-X DATA**

Wendleder, Anna (1), A. Wendleder (1), A. Heilig (2), A. Schmitt (3) and C. Mayer (4)

(1) German Aerospace Center (DLR) (Weßling, Germany);
(2) Munich University (Munich, Germany);
(3) University of Applied Sciences Munich (Munich, Germany);
(4) Bavarian Academy of Sciences and Humanities (Munich, Germany)

Due to the climate change the hydrological cycle changes globally. For the high Alpine regions a warmer and shorter winter with less precipitation is predicted. Consequently, the glaciers are melting. These parameters lead to more flooding events during the spring time and a low water level in the summer. Snow melt is the greatest contributor to runoff. Only during the summer, ice melt dominates the runoff regime, whereas rain has only a small contribution of the total discharge. For a better prediction of runoff, a better understanding and knowledge of the spatial distribution and temporal change of wet snow and accumulation is needed. In particular satellites equipped with Synthetic Aperture Radars (SAR) have the capacity to provide accurate high resolution information. Due to their all-weather and day and night observation capability they enables a regular mapping and monitoring of wet snow and accumulation occurrences and their temporal variations. The test site is located in the Rofental (Oetz Valley), Austria, with its glacier Vernagtferner, Gepatschferner, Hintereisferner und Kesselwandferner. The glaciers are located at an altitude between 2800 m and 3700m, but in different expositions. The objective is to analyse the temporal and spatial change of wet snow during the melting season and hence to understand better the superficial melting process. Therefore, the time series of TerraSAR-X stripmap data acquired during the melting season (April – September) in 2016 are analysed. Furthermore, the accumulation area ratio (AAR) for both glaciers Vernagtferner and Hintereisferner are derived. All images are acquired in the dual-cross-polarized mode with the VV and VH channels. The polarimetric information is processed by the help of the Kennaugh Multi-SAR framework. It comprises the Kennaugh Decomposition as well as the temporal change detection using differential Kennaugh elements. The advantage of this framework is that any SAR data independent of its wavelength, orbit geometry, radiometry or acquisition date can be used. The results are compared with optical data acquired with Landsat-7 and with manual measurements.

**ADDRESSING FOOD SECURITY IN THE INUVIALUIT SETTLEMENT REGION, WESTERN CANADIAN ARCTIC: A PARTICIPATORY RESEARCH PROGRAM**

Wesche, Sonia (1), T.-A. Kenny (1), J. MacLean (2), N. Girard (1), M. Fillion (3), L.H.M. Chan (1), P. Gauley Gale (4) and S. O’Hara (2)

(1) University of Ottawa (Ottawa, Canada);
(2) Inuvialuit Regional Corporation (Inuvik, Canada);
(3) Université Laval (Quebec City, Canada);
(4) East Three Secondary School (Inuvik, Canada)
Rationale: Recent changes in social-ecological systems are challenging the integrity of both country (wild) food and market food components of the Inuit food system. In the Inuvialuit Settlement Region (ISR), Northwest Territories, 46% of households experience some level of food insecurity—a rate that far exceeds the Canadian average. In response, the Inuvialuit Regional Corporation (IRC) has been working with a team from the University of Ottawa to identify and prioritize research and programs/initiatives to promote food safety and food security in the six ISR communities. Together, we conducted workshops in 2012 and 2014 with a wide range of representatives and continue to work jointly on a suite of participatory research projects. These include: a food costing study across all communities (2014-2016), a traditional food program at East Three Secondary School in Inuvik (2015), and a regional-scale community consultation (2016). Here, we report on project outcomes and discuss the process of working collaboratively (from research to action) to address food security in the region.

Food Costing: We undertook a participatory food costing study seasonally in ISR communities during a 14-month period (late 2014 to early 2016). Study results provide evidence of significant price differentials between energy-dense/nutrient-poor foods and costlier, energy-dilute/nutrient-dense foods. These findings from a northern remote context contribute to the international weight of evidence regarding food price and diet quality.

School Program: ISR community members have prioritized improved youth engagement with country foods, including both consumption (access/availability at school) and knowledge (harvesting, preparation, cooking, nutritional profiles). Building on existing food-related programs at East Three Secondary School (e.g. Foods classes, On the Land Program) we developed school-based activities in three areas: country food harvest, food preparation, and intergenerational knowledge transmission. Two community youth worked as project assistants. Led by community elders and harvesters, students spent time on the land picking berries and gathering medicinal plants. They also learned about traditional and contemporary butchering, preparation and preservation methods for various country foods (e.g. arctic char, caribou, reindeer). Once prepared, these foods were shared with other students and the community at large.

Community Consultation: We are collaborating to better coordinate food security interventions, which are often ad hoc and locally-scaled, by supporting the development of a regional Inuvialuit Food Security Strategy. Objectives include: • Identifying lessons learned from the Nunavut Food Security Strategy and Action Plan (2014-16) process to apply to the ISR; • Conducting a consultation process in the six ISR communities. We undertook focus groups and interviews in each community in fall, 2016. Participants identified community assets, gaps, priorities, and relevant actors and resources to address food security. We are working to effectively scale up local findings into a regional-scale strategy.

Conclusion: Our participatory approach ensures that we address community priorities while both a) developing theoretical and methodological insights to better understand and address food security, and b) enabling shared capacity-building among community members and researchers. These activities can help to build resilience within local and regional food systems, and support the process of adaptation to changing social-ecological conditions.

THE ACCELERATION OF CHANGE – HOW UAV TECHNOLOGY IS BEING USED TO BETTER UNDERSTAND COASTAL PERMAFROST LANDSCAPES IN THE MACKENZIE-BEAUFORT REGION, NWT

Whalen, Dustin, P. Fraser, R. Maclead, D. Forbes and V. Kostylev

Natural Resources Canada (Dartmouth, Canada)

Much of the coastline of the Inuvialuit Settlement Region (ISR) in the Mackenzie –Beaufort region (Yukon and Northwest Territories) is characterised by low (~2 m) to high (> 10 m) ice-rich cliffs predominantly composed of glacially derived clastic sediments and abundant excess ground ice. Including the eroding front of the Mackenzie Delta these cliffs encompass 62% of the backshore region and are experiencing rapid erosion as a result of widespread thermal abrasion and thermal denudation of shorelines. Coastal change assessment across the region relies on shoreline positions established from historical air photos and more recent satellite imagery, supplemented by ground-based positional measurements at coastal monitoring sites. Past studies have suggested that decadal rates of change for this region have remained relatively constant over the last 50-60 years. However, new data targeted along coastal sections characterised by high (>10 m) ice-rich cliffs suggest an acceleration of coastal erosion in the last decade or two. The rate of coastal change has increased 20 to 200% since
This change in erosion rate will substantially increase the volume of sediment, nutrients and organic carbon exported to the marine ecosystem on an annual basis. To better understand the response of coastal landscapes to changing environmental conditions in this highly dynamic environment, the Geological Survey of Canada has deployed unmanned aerial vehicles (UAVs) at selected sites. The use of UAV-based aerial imagery with derived high-resolution digital surface models provides unprecedented capability to monitor change along the Beaufort Sea coast. These data will undoubtedly aid in the study of geomorphological change and sediment budgets of coastal permafrost landscapes. This efficient, low-cost, and rapid method for remote sensing and monitoring of dynamic natural environments is particularly suitable in remote or poorly accessible areas. Ten locations, including Tuktoyaktuk, were visited during the summer of 2016. Fronting Tuktoyaktuk Harbour is Tuktoyaktuk Island, 1500 m long by 50 m wide at its narrowest point. This island acts as an important natural barrier protecting the harbour from the action of waves and associated erosion. However, the island is eroding at an average rate of 2.1 ±0.3 m/yr (2000-2015, up from 1.7±0.7 m/yr (1947-2000). The island is the main source of new sediment to the system fronting Tuktoyaktuk Harbour, contributing 4812 m3/yr over 53 years (1947-2000) and 7773 m3/yr over 14 years (2000-2014). The dispersal of this sediment in the nearshore region (surrounding the island and main harbour approach channel) results in changing seabed morphology and shallower water depths, thereby creating hazardous conditions for marine traffic entering the harbour. Changing climate is causing accelerated rates of coastal landscape and seascapes changes in Mackenzie-Beaufort region, the application UAV technology for digital surface modeling serves as the logical next step to better monitor and understand the implications and consequences of this unprecedented geomorphologic change.

INORGANIC CARBON VARIATIONS IN RESPONSE TO UNDER ICE ALGAE BLOOMS AND GROWTH

Whitehead, Jeremy and B. Else

University of Calgary (Calgary, Canada)

With climate change strongly impacting the Arctic, studies conducted on the inorganic carbon system are primarily concerned with air-sea exchanges and the potential of the Arctic to act as a carbon dioxide sink. One research interest is how inorganic carbon is changing to increases in atmospheric flux and the changing dynamics of sea-ice from rising temperatures. Variations in inorganic carbon components such as DIC (Dissolved Inorganic Carbon) and TA (Total Alkalinity) reflect the biological and physical processes occurring in the water column and the rate at which they occur. The ice algae community has gained a focus on their bloom dynamics inside and under sea-ice prior to other open water and ice marginal zone blooms. However, no much research has been conducted under sea-ice to see the impacts ice algae may have on water column inorganic carbon. This is important to understand to see if ice algae have any preconditioning effects on water column inorganic carbon prior to open water conditions and enhanced air-sea exchange. During a field campaign in Qikiqtarjuaq, NU, DIC and TA samples were collected at an off-shore ice camp to create water column profiles. Sampling occurred during late spring and early summer, which included the ice-algae bloom period and the beginning stages of sea-ice melt. DIC and TA concentrations are coupled with ice algae chlorophyll concentration, productivity rates, nutrients, and other parameters to develop a more complete profile of the water column and environment for analysis. Results show that ice algae blooms have a small impact on DIC concentrations in the upper 5 meters of the water column, but these changes pale in comparison to the rapid and drastic fluctuations during the transient period of sea ice melt. TA showed similar trends as DIC, inferring that ice algae have little biological impact prior to drastic physical transformation due to sea-ice melt. Subsequently after sea-ice melt, ice algae chlorophyll drops dramatically as their habitat is removed, thus removing their contributive ability to the carbon system. Ice algae, which have gained increasing research interest, have shown that their primary production numbers are underestimated with more studies and new methods trying to accurately represent their productivity. However, ice algae’s contribution to under-ice carbon concentrations at this field study seem to have an insignificant or at best marginal impact.
GENETIC ASSESSMENT OF INCONNU (STENODUS LEUCICHTHYS) STOCKS TO AID FISHERIES MANAGEMENT IN GREAT SLAVE LAKE

Wiens, Lauren (1), R. Bajno (2), J. Detwiler (3) and R. Tallman (2)

(1) Department of Biological Sciences, University of Manitoba; Freshwater Institute, Fisheries and Oceans Canada (Winnipeg, Canada);
(2) Freshwater Institute, Fisheries and Oceans Canada (Winnipeg, Canada);
(3) Department of Biological Science, University of Manitoba (Winnipeg, Canada)

Inconnu (Stenodus leucichthys) are highly valued in commercial and subsistence fisheries in northwestern North America. Stocks of Inconnu in Great Slave Lake, Northwest Territories, have been under intense fishing pressure from commercial fishing and many have declined due to exploitation and other anthropogenic activities. Management actions, such as area closures, occur for threatened stocks and have had mixed results in reducing Inconnu harvest. Although some stocks are declining and require area closures, others are thought to be healthy and productive. Areas in which higher catches have been observed could be a result of expansion by healthy stocks and therefore a decline in a stock could go unnoticed. It is critical to understand the number of distinct genetic stocks that use an area and their overall geographic distribution so that fisheries management decisions can focus on the declining stock and their habitat. The objective of our research is to use microsatellite markers and population genetic analysis to determine the number of genetic stocks that reside in Great Slave Lake. Our hypothesis is that each river with a population of Inconnu migrating into Great Slave Lake represents a distinct genetic stock because Inconnu are thought to home to natal rivers and these rivers are geographically isolated relative to each other. From 1992 to 2012, finclips were collected from fish in Great Slave Lake and the surrounding river systems including Yaya Lake and Campbell Lake, Yellowknife Bay, Slave River, Marian Lake, Mackenzie River and the mouth of Buffalo River. Preliminary data analyses with 17 microsatellite markers suggest the presence of three distinct stocks: Yaya and Campbell Lake, Marian Lake and Yellowknife Bay, and the stock from Slave River. The samples from the mouth of Buffalo River were inconclusive, likely because of the presence of a mixed stock. Further genetic analyses on the natal river sites, such as Buffalo River, will provide a better understanding of the genetic diversity within Great Slave Lake. We will perform genetic analyses on new samples from natal river systems and lakes that will supplement the current data on the Inconnu stocks. In addition, we plan to estimate the effective population size of each genetic stock to help inform management decisions. Overall, the genetic research will improve and assist in future management decisions for an important fishery in Canada.

WHY HAS THE WORLD NOT COLLAPSED AND WHAT SHOULD WE DO TO KEEP IT THAT WAY?

Wiese, Francis K.
Stantec Consulting (Anchorage, United States)

Changes in physical-biological interactions in marine ecosystems occur across various spatial and temporal scales and may be mitigated or strengthened based on varying rates of behavioural, physiological, evolutionary and management adaptation. “Panarchy” provides an interdisciplinary approach in which structures, scales, and linkages of complex-adaptive social-ecological systems, are mapped across multiple space and time scales in continual and interactive adaptive cycles of growth, accumulation, restructuring and renewal. Through these adaptive cycles, a system may cope with pressures and adversities such as exploitation, warming, and governance restrictions, making it more or less resilient, manifesting a balance between stability and change. In this paper I explore processes at four linked spatial domains in the Arctic Ocean and link it to ecosystem resilience and re-organization characteristics. From this I explore the implications and application of Panarchy theory to observational strategies, science funding, resource management, and policy, and propose and alternate approach towards resilient management for the oceans of today and tomorrow.

VULNERABILITY OF TUNDRA LAKES TO CLIMATE CHANGE

Wilcox, Evan (1), P. Marsh (1), O. Sonnentag (2), G. Hould Gosselin (2), B. Walker (1) and P. Mann (1)

(1) Wilfrid Laurier University (Waterloo, Canada);
(2) Université de Montréal (Montreal, Canada)
Lakes cover a large portion of the western Arctic landscape, and they are in danger of disappearing if water budget outputs exceed inputs (Bouchard et al., 2013). The Arctic is experiencing rapid climate warming relative to the global average, resulting in warming and changes in snowfall and rainfall, with hydrological impacts on these nival systems. This warming climate extends the lake ice free period and maximum lake temperature, which increases both cumulative evaporation and summer evaporation rates (Arp et al., 2015). In addition, the increase in shrubs across tundra regions may be resulting in changes in snowcover and active layer thickness. Both which may be impacting runoff to tundra lakes. Measuring the components of the water inputs and outputs for a lake can help to better understand the processes governing them and how they will be affected by climate change in the future.

In the Spring of 2016, six 0.5-30 hectare lakes in the Trail Valley Creek basin (68.75°N, 133.5°W) were instrumented with water level recorders, and an eddy covariance system was installed at one lake to measure sensible and latent heat fluxes from the lake. This region of study is typical of a low Arctic tundra landscape, and remnants of catastrophically drained lakes in the region. Prior to snowmelt, intensive snow surveys were conducted in one lake basin, combining traditional and UAS methods. The UAS was also used to monitor the snow and lake ice melt period of 4 nearby lakes. Using these data, a water balance was calculated for the snowmelt and summer season, and characteristics of the snow and ice melt were documented. Future work will include bathymetric surveys of the lakes, weir based measurements of discharge, and expanding the network of water level recorders. The assistance of various techniques, including UAS and eddy covariance, will provide key data to better estimate lake water balance. For example, the UAS can sample at 3 cm/pixel and be flown daily over large areas, and eddy covariance systems can provide evaporation on a much finer temporal scale than older methods. These improvements allow the water balance and its components to be calculated on a finer temporal scale, and allow better understanding of the components’ processes. These data will provide key information needed to use high resolution hydrological models to simulate current, and future conditions. Arp, C. D., Jones, B. M., Liljedahl, A. K., Hinkel, K. M., Welker, J. A. (2015). Depth, ice thickness, and ice-out timing cause divergent hydrologic responses among Arctic lakes. Water Resources Research, 51, 9379–9401. http://doi.org/10.1002/2016WR019555


ADVENTURES IN A NEW ARCTIC FRONTIER: INVESTIGATING THE TIDAL-DRIVEN ‘WINTER HOLES’ AND ‘SUMMER GARDENS’ OF THE KITIKMEOT MARINE REGION OF THE CANADIAN ARCTIC ARCHIPELAGO.

Williams, Bill (1), B. Bluhm (2), K. Brown (3), E. Carmack (1), C. Clarke (1), S. Danielson (4), L. Rotermund (5), A. Schimnowski (6) and Oksana Schimnowski (7)

(1) Fisheries and Oceans Canada (Sidney, Canada);
(2) UiT - The Arctic University of Norway (Tromso, Norway);
(3) Woods Hole Oceanographic Institution (Woods Hole, United States);
(4) University of Alaska Fairbanks (Fairbanks, United States);
(5) University of Victoria (Victoria, Canada);
(6) Arctic Research Foundation (Winnipeg, Canada);
(7) Polar Knowledge Canada (Winnipeg, Canada)

We report preliminary results from an August 2016 expedition to the Kitikmeot Marine Region – which includes Coronation Gulf, Bathurst Inlet, Queen Maude Gulf and Chantry Inlet in the southern Canadian Arctic Archipelago - aboard the 20m RV Martin Bergmann. We used a suite of oceanographic tools including CTD/Rosettes, underway ADCPs, CTDs, and surface water sensors, towed thermistor-fluorometer chain, bottom cameras, benthic grabs, ocean and river geochemistry and satellite-tracked surface drifters to undertake a hypothesis-driven survey of the regional marine ecosystem. The Kitikmeot Marine Region is unique in the pan-Arctic system because of its massive freshwater input relative to the area’s size, and for the shallow bounding sills to the north and west (≤30m deep). These conditions maintain an estuarine-like circulation wherein surface inflowing freshwater mixes with the deep inflowing salty oceanic waters. Strong stratification generally restricts vertical mixing and the upward fluxes of dissolved nutrients. The resulting low annual primary productivity affects the entire food web, and we speculate that this is why the region supports char and seals as top predators instead of the larger polar bears and whales that are
found elsewhere. However, observations by residents, and high-resolution satellite imagery, suggest that the narrow gaps and straits between the many islands of the Kitikmeot can be prone to early ice breakup, making them dangerous places for winter travel. We thus hypothesize that these ‘winter holes’ are caused by upward mixing of subsurface heat, induced as tidal flow accelerates over sills and through narrow passes. Furthermore, the subsurface water is nutrient-rich, so the same upward mixing will also deliver nutrients to the euphotic zone year-round, creating local regions of enhanced biological productivity and a patchwork of nearby benthic ‘gardens’ that contrast with the region’s overall very low productivity. Such biological hotspots may form critical feeding sites for the higher trophic levels. Our preliminary results show that these sites are often characterized by high tidal current velocities and a predominance of hard bottom substrate with high proportions of suspension-feeding taxa such as feather stars and certain sea cucumbers. Currents slowed outside the narrows, where soft bottom became more prominent which were inhabited by deposit-feeding brittle stars and bristle worms. The next stages of sample analyses and data synthesis are expected to reveal a dynamic ecosystem, forced by the physical flow field and external inputs of nutrients and freshwater.

OBSERVATIONS OF SHELF-BREAK UPWELLING AND DOWNWELLING AT CAPE BATHURST AND HERSCHEL ISLAND ON THE CANADIAN BEAUFORT SHELF.

Williams, Bill and H. Melling
Fisheries and Oceans Canada (Sidney, Canada)

Upwelling/downwelling on the Canadian Beaufort Shelf due to westward/eastward along-shelf wind and ice motion is distributed along the shelf-break and topographically focused at 1) Cape Bathurst and 2) Herschel Island at Mackenzie Trough. In these two locations, strong convergences of isobaths amplify the along isobath currents and this, in-turn, locally amplifies upwelling and downwelling bottom boundary layers. At Cape Bathurst there is a ~10-fold increase in bottom slope compared to the shelf and thus ~10-fold amplification of along isobath flow. At Mackenzie Trough, upwelling due to the trough is additionally amplified over the steeply sloping narrow shelf adjacent to Herschel Island before it spills onto the Yukon Shelf towards the west. In these locations, nutrient-rich Pacific-origin water upwells across the shelf-break to the shelf and to the surface, which can drive additional primary production. Winds over the Canadian Beaufort Shelf are predominately towards the west and so generally upwelling favourable, with westward stress peaking in spring and autumn due to the development of the Beaufort High and Aleutian Low. The unusual increase in summertime westward wind from 2006, due to a persistent Beaufort High, likely produced a large increase in summertime primary production over the shelf due to addition of upwelled nutrients. Single moorings deployed within the upwelling at Cape Bathurst (2010 to 2016) and Herschel Island (2014-2016) show episodic, seasonal and inter-annual variation of upwelling and downwelling and its connection to along-shelf surface-stress over the Canadian Beaufort Shelf. Upwelling favourable flow dominated during 2010-2011 but returned to a mix of upwelling and downwelling in 2012-2014 following a return to more variable wind-stress. In winter, transmission of wind-stress to the ocean is blocked by ice and flows are greatly reduced. Both upwelling ‘hotspots’ of Cape Bathurst and Herschel Island have strong influences on the local ecosystem and are potential candidates for observational focus, as recognized by the inclusion of Cape Bathurst in the Distributed Biological Observatory.

SPATIAL AND TEMPORAL VARIATION IN REPRODUCTIVE HEALTH AND SUCCESS OF EASTERN CANADIAN ARCTIC WHALES

Willing, Cornelia (1), C. Willing (1), D. Yurkowski (1) and S. Ferguson (2)
(1) University of Manitoba (Winnipeg, Canada);
(2) Department of Fisheries and Oceans (Winnipeg, Canada)

Marine mammals residing in the Arctic region require the ability to adapt to changing and challenging environments. Many Arctic marine mammals are closely associated with the seasonal sea ice during their breeding period and show a highly synchronized reproduction. Because of their strong adaptation and dependence on sea ice habitats for reproduction and survival; climate-induced changes pose serious threats to their success. Narwhal (Monodon monoceros) and beluga whale (Delphinapterus leucas) play important roles as traditional resources for Inuit throughout communities of the Eastern Canadian Arctic and act as indicators of ecosystem health and environmental
change. Therefore, monitoring and assessing the reproductive parameters of marine mammal populations is needed to ensure their persistence in the Canadian Arctic. The main objective of this study was to examine reproductive tract morphometrics and pathologies, and ovarian reproductive activity of narwhal and beluga in the eastern Canadian Arctic and to identify differences within each whale species between northern and southern regions and over time. Using comparative analysis of these reproductive parameters allowed us to evaluate unique reproductive patterns and estimate life-history vital rates. As a result, we summarize reproductive activity, health, and success of Arctic whales. Thus, this information can be used to monitor the health of populations and help the management of subsistence harvests and the conservation of these Arctic whales.

INFLUENCE OF VEGETATION SUCCESSION ON ACTIVE LAYER THICKNESS AND GROUND TEMPERATURES (1978-2016), ILLISARVIK, WESTERN ARCTIC COAST

Wilson, Alice, C. Burn and E. Humphreys

Carleton University (Ottawa, Canada)

There are numerous thaw lakes and drained thaw lake basins in Canada’s western Arctic coastlands. The majority of the drained lakes formed catastrophically. Permafrost and vegetation have subsequently developed in these lake basins. Illisarvik is a long-term research site, experimentally drained by Dr. J. Ross Mackay in 1978. The purpose of our research was to analyze change in active layer thicknesses and ground temperature that have occurred in response to vegetation development within the basin. Annual monitoring in August of thaw depth and ground temperatures, and of snow depth in April has been accompanied by assessment of vegetation establishment in the lake basin from 1978-2016. The basin has three primary vegetation units: willows around the former lake edge and towards the topographically sheltered north side of the basin; graminoids in southern and central portions; and bare ground in the middle of the lake basin. Characteristic snow depths in the units and in tundra surrounding the basin are 60, 40, 20, and 20 cm respectively. Snow depths in the willows are continuously increasing while the other vegetative units have no change. In the past 20 years, active layer thickness in the willow unit has increased by about 20 cm, not changed in the grass unit, was disrupted by flooding in the bare ground area and increased up to 5 cm in the surrounding tundra. Where permafrost has established throughout the talik, temperatures have increased by 1 to 1.5 °C in willow areas since 2003 in association with increased snow depth. The mean annual air temperature in the surrounding tundra is -6.8 °C, while in the basin it is about -3 °C where the former talik has frozen through. The basin is not continuing to cool towards tundra ground temperatures due to growth of vegetation and associated increases in snow depth.

A CONVERSATION ON MOBILIZING TRADITIONAL ECOLOGICAL KNOWLEDGE

Wilson, Katherine (1), T. Bell (1) and G. Ljubicic (2)

(1) Memorial University of Newfoundland (St. John’s, Canada);
(2) Carleton University (Ottawa, Canada)

Known as traditional ecological knowledge (TEK) in the southern research community, it is better known as Inuit Qaujimajatuqangit (IQ) in Canadian Inuit communities and Indigenous Knowledge (IK) in the circumpolar Arctic to capture the holistic, cultural and evolving aspects of this knowledge. Over the past decade there has been a positive shift in acknowledging the value of TEK in evidence-based decision making for a range of Arctic issues. Although well intentioned, the complexities of collecting, analyzing and mobilizing TEK with western science methods have proven difficult. Utilizing a white board and a variety of magnetized words, this interactive poster is intended to create a dialogue with ArcticNet participants to better understand the perspectives on TEK and western science, their approaches, successes and challenges working with northern communities to utilize TEK. The purpose of this research is to better understand the barriers and successes of TEK in research, and to examine approaches and methodologies to help northern and scientific communities better mobilize TEK into research and monitoring programs in a more respectful way. These approaches and methodologies will be evaluated as part of the Pond Inlet, Nunavut SmartICE (Sea-ice Monitoring And Real-Time Information for Coastal Environments) project).
THE METABOLISM OF SKELETON LAKE, NORTHERN ELLESMERE ISLAND, NUNAVUT: UNDERSTANDING THE EFFECTS OF CLIMATE CHANGE IN THE CANADIAN HIGH ARCTIC BY QUANTIFYING BIOGEOCHEMICAL PROCESSES

Wisniewski, Victoria (1), I. Lehnherr (2), S. Schiff (3), P. Aukes (4) and J. Kirk (5)

(1) Department of Geography, University of Toronto Mississauga, Mississauga, Ontario, L5L 1C6, Canada. (Oakville, Canada);
(2) Department of Geography, University of Toronto Mississauga, Mississauga, Ontario, L5L 1C6, Canada. (Burlington, Canada);
(3) Department of Earth and Environmental Sciences, University of Waterloo, Waterloo, Ontario, N2L 3G1, Canada. (Waterloo, Canada);
(4) Department of Earth and Environmental Sciences, University of Waterloo, Ontario, N2L 3G1, Canada. (Waterloo, Canada);
(5) Environment and Climate Change Canada, Aquatic Contaminants Research Division, Burlington, ON, L7S 1A1, Canada. (Burlington, Canada)

Lake metabolism is an important indicator of biological activity, biogeochemical processes, and nutrient fluxes between landscape-lake ecosystems. Rapidly warming temperatures in the Arctic are predicted to markedly alter the limnology of tundra lakes and ponds. These changes include increases in aquatic productivity, pH, specific conductivity, and nutrient levels (Keatley, Douglas, Smol, 2007). The objective of this study is to understand how the productivity of Skeleton Lake (81 49.757°N, 71 28.782°W) – a sub-catchment to Canada’s most Northern Great Lake ecosystem, Lake Hazen – is impacted by climate change. The research aim is to characterize water chemistry; and, to collectively quantify Net Primary Productivity (NPP) in surface waters, ecosystem respiration, and air-water CO2 fluxes. Together, these measurements provide a clearer understanding of the whole-ecosystem metabolism of Skeleton Lake. In July 2016, we quantified metabolic processes during the open water (i.e., ice-off) season. Continuous measurements of dissolved oxygen concentrations, temperature, and chlorophyll abundance were collected using a YSI EXO2 sonde. Vertical water column profiles were additionally conducted to analyze transitional zones. Surface measurements of dissolved CO2 were gathered (using a Vaisala CO2 sensor) to quantify air-water exchange of CO2 to determine whether Skeleton Lake acts as a source or sink of atmospheric CO2. Dissolved O2 stable isotopes (δ18O–O2) will be used to assess whole-lake metabolism (Venkiteswaran, Wassenaar, Schiff, 2007) by separating changes in O2 saturation due to temperature, and mixing from changes due to metabolic activity (Wang, Depew, Schiff, Smith, 2008). We will present here preliminary results from our 2016 field campaign on the limnology and metabolism of Skeleton Lake. Similar measurements will be conducted in spring 2017 to quantify lake metabolism prior to, and during, lake ice thaw. In doing so, a more thorough understanding of year-round lake metabolism and carbon cycling within this ecosystem can be achieved, as well as a greater understanding of how changes in the relative duration of the ice-on/ice-off season will impact productivity in Arctic Aquatic ecosystems. This research is part of a larger project aimed at quantifying coupled terrestrial-aquatic impacts of climate change on high Arctic watersheds, using the Lake Hazen watershed on Northern Ellesmere Island as a pivotal system. Understanding how nutrients, contaminants, and carbon cycle within water-bodies adjacent to Lake Hazen (i.e., Skeleton Lake) will help to identifying potential sources, sinks, and transport routes.

CHANGING HUMAN-BELUGA RELATIONS AND SUBSISTENCE LIVELIHOODS IN THE ARCTIC

Worden, Elizabeth (1), T. Pearce (2), J. Oakes (3) and L. Loseto (4)

(1) Department of Environment and Geography, University of Manitoba; Freshwater Institute, Fisheries and Oceans Canada, Central and Arctic Division (Winnipeg, Canada);
(2) Sustainability Research Centre, University of the Sunshine Coast; Global Environmental Change Group, University of Guelph (Sunshine Coast, Australia);
(3) Department of Environment and Geography, University of Manitoba (Winnipeg, Canada);
(4) Freshwater Institute, Fisheries and Oceans Canada, Central and Arctic Division (Winnipeg, Canada)

The aim of the proposed research is to improve our understanding of human-beluga whale relations over time and the implications of change for subsistence livelihoods through a case study of Aklavik, North West Territories. A decline in the annual Mackenzie River Estuary beluga harvest has been noted in research by
Harwood et al (2002); from an average of 131.8 landed whales in the 1970’s, to 111.0 landed whales in the 1990’s. More recently, in the last decade, the number of whales harvested by Aklavik hunters has remained near or under five per year. At the 2016 Beluga Summit in Inuvik, a group of knowledge holders from Aklavik presented and shared on various reasons why fewer beluga whales were being harvested; ranging from difficult weather, changes in sea ice, changes in beluga presence and associated accessibility, and changes in cultural approaches for beluga whaling. The proposed research objectives are: (1) characterize historical relations between community members in Aklavik and Beluga; (2) document and describe how these relations have changed over time, including the drivers of change (e.g. social, cultural, economic, political, environmental); and (3) assess the implication of these changes for subsistence livelihoods. The research will be conducted in collaboration with community members in Aklavik and will be guided by considerations for community-based participatory research. Data will be collected using ethnographic research methods including: semi-structured interviews with community members, analysis of secondary sources (e.g. beluga harvesting data), and participant observation. Community members will be involved throughout the research process - from problem identification and development, to data collection, analysis, results interpretation and dissemination. It is hoped that an improved understanding of the changes affecting human-beluga relations will help identify opportunities to support sustainable livelihoods in Aklavik. This research is part of ArcticNet Project 1.8 “Knowledge Co-Production for the Identification and Selection of Ecological, Social, and Economic Indicators for the Beaufort Sea.”

HOUSEHOLD STORED DRINKING WATER IN RIGOLET, NUNATSIAVUT: SECONDARY CONTAMINATION AND POTENTIAL RISK FACTORS FOR ACUTE GASTROINTESTINAL ILLNESS.

Wright, Carlee (1), J. Sargeant (1), V. Edge (2), J. Ford (3), K. Farahbakhsh (1), RICG (4), I. Shiwak (4), C. Flowers (4), IHACC Research Team (5) and S. Harper (2)

(1) University of Guelph (Guelph, Canada); (2) University of Guelph; Indigenous Health Adaptation to Climate Change Research Team (Guelph, Canada); (3) McGill University; Indigenous Health Adaptation to Climate Change Research Team (Montreal, Canada); (4) Rigolet Inuit Community Government (Rigolet, Canada); (5) Indigenous Health Adaptation to Climate Change Research Team (-, Canada)

One of the highest self-reported incidence rates of acute gastrointestinal illness (AGI) in the global peer-reviewed literature occurs in Inuit communities in the Canadian Arctic. This high burden of illness could be, in part, due to the consumption of contaminated water, as many Arctic communities face challenges related to the quality of municipal drinking water. Furthermore, many Inuit store drinking water in containers in the home, and this may result in secondary drinking water contamination. This research characterized drinking water collection and storage practices, identified potential risk factors for secondary water contamination, and examined possible associations between drinking water contamination and self-reported AGI in order to inform safe water management practices in the Inuit community of Rigolet, Nunatsiavut. The study included a census survey in June 2014 that captured data on types of drinking water used, household practices related to drinking water (e.g. how it was collected and stored), physical characteristics of water storage containers, and self-reported AGI. Water samples were collected from all identified drinking water containers in homes and analyzed for most probable number (MPN) of Escherichia coli (E. coli) and total coliforms. Despite municipally treated tap water being available in all homes, over 90% of households had drinking water stored in containers, and of these containers, 25.2% tested positive for total coliforms. The use of transfer devices and dippers (e.g. smaller bowls or measuring cups) for the collection and drawing of water from containers were significantly associated with increased odds of total coliform presence in stored water (OR=3.4; 95% CI 1.15–11.65 for transfer devices OR=13.4; 95% CI 3.81–47.06 for dippers). Period prevalence of self-reported AGI in the community during the month before the survey was 17.2% (95% CI 13.0-22.5%), which corresponds to an annual incidence rate of 2.43 cases per person per year (95% CI 1.76 – 3.10). No water-related risk factors for AGI were identified in this study. Potential exposure to waterborne pathogens may be minimized through simple interventions at the household level, such as education on regular cleaning of containers and transfer devices.
EXPLORING THE POTENTIAL OF ACTIVE LEARNING FOR MARINE OIL SPILLS CLASSIFICATION USING 10-YEAR (2004-2013) RADASAT DATA

Xu, Linlin (1), D. Clausi (1), L. Xu (1), Y. Cao (2) and D. Clausi (1)

(1) University of Waterloo (Waterloo, Canada); (2) Guizhou Normal University (Guiyang, China)

Marine oil spill classification aims to discriminate the true oil spills from the look-alike phenomena in synthetic aperture radar (SAR) imagery. Many supervised classifiers can be used for this purpose where some training samples involving both oil spills and look-alikes are needed to "teach" the classifiers before using them to perform binary classification. However, collecting the reliable training samples by manual interpretation of SAR imagery and on site verification of airplane or ships is difficult and costly. Given the difficulties, how to reduce the number of training samples by improving the efficiency and effectiveness of the classifier training process is critical for building a robust classification system in a quick and cost-saving manner for operational oil spill monitoring. In this paper, we explore the use of active learning (AL) approach for improving the efficiency of classifier training, where the classifiers actively ask the most informative samples to be verified during the classifier training process, such that by eliminating the information redundancy in training samples, the number of training samples needed is reduced. The data of this study consists of 56 features of 267 oil spills and look-alikes identified by Canadian Ice Service (CIS) between 2004 and 2013 off Canada's east and west coastal areas. First, to compare different AL approaches, six different active sample selecting (ASS) methods are designed to determine the informative training samples. Moreover, the iteration-dependent ASS approach and the approach to reduce information redundancy among the selected samples are also compared. Second, considering that different classifiers may favor different ASS approaches, four classical classifiers (i.e., SVM, LDA, K-NN and classification tree) are integrated into the AL framework to provide a comprehensive exploration of the interaction between classifiers and ASS. At last, considering that different numerical measures tend to highlight different aspects of the classifier performance, three different numerical measures are adopt to evaluate the performance of the AL-boosted classifiers to provide a comprehensive and unbiased assessment. Overall, 4% to 96% reduction on training samples could be obtained in different settings, showing the great potential of AL methods to reduce the number of training samples needed. The ASS methods, except when they are implemented with SVM, perform differently according to different performance measures, revealing the importance of the choice over different ASS options. The SVM classifier is the best classifier to work within the AL frame. The other classifiers, i.e., KNN, LDA and DT, do not work very well in some of the AL settings.

DEEP CONVOLUTIONAL NEURAL NETWORK FOR ICE-WATER CLASSIFICATION USING DUAL-POL SENTINEL-1 IMAGERY

Xu, Linlin and D. Clausi

University of Waterloo (Waterloo, Canada)

The classification of ice and water in the Arctic region from synthetic aperture radar (SAR) imagery is crucial for supporting various applications, such as navigation and climate change studies. Comparing with manual identification of ice and water, automatic classification programs are more objective and can provide pixel-level classification accuracies, and as such have been a better choice for SAR imagery classification. Although ice generally appears brighter than water in SAR imagery, this signature information is not reliable due to the complex marine environment and the SAR sensor limitations. For example, due to its smooth surface, new ice tends to appear darker than open water, and due to SAR incidence angle effect, open water could have a brighter appearance than the ice. These uncertainties and complexities pose great challenges on algorithms, and call for a robust algorithm with strong texture learning and modeling capability. In this study, we explore the use of deep convolutional neural network (CNN) for ice water classification from Sentinel-1 dual-pol imagery. The deep CNN model is very flexible and therefore it is capable of capturing the complex signature information hidden in training samples for improved classification accuracy. Since the Sentinel-1 data is free, large amount of images are available for feeding the CNN model in a cost-effective manner. Moreover, by leveraging the graphics processing units (CPU) technique, the deep CNN model is suitable for addressing large data volume in an operational setting. We train the CNN model using the selected pixels from 11 Sentinel-1 dual-pol images during the ice melting season, and then used the trained
model for ice water classification. The results indicate that without relying on external textural features, the CNN model is capable of resisting the incidence angle effect and accurately identifying ice and water.

MOVEMENT OF ARCTIC CHAR IN NUNAVUT’S LARGEST LAKE

Young, Angela (1), S. Larocque (2), W. Hyndman (3), R. Currie (4), J. Kennedy (5), A. Fisk (2) and R. Tallman (6)

(1) Government of Nunavut (Iqaluit, Canada);
(2) Univeristy of Windsor (Windsor, Canada);
(3) Project Nunavut (Iqaluit, Canada);
(4) West Winds (Windsor, Canada);
(5) Government of Nunavut (Iqaluit, Canada);
(6) Fisheries and Oceans Canada (Winnipeg, Canada)

The Arctic Char (Salvelinus alpinus) is the most harvested species of wildlife in Nunavut and represents a culturally important species that is used by Inuit across the territory for both subsistence and commercial purposes. Nettilling Lake, the largest lake in Nunavut and the largest found on an island in the world, has the largest commercial char quota in the Eastern Arctic at 22,700 kg but the fishery has been dormant since at least 2001 due to the high cost of air transportation of harvested char back to Iqaluit by Twin Otter airplanes. There are also many unanswered questions regarding the general biology and ecology of Arctic Char in this unique freshwater system, particularly relating to the three different morphotypes believed to exist in this system (two searun and one non-searun morph). We used acoustic telemetry to study the seasonal movement patterns of Arctic Char (102 Char tagged) in Amadjuak River, which connects the large Amadjuak Lake to Nettilling Lake, and movement through Nettilling Lake to the ocean over a 24-month period. There was no evidence of the Char remaining in the Amadjuak River over the winter or moving south into Amadjuak Lake, suggesting Char move into smaller lakes for the winter. Of the three Arctic Char morphs, only the bright orange, low parasite morph moved into Nettilling Lake in July, and evidently into the ocean, and returning in August. Preliminary results of the telemetry work suggest significant differences in the movement of the three Arctic Char morphs in the Nettilling Lake system.

A DYNAMICAL SHIFT IN INTRAGUILD PREDATION INCREASES INTER-SPECIFIC COMPETITION BETWEEN NEAR-TOP PREDATORS IN A CHANGING ARCTIC

Yurkowski, David (1), N. Hussey (2), A. Fisk (2) and S. Ferguson (3)

(1) University of Manitoba (Winnipeg, Canada);
(2) University of Windsor (Windsor, Canada);
(3) Fisheries and Oceans Canada (Winnipeg, Canada)

Food webs consist of a myriad of trophic relationships among species that influence ecosystem structure and function. Intraguild predation – whereby a predator feeds upon another predator species that both compete for similar prey resources, thereby reducing interspecific competition – is a common yet complex phenomenon in nature with implications for community trophodynamics. In the Arctic, the impacts of climate change are pronounced with shifts in seawater temperature and sea ice dynamics redistributing resources across space and time. Our understanding of how these environmental changes have affected the complexities of trophic interactions and intraguild predation between Arctic predators and in turn community trophodynamics is unknown. Here, we quantify trophic interactions and community structure among ringed seals (Pusa hispida), beluga (Delphinapterus leucas) and Greenland halibut (Reinhardtius hippoglossoides) within an intraguild predation context. Specifically, we examine these trophic interactions in Cumberland Sound, a site where: (i) summer sea surface temperature has risen by 1.4°C, and June sea ice extent has decreased by 19% between 1982 and 2011, and (ii) a distribution shift of Capelin has resulted in a new and abundant forage fish since the mid- to late-2000s. Stable carbon and nitrogen analysis was performed on muscle samples from 79 beluga, 228 ringed seals and 50 Greenland halibut and their prey (pelagic squid, epi-benthic shrimp and pelagic forage fish - Arctic cod and Capelin) collected over two time periods (1982-2001 and 2002-2011). A recent dietary shift occurred for beluga and Greenland halibut and in turn the degree of intraguild predation has decreased where beluga now consume nearly half as much Greenland halibut (27% vs. 47%) and shrimp (17% and 34%). Greenland halibut diet now primarily consists of pelagic forage fish (95% vs. 39%). Ringed seal diet consisted of pelagic squid and forage fish which remained relatively constant throughout the study period (83% and 98%). Dietary shifts observed in
Greenland halibut and beluga has increased competition for resources between ringed seals and beluga where the level of niche overlap nearly doubled, from 54% to 91% between 1982-2001 and 2002-2011. Moreover, community-wide metrics amongst ringed seals, beluga and Greenland halibut were approximately 50% more constrained after the Capelin invasion, suggesting all three near-top predators are converging on this new prey resource. These results illustrate how environmental changes and the prominence of relatively new food sources influence predator-prey foraging dynamics and overall community structure which could cause negative implications on endemic Arctic species.

COMPOSITION AND CONTENT OF COLD-WATER CARBONATE BIOCLASTS IN FROBISHER BAY, NUNAVUT

Zammit, Kendra
Memorial University of Newfoundland (St. John’s, Canada)

Cold-water carbonate sediment in polar environments is a new area of geological concern, compared to warm-temperate or cold-temperate environments such as the Mediterranean or the European Atlantic Margin. A relative lack of research in this field in Canada, and it is of increasing importance to understand and appreciate arctic habitats which are susceptible to ocean acidification and climate change. This project studies cold-water carbonate bioclasts in Frobisher Bay. Frobisher Bay is an inlet of the Labrador Sea, located adjacent to the rapidly expanding city of Iqaluit, Nunavut. In July of 2016, sampling in Frobisher Bay was conducted during a leg of a larger habitat mapping project using an Agassiz Trawl and box core aboard the CCGS Amundsen. Carbonate bioclasts from these samples were removed and separated into species groups. Preliminary findings indicate that the majority of bioclasts in the samples consist of the bivalves Hiatella arctica, Musculus niger, Musculus discors, Clinocardium ciliatum, Astarte borealis, barnacles, gastropods, echinoderms (including Ophiopleura borealis) and minor amounts of bryozoans. The taphonomic condition of the bioclasts were fair; the majority of the bivalves were disarticulated, however, they were not badly fragmented nor chalky. The scarcity of bryozoans was particularly interesting as bryozoans are generally considered characteristic of most cold-water carbonate sediments worldwide. Further sampling of Inner and Outer Frobisher Bay will be conducted aboard the MV Nulijuk in October 2016. During this time, additional samples of carbonate bioclasts will be taken from sediments of less than 200m in depth, due to equipment limitations. After sampling has been completed, constituent analysis of carbonate bioclasts will be conducted by separation into categories of bivalves, barnacles, bryozoans and other, and their proportions will be documented by weight. Furthermore, the taphonomic condition of the observed bioclasts will be recorded. The remaining sediment will be studied using a binocular microscope to estimate the various types of carbonate components, and then, the total carbonate content in residual sediments will be determined by acid dissolution weight loss. Using these data, the sediment samples will be classified with a ternary diagram, and the results will be recorded into ArcGIS using GPS data from sampling points. Using results generated from these data, classifying depositional zones and carbonate sediment types in Frobisher Bay may be possible. Understanding modern polar carbonate deposition will provide insight into carbonate deposition throughout geologic time. Furthermore, this information would be very useful in determining marine arctic habitats that will need to be protected as northern development and ocean acidification continue.

SNOW THICKNESS ESTIMATION ON FIRST-YEAR SEA ICE USING MICROWAVE AND OPTICAL REMOTE SENSING WITH MELT MODELLING

Zheng, Jiacheng, T. Geldsetzer and J. Yackel
University of Calgary (Calgary, Canada)

The Arctic sea ice and its snow cover have a direct impact on both the Arctic and global climate system through their ability to moderate heat exchange across the ocean-sea ice-atmosphere (OSA) interface. Snow cover on first-year sea ice (FYI) plays a key role in sea ice thermodynamics by modulating sea ice ablation and accretion processes. However, meteoric accumulation and redistribution of snow on FYI is highly stochastic over space and time, which makes it a poorly understood parameter. Previous studies show that the information about snow cover on sea ice can be estimated through in-situ based, laboratory based, and remote sensing based techniques. Owing to the logistical difficulty in direct measurement, a reliance on remote sensing techniques is required. In this study,
late-winter snow thickness on FYI in Dease Strait near Cambridge Bay, Nunavut, Canada is estimated based on the duration of snow melt. The study encompasses the late winter to advanced-melt period (April-June, 2014). The beginning of snow melt (melt onset) is detected using space-borne C-band microwave scatterometer measurements (ASCAT). A sharp increase in the microwave backscatter coefficient is observed at melt onset (May 23, 2014), caused by increases in both volume and surface scattering, due to a combination of liquid water content and elevated brine volume in the snow cover. The end of snow melt (pond onset) is detected using optical satellite measurements (MODIS). A rapid, large decrease in albedo occurs as melt ponds begin to form on the surface. The snow melt duration (melt onset to pond onset) is then used to invert a degree-day snow melt model based on air temperature. A degree-day melt coefficient for snow on FYI is calibrated with in situ observations. The modelled snow thickness estimation is validated with distributed in situ measurements of snow thickness throughout Dease Strait. We run the model throughout the time-series MODIS imagery for Dease Strait, and produce a pixel-based map of estimated snow thickness distribution. Results show a good correspondence between the modelled snow thickness and the topography and microwave backscatter measured ice roughness of the study area. The mean snow melt duration for the study sites is $24.6 \pm 1.2$ days, and the estimated mean snow thickness is $14.7 \pm 3.0$ cm. The overall performance of the model reveals a RMSE of 3.9 cm and a bias of 4.5 cm. The methodology shows promise; particularly because it can easily be scaled up in order to estimate snow thickness on a regional basis.

A LOW-COST, MODULAR ICE MASS BALANCE BUOY DESIGN FOR ENVIRONMENTAL MONITORING AND SEA ICE PHYSICS

Zilinski, Nicholaus (1), R. Galley (2), D. Babb (2) and S. Rysgaard (2)

(1) CEOS (Winnipeg, Canada);
(2) CEOS - University of Manitoba (Winnipeg, Canada)

Arctic sea ice plays a large role in the global climate, acting as a heat sink, influencing ocean circulation, as well as being a major contributor to the earth’s albedo. These relationships are best understood through monitoring changes in the thickness and extent of sea ice, known as ice-mass balance, and using GPS to illuminate sea ice dynamics. Ice volume and extent provide key insight into ocean-ice-atmosphere interactions, integrating both the surface heat budget and ocean heat flux. Monitoring sea ice mass balance changes is accomplished using an autonomous ice mass buoy (IMB) that measures air temperature, pressure, and humidity, snow depth, as well as internal ice temperature and thickness. However, these monitoring systems are expensive – currently commercial systems are ~$40k. We aimed to reduce the cost of these systems and thereby increase the frequencies of deployment and of data collection. In turn this will substantially enhance the users control of the hardware and software. This allows for purpose-built, best-fit systems for a variety of deployment scenarios. To accomplish this, we have developed a modular, open source, autonomous IMB system using an Arduino micro-controller. The Arduino allows for the use of high quality peripheral sensors purchased directly from their manufacturers at low cost, eliminating the need for third party software and logger integration. Additionally, we have also custom engineered a new digital one-wire bus temperature string. This work has reduced the cost of an IMB by almost half. The high degree of modularity now offered by this new IMB system allows for the cost to be reduced further as users can create more focused systems to suit their needs for an incredible variety of remote monitoring applications. For example, systems deployed in fjords to omit satellite transmitters and mobile sea ice tracking systems to only implement the GPS.

A 14 YEAR OCEANOGRAPHIC TIME SERIES OF THE BEAUFORT GYRE REGION OF THE SOUTHERN CANADA BASIN: RESULTS FROM JOINT OCEAN ICE STUDIES.

Zimmermann, Sarah (1), B. Williams (1), R. Krishfield (2) and A. Proshutinsky (2)

(1) Fisheries and Oceans Canada (Sidney, Canada);
(2) Woods Hole Oceanographic Institution (Woods Hole, United States)

The Arctic Ocean’s Canada Basin, bordering northern Canada and Alaska, is layered with many water masses. The surface waters have low salinity, resulting from sea-ice formation and melt and from advection of Eurasian and North American river water. Beneath these surface waters is the distinctive Arctic halocline, containing Pacific-origin water (that enters
the Arctic through Bering Strait) and which overlies the saltier Atlantic-origin water (that enters the Arctic through Fram Strait). Beneath the Arctic halocline, slower flows circulate above the depth of the Arctic’s deep ocean ridges and below the ridge depth there is a thick layer of well-mixed bottom water. Joint Ocean Ice Studies (JOIS) is a collaboration primarily between Fisheries and Oceans Canada and Woods Hole Oceanographic Institution’s Arctic Observing Network – Beaufort Gyre Observing System (USA), but has many participants from Japan and other countries. JOIS has conducted annual oceanographic surveys of the Beaufort Gyre Region of the southern Canada Basin since 2003 using the CCGS Louis S. St-Laurent. CTD/Rosettes, geochemistry, zooplankton net tows, phytoplankton samples, moorings, ice tethered buoys, and ice observations are all used on a grid extending from the Beaufort Shelf in the south, through the ice up to 79N and between the Northwind Ridge in the west and the Canadian Arctic Archipelago in the east. Data from this program are used for studies of climate change, water mass circulation and variation and biological distribution. Importantly, research includes quantification of 1) low salinity water stored in the Beaufort Gyre which, when released, will have downstream effects in the North Atlantic and potentially disrupt the global meridional overturning circulation; 2) the contributions of river water and sea-ice melt to the low-salinity surface waters; 3) ocean acidification; 4) the distribution, circulation and modification of Pacific- and Atlantic-origin waters; and 5) the response of bacteria, phytoplankton and zooplankton to observed oceanic change. We will present an overview of the program and time-series results of the CTD and water chemistry data, describing the observed changes of the water masses within the Beaufort Gyre over the last 14 years including recent data from this year’s survey (September - October 2016).