ArcticNet

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Programme

2012

Annual Scientific Meeting

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Réunion scientifique annuelle

10-14/12/2012, Vancouver, BC

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GENERAL CONFERENCE PROGRAMME

	MONDAY 10 DECEMBER	TUESDAY 11 DECEMBER	WEDNESDAY 12 DECEMBER	THURSDAY 13 DECEMBER	FRIDAY 14 DECEMBER
08:30		Student Day	Plenary Session *(Bayshore Ballroom - Salon ABC)*	Plenary Session *(Bayshore Ballroom - Salon ABC)*	**09:00-10:30** Plenary Session *(Bayshore Ballroom - Salon ABC)*
10:00		Coffee Break	Coffee Break	Coffee Break	**10:30-11:00** Coffee Break
10:30		Student Day	Topical Sessions	Topical Sessions	**11:00-12:30** Topical Sessions
12:00		Lunch *(Stanley Park Ballroom)*	Lunch *(Stanley Park Ballroom)*	Lunch *(Stanley Park Ballroom)*	**12:30-14:00** Lunch *(Stanley Park Ballroom)*
13:30	Student Day *(Bayshore Ballroom - Salon ABC)*	Student Day	Plenary Session *(Bayshore Ballroom - Salon ABC)*	Plenary Session *(Bayshore Ballroom - Salon ABC)*	**14:00-15:30** ArcticNet Plenary *(Bayshore Ballroom - Salon ABC)*
15:00	Coffee Break	Coffee Break	Coffee Break	Coffee Break	**15:30** Meeting Adjourns
15:30	Student Day *(Bayshore Ballroom - Salon ABC)*	Student Day	Topical Sessions	Topical Sessions	
17:00		Registration/ Poster Session *(Bayshore Ballroom - Salon EF)*	Poster Session *(Bayshore Ballroom - Salon EF)*	Arctic Inspiration Prize Ceremony *(Bayshore Ballroom - Salon ABC)*	
19:00		Dinner on your own	**19:30** (Dinner on your own) People of a Feather *(Bayshore Ballroom - Salon ABC)*	**19:30** Banquet *(Bayshore Ballroom - Salon ABC)*	

STUDENT DAY PROGRAMME

MONDAY, 10 DECEMBER **ArcticNet Student Day** **Plenary Session** *(Bayshore Ballroom - Salon ABC)*		
13:30	Karley Campbell *(President, ArcticNet Student Association)*	Opening remarks
13:45	Dr. John Nightingale *(President, Vancouver Aquarium)*	The graduate student – A success story
15:00	**Break**	
15:30	Dr. Josée Michaud *(Data Manager, ArcticNet)*	The Polar Data Catalogue: A new "survival tool" for northern research and collaboration
15:45	Mr. Duane Smith *(President , Inuit Circumpolar Council - Canada)*	The future of environmental science in the North
18:00	Evening Gathering	
TUESDAY, 11 DECEMBER **ArcticNet Student Day** **Plenary Session** *(Bayshore Ballroom - Salon ABC)*		
08:00	Karley Campbell *(President, ArcticNet Student Association)*	Opening remarks
Workshop Session (1)		
08:30	**Title**	**Room**
	Planning a successful field season	Grand Ballroom D
	Tips for survival and success	Mackenzie
	The Inuit culture	Seymour
	Publishing results	Grand Ballroom ABC
	Education and outreach	Marine
10:00	**Break**	

STUDENT DAY PROGRAMME

TUESDAY, 11 DECEMBER **ArcticNet Student Day** **Workshop Session (2)**		
	Title	**Room**
10:30	Presenting your research	Grand Ballroom D
	The art of the Arctic	Mackenzie
	Community based research	Seymour
	Publishing results	Grand Ballroom ABC
	Arctic toolkit	Marine
12:00	**Lunch** *(Stanley Park Ballroom)*	
Workshop Session (3)		
	Title	**Room**
13:30	Audience specific communication	Grand Ballroom ABC
	Presenting your research	Grand Ballroom D
	The Inuit culture	Seymour
	The art of the Arctic	Mackenzie
	Arctic safety skills	Marine
15:00	**Break**	

STUDENT DAY PROGRAMME

TUESDAY, 11 DECEMBER **ArcticNet Student Day** **Workshop Session (4)**		
	Title	**Room**
15:30	Grant writing	Grand Ballroom D
	Education and outreach	Mackenzie
	Community based research	Seymour
	Arctic toolkit	Grand Ballroom ABC
	Arctic safety skills	Marine
Plenary Session *(Bayshore Ballroom - Salon ABC)*		
16:45	Karley Campbell *(President, ArcticNet Student Association)*	Closing remarks
17:00	Annual ASA Meeting	

PLENARY SESSION PROGRAMME

WEDNESDAY, 12 DECEMBER - 8:30 to 10:00 **Chair: Martin Fortier** *(Bayshore Ballroom - Salon ABC)*		
08:30	Louis Fortier *Professor, Université Laval / Scientific Director, ArcticNet*	Opening remarks
08:45	Terry Audla *President, Inuit Tapiriit Kanatami*	Address from new ITK President
09:00	Shannon O'Hara *Inuit Research Advisor, Inuvialuit Settlement Region*	Inuit Research Advisors: Bridging relationships with research
09:20	Trevor Bell *Professor, Memorial University of Newfoundland*	ArcticNet's Eastern Arctic Integrated Regional Impact Study (IRIS-2): Building communication networks, engaging scientists and decision makers, cultivating knowledge to action
09:40	Scott Lamoureux *Associate Professor, Queen's University*	Hydrological impacts of climate change on high Arctic rivers: Findings from a decade of research at the Cape Bounty Arctic Watershed Observatory (CBAWO), Melville Island, Nunavut
10:00 **10:10**	Michel Allard *Professor, Université Laval*	Release of the IRIS 4 Report
WEDNESDAY, 12 DECEMBER - 13:30 to 15:00 **Chair: Helen Joseph** *(Bayshore Ballroom - Salon ABC)*		
13:30	Vincent L'Hérault *PhD Student, Université du Québec à Rimouski*	Large-scale ecological monitoring of top carnivores in the tundra ecosystem of Nunavut
13:50	Jim Reist *Section Head, Fisheries and Oceans Canada*	Offshore marine fishes in the Canadian Beaufort Sea – initial findings and future directions
14:10	Derek Mueller *Assistant Professor, Carleton University*	The drift, deterioration and demise of Berghaus: From Petermann ice island fragment to ice cube
14:30	Søren Rysgaard *Professor, University of Manitoba*	Enhancing science and education cooperation in the Arctic

PLENARY SESSION PROGRAMME

THURSDAY, 13 DECEMBER - 8:30 to 10:00 **Chair: John Cheechoo** *(Bayshore Ballroom - Salon ABC)*		
08:30	Duane Smith *President, Inuit Circumpolar Council (Canada)*	Implementing the circumpolar Inuit declaration on resource development principles in Inuit Nunaat: Informed decision making through traditional knowledge and Arctic science
08:50	Tom Sheldon *Director, Environment Division, Nunatsiavut Government*	SakKijânginnatuk Nunalik: Building sustainable communities in the coastal subarctic – understanding the risks and developing tools and best practices for local priorities in Nunatsiavut
09:20	Sara Statham *MSc Student, McGill University*	Collaborating toward improving food security in Nunavut
09:40	Don Forbes *Adjunct Professor, Memorial University of Newfoundland*	Landscape and seabed mapping for safe and sustainable Eastern Arctic (IRIS-2) communities
THURSDAY, 13 DECEMBER - 13:30 to 15:00 **Chair: Russel Shearer** *(Bayshore Ballroom - Salon ABC)*		
Panel - Knowledge to Action: Federal Initiatives and Partnerships		
13:30	Danielle Labonté *Director General, Aboriginal Affairs and Northern Development Canada - Northern Policy and Science Integration Branch*	The Big Picture: Science and Technology and Canada's Northern Strategy
	David Scott *Executive Director, Canadian Polar Commission*	The revitalization of the Canadian Polar Commission
	Michael Jordan *Director, Polar Continental Shelf Program*	Polar Continental Shelf Program update
	Jill Watkins *Senior Scientific Advisor, Fisheries and Oceans Canada*	Fisheries and Oceans Canada's aquatic climate change adaptation services program
	Geneviève Carr *Scientific Advisor, Aboriginal Affairs and Northern Development Canada*	Beaufort Regional Environmental Assessment (BREA): Some preliminary results

PLENARY SESSION PROGRAMME

FRIDAY, 14 DECEMBER - 9:00 to 10:30 *(Bayshore Ballroom - Salon ABC)*		
09:00	Mason White *Assistant Professor, University of Toronto*	Arctic Food Network: An architecture/infrastructure proposal
09:20	Fiona Walton *Assistant Professor, University of Prince Edward Island*	Alluriarniaq [stepping forward]: Youth perspectives on high school education in Nunavut
09:40	Lisa Loseto *Section Head, Fisheries and Oceans Canada*	Insights into a changing Arctic through the eyes of a long-term beluga monitoring program
10:00	Kim Juniper *Professor, University of Victoria*	Cambridge Bay observatory – A miniature cabled ocean observatory for science and outreach
FRIDAY, 14 DECEMBER - 14:00 to 15:30 *(Bayshore Ballroom - Salon ABC)*		
14:00	Louis Fortier *Professor, Université Laval / Scientific Director, ArcticNet*	ArcticNet: Where do we go from here?
15:30	Meeting adjourns, meeting rooms available if needed	

TOPICAL SESSION PROGRAMME
(Schedule)

WEDNESDAY, 12 DECEMBER - 10:30 to 12:00

Arctic Security - A Changing Geostrategic Reality (Panel)
Chair: Rob Huebert
Grand Ballroom ABC

10:30	Lackenbauer, Whitney	The Harper government and its plans for Arctic security
10:45	Lalonde, Suzanne	Protecting canadian sovereignty in the Northwest Passage
11:00	Funston, Bernie	Canada and the Arctic Council: Entering the chairmanship
11:15	Manicom, James	The arrival of the asian tigers into the Arctic: New challenges
11:30	Huebert, Rob	Arctic security - A changing geostrategic reality
11:45	Panel discussion	

Arctic Lakes, Rivers and Estuaries (Part I)
Chair: Milla Rautio
Grand Ballroom D

10:30	Godin, Pamela	Tracing the terrigenous sources of POC and DOC in the Arctic rivers of the Hudson Bay using lignin biomarkers, δ13C and Δ14C
10:45	MacDonald, Lauren	Avian-driven alterations in seasonal carbon cycling of an arctic tundra pond in Wapusk National Park (Manitoba, Canada)
11:00	Rautio, Milla	Carbon pools and transformations in subarctic thaw ponds between summer and winter
11:15	Scott, Neal	Spatial and temporal patterns of net ecosystem exchange of carbon dioxide and ecosystem respiration at the Cape Bounty Arctic Watershed Observatory, Melville Island, Nunavut
11:30	Walker, Sally	Seasonal changes of chromophoric dissolved organic matter (CDOM) quality: A comparison of large arctic rivers
11:45	Gueguen, Celine	The estuarine mixing behaviour of terrestrially derived dissolved organic carbon and its relationship to colored dissolved organic matter in two Hudson Bay estuaries

Arctic Marine Ecosystems (Part I)
Chair: Alexandre Forest
Mackenzie

10:30	Forest, Alexandre	Integrating marine ecological processes of the Canadian Arctic environment within a community-based modeling framework
10:45	Dmitrenko. Igor	Heat loss from the Atlantic water layer in the St. Anna Trough (northern Kara Seas): Causes and consequences
11:00	Jin, Meibing	Sensitivity study of ocean mixing under sea ice using multi-column ocean grid in climate model
11:15	deYoung, Brad	The oceanographic dynamics of a subarctic Fjord - Lake Melville: Avativut, Kanuittailinnivut
11:30	Atkinson, David	Low visibility event climatology and synoptic drivers, Bering Strait region

Arctic Contaminants
Chair: Feiyue Wang
Seymour

10:30	Beattie, Sarah	Role of multiyear sea ice in the biogeochemical cycling of mercury in the Arctic Ocean
10:45	Foster, Karen	Mercury biomagnification in marine zooplankton food webs in Hudson Bay
11:00	St.Louis, Vincent	Quantifying contaminant loadings, water quality and climate change impacts in the world's largest lake north of 74° latitude (Lake Hazen, Quttinirpaaq National Park, Northern Ellesmere Island, Nunavut)
11:15	Wang, Feiyue	Total and methylated mercury in the Beaufort Sea: The role of local and recent organic remineralization
11:30	Fillion, Myriam	Food insecurity is compounded by increased mercury and lead exposure among Inuit in the Canadian Arctic

Arctic Marine Mammals (Part I)
Chair: Yvan Simard
Marine

10:30	Choy, Emily	The offshore diet of the Eastern Beaufort sea beluga population and the energetic effects of climate change
10:45	McKinney, Melissa	Validation of adipose lipid content as a body condition metric in southern Beaufort Sea polar bears
11:00	Reinhart, Natalie	An assessment of killer whale *Orcinus orca* rake mark occurrence in the Eastern Canada-West Greenland bowhead whale *Balaena mysticetus* population
11:15	Simard, Yvan	Global warming effects on Arctic and subarctic underwater soundscapes and marine mammal frequentation from an acoustic observatory

WEDNESDAY, 12 DECEMBER - 15:30 to 17:15

Arctic Tundra and Vegetation (Part I)
Chair: Greg Henry
Grand Ballroom ABC

15:30	Bjorkman, Anne	Migration potential of tundra plant species in a warming Arctic: Responses of southern ecotypes of three species to experimental warming in the High Arctic
15:45	Boulanger-Lapointe, Noémie	Populations' dynamic and growth pattern of the Arctic willow in High Arctic Canada and Greenland
16:00	Carrie, Jesse	Organic matter sources and cycling in soils, sediments, peats and coal: A comparative review using Rock-Eval analyses
16:15	Christiansen, Casper	Does enhanced winter snow accumulation affect tundra carbon and nutrient dynamics during the growing season?
16:30	Fritz, Michael	Late glacial and Holocene vegetation and climate history from easternmost Beringia (Northern Yukon Territory, Canada)
16:45	Gennaretti, Fabio	A network of millennial tree ring chronologies for climate reconstructions from the margin of the Eastern Canadian Arctic
17:00	Henry, Greg	Annual variations in growing season length in a warming Arctic: Changes at Alexandra Fiord, Ellesmere Island, Nunavut

Arctic Lakes, Rivers and Estuaries (Part II)
Chair: Fred Wrona
Grand Ballroom D

15:30	Wrona, Fred	Hydro-ecological responses of Arctic upland lakes to a changing cryosphere
15:45	Bonnaventure, Philip	Complex thermal storage and mixing of High Arctic lakes: Transitioning to seasonal ice cover and a longer ice-free period
16:00	Medeiros, Andrew	Examining the effect of catchment disturbance on nutrients and biological communities of Arctic lakes (Seward peninsula, Alaska)
16:15	Gantner, Nikolaus	CSI Husky Lakes: Evaluation of hydro-climatic drivers of contaminant transfer in aquatic food webs in the Husky Lakes watershed, Northwest Territories, Canada
16:30	Omelon, Christopher	Phototrophic and heterotrophic respiration associated with cryptoendolithic microorganisms, Ellesmere Island, Canadian high Arctic
16:45	Przytulska-Bartosiewicz, Anna	The effects of warming and nutrient enrichment on bloom-forming cyanobacteria in subarctic lakes
17:00	Bell, Trevor	Lake Melville: Avativut, Kanuittailinnivut (our environment, our health)

Ocean mapping, Coastal & Shelf Processes
Chair: Steve Blasco
Mackenzie

15:30	Bennett, Robbie	Distribution of seabed ice scour caused by grounded icebergs on the Canadian Baffin shelf
15:45	Blasco, Steve	Outer shelf and upper slope seabed dynamics, Canadian Beaufort Sea based on geological data
16:00	Hugues Clarke, John	A new inshore seabed mapping capability in Nunavut
16:15	James, Thomas	Vertical land motion, sea-level fingerprinting, and projections of relative sea-level change in Northern Canada
16:30	Lantuit, Hugues	Organic carbon release from coastal erosion on ice-rich permafrost coasts: A comparison of the Southern Laptev Sea and the Southern Beaufort Sea
16:45	Simon, Karen	Glacial isostatic adjustment in Northern Canada: Improving Innuitian and Laurentide Ice Sheet reconstructions using relative sea-level and GPS data

Arctic Remote Sensing
Chair: Monique Bernier
Seymour

15:30	Bernier, Monique	Temporal variations in the structure of the subarctic snowpack and its effects on SAR satellite imagery at X- and C-band
15:45	Collingwood, Adam	Biophysical modeling and monitoring in the Canadian High Arctic with RADARSAT-2
16:00	Duffe, Jason	21st century methods to derive and deliver coastal information: Improved emergency preparedness in Canada's Arctic
16:15	Roth, Achim	Processing of high resolution polarimetric sar data to support mapping and monitoring of Arctic environments
16:30	Rudy, Ashley	Satellite change detection techniques and object-based analysis to identify permafrost slope disturbances at Cape Bounty, Melville Island, Nunavut
16:45	Ullman, Tobias	Land cover characterization of Arctic environments by means of polarimetric synthetic aperture radar (SAR) and digital elevation model (DEM) data
17:00	Atkinson, David	High spatial resolution remote sensing models for landscape-scale CO_2 exchange

Arctic Monitoring, Modeling and Data Management
Chair: Jill Watkins
Marine

15:30	Watkins, Jill	Identifying indicators for monitoring Arctic marine biodiversity in Canada
15:45	Culp, Joseph	Developing a circumpolar monitoring framework for Arctic freshwater biodiversity
16:00	McLennon, Donald	A potential role for CHARS in Arctic monitoring and reporting in Canada
16:15	Liu, Zhuo	Preliminary study of NEMO and its use in the Arctic IRIS process
16:30	Markovic, Marko	A Transition from CMIP3 to CMIP5 for climate information providers: the case of surface temperature over eastern North America
16:45	LeDrew, Ellsworth	The future of citizen science and social media in polar data management

Education and Outreach
Chair: Thierry Rodon
Stanley Park Ballroom

15:30	Berkes, Fikret	Local people's accounts of climate change: To what extent are they influenced by the media?
15:45	Reinfort, Breanne	The overlooked importance of communication processes in disseminating contaminants research to Inuvialuit
16:00	Rudin, Sofia	High school student-led research examining peatland vegetation-permafrost relationships in the Hudson Bay lowlands, Manitoba, Canada
16:15	Petrasek MacDonald, Joanna	A necessary voice: The importance of engaging and including Inuit youth in Northern research and policy
16:30	Watts, Michelle	Schools on Board - from ship to shore; authentic and simulated Arctic science research experiences for high school students and teachers
16:45	Rodon, Thierry	Research in action: Improving access to university education in the Canadian Arctic, learning from past experiences, listening to the Inuit students and developing tools and policies

THURSDAY, 13 DECEMBER - 10:30 to 12:00

Arctic Marine Mammals (Part II)
Chair: Mike Hammill
Grand Ballroom ABC

10:30	Doniol-Valcroze, Thomas	Graphical models of co-management frameworks: Applying a bayesian decision network to the subsistence hunt of Eastern Hudson Bay beluga
10:45	Breton-Honeyman, Kaitlin	Enhancing understandings in marine mammal ecology: Beluga whale ecology, science and Inuit knowledge in Nunavik
11:00	Gélinas, Véronique	Understanding the feeding ecology of bowhead whales in Nunavik using stables isotopes, trace elements and Inuit knowledge
11:15	Hammill, Mike	Harbour seals and declining ice in Western Hudson Bay: Will climate change be beneficial?
11:30	Iverson, Samuel	Cascading ecological impacts of climate change: Temporal advances in summer sea ice break-up are correlated with increased predation of colonial-nesting bird eggs by polar bears

Future Directions in Inuit Education Research: A Roundtable Discussion
Chair: Scot Nickels
Grand Ballroom D

10:30 - 12:00	Roundtable Discussion	Future directions in Inuit education research

Arctic Marine Ecosystems (Part II)
Chair: C.J. Mundy
Mackenzie

10:30	Mundy, C.J.	Particulate absorption in the bottom layer of first-year sea ice in the Canadian Arctic: Characterization and seasonal trends
10:45	Meisterhans, Guillaume	Dissolved organic matter input from sea-ice melt increases heterotrophy in Arctic surface water communities
11:00	Poulin, Michel	Patchy distribution of *Melosira arctica* in Arctic first-year sea ice: Challenges and implications
11:15	Bozman, Andrea	Smack in the subarctic: Population dynamics and vertical habitat preference of a deep water jellyfish, *Periphylla periphylla*, in a subarctic fjord
11:30	Grigor, Jordan	Life history, annual routine and vertical distribution of an Arctic fjord population of the chaetognath *Parasagitta elegans*
11:45	Schmid, Moritz	Assessing spatiotemporal variability in the mesozooplankton using a newly developed plankton imaging system: First results from the BaySys 2012 expedition to Hudson Bay

Arctic Glaciers. Ice Shelves and Ice Islands
Chair: Christian Haas
Seymour

10:30	Haas, Christian	Thickness of sea ice, ice islands, and ice shelves in the High Canadian Arctic
10:45	White, Adrienne	Changes to the Petersen Ice Shelf and epishelf lake, Northern Ellesmere Island, since 2005
11:00	Crawford, Anna	Deterioration patterns of ice islands adrift in the Canadian Arctic
11:15	Forrest, Alexander	Observations beneath Petermann Ice Island–B (PII–B) in the Canadian Arctic
11:30	Schaffer, Nicole	Current ice motion over Penny Ice Cap, Baffin Island, Nunavut
11:45	Tamil Selvan, Muthusamy	Comparative study of impact of climate change on the Canadian Arctic and Himalayan glacier dynamics

Indigenous Knowlege & Community Adaptation
Chair: Jennie Knopp
Marine

10:30	L'Hérault, Vincent	The ARCTIConnexion program: Bridging northern communities and Arctic research
10:45	Gibéryen. Tania	Life on permafrost in Nunavik: Community planning empowerment
11:00	Buckham, Meghan	Barriers and facilitators to indigenous knowledge integration in environmental decision-making: A case study of the Nunatsiavut government
11:15	Knopp, Jennie	Inuvialuit and ecological knowledge to examine effects of lake environment on Arctic char growth and health

THURSDAY, 13 DECEMBER - 15:30 to 17:00

Arctic Maritime Boundary Disputes (Panel)

Chair: Michael Byers
Grand Ballroom ABC

15:30 - 17:00	Byers, Michael	Arctic maritime boundary disputes: Lessons and opportunities
	Kolodkin, Roman	
	Ulfstein, Geir	
	Nankivell, Justin	
	Baker, James	

Food Security and Human Health

Chair: Myriam Fillion
Grand Ballroom D

15:30	Fillion, Myriam	Adaptation planning in the Inuvialuit Settlement Region: Summary and recommendations from a workshop on food security and food safety
15:45	Hirsch, Rachel	Aullak, sangilivallianginnatuk (going off, growing strong): A community-led enhancement of the community freezer program for improved mental health, nutrition and intergenerational skills transmission in Nain, Nunatsiavut
16:00	Juillet, Cédric	Arctic food security and climate changes: towards a quantitative integrated approach to enhance decision-making capacity
16:15	Durkalec, Agata	Environmental health risk management in Nunatsiavut: Negotiating climate change and health influences of sea ice use

Arctic Marine Ecosystems (Part III)

Chair: Brent Else
Mackenzie

15:30	Else, Brent	Sea ice loss and the changing atmospheric CO_2 uptake capacity of the Arctic Ocean: Insights from the southeastern Canada Basin
15:45	Campbell, Karley	Characterizing the ice algae biomass-snow depth relationship over spring melt using transmitted irradiance
16:00	Galindo, Virginie	DMSP bacterial metabolism at the ice-water interface during the spring melt period in Arctic
16:15	Nephin, Jessica	Investigating associations between macro- and megafauna communities on the Beaufort Shelf and Slope --- with applications for future monitoring using biological surrogates
16:30	Outridge, Peter	Change at the margin of the North Water Polynya, Baffin Bay, inferred from organic matter records in dated sediment cores

Arctic Rangifers
Chair: Gita Ljubicic
Seymour

15:30	Ljubicic, Gita	Where are the caribou? The curious case of King William Island, Nunavut
15:45	Le Corre, Mael	Effects of climate on the timing of the spring and fall migration of migratory caribou
16:00	Rasiulis, Alexandre	Survival and demography of migratory caribou in Northern Québec and Labrador
16:15	Young, Kathy	What killed the caribou? A caribou snow investigation (CSI)

Arctic Charr
Chair: Niloshini Sinnatamby
Seymour

16:30	Murdoch, Alyssa	The effect of lake morphometry on thermal habitat use and growth in Arctic charr populations: Implications for understanding climate-change impacts
16:45	Sinnatamby, Niloshini	Latitudinal compensation in growth and metabolic rate of Canadian young-of-the-year Arctic charr

Arctic Sea Ice
Chair: David Barber
Marine

15:30	Prinsenberg, Simon	Observing the snow and melt pond properties in the Canadian Beaufort Sea
15:45	Barber, David	On the detection and monitoring of sea ice and glacial ice hazards in the Southern Beaufort Sea
16:00	Asplin, Matthew	Dynamic and thermodynamic implications of ocean swell fracturing on summer Arctic sea ice as a result of Arctic storms
16:15	Kinda, G. Bazile	Under-ice noise in Eastern Beaufort Sea: Ice drift forcing, fracturing and formation of leads
16:30	Horton, Brian	On the relationship between the decline in sea ice and the size, strength and shape of the polar vortex
16:45	Nudds, Shannon	Ocean and sea-ice variability in the Arctic Ocean and Canadian Arctic Archipelago: High-resolution model simulation and assessment with observations

FRIDAY, 14 DECEMBER - 11:00 to 12:30

Arctic Tundra and Vegetation (Part II)

Chair: Esther Lévesque
Grand Ballroom ABC

11:00	Lévesque, Esther	Recent warming in Kangiqsualujjuaq, Nunavik : More shrubs, more trees, less berries?
11:15	Lafleur, Peter	Shrub cover and the carbon dioxide sink strength of canadian low Arctic tundra
11:30	McLaren, Jennie	Seasonal variation in soil nitrogen availability across a fertilization chronosequence in moist acidic tundra
11:45	Myers-Smith, Isla	Feedbacks between shrubs and temperatures across Northern Canada
12:00	Ravolainen, Virve	Tall shrub tundra vegetation and drivers of change
12:15	Zamin, Tara	Experimental warming increases tundra plant and soil C, N, and P pools, with disproportionate effects of *Betula glandulosa* and *Eriophorum vaginatum*

Arctic Wildlife

Chair: George Divoky
Grand Ballroom D

11:00	Divoky, George	Monitoring nearshore Arctic forage fish with a nesting seabird: Using prey observations and chick quality to assess temporal variation
11:15	Christie, Katie	Ptarmigan in a changing Arctic - Distributional patterns and browsing by ptarmigan in Northern Alaska
11:30	Elliott, Kyle	Physiological but not behavioural senescence in Arctic seabirds
11:45	Robinson, Barry	Modelling spatial variation in the densities of different avian guilds in the Northern Arctic ecotone
12:00	Bilodeau, Frédéric	Are tundra lemming populations controlled from the bottom-up or the top-down?
12:15	Robinson, Samuel	FLYCATCHER: An algorithm for processing insect visitation data from time-lapse cameras

Arctic Marine Ecosystems (Part IV)

Chair: Caroline Bouchard
Mackenzie

11:00	Benoit, Delphine	Distribution and habitat characteristics of polar cod (*Boreogadus saida*) in southeastern Beaufort Sea before the formation of dense under-ice winter aggregations
11:15	Bouchard, Caroline	Larval survival in frozen seas: Biological and physical factors influencing polar cod (*Boreogadus saida*) recruitment
11:30	Nelson, R. John	Pan-Arctic genetic population structure of the Arctic cod *Boreogadus saida*
11:45	Grant, Scott	Investigations of gear modifications to reduce the bycatch of Greenland shark in turbot longline fisheries
12:00	Munden, Jenna	Reducing gangion breaking strength of Greenland halibut (*Reinhardtius hippoglossoides*) longline gear to reduce Greenland shark (*Somniosus microcephalus*) bycatch in the Cumberland Sound
12:15	Geoffroy, Maxime	An answer to the mystery of the missing Arctic cod?

Arctic Polynyas
Chair: Geoffrey Gunn
Seymour

11:00	Gunn, Geoffrey	A time-series analysis of polynya geometry in northwestern Hudson Bay, 1980-2012
11:15	Heinemann, Guenther	The Laptev Sea polynya project: The Siberian perspective of the Circumpolar Flaw Lead System
11:30	Heinemann, Guenther	A study of the dynamics of the North Water polynya using different satellite data sets and methods
11:45	Vincent, Ron	The 2009 North Water anomaly: Mechanisms of Arctic amplification

Arctic Communities and Resource Development
Chair: Frank Tester
Marine

11:00	Furgal, Chris	Impacts of mineral development in the Arctic: A 10-year review of the monitoring and impacts of the Voisey's Bay development on Inuit, Nunatsiavut communities and the environment
11:15	Cameron, Emilie	IBAs and the neoliberalization of Northern resource extraction
11:30	Cater, Tara	"The road to Meliadine:" Exploring past, present, and future mining encounters in the Kivalliq region, Nunavut
11:45	Green, Heather	Colonialism, community consultation, and Inuit employment in an Arctic mine, 1970-2002
12:00	Lambert, Drummond	Pioneering on the behalf of Inuit: Planning Canada's first High Arctic mine
12:15	Lim, Tee Wem	"We thought it would last forever": The social scars and legacy effects of mine closure at Nanisivik, Canada's first High Arctic mine

Plenary Session Oral Abstracts

ARCTICNET'S EASTERN ARCTIC INTEGRATED REGIONAL IMPACT STUDY (IRIS-2): BUILDING COMMUNICATION NETWORKS, ENGAGING SCIENTISTS AND DECISION MAKERS, CULTIVATING KNOWLEDGE TO ACTION

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After almost a decade since ArcticNet was established, the concept of and motivation for Integrated Regional Impact Studies (IRIS) should be embedded in the planning and activities of network investigators and graduate students. By the time of the 8th Annual Science Meeting in Vancouver, there will have been three Regional Science Meetings (Kuujjuaq, 2009; Inuvik, 2011; Iqaluit, 2012), hosting decision makers from all parts of the Canadian coastal Arctic, and at least first drafts of Integrated Regional Impact Assessments (IRIAs) covering all Inuit regions. The urgent need to address issues of Inuit Health and Adaptation, food and water security, community sustainability, ecosystem maintenance, services and integrity, among others, while facing dramatic climate and environmental changes, and planning for resource development, cannot be understated. Northern and Inuit governments by necessity are rapidly moving from a need for more understanding to a need for immediate action. The scientific conclusions and recommendations produced by the core research program of ArcticNet, integrated with Inuit Knowledge and expertise, are needed now more than ever. But the task is not complete with the published journal article or the successfully examined thesis; there is a growing awareness that the gap between science and policy or knowledge and action must be bridged by movement on both sides to come together to identify "what we know, what we don't know, and what we need to know" to make informed decisions.

From the outset, the Eastern Arctic IRIS has been motivated by the need to bridge the gap between knowledge and decision making in our region. The IRIS steering committee (see co-author list) has helped guide our efforts to make ArcticNet and its investigators and projects better known in the region, and local governments, agencies and initiatives better known to the network. That relationship building will reach a new level during the Regional Science Meeting when we ask ArcticNet investigators to present draft chapters of our regional assessment to an invited group of decision makers for feedback on content and format. We are confident that this interaction will help bridge the gap between ArcticNet knowledge and local action in the Eastern Arctic. Our presentation will report on the Iqaluit Regional Science Meeting and the progress made in generating a regional impact assessment that meets local needs and addresses needed actions. We will also be soliciting ideas on how to build on the momentum of the Regional Science Meeting through continued interaction and dialogue.

BEAUFORT REGIONAL ENVIRONMENTAL ASSESSMENT (BREA): SOME PRELIMINARY RESULTS

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The Beaufort Regional Environmental Assessment (BREA) is a partnership among Inuvialuit, industry, governments, regulators and academia to prepare for oil and gas activity in the Beaufort Sea. Through multi-stakeholder committees, BREA is building a regional knowledge base to inform regulatory processes and project-specific environmental assessments related to oil and gas activity in the Beaufort Basin. This is being achieved through the implementation of a targeted research program and working groups that are addressing key regional issues including cumulative effects assessment, information management, regional waste management, oil spill preparedness and response, socio-economic indicators, and climate change. An overview of preliminary research and working group results will be presented in this talk.

LANDSCAPE AND SEABED MAPPING FOR SAFE AND SUSTAINABLE EASTERN ARCTIC (IRIS-2) COMMUNITIES

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ArcticNet researchers and partners over the past few years have assembled a remarkable array of new data onshore and in the nearshore for a number of communities in the IRIS-2 region (Eastern Canadian Arctic). These new data sets on land and seabed geomorphology, surficial geology, permafrost and ground-ice conditions, slope stability and rockfall hazards, runoff and drainage, nearshore and intertidal sediment dynamics, benthic habitat and harbour approaches represent a quantum leap in our knowledge of the physical setting for community development in the eastern Arctic. Coupled with work on periglacial processes, sea-level trends, sea-ice dynamics, runoff and marine flooding, and coastal storm impacts, our understanding of coastal landscape hazards is greatly enhanced. Physical landscape mapping has been undertaken in Hall Beach, Arctic Bay, Clyde River, Pangnirtung, and Iqaluit, as well as other communities in Kivalliq and Kitikmeot. The outputs include maps of surficial geology, slope hazards, permafrost and periglacial landforms and InSAR mapping of seasonal subsidence, with direct application to assessment of building foundation stability. New approaches to integrated landscape hazard mapping have also been explored. In the shore zone, new mapping of the Iqaluit tidal flats at low and high water provides a basis for modelling intertidal sea ice dynamics and wave shoaling along the Iqaluit waterfront and a baseline for evaluating future response to climate change. Limited nearshore mapping from high-resolution satellite imagery has been accomplished in exceptionally clear waters of Foxe Basin in the vicinity of Hall Beach. More extensive ship- and launch-based multibeam sonar surveys have provided entirely new visualizaiton of the seafloor in Arctic Bay, Nanisivik, Eclipse Sound near Pond Inlet, and other communities such as Resolute Bay. A major coastal mapping program from the GN research vessel MV *Nuliajuk* is currently underway along the southeast Baffin coast from Clyde River to Iqaluit, providing new data for port planning, fisheries assessment, and sea-level studies. Preliminary findings will be presented at the 2012 ArcticNet meeting. These data form an important component of the knowledge base for safe and sustainable community development and an important contributor to adaptive capacity for northern residents. These outcomes are highly relevant in the context of the IRIS process and feed our collaboration with the City of Iqaluit and the SSHRC-funded C-Change Project on sustainability of coastal communities in Canada and the Caribbean. Insights from this work are also applicable to the *SakKijânginnatuk Nunalik* (Sustainable Communities) initiative in Nunatsiavut, which is helping Inuit communities to adapt to the already occurring and unavoidable impacts of environmental and social changes in the coastal subArctic.

POLAR CONTINENTAL SHELF PROGRAM UPDATE

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The Polar Continental Shelf Program (PCSP) coordinates logistics for Canadian government agencies, provincial and territorial government agencies, northern organizations, universities and independent groups conducting research in Canada's North. PCSP provides safe, efficient and cost-effective logistics services including coordination of charter air transportation to and from remote field camps throughout the Canadian Arctic; meals, accommodations and working space (including a laboratory facility) at the PCSP facility in Resolute, Nunavut; field equipment (including communications equipment) and vehicles for loan; fuel for aircraft, equipment and camps; and a communications network that links PCSP with the scientific teams in field camps dispersed throughout the Arctic. In addition, PCSP also supplies specialized field equipment to federal departments and agencies across Canada.

PCSP continues to update and adapt its operations in order to better maximize cost-effective scientific fieldwork logistics, particularly in the Arctic. PCSP has streamlined its project review process in order to provide earlier notification of decisions relating to project feasibility and PCSP also continues to seek innovative partnerships with other Arctic organizations (e.g., DND partnership to construct the Canadian Forces Arctic Training Centre (CFATC) expansion to the PCSP Facility in Resolute which will be complete in Summer 2013).

CAMBRIDGE BAY OBSERVATORY – A MINIATURE CABLED OCEAN OBSERVATORY FOR SCIENCE AND OUTREACH

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In September 2012, Ocean Networks Canada, based at the University of Victoria, completed installation of a cabled undersea observatory in Cambridge Bay. This represents the first location in Canada's Arctic for year-round monitoring of the marine environment. The observatory consists of a single underwater instrument platform (6.3 m water depth) connected by power and communications cables to a shore station on the wharf in the hamlet of Cambridge Bay. The seafloor platforms hosts a Wetlabs Water Quality Monitor (CTD, O_2, fluorescence, turbidity), an Ocean Presence HD video camera and hydrophone, and an ASL Shallow Water Ice Profiler. On the wharf, a Davis Vantage Pro weather station and seaward-looking Axis video camera provide further environmental information. A wireless connection transmits all data and imagery from the shore station to a Nunavut government building in Cambridge Bay, where a commercial satellite link is established to the NEPTUNE Canada data centre at the University of Victoria, allowing quasi-real-time monitoring and archiving of data. Data have been flowing over this link since early October 2012.

We plan to operate this mini-observatory in Cambridge Bay for a period of 5 years. During this time we will work with the research community to develop shore-based scientific programs that will take advantage of the continuous, year-round data stream from the undersea platforms. An equally important goal of this project involves working with the local secondary school to enable students to discover marine science through access to live video, underwater sounds and data from the observatory. The school program will draw from a successful program at Brentwood College School near Victoria, BC, where a similar shallow-water, mini-observatory provides data to high school science classes. All imagery and data will be archived for long-term study of the changing ocean environment in the arctic.

LARGE-SCALE ECOLOGICAL MONITORING OF TOP CARNIVORES IN THE TUNDRA ECOSYSTEM OF NUNAVUT

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The arctic tundra is currently experiencing important environmental changes (global warming, industrial development, habitat degradation) and its simplified structure increases its vulnerability. The functioning of the tundra ecosystem is still poorly known which hamper our capacity to anticipate the impact of environmental changes on this system. Studying top predators such as large carnivores (wolf, wolverine, and grizzly bear) is an essential step towards assessing the functioning and

vulnerability of the tundra to environmental changes because they depend on a large prey base and they are sensitive to perturbations. Moreover, they are a critical component of the ecology of large herbivores, which are crucial for northern communities.

Our monitoring project aims at studying wolf, wolverine, and grizzly bear ecology to better understand their role in the functioning of the Arctic terrestrial ecosystem. This is a collaboration between the hunters and trappers organizations and conservation officers from 15 Nunavut communities, the Department of Environment of the Government of Nunavut, and the Université du Québec à Rimouski. We combine scientific knowledge to Inuit local Knowledge. This community-based project relies on the collection of animals harvested by hunters. The objectives are 1) to investigate variations in the diet of large carnivores across regions and seasons, 2) to better understand the reproduction and health status of carnivore populations, and 3) to document Inuit traditional knowledge to complement scientific knowledge on the ecology of large carnivores, particularly regarding their vulnerability to ongoing environmental change.

We conducted our first analyses using stomach contents of wolverines and wolves and we found important diet variation among the two mainland regions of Nunavut (Kivalliq vs Kitikmeot) during the past three years (2010-12). Analyses conducted during seven years in the Kugluktuk area (Kitikmeot) revealed that seasons and gender were important factors explaining diet variation in wolverines. Further analyses including multi-factorial and stable isotopes analyses are nonetheless required to confirm the observed patterns and delineate energy use by these predators. Preliminary results obtained from interviews with active Inuit hunters and elders suggest recent changes in the ecology of large carnivores, likely as a result of industrial development, hunting pressure, and climate changes. For instance, the grizzly bear distribution has undertaken an unprecedented shift toward the northeast of Kivalliq, with several safety concerns for communities. Hunters have also experienced changing patterns in the consolidating-melting cycle of freshwater ice as well as in the snow cover quality (increased density and decreased duration). This raises new questions about the displacement capacity of large carnivores and their efficiency in tracking herds of herbivores.

This is the third year of this ecological monitoring program, which is building a growing relationship between the various stakeholders involved, with a clear enthusiastic participation of northern communities.

THE BIG PICTURE: S&T AND CANADA'S NORTHERN STRATEGY

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The Government of Canada's commitment to build a world-class Arctic research station was reaffirmed in August 2012 by the Prime Minister. The Canadian High Arctic Research Station (CHARS) is a key deliverable of Canada's Northern Strategy. CHARS is being designed to undertake solution-driven science and technology to address pressing economic, social and environmental issues in the North. CHARS will be located in Cambridge Bay, Nunavut, and it will employ resident scientists and host domestic and international collaborators and visiting researchers on a year-round basis, as well as work with the existing network of Arctic research infrastructure. The opening of the Station is anticipated to be July 1, 2017. The Science and Technology (S&T) Program of CHARS will begin earlier and will grow to ensure the full utilization of the Station by 2017. Work is ongoing to define CHARS' S&T Program, infrastructure requirements and potential partnerships in collaboration with Northerners, scientists, industry and governments.

HYDROLOGICAL IMPACTS OF CLIMATE CHANGE ON HIGH ARCTIC RIVERS: FINDINGS FROM A DECADE OF RESEARCH AT THE CAPE BOUNTY ARCTIC WATERSHED OBSERVATORY (CBAWO), MELVILLE ISLAND, NUNAVUT

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Projected climate change is expected to substantially alter the surface water environment in the Canadian Arctic, with potential impacts on discharge characteristics and water quality, which in turn impact aquatic ecosystems that represent an important natural resource in the region. We have undertaken a long term hydrological research program at the Cape Bounty Arctic Watershed Observatory (CBAWO), Melville Island, with the goal of developing a framework to understand the hydrological and biogeochemical processes that operate in watersheds and to identify their responses and sensitivities to climate change, and to project future changes in these surface water environments. The program includes paired river

basin and lake studies that have investigated the timing, magnitude and controls over discharge along with detailed sediment, hydrochemical and nutrient transport studies. This record of research activity spans the 2003-12 period, and encompasses a wide range of climatic conditions including the warmest and coldest melt seasons since records began, along with an episode of widespread permafrost perturbation and disturbance that began in 2007. Following disturbance, detailed assessments of the impact of varying degrees of slope disturbance were undertaken at the subcatchment scale.

Despite climate model projections for higher winter snowfall that is expected to drive higher spring flow intensity, results at CBAWO show that warm spring temperatures fragment snow cover and reduce the magnitude of peak river discharge. Lower peak discharge has resulted in substantial reductions in nival-transported sediment and solutes. Initial melt has advanced by up to three weeks between 2003-12, but the pattern is highly variable and poorly correlated to climate measures. By contrast, reduced residual snow cover in the catchment by mid-season has resulted in lower baseflow discharge and instances of flow cessation in higher order rivers. While infrequent, major rainfall that rejuvenates streamflow is highly effective for generating sediment erosion, and flushing of deeply thawed soils results in high solute and nutrient fluxes. In several instances, individual rainfall events exceeding 30 mm have contributed the majority of the seasonal fluxes of sediment and solutes.

Localized physical disturbance of slopes by active layer detachments (ALDs) generate high sediment and solute loads that have been sustained for five years. However, at the catchment scale, these impacts are muted by broader hydrological controls and limited connectivity of some disturbances to the channel system. Channel dynamics further dampen the impact of lateral inflows of particulates through longitudinal storage and progressive release. Hence, the channel system has responded by effectively dampening the impact of disturbance.

Key areas of uncertainty that require further research include: improved quantification of changing pre-runoff snowpack; processes that control the differential release of sediment and solutes from different catchment sources, and better characterization of subsurface (shallow soil) water flows and pathways, along with riparian interactions.

INSIGHTS INTO A CHANGING ARCTIC THROUGH THE EYES OF A LONG-TERM BELUGA MONITORING PROGRAM

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In recent years the warming Arctic has seen record low sea ice extent, with historic lows in 2012. While the implications for biota are unclear, they may be dramatic for those species that rely on sea-ice associated food webs. For the Beaufort Sea beluga whale population that rely on sea ice associated prey such as Arctic cod, these recent climate driven-changes may alter the quantity and quality of available food. Such altered food webs have likely modified the exposure of a variety of contaminants to beluga whales. This beluga population forms one of the largest summering aggregations in the Beaufort Sea/ Mackenzie Estuary, a habitat rich in oil and gas resources. With recent renewed interest in both nearshore and offshore hydrocarbon development along with a changing ice habitat there is a need for focused research and monitoring to assess cumulative impacts of multiple system stressors. Since interests in petroleum resources were heightened in the 1970's and 1980's this population of beluga whales has been monitored for decades representing one of the longest arctic marine mammal data sets. More recently a three year holistic health assessment took place at a whaling camp. The assessment evaluated contaminant associated effects, nutritional status and potential effects driven by climate change cascading impacts on the food web and disease exposure. Examining some of the longer term monitoring and recent process studies has revealed dynamic trends in contaminants over time as well as within population shifts that are partially related to diet and reductions in available sea ice habitat. These results highlight the need to consider ecosystem connectivity and variability in addition to community knowledge and perspectives. The beluga monitoring program is now moving into a phase of refining monitoring approaches that narrows on key indicators and integrating local knowledge and perspectives to ensure the inclusion of meaningful and responsive indicators while expanding spatially and temporally to capture regional variability. The long term monitoring of beluga in the Beaufort Sea has provided insight into the consequences of climate change to their habitat use and

diet, and will support the provision of advice needed for the consideration of cumulative impacts of multiple stressors.

THE DRIFT, DETERIORATION AND DEMISE OF BERGHAUS: FROM PETERMANN ICE ISLAND FRAGMENT TO ICE CUBE

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Recent calving of glacial ice tongues in Greenland has led to the production of large tabular icebergs, known as ice islands. These vast ice masses break into numerous fragments as they drift south in the Labrador Current. Given that ice islands are rare relative to more typical icebergs (i.e., non-tabular), their drift and deterioration behaviour is poorly understood. More in situ environmental data is required to manage risk since this particular type of ice hazard is becoming more prevalent as climate warms and marine transportation and offshore development increases. In 2011 a fragment of the Petermann Ice Island, which originated from Northwestern Greenland in August 2010, was visited to measure its shape, drift and deterioration over time. This fragment was named 'Berghaus' after a Heinrich Berghaus (1797-1884) a German geographer and mentor to August Petermann after whom the Petermann Glacier was named. Total ice thickness of Berghaus was obtained using a 10 MHz ground penetrating radar (GPR) and freeboard was estimated photogrammetrically. A microclimate station was installed on 3 m-long posts that were drilled vertically into the ice as anchors. Hourly air temperature, ice temperatures, wind speed/direction, radiation and humidity were measured with a datalogger and daily observations were telemetered via satellite modem. In addition, a sonic ranger measured surface ablation while a differential GPS measured the hourly position, elevation, pitch roll and heading of the ice island. The vertical face of the ice island was measured with a barge-mounted EM3002 multi-beam sonar and survey data was processed into a 3-dimensional model of the ice island.

Berghaus had a total thickness of 127±1.2 m, a freeboard of 18 to 25 m and a draft of ~104 m. It was 260 to 460 m long, by 190 to 260 m wide with a surface area of 0.9 km^2 and a volume of 13.72 x 10^6 m^3. This equates to an estimated mass of 12 million tonnes. The drift of this ice island was tracked from Lancaster Sound, north of Navy Board Inlet (73.999°N, 81.511°W) on July 30 to east of Bylot Island (73.467°N, 75.092°W) on August 27. Communication with the microclimate station was lost following this and only a small fragment (90 x 110 m) remained on September 8 when Berghaus was visited by a Coast Guard icebreaker. This terminated the deterioration experiment as no resurvey could take place to calculate mass loss. The station recorded nearly 1 m of surface ablation over this four week period and an elevation change from 18 to 50 m. This can be accounted for by the tilting of the ice island (roll increased 5° and pitch increased to 1°) and subsequent destabilization/break-up. Results from this study will be used to improve operational ice island drift and deterioration models as well as augment our understanding of key processes that are important for managing risk posed by these ice hazards.

INUIT RESEARCH ADVISORS: BRIDGING RELATIONSHIPS WITH RESEARCH

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The Inuit Research Advisors (IRA's) are representatives from each of the four Inuit land claims regions in Canada. Each IRA position is housed at a host organization such as Nunavut Tunngavik Inc., Kativik Regional Government, Inuvialuit Regional Corporation and the Nunatsiavut Government. The role of the Inuit Research Advisor is to act as a contact for researchers coming to the north, and to advise and assist them as needed. IRA's communicate research and research issues to communities in their region and also provide a means for community members to voice their concerns, comments

and questions to researchers as appropriate. IRA's advise their organizations on various research issues through participation on committees and conferences. Overall, the IRA strives to represent Inuit from their respective regions on research related matters. The role of the IRA is diverse and variant from region to region based on the needs, resources and priorities of each host organization. They have collaborated with a number of researchers in the past and continue to make these connections. During their presentation, they will briefly discuss the history of the Inuit Research Advisor position, current work and projects of each IRA, and how the IRA can work with researchers.

OFFSHORE MARINE FISHES IN THE CANADIAN BEAUFORT SEA – INITIAL FINDINGS AND FUTURE DIRECTIONS

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Fisheries and Oceans Canada (DFO), Central and Arctic Region, conducted the first ever deepwater baseline survey of fishes and habitat parameters in the offshore Canadian Beaufort Sea between August 5th and September 3rd, 2012, as part of the Beaufort Regional Environmental Assessment (BREA). The 2012 program also marked the first of a three year collaboration with the US Bureau of Ocean Energy Management (BOEM), and the University of Alaska Fairbanks (UAF), aimed at integrating methods and results from concurrent research programs in both countries to gain a better regional understanding of the Beaufort Sea ecosystem. The fishing vessel Frosti was used to sample four primary transects, each with stations at 40, 75, 200, 350, 500, 750 and 1000 m depths. Fishes were collected with two types of nets; a modified Atlantic Western IIA (WIIA) benthic trawl and a Cosmos-Swam 260 m mid-water trawl. Pelagic fishing was conducted in conjunction with hydroacoustic data collection. A suite of habitat and foodweb parameters were also sampled at each station including: oceanography, water chemistry, benthic fauna, sediment characterization, zooplankton, bacterial and primary production. Initial results indicate a distinct shift in fish community structure beyond 200 m depth including a large near-bottom aggregation of Arctic cod (*Boreogadus saida*) starting at approximately 200 m depth and extending down slope to 400 m. Beyond approximately 400 m bottom depth, a target layer persisted in the water column, within the same depth range. Additional investigations showed that this aggregation occurred along the entire Canadian Beaufort Sea Shelf. This study documented several new species' occurrences in the Canadian Beaufort Sea and, in combination with the Arctic cod knowledge, results will significantly improve our understanding of fishes in the Beaufort Sea. Knowledge regarding Arctic cod may also help to answer questions in regards to sufficient food base for higher trophic levels (e.g., birds, seals, whales).

ENHANCING SCIENCE AND EDUCATION COOPERATION IN THE ARCTIC

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In 2012, the University of Manitoba, the Greenland Climate Research Centre and the Arctic Research Centre at Aarhus University initiated a strong collaboration through the Canada Excellence Research Chair (CERC) in Arctic Geomicrobiology and Climate Change. This new and extensive Greenland-Danish-Canadian research collaboration is bringing together a number of the world's leading scientists in climate related research in the Arctic. The idea is to create the basis for highly integrated and coordinated climate-related research and education collaboration between Denmark, Greenland and Canada around much of the Arctic region. The new collaboration will be structured in a new joint research partnership, the 'Arctic Science Partnership' that provides unique opportunities for comprehensive research, educational cooperation and synergy between the three centers.

SAKKIJÂNGINNATUK NUNALIK: BUILDING SUSTAINABLE COMMUNITIES IN THE COASTAL SUBARCTIC – UNDERSTANDING THE RISKS AND DEVELOPING TOOLS AND BEST PRACTICES FOR LOCAL PRIORITIES IN NUNATSIAVUT

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Nunatsiavut communities are rapidly growing and changing, placing new pressures on development planning for sustainable, healthy communities. Infrastructure development is a priority as the Nunatsiavut Government establishes its administration in the region and each of the five Inuit Community Governments responds to infrastructure deficits and over-crowded dwellings. The Inuit Health Survey recently estimated that 28.5% of Nunatsiavut children live in a crowded house, 38% live in a house needing major repair, and 34% live in a house with a mould problem. Additionally, much of the infrastructure historically built in the communities was constructed according to Newfoundland standards and practices that do not necessarily accommodate the landscape setting and processes of a subarctic environment, nor Inuit culture and traditional ways of life.

At the same time, climate change is having an increasingly pronounced impact in the region, affecting infrastructure, community services and the wellbeing of residents. Recognizing the urgency to respond, the fiscal return from appropriately designed, low maintenance infrastructure and the opportunities associated with community expansion and a changing climate, the Environment Division of the Nunatsiavut Government, in partnership with the Joint Management Committee of Nunatsiavut and University partners, have developed the *SakKijânginnatuk Nunalik* (Sustainable Communities) initiative.

The *SakKijânginnatuk Nunalik* initiative is an innovative high level program that completely collapses the research-policy gap by working directly through AngajukKâks (mayors), Deputy Ministers and Ministers in Nunatsiavut. It is strongly aligned with the Nunatsiavut Government's Strategic Plan, specifically issues of Housing, Capacity Building, and Economic and Resource Development, as well as the Government of Newfoundland and Labrador's Northern Strategic and Climate Change Action Plans. The objective of Phase I, which is now complete, was to understand current community priorities, challenges and opportunities through a series of workshops with focus groups from each community. Phase II, which is ongoing, aims to adopt an integrated and holistic approach to the challenges and priorities identified by communities. It will explore innovative solutions and establish best practices in community development in Nunatsiavut and the subarctic. Specifically, Phase II will focus on the following issues, among others: (i) Adapt and modify building codes and best practices for building design through local design charettes in partnership with community members and stakeholders; (ii) Create or adapt community sustainability plans for the new climate reality; (iii) Pilot the implementation of climate-adapted coastal infrastructure and evaluate the performance of that infrastructure over time (eg. integrity, energy efficiency, social suitability), and; (iv) Build the local capacity and skills required to improve the long-term environmental, social and economic sustainability of Inuit communities.

Broad Government support for the *SakKijânginnatuk Nunalik* initiative will ensure that Nunatsiavut communities have the information and support needed to adapt to the already occurring and unavoidable impacts of environmental and social changes, while embracing integrated plans and opportunities to make Labrador Inuit communities more resilient and sustainable.

IMPLEMENTING THE CIRCUMPOLAR INUIT DECLARATION ON RESOURCE DEVELOPMENT PRINCIPLES IN INUIT NUNAAT: INFORMED DECISION MAKING THROUGH TRADITIONAL KNOWLEDGE AND ARCTIC SCIENCE

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The Arctic is experiencing complex, rapid and unpredictable change. Physical systems are undergoing rapid and unpredictable transitions due to climate change, and human settlements are experiencing a transition that rivals any seen since first contact. The physical changes taking place provide both opportunities and challenges and the need for new tools, protocols, and modalities of knowledge translation. At the forefront of the new Arctic is non-renewable resource development.

Non-renewable resource development in Inuit Nunaat (the Inuit circumpolar Homeland) has changed significantly over a period of 40 years. While it may have started dramatically with oil in Alaska, the resource extraction industry has expanded across the Arctic. Mineral exploration has left no region untouched, mines were opened, hydro resources were tapped, and oil and

gas development expanded across Inuit Nunaat. Inuit have experienced these developments in various ways. In February 2011, the Inuit Circumpolar Council (ICC) Canada hosted circumpolar Inuit leadership at a Summit on resource development in the Arctic. The Summit's objective was to discuss resource development in the Arctic, and in the spirit of Inuit unity, develop a strategy for the future. The Summit was held in accordance to the 2010 Nuuk Declaration article 20, which directed ICC to address the issue of resource development throughout the Inuit occupied circumpolar region. The outcome was a Declaration on Resource Development, which sets the context for resource development in the modern Arctic, taking into account economic, social, and political development of Inuit in Canada, Greenland, Alaska, and Russia. The Declaration was presented at the May 2011 Arctic Council Ministerial Meeting in Nuuk Greenland and clearly states, "We, the Inuit of Inuit Nunaat…are entitled to expect – all those who have or seek a role in the governance, management, development, or use of the resources of Inuit Nunaat to conduct themselves within the letter and spirit of this Declaration."

Implementation of this historic document requires the consideration and use of all knowledge available, including Inuit knowledge, to ensure sustainable decisions and actions. Associated with this Declaration, ICC has identified 18 priority tasks grouped under the following thematic areas: 1) Liaison and Outreach; 2) Resource Development Research and Analysis; 3) Political Strategy Development; and 4) Policy Research and Development.

ArcticNet has supported the development of the Declaration through the Arctic Net Science to Policy Project. This team has examined research decision paths on key Arctic issues and how knowledge, both western science and Inuit knowledge, informs these processes. Using the case of the ICC Declaration on Resource Development, this sub-project details: 1) how knowledge is used in decision making on a complex subject with multiple drivers, and issues of access and communication of knowledge/data; 2) the development of a process to work with industry to make available and share data to understand the social and environmental impacts of mining and development; and, 3) a path for the future identification of Inuit needs.

COLLABORATING TOWARD IMPROVING FOOD SECURITY IN NUNAVUT

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The recent Inuit Health Survey has confirmed, with greater statistical strength, what national surveys have implied for years: rates of food insecurity in Nunavut are considerably higher than in any other Canadian jurisdiction, and this issue affects the well-being of most people in Nunavut. Other studies continue to corroborate these findings, suggesting significant health implications for Inuit.

Much government and academic investment has been made to understand the determinants of and potential solutions to food insecurity in Nunavut. It is widely acknowledged that addressing this critical and complex issue is broader than the mandate of any one organization. Therefore, an integrated approach is essential. However, no coordinated action plan to address food insecurity has existed – until recently.

At the November 30, 2011 conclusion of Nunavut's Poverty Summit, Premiere Eva Aariak announced the establishment of the Nunavut Food Security Coalition (NFSC). The NFSC would convene stakeholders from government, Inuit organizations, NGOs, business, and research to "develop a long term, ongoing, inclusive, and sustainable approach to food security in Nunavut." The NFSC currently consists of seven Government of Nunavut departments and four Inuit organizations, whose goal is to engage a broader group of partners to determine which policies, programs, and initiatives are most likely to have a positive impact on the food security of Nunavummiut.

This imperative work is indeed timely, and many factors have converged to allow it to take place. The development of a territorial food security strategy requires specific considerations given Nunavut's unique environmental, social, economic, political, and cultural context. This collaborative approach includes contributions from coalition members, key partners, expert advisors, and community members who have an interest in improving the health of Nunavummiut.

ALLURIARNIAQ [STEPPING FORWARD]: YOUTH PERSPECTIVES ON HIGH SCHOOL EDUCATION IN NUNAVUT

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Nunavut high schools play significant roles as bridges between life in small, isolated communities and participation in the wider national and international contexts. While strategies based on Inuit Qaujimajatuqangit have helped support the success of Inuit youth in high schools (Walton et al., 2011), graduation rates remain among the lowest in Canada (Canadian Council on Learning, 2009; Richards, 2008; Statistics Canada, 2006). Funded by ArcticNet and conducted in partnership with the Nunavut Department of Education and the Coalition of Nunavut District Education Authorities, this mixed-method research explores the intersection between youth's perceptions of high schools and community high schools' histories.

Methods: A protocol for semi-structured interviews was developed to explore participants' experiences with high school and to encourage reflection on the impact those experiences. In conjunction with community partners, researchers from the University of Prince Edward Island conducted interviews with a cross-section of 19 Nunavut youth of diverse educational backgrounds during February and April 2012. Participants between the ages of 17-25 were drawn from Pangnirtung (n= 5), Rankin Inlet (n= 6), Kugluktuk (n= 5) and students attending the Nunavut Sivuniksavut program in Ottawa (n=3). Interviews were video recorded and transcribed and transcriptions were analyzed for common themes that were then compared with interpretive historical and statistical reports independently developed over the last year (McGregor, 2011, 2012). Inuit researchers worked as part of a team to create a bilingual, Inuktitut and English, documentary film to reflect the themes in the words of the participants.

Results: Developed independently of the interview research results, the interpretive historical and statistical reports (McGregor, 2011, 2012) profile each community, providing a brief history of each community's high school and summaries of student data from 2000-2010. Against the backdrop of these historical and statistical profiles, the youth interviews provide a more human perspective on the lived experiences of Nunavut youth in high schools and the factors that contribute to and/or impair their chances of success.

Discussion: While high schools in Nunavut communities outside of Iqaluit have a history of over twenty-five years and have made substantial contributions to improving educational opportunities for Inuit youth, the historical and statistical data indicate that they have a long way to go if the National Strategy on Inuit Education launched by Inuit Tapiriit Kanatami in June 2011 is to achieve its call for improved educational outcomes for Inuit learners. In contrast, the youth interviewed in this research display a confidence for the future that implies that the legislative, policy, and curriculum changes initiated by the Nunavut Department of Education are having at least some effect. Unfortunately, while the participants bring to light the challenges they faced, they are less specific about the factors that enabled them to address those challenges.

Conclusion: The research results provide unique insight into the perspectives of youth on high school education in Nunavut. Future work will identify the specific factors that facilitated their success and which may provide empirical support for policy and curriculum initiatives.

FISHERIES AND OCEANS CANADA'S AQUATIC CLIMATE CHANGE ADAPTATION SERVICES PROGRAM IN THE ARCTIC

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In 2011, Fisheries and Oceans Canada received $16.5M for a new program to integrate climate change considerations into departmental decision making and the delivery of programs and policies relating to: oceans management, species at risk, fisheries management, provision of advice to northern co-management boards, small craft harbours, and aquaculture, among others. This program, the Aquatic Climate Change Adaptation Services Program (ACCASP), is being implemented over 2011-2016 as part of a broader federal climate change adaptation program. Through ACCASP, climate change risks to the department are being assessed on a regional basis, including in the Arctic. Risks to biological systems and infrastructure are being assessed, based on two temporal scales: 10- and 50-year climate "Trends and Projections"; and "Impacts, Vulnerabilities and Opportunities" corresponding to each scale. Research projects are being funded to understand better the impacts of climate change on the department's ability to carry out its mandate, and practical science-based tools are being developed to assist front-line managers respond to climate change.

This presentation will provide an overview of the ACCASP and its objectives, and present results to date, focusing on the Arctic Large Aquatic Basin (LAB), one of four LABs covered by the program. Current research projects are investigating the impacts of climate change on oceanography, fishes, lower trophic organisms, marine mammals, as well as at the ecosystem level. The science-based risk assessment for the Arctic LAB is being conducted through the Canadian Science Advisory Secretariat (CSAS), which coordinates the peer review of scientific issues for the department. (Similar CSAS reviews are being undertaken for the other LABs.) Due

to the complexity of drivers, diversity of ecosystems, and nature of scientific expertise, a sub-regional approach is being taken for the Arctic risk assessment. The sub-regions are the Beaufort Sea, Arctic Archipelago, Baffin Bay/ Davis Strait, and Hudson Bay Complex. The results of this science-based risk assessment will be combined with those from concurrent socio-economic and policy analyses to culminate in an integrated risk assessment to determine the most important basin-level climate risks facing the department and its northern co-management clients.

ARCTIC FOOD NETWORK: AN ARCHITECTURE/ INFRASTRUCTURE PROPOSAL

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The Arctic Food Network (AFN) is a regional food-gathering system that enables communities to expand traditions of hunting and sharing, introduces new ways to acquire and store food, and encourages Northern Canadians to strengthen cultural connections with the land and each other. The network is comprised of a variety of cabins, sheds and supporting infrastructure which merge architecture, landscape, and technology for the northern climate and Inuit culture. The AFN proposal exists at the intersection of human health, socio-cultural issues, and environment. In particular, AFN identifies innovative opportunities where sustainable development, country food harvesting, and community integration overlaps.

Lateral Office has teamed up with Nunavut Tunngavik Inc. and the Arctic College trades training program on this ambitious project aimed at addressing important Arctic issues such as food security, cultural identity and traditions, and capacity building. The team is supported by experts in the fields of food security, environmental health, and Inuit land and ice use, and construction techniques and design will be integrated into the Arctic College Trades Program as part of efforts to increase local skilled capacity. Not only are cabins designed to use local materials, techniques and to advance skill sets as much as possible, but they also allow for a variety of new connections within communities and with the land, an important cultural aspect of living in the North. Cabins located directly in communities can be expected to have very robust activity programs (larger spaces, greenhouses, cold storage, etc.). Those on the land provide greater access to hunting, fishing and gathering opportunities, as well as support a variety of land-based cultural and educational programs. The most remote of the cabins would increase land security and inter-community connectivity, acting as sanctuaries on longer journeys. Together, the strings of cabins along traditional use paths will connect communities in a network of food-gathering, sharing and celebrating infrastructure.

Increased access to the land is expected to provide communities with more opportunities to procure country food, thereby positively affecting community health and wellness. Greater access to the land also provides a place to hold small on-the-land camps, educational or cultural activities beyond or related to hunting, fishing and gathering. The locations and uses of each cabin or hub of cabins will be customized by the community, and can be quite versatile. AFN will engage local knowledge holders and users to determine design, use and location of the cabins in and around participating communities that best reflect the needs of each place.

AFN proposes to promote health, build local capacity, and strengthen inter-community connectivity. It aims to achieve food security and self-sufficiency, and allows for cultural invigoration and development. The Arctic Food Network celebrates a rich history and empowers life in a growing North. It is a 21st century arctic snow highway, with arctic rest-stop cabins.

Topical Sessions Abstracts

DYNAMIC AND THERMODYNAMIC IMPLICATIONS OF OCEAN SWELL FRACTURING ON SUMMER ARCTIC SEA ICE AS A RESULT OF ARCTIC STORMS

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The Arctic summer minimum sea ice extent of 3.41 x106 km2 observed on 16 September 2012 is the lowest ice extent in the satellite record and strongly reinforces a non-linear trend of sea ice decline over the past 30 years. Furthermore, the past six years have been characterized by large, expanses of open water, particularly in the Chukchi, Beaufort, Laptev, Kara and Siberian seas. These areas introduce fetch that permits the generation of large storm swells within the Arctic Basin that can reach the thick multi-year (MY) ice that builds against the Canadian Arctic Archipelago. Long waves can propagate under sea ice deep into the pack causing flexural swell and failure of floes within the sea ice cover, thereby shifting ice floe distributions towards smaller diameter floes. This can affect dynamic processes like ridging and rafting and thermodynamic processes such as area-averaged albedo and lateral melting. Using field data collected during the IPY-GEOTRACES/ArcticNet 2009 Cruise, we first assess the surface characteristics of a post-flexural fracture region of multi-year sea ice. Using in situ radiation data, we then calculate the net radiative energy at the ocean-ice interface. The timing of this process is investigated by estimating melt rates for a fractured sea ice cover occurring earlier in the melt season. We further discuss the importance of timing of flexural failure events during the melt season by discussing this work in the context of a very large and intense Arctic cyclone that occurred in early August 2012. This storm enhanced mechanical and thermodynamic decay of sea ice, thereby contributing to the record minimum sea ice extent of summer 2012.

LOW VISIBILITY EVENT CLIMATOLOGY AND SYNOPTIC DRIVERS, BERING STRAIT REGION

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Northern communities are very dependent on the transportation sector in order to conduct economic activity and maintain their way of life. The “transportation sector” in the northern context covers a wide range of activities and scales, and includes movement over land, sea and air by whatever means is relevant for consideration at a given location under study: on foot or via marine small craft for subsistence, by terrestrial road/ice road for industrial applications, large ship/barge for sea lift, industry, and tourism, and all scales of aircraft operations, including animal reconnaissance via light helicopter, small fixed wing operations, and large air carriers connecting to the south. All of these activities can be impacted very dramatically by the occurrence of fog and low-visibility. There has been little work to systematically analyze the occurrence of these events. This includes work to establish the basic climatology of visibility types and how they vary by season and by region, and it includes examining the weather patterns that favour the occurrence of various types of low visibility.

This presentation overviews a project conducted in the Bering Sea region of Western Alaska/eastern Chukotka for which low visibility event climatologies were complied, along with the synoptic weather drivers responsible. Twelve communities in this region possessed sufficient data records to conduct the work. An algorithm was developed to search through records, correct missing values where possible, and identify singular and regionally coherent low visibility “events”. The weather cause for low visibility was categorized (e.g. fog, snow with fog, blowing snow, smoke, etc.). Climatological results indicated that stations tended to possess strong annual preferences for low visibility occurrence, which often were very different despite similar regional settings. For example, Point Hope, AK, exhibited a decline in event occurrence in June, July, and August,

whereas Kotzebue, AK, exhibited a strong increase in summer events. Some stations also exhibited a pronounced diurnal pattern, for example, Tin City, AK, exhibited little variation throughout the day, whereas Andreafsky, AK, exhibited a strong late-evening/early morning peak. Synoptic results indicated six categories of pressure pattern accompanied periods of low visibility; approximately only 7% of events defied synoptically classification.

These results indicate that using one station to predict local weather patterns at another station, which is a temptation in the North due to data scarcity, would likely generate erroneous results even if the other station is relatively close. As well, in an era of planning needs for future infrastructure in light of changing climate, work to link these local weather occurrences, which are very impactful for Northern communities, with their broad synoptic drivers can act as a form of downscaling. This then sets the stage for better directing climate projection analyses using IPCC data to begin to assess possible trajectories of their occurrence.

HIGH SPATIAL RESOLUTION REMOTE SENSING MODELS FOR LANDSCAPE-SCALE CO2 EXCHANGE

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Climate change is impacting the terrestrial ecosystems of the high and mid Canadian Arctic, with the potential to shift these ecosystems from a sink to a source of atmospheric CO_2. High spatial resolution remote sensing has the potential to model net ecosystem exchange (NEE) and its component fluxes, gross ecosystem productivity (GEP) and ecosystem respiration (ER). The most significant challenge with this type of imagery is the difficulty in acquiring multiple images to monitor the potential variability of the exchange rates through the growing season. In this study, we explore the variability of daytime CO_2 exchange rates in three major ecosystem types along a natural moisture gradient at ecologically distinct Canadian high and mid Arctic sites. With no statistically significant variation through the study period, we can use limited imagery to model CO_2 exchange rates. We develop a common model, which operates at both study sites, of each exchange component that is independent of vegetation composition, instead using the normalized difference vegetation index (NDVI) as the sole independent variable. We compare this spectral model to an ecosystem-based spatial model of total CO_2 exchange. The spectral model explains between 42% and 95% of the variation within CO_2 exchange rates at each site. Further improvements to the model will come with additional study sites and further research into the spatial and temporal variation of CO_2 exchange. The spectral model, though, does indicate a high level of functional convergence in ecosystem-level structure and function within Arctic landscapes.

ARCTIC MARITIME BOUNDARY DISPUTES: LESSONS AND OPPORTUNITIES

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In 2011, Russia and Norway concluded a boundary treaty for the Barents Sea, where the two countries had previously disputed 51,000 nautical square miles of oil-and-gas rich seabed. This leaves just one significant unresolved Arctic maritime boundary: in the Beaufort Sea between the United States and Canada. The Russia-Norway treaty, and the negotiations leading to it, offer important lessons to the United States and Canada. For instance, the treaty creates a joint hydrocarbon regime for any oil and gas reserves that straddle the new boundary. This panel will bring the leading experts on the Russia-Norway treaty to Canada where they will interact with leading Canadian and US experts, in a focused effort to promote cross-fertilization of the latest best practice in Arctic boundary negotiations.

ON THE DETECTION AND MONITORING OF SEA ICE AND GLACIAL ICE HAZARDS IN THE SOUTHERN BEAUFORT SEA

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The sea ice in the Pacific sector of the Arctic has changed in both extent and thickness over the past several decades. A rather counterintuitive effect of this change is an increase in the number of glacial ice features, increased first year sea-ice deformation, increased multiyear sea ice hazards, and an increase in the speed at which these features circulate within the Beaufort gyre. We summarize

sea-ice related research conducted within the ArcticNet Oil and Gas Industry Partnership with an outlook towards development of an ice management system by the hydrocarbon industry. We summarize the current decline in sea ice areal extent and thickness, describe the detection of various sea ice and glacial ice features both in situ and via Radarsat analysis, and present an assessment of the relative velocities of these ice hazards in the Southern Beaufort Sea. We conclude the paper with a new technique that has been developed to estimate floe thickness through measurement of differential ice motion, and provide a summary of how this ice information requires new approaches in modeling ice motion.

ROLE OF MULTIYEAR SEA ICE IN THE BIOGEOCHEMICAL CYCLING OF MERCURY IN THE ARCTIC OCEAN

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In recent years the Arctic environment has undergone drastic changes; the most notable being the significant decrease in summer sea ice extent. The effects of this on the transport, transformation and ultimate environmental fate of chemical contaminants in the Arctic Ocean have yet to be fully understood. One such contaminant is the trace element mercury (Hg) and its various species, most of which demonstrate severe ecotoxicological implications. The objective of this study is to better define the roles of sea ice in the biogeochemical cycling of Hg in the Arctic Ocean by investigating its potential as: 1) a transformation medium for monomethylmercury (MMHg) production; and 2) a source of Hg into the Arctic marine ecosystem. Replicate sea ice cores were taken from a single sampling site on a multiyear sea ice (MYI) floe in the southern Beaufort Sea in August 2011 as part of the ArcticNet cruise of the CCGS Amundsen. Quantification of total mercury (THg), MMHg, Chlorophyll a, and δ18O was performed on separate cores, and temperature and salinity profiles were recorded. Very low levels of MMHg ($\bar{x} = 0.03 \pm 0.03$ ng L-1; n = 56) were present throughout in the entire sea ice core, suggesting MYI is not an effective medium for Hg methylation. Based on the data from this core and another core taken in spring 2008, a one-box mass balance model is being developed to investigate Hg loading into the Arctic Ocean via MYI desalination and ablation. We report here the first measurement of MMHg in bulk sea ice, and the first quantitative prediction of Hg input into the Arctic Ocean system upon MYI desalination and ablation.

LAKE MELVILLE: AVATIVUT, KANUITTAILINNIVUT (OUR ENVIRONMENT, OUR HEALTH)

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Since 1970, the Churchill River in central Labrador has been diverted from its natural channel through a hydroelectric power generating station at Churchill Falls and the headwaters have been controlled through the creation of the Smallwood Reservoir. The downstream effects of the Upper Churchill project on Lake Melville, the large saltwater estuary that drains the Churchill River into the Labrador Sea, are largely unknown. Recent studies have documented elevated mercury levels in fish and local residents have observed and reported changes in wildlife, sea ice, water quality, and climate, among others, since the 1970s. A second hydroelectric scheme, the Lower Churchill project, is now proposed at Muskrat Falls, about 25 km upstream of Lake Melville along the Churchill River. Flooding of its associated 59-km-long reservoir is scheduled to begin in 2016.

Lake Melville: Avativut, Kanuittailinnivut is a Nunatsiavut Government-led research and monitoring program to study the downstream effects of the proposed Lower Churchill project on Inuit community health and well-being in the Lake Melville region. The Labrador Inuit Settlement Area includes the eastern two-thirds of Lake Melville. Rigolet, the southernmost Nunatsiavut community, is located at the Narrows where Lake Melville opens to the Labrador Sea. Significant numbers of Labrador Inuit and land claim beneficiaries live in the two main communities of Upper Lake Melville (ULM) − Happy Valley-Goose Bay and North West River. Harvesting of

country foods is a central component of traditional Inuit lifestyle in all communities in the region and an important cultural activity in the mixed economy of ULM. Winter sea ice travel connects communities at either end of Lake Melville and provides access to country foods.

Lake Melville: Avativut, Kanuittailinnivut aims to: 1) establish baseline conditions for Inuit health, community well-being and ecosystem function/integrity in Lake Melville prior to any Lower Churchill development, and 2) develop the science for monitoring the downstream effects of hydroelectric development on a subarctic estuary and coastal Inuit communities in the context of ongoing climate change impacts. Specifically, the project focuses on three interconnected components that directly impact Inuit health: Mercury Levels, Ecosystem Status, and Community Well-being. Mercury Levels: Flooding associated with the creation of new reservoirs for hydroelectric development has been shown to increase bioaccumulation of mercury in fish and seals through a combination of factors that enhance methylmercury production in aquatic environments and shifts in trophic structure of food webs. Community Well-being: In the context of ongoing social, cultural, economic and environmental change in ULM, large-scale resource development such as the Lower Churchill project can be significant stressor on community well-being, lifestyle and livelihoods. Ecosystem Status: Key ecosystem indicators sensitive to the proposed changes in oceanography, sea ice regime and benthic habitats will be identified, tracked to establish baseline conditions, and integrated into an ecosystem monitoring plan. A fourth project component will focus on documenting ecosystem changes that resulted from the Upper Churchill project to help guide our understanding of potential future impacts of the Lower Churchill. Lake Melville: Avativut, Kanuittailinnivut is a new research initiative of ArcticNet's Nunatsiavut Nuluak project.

DISTRIBUTION OF SEABED ICE SCOUR CAUSED BY GROUNDED ICEBERGS ON THE CANADIAN BAFFIN CONTINENTAL MARGIN

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Multibeam echosounder data were used to map the distribution of ice scour on the Canadian Baffin Shelf. The data were collected by the Ocean Mapping Group at the University of New Brunswick (OMG-UNB) during ArcticNet and CASES expeditions onboard CCGS *Amundsen* from 2003 to 2011. Using the multibeam data set gridded at 25 m horizontal resolution, ice scour was observed in water depths up to 850 m. Scours typically have an incised depth of 1 – 4 m into the seabed but can occasionally be greater than 4 m with the maximum scour depth observed to date being 19 m. Scour widths typically range from ~65 m across up to ~500 m across. Total scour lengths are difficult to measure as their start and end points are often not recorded in the incomplete multibeam coverage. The scours that do have large sections imaged in the multibeam data set are several tens of kilometres long.

Modern-day icebergs in Baffin Bay usually have drafts between 100 and 200 meters for the larger icebergs but occasionally can be much deeper. The deepest ice keel observed in Northern Baffin Bay destroyed acoustic monitoring equipment on the seabed in 427 m of water during the 1967-1968 ice season. Even such extreme modern icebergs cannot account for the Baffin Shelf scours observed in water depths significantly greater than ~430 m. Relict iceberg scours are scours that occur in areas where icebergs are no longer found, or in areas where icebergs can no longer reach the seabed due to an increase in water depth or a decrease in iceberg size. Iceberg scour has been identified using the OMG-UNB multibeam data set to depths of 850 m water depth in Baffin Bay and other studies have observed features that might be interpreted as ice scour at depths over 1000 m on the Greenland side of Baffin Bay. While the age of these scours is unknown, their occurrence in water depths beyond what can be scoured by the modern-day iceberg regime and their superposition on glacial sediments suggest that they were likely formed during deglaciation of Late Pleistocene ice shelves and ice sheets. Even accounting for a lowered sea level of ~120 m at that time, these Late Pleistocene icebergs calving from the large ice sheets and ice shelves in the area must have been much larger than those observed at present.

Using observations from the data available at present, modern-day icebergs are capable of scouring to water depths of ~430 m in Baffin Bay. Ice scours in water depths greater than 430 m are likely relict features; some being formed more than ~9,000 years ago.

DISTRIBUTION AND HABITAT CHARACTERISTICS OF POLAR COD (BOREOGADUS SAIDA) IN SOUTHEASTERN BEAUFORT SEA BEFORE THE FORMATION OF DENSE UNDER-ICE WINTER AGGREGATIONS

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Polar cod is a key species in the pelagic food web of the Arctic Ocean. Recent observations have shown that the species forms dense under-ice winter aggregations in Amundsen Gulf (Beaufort Sea). However, the actual aggregation process is still largely unknown. This paper is a contribution to fill this knowledge gap by determining the distribution and habitat characteristics of adult polar cod before they start to form winter aggregations. Fisheries acoustic data collected in southeastern Beaufort Sea in October-November 2003 revealed that highest adult polar cod biomasses (1 to 37 g m^{-2}) were aligned along Mackenzie shelf and Amundsen Gulf slopes, between 100-m and 550-m isobaths, with highest values in Amundsen Gulf. This adult polar cod biomass occupied the mesopelagic zone (ca. 200 - 400 m), and were associated with the warmer waters of Pacific Halocline and Atlantic layer. Youngs-of-the-year polar cod formed an epipelagic layer (0 - 60 m) over the entire region. The mesopelagic polar cod, which concentrated on the slopes during the freeze-up, are thought to constitute the part of the population that was later observed forming the dense under-ice winter aggregations. The possible aggregation mechanisms are reviewed and the hypothesis of active short-distance displacements combined with prevailing mean currents is retained. Concentration at slopes is likely governed by the combined effects of 1) an active maintenance of close trophic association with predictable aggregations of their zooplankton preys in convergent flow along slopes and 2) the depth-keeping interaction with cross-slope vertical currents favouring both zooplankton and polar cod concentration at the shelf-break.

LOCAL PEOPLE'S ACCOUNTS OF CLIMATE CHANGE: TO WHAT EXTENT ARE THEY INFLUENCED BY THE MEDIA?

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Researchers using local and indigenous people's accounts of climate change in their scientific work often face scepticism regarding the value of such information. The critics' argument is that since local and indigenous people are often exposed to the global discourse on climate change, their observations and information may in fact be reproductions of science popularised through communications media. There are instances in which local people's accounts of climate change and impacts thereof may be influenced by how media frame and popularise scientific models and predictions. However, we propose several reasons why the influence of media reports and coverage of climate change is usually superficial. First, there are significant differences between the epistemologies employed by media and those of local people. Although media may be borrowing local environmental categories, they may be filling them with different content, leading to incoherence. Second, media accounts are often general and locally irrelevant, in contrast with the detailed local anchoring of the knowledge held by people who rely on natural resources for their livelihoods. Their observations often rely on holistic ways of knowing their environments, integrating large numbers of variables and the relationships between these. We propose that accounts based on such observations are probably not influenced by media framings and that uncovering their underlying 'ways of knowing' would provide valuable additional evidence in interdisciplinary studies of climate change.

TEMPORAL VARIATIONS IN THE STRUCTURE OF THE SUBARCTIC SNOWPACK AND ITS EFFECTS ON SAR SATELLITE IMAGERY AT X- AND C-BAND

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During the winter, the structure of a snowpack undergoes various stages of metamorphism through different physical processes, affecting its physical properties. Winter rain events and subsequent refreezing of the snowpack generate large clustered grains and ice layers, modifying the albedo and insulating properties of the snow cover. This ultimately affects the energy budget and can have important impacts on subarctic ecosystems. This study shows the impact of changes in snow structure on SAR satellite imagery at X-band (9.6 GHz) and C-band (5.4 GHz) and potential applications deriving from these observations.

The study area is a 60 km^2 region situated around the Umiujaq community (56.55° N, 76.55° W) in northern Quebec, Canada. The area can be divided into two distinct environments: the coastal region to the east and the Lac Guillaume-Delisle graben to the west. The vegetation in the coastal region is very sporadic and dominated by tundra vegetation, while the graben vegetation is mainly shrublands with patches of conifers. A series of polarimetric RADARSAT-2 C-band images (HH, VV, HV, VH polarizations) and dual-polarized TerraSAR-X X-band images (HH, HV polarizations) have been acquired over the area between October 2011 and April 2012 during the fall and winter seasons. Two field campaigns were carried out in coordination with satellite data acquisitions in March and April 2012 when the snow cover is maximal. Snow depth and snow water equivalent were measured over various terrain types. Snowpits were dug at selected sites to gather information on particle size and shape in addition to snow densities from the different layers of the snowpack. A temporal analysis was performed on the SAR data, comparing the measured backscattered signal at different dates for various polarization and incidence angles. Backscattered intensity ratios were calculated between late fall acquisitions (December) and winter acquisitions (March, April) to minimize the impact of some environmental variables, such as soil and vegetation characteristics, in order to isolate the effect of snow on the SAR signal.

The occurrence of a rainfall event between the March and April satellite image acquisitions has resulted in increased snow grain sizes and the appearance of an ice layer within the snowpack, through melt-freeze metamorphic processes. Results show that this increases the backscattered signal for both RADARSAT-2 and TerraSAR-X, but this effect is more significant on the C-band data. When observing the March/December temporal ratio, the C-band signal displayed a general decrease in March, suggesting that the snowpack attenuates backscattering from the ground and vegetation. However, the April/December ratios the C-band signal displayed an important increase for the April acquisitions, after the rain event when the snowpack had refrozen. In comparison, the X-band data showed an increased backscattering both in March and April when compared to December images, but the increase in April was more important. These results not only provide useful insights for the mapping of snow cover characteristics using SAR data, but also demonstrate the possibility to use these data to detect rainfall events during the winter season in regions where meteorological observations are scarce.

ARE TUNDRA LEMMING POPULATIONS CONTROLLED FROM THE BOTTOM-UP OR THE TOP-DOWN?

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The relative importance of bottom-up vs top-down forces in controlling small mammal populations in northern ecosystems is still debated. According to the bottom-up hypothesis, herbivore abundance is determined by the abundance of their food resources (i.e. plants). However, according to the top-down hypothesis, herbivores are controlled by their predators. In order to maintain a cyclic dynamic, the acting processes must show a delayed response, meaning that the impact of high grazing or predation pressure must be maintained after lemmings have declined. We tested some predictions from both hypotheses at Bylot Island, Nunavut, where the brown (*Lemmus trimucronatus*) and collared (*Dicrostonyx groenlandicus*) lemmings are present and show cyclic fluctuations of abundance. This was done by (1) setting exclosures in their preferred winter habitats and assessing their impact on vegetation through a complete population cycle (2009 to 2012) and (2) examining the response of two key predators, the ermine (*Mustela erminea*) and the arctic fox (*Vulpes lagopus*), to fluctuating lemming abundance from 2004 to 2012. The collared lemming peaked in 2010 and crashed before snow melt in the following year but no impact was detected on their preferred food. Brown lemmings, the most abundant species, increased in 2010 and peaked in summer 2011, but crashed the following winter. We found a trend towards a reduction in biomass of some of their preferred food (biomass of Polytrichum mosses in

spring was 24 % lower outside exclosures and there was 42 % less biomass of poaceae at the end of the growing season in 2010 and 2011 compared to 2009). However, this impact was weak and not carried to the next growing season, an essential condition to cause a cyclic dynamic driven by bottom-up forces. As for predators, we found some evidence that ermines had a delayed numerical response to collared lemming density (ermine density in year t depended upon lemming winter nest density at time t-2; $R^2 = 0.85$). In contrast, the number of young foxes observed and the proportion of breeding pairs showed an instantaneous numerical response ($R^2 = 0.70$ and 0.84 respectively) towards summer and winter densities of lemmings. Summer observations of ermines revealed that they can show a high predation rate (5.1 lemmings/day/ermine), but their densities appear low (2.96 ermine/km^2), even at high prey density. The total predation rate exerted by both mammalian and avian predators (Therrien 2012, PhD, Univ. Laval) combined with the evidence of a delayed response of ermines to collared lemming abundance suggests that the cyclic dynamic of this species may be controlled by predators. In contrast, ermines and foxes remove only 0.89 %/day of brown lemming population at their highest densities, which falls short of their maximal growth rate (2.44 %). This, combined with the absence of a clear delayed response, suggests that mammalian predators may not be sufficient to control the brown lemming cyclic dynamic, though it may act in synergy with other mechanisms.

MIGRATION POTENTIAL OF TUNDRA PLANT SPECIES IN A WARMING ARCTIC: RESPONSES OF SOUTHERN ECOTYPES OF THREE SPECIES TO EXPERIMENTAL WARMING IN THE HIGH ARCTIC

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Climatic changes due to anthropogenic activity are predicted to have a profound effect on the world's biodiversity and ecosystem functioning. The response of natural communities to climate change will depend primarily on two factors: 1) the ability of species to adapt quickly to changing temperatures and precipitation trends, and 2) the ability of species and populations from southern latitudes to migrate northward and establish in new environments. The assumption is often made that species and populations will track their optimal climate northward as the earth warms, but this assumption ignores a host of other potentially important factors, including the lack of adaptation to photoperiod, soil moisture, and biotic interactions at higher latitudes. In this study, we aim to better understand the ability of southern populations to establish and grow at northern latitudes under warmer temperatures. We collected seeds or ramets of three Arctic plant species (*Papaver radicatum, Oxyria digyna,* and *Arctagrostis latifolia*) from Alexandra Fiord on Ellesmere Island, Canada and from southern populations at Cornwallis Island, Canada, Barrow, Alaska, and Latnjajaure, Sweden. These seeds were planted into experimentally warmed and control plots at Alexandra Fiord in 2011. We have tracked their survival, phenology, and growth over two growing seasons. Here, we will present the preliminary results of these experiments. In particular, we will discuss whether individuals originating from southern latitudes exhibit higher growth rates in warm plots than control plots, and whether southern populations survive and grow as well as or better than individuals from Alexandra Fiord in the warmed plots. In both cases, a positive response would indicate that a warming climate may facilitate a migration northward of more southerly species or populations, and that the lack of adaptation to local conditions (soil chemistry, microhabitat, etc.) will not limit this migration. Alternately, a negative response may indicate a need to reassess our fundamental assumptions about species migrations in response to climate change.

OUTER SHELF AND UPPER SLOPE SEABED DYNAMICS, CANADIAN BEAUFORT SEA BASED ON GEOLOGICAL DATA

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Sediments deposited on the outer shelf and upper slope preserve a record of seabed dynamics over the past several thousand years. Stratigraphic and chronologic data have been integrated from the ArcticNet/GSC/IOL and BP

collaboration 2009 to 2011 to determine the distribution of recent sediments and implications to bottom sediment mobility.

In general, radiocarbon dates on the outer shelf to shelf edge indicate sediments are less than 9000 years old less than 2 m below seabed. Dates increase consistently with depth below seabed. Stratigraphically, these sediments are conformable. This implies the outer shelf to shelf edge region has been a zone of low sedimentation rate over the last 9000 years. On the upper slope, radiocarbon dates below seabed range from 1800 to 14,000 years in the upper 5 m. Stratigraphically these sediments are also internally conformable. Together this implies that sedimentation rates are low (< 35 mm/kyr).

The consistent increase of radiocarbon dates with depth and the conformable stratigraphy on both outer shelf and upper slope suggest that the region is subject to very low sedimentation rates rather than to erosional processes. From a sediment flux perspective, sediments transported across the shelf and down slope or along the shelf edge and upper slope appear to be mainly bypassing this area of the central Beaufort Sea.

Collectively the stratigraphy and chronology indicate bottom sediment transport is an active seabed process on the outer shelf and upper slope area on the central Beaufort Shelf. Sediments pass through this environment to be deposited further down slope and perhaps as far north as the Canada Basin. Physical oceanographic data including bottom current magnitude, direction and duration are required to support this active sediment transport hypothesis. Upwelling and eddy processes may provide the water velocities required to move sediments down slope either continuously or episodically.

Bottom water and seabed research that requires knowledge of bottom sediment dynamics needs to consider the impact of low sedimentation rates and bottom sediment transport.

COMPLEX THERMAL STORAGE AND MIXING OF HIGH ARCTIC LAKES: TRANSITIONING TO SEASONAL ICE COVER AND A LONGER ICE-FREE PERIOD

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This study examines the thermal storage potential of a High Arctic lake currently transitioning from near-perennial ice cover to significantly longer ice-free seasons. West Lake is situated in the Cape Bounty Arctic Watershed Observatory (CBAWO), Melville Island, Nunavut (74° 53'N, 109° 35'W). This lake is regarded as medium sized with an area of 1.4 km^2 and a maximum depth of approximately 33m. Unlike smaller tundra ponds, which are expected to warm as a direct result of increased air temperatures, the impact of warming to a body of water at this scale is not well understood.

When lakes are persistently ice covered, water column temperatures are moderated by isolation from the atmosphere, whereas seasonally ice covered lakes are exposure to turbulent fluxes on the surface and increased solar heating and potential thermal stratification. While warming may result in earlier ice-off and increased heat gain, extended ice-free conditions in the autumn can result in increased wind stress on the water surface and water column mixing with significant energy loss to the atmosphere.

The aim of this study is to examine the sensitivities of these lakes to changing ice cover duration and quantify the energy exchanges under different sets of ice conditions. Water column temperature data collected at West Lake for June through August (2005-2012) indicates that energy intake under ice can vary considerably on an annual basis. In addition two freeze up and winter data sets (2008-09 and 2011-12) were collected showing energy exchanges associated with under ice warming, ice-fee warming, open water energy loss from overturn and heat flux from the sediment after ice cover establishment. Results indicate that energy loss during the early autumn occur rapidly as the water column is overturned by wind circulation. Data demonstrates that the lake looses a greater amount of energy during this short autumn event than is gained over the entire warming season. Hence, there is a dominant and complex temporal asymmetry that has important implications for the thermal budget and structure of these lakes. The thermal evolution of this scale of lake is potentially not impacted by year-to-year climatic change on a perennial scale. Although increased temperatures during a summer season are likely to lead to increased lake ecosystem productivity in a given year, because the majority of energy is lost during the fall overturn event productivity is potentially independent in the progressive years. This shows that the relationship between thermal retention in these lakes is highly dependent on ice conditions and turbulent fluxes in addition to warming air temperatures.

LARVAL SURVIVAL IN FROZEN SEAS: EARLY SURVIVAL IN FROZEN SEAS: SYNTHESIS OF THE FACTORS INFLUENCING SURVIVAL OF POLAR COD (BOREOGADUS SAIDA) LARVAE AND JUVENILES

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The polar cod (*Boreogadus saida*) is a small pelagic fish highly connected in Arctic food webs and representing a high proportion of the marine ecosystem biomass. Understanding the factors influencing larval survival of this pivotal species is essential for predicting the response of marine arctic ecosystems to the ongoing climate change. The reconstruction of hatch date frequency distributions of polar cod larvae and juveniles collected over the last two decades in several arctic seas helped pinpoint the main physical factors determining larval survival. It appeared that sea surface temperature and salinity, freshwater input from large rivers and sea-ice dynamic are the dominant forces driving early mortality of polar cod. Those factors interplay in determining the survival of polar cod over its protracted hatching season spreading from December to August. In regions where appropriate characteristics of salinity, temperature and sea-ice combined, survival of winter hatchers is observed, but with high interannual variability. Early hatching maximizes the duration of the first growth season and allows large pre-winter size, an attribute particularly important in fending off winter mortality. Ongoing trends in arctic sea-ice cover, sea surface temperature and freshwater discharge all hold the potential to alter the timing and success of the reproduction of polar cod. An earlier ice break-up, more frequent winter polynyas, a warmer surface layer, and increased river discharge would be expected to favor the feeding, growth and survival of winter hatchers, perhaps enhancing the overall recruitment of the species, at least in some regions in the short term.

POPULATIONS' DYNAMIC AND GROWTH PATTERN OF THE ARCTIC WILLOW IN HIGH ARCTIC CANADA AND GREENLAND

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Modification of plant abundance and distribution, especially shrubs, has been predicted by warming experiments and confirmed by aerial photography analyses and land based observations in the low Arctic. In the high Arctic relatively little of this research has been conducted, although satellite image analyses suggest an increase in NDVI and warming experiments have had a positive effect on shrub cover. We hypothesized that Arctic willow (*Salix arctica* Pall.), a structuring species in these environments, could induce noticeable vegetation cover changes by increased growth of established individuals and colonization of new sites. To evaluate the potential contribution of this species for shrub expansion, we studied populations through measurements of size structure, historical changes in cover, and dendrochronological analyses on eight semi-desert sites in high Arctic Canada and Greenland.

Size distributions showed that recruitment was more frequent on proglacial landscapes even though seedling establishment was common in other sites. Comparative analysis of current and historical cover data revealed that significant increases over the past few decades occurred only on glacier forelands. Dendrochronological analysis of over 200 large individuals established by seed showed that arctic willows can live up to 270 years. The populations' age structure suggested discrete colonization events associated with the melting of permanent snow and glacier ice. Although our study sites were located on a 1000 km long north-south transect, no trend between mean annual growth and latitude was found. Using a linear mixed effect model analysis on the annual growth ring data, we found that six of the eight study sites were expressing a strong climate signal: the climate variables involved varied between sites and encompassed summer and winter precipitations as well as thawing degree-days. The two remaining sites expressed little synchrony in their growth pattern. Based on our investigations of site characteristics, the pattern observed on these two sites may be linked to a negative impact of herbivore activity on growth.

Our results suggest that arctic willow has heterogeneous population dynamics and growth responses

to climate in the high Arctic. Glacier forelands, which are currently experiencing rapid ice retreat and plant colonization, and some sheltered sites will probably benefit from current and predicted increase in mean summer temperature. However, water stress, as well as length and quality of the growing season remain strong limiting factors to recruitment and growth in many polar semi-desert areas.

SMACK IN THE SUBARCTIC: POPULATION DYNAMICS AND VERTICAL HABITAT PREFERENCE OF A DEEP WATER JELLYFISH, PERIPHYLLA PERIPHYLLA, IN A SUBARCTIC FJORD

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The population dynamics and diel vertical migration of the deep water scyphozoan, *Periphylla periphylla*, was studied in Vefsnfjorden (65° 55' N:13° 06' E) on five separate dates between October 2010 and August 2011. At the time of study, Vefsnfjorden was the northernmost population with persistent numbers of *P. periphylla*. In this fjord, the species population structure varied with season. Reproduction was limited to the winter months and slowed or stopped in the summer periods. Abundances were higher in the winter months and the population experienced loss in the summer, although reasons for the decrease in numbers are unclear. At the time of investigation, the population was in a period of growth with coronal dome width size classes of < 1 – 30 mm and 70 – 160 mm but was lacking size classes between 30 – 70 mm. Estimated growth rates for early developmental stages averaged at 0.013 mm day^{-1} over the entire study period. Jellyfish distribution within the vertical habitat indicated signals of diel vertical migration in only the sexually mature members of the population. The population structure and suspected seasonal spawning in Vefsnfjorden differ from previous knowledge on the species from other Norwegian locations and this may be related to the light regime of the north.

ENHANCING UNDERSTANDINGS IN MARINE MAMMAL ECOLOGY: BELUGA WHALE ECOLOGY, SCIENCE AND INUIT KNOWLEDGE IN NUNAVIK

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Marine mammals, particularly cetaceans, are challenging to study, especially in the arctic due to remoteness and the sometimes inaccessible or difficult environments in which they live. These conditions often result in a lack of observational data for key species at specific, often critical, times of the year leaving significant gaps in our understanding of species' ecology and behaviour. Using a case study of research on two endangered populations of beluga whales that summer in the coastal waters of Nunavik, this project investigates how these challenges may be addressed using different methods and drawing upon different ways of understanding or observing these animals.

Nunavimmiut (Inuit of Nunavik) live in 14 communities along the coastline of the Arctic region of Quebec, and have depended on belugas for centuries for a variety of cultural, health, and economic purposes. Through the close relationship they have with beluga, Nunavimmiut have developed a rich and deep understanding of the species and its ecology. The combination of this species being difficult to access and study, and the existence of a rich and robust form of knowledge among Nunavimmiut provides the impetus for the examination of opportunities to bring together different methods and ways of understanding this species.

This project used a mixed methods research design to bring together Inuit Knowledge and science and developed different tools and approaches to data integration to enhance our understanding of beluga whale ecology and behavior in Nunavik. Due to the lack of documented Inuit Knowledge in Nunavik on this species (NK) the first stage of this study included the detailed documentation, verification and internal validation of NK through 40 semi-directed interviews with local experts in four Nunavik communities (Kangiqsualujjuaq, Quaqtaq, Ivujivik, and Kuujjuaraapik). This produced a robust qualitative database of information on beluga migratory and local movement, feeding ecology, and important habitat areas with associated behaviours (e.g. moulting and calving). Mapped information gathered during interviews was transformed and spatially displayed using kernel density estimates in a novel approach to aggregate data and incorporate uncertainty in group observations. Further, NK observations and environmental data from remote sensing technologies were incorporated into circuit theory

models and analyzed to determine variables best predicting observed migratory movement and pathways of the species in Nunavik waters.

These tools, combined through a mixed methods design and approach to the study, offer a promising avenue for balanced integration of knowledges and enhancement of our collective understandings of marine mammal ecology.

BARRIERS AND FACILITATORS TO INDIGENOUS KNOWLEDGE INTEGRATION IN ENVIRONMENTAL DECISION-MAKING: A CASE STUDY OF THE NUNATSIAVUT GOVERNMENT

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The rising need and pressure for a response to complex environmental problems has spawned an interest in understanding environmental issues from various perspectives beyond conventional science. Of particular interest, literature surrounding Indigenous peoples, their knowledge, and their role in the environmental policy process has grown extensively. Although the consultation and collection of Indigenous Knowledge (IK) has been generally recognized by policy makers as useful in the development of environmental policies and programs, there is still a lack of understanding and very few examples of how IK can be effectively incorporated and influence the development of environmental policy. Therefore, a need exists to study the interaction between IK and policy to further our understanding of how best to engage and involve IK in the development of environmental policies and programs.

In an effort to better understand what processes are used to incorporate IK into policy and their effectiveness, a framework of critical elements was developed that could be used to aid in evaluating IK integration. The framework was developed through literature review and analysis that sought to capture examples, lessons learned, and identify critical factors related to IK incorporation across jurisdictions and policy areas. The framework was then used it to evaluate the case of the development of environmental policy in Nunatsiavut. A qualitative single-instrument case study approach was used to explore the development of environmental protection legislation in the region that endeavoured to reflect Inuit Knowledge principles. Multiple methods including semi-directive interviews with environmental policy-makers in the region, focus groups with Inuit Elders and active hunters/land-users, participant observation of policy workshops and meetings, and document review and analysis of local archives, and government output were used.

The results of this research support the argument that opportunities for IK integration are created through three main avenues: Governance and Institutions (formal decision and policy-making structures and processes); Community Participation and Engagement (formal avenues and processes that give community members influence over policy-making); and Accessibility and Availability of IK (indirect avenues and sources of IK that effect how IK is accessed and if IK is available to decision-makers). Under each of these themes, a series of characteristics are identified that could be used by practitioners to identify areas of strength and improvement related to IK integration at a particular scale. In examining the Nunatsiavut case, notable strengths related to Indigenous representation, political autonomy, and recognition of IK in governance and institutions, in addition to steps to increase availability of IK through community owned and controlled research were noted. However, considerable barriers to IK integration existed due to a predominately western procedural format found in both its institutions and community participation processes, accessibility challenges related to collecting and storing IK, and availability issues related to the prevalence of IK in the community. The findings of this study are valuable for policy and decision-makers (both Indigenous and non-Indigenous) regarding how to appropriately navigate when developing policies related to Indigenous peoples across all policy sectors.

ARCTIC MARITIME BOUNDARY DISPUTES: LESSONS AND OPPORTUNITIES

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In 2011, Russia and Norway concluded a boundary treaty for the Barents Sea, where the two countries had previously disputed 51,000 nautical square miles of oil-and-gas rich seabed. This leaves just one significant unresolved Arctic maritime boundary: in the Beaufort Sea between the United States and Canada. The Russia-Norway treaty, and the negotiations leading to it, offer important lessons to the United States and Canada. For instance, the treaty creates a joint hydrocarbon regime for any oil and gas reserves that

straddle the new boundary. This panel will bring the leading experts on the Russia-Norway treaty to Canada where they will interact with leading Canadian and US experts, in a focused effort to promote cross-fertilization of the latest best practice in Arctic boundary negotiations.

IBAS AND THE NEOLIBERALIZATION OF NORTHERN RESOURCE EXTRACTION

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This presentation will examine the emergence and predominance of Impact and Benefit Agreements (IBAs) in Northern Canada in relation to processes of neoliberalization. We pay particular attention to the ways in which a neoliberalizing state defines and advances its interests in relation to resource development, Indigenous governance, and the management of Crown lands. Although IBAs are typically negotiated bilaterally between resource extraction companies and Indigenous organizations, and the state is not directly involved in their negotiation and implementation, we argue that this lack of direct involvement is by no means indicative of a retreating or absent state. On the contrary: IBAs, we argue, provide insight into a shifting set of relations between the state, northern Indigenous peoples, and resource extraction companies and ultimately facilitate state objectives in the contemporary North.

CHARACTERIZING THE ICE ALGAE BIOMASS-SNOW DEPTH RELATIONSHIP OVER SPRING MELT USING TRANSMITTED IRRADIANCE

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The nature of the ice algae chlorophyll *a* (chl *a*) - snow depth (H_S) relationship was investigated on first-year sea ice in Allen Bay, Nunavut, from 27 April to 13 June 2011. A transmitted irradiance technique was used to estimate ice algae chl *a* throughout the period at time series locations under a snow cleared site, and under a low, medium, and high snow depth cover. Furthermore, chl *a* was estimated along transects perpendicular to dominant snow drift orientation, and at short term snow clear experimental sites. The association between chl *a* and H_S was characterized by four phases over the spring bloom period; light limitation (characterized by a strong negative relationship), a transitional period (no relationship), limitation driven by excess irradiance (strong positive relationship), and snow independent limitation (no relationship). These periods held true for low, medium, and the majority of high snow depths, but algae under H_S greater than 30 cm did not follow these trends and were likely light limited throughout the spring. Algal biomass under areas cleared of snow was lower and experienced earlier termination (reaching zero biomass) than snow-covered control sites. Rates of biomass decline were also greater at snow free locations, especially towards the end of the spring period. Results indicated that bottom ice temperature and the magnitude of photosynthetically active radiation incident at the ice surface (S_{PAR}) were the most important factors driving biomass loss from snow free areas, most likely due to minor ice melt and accompanying changes in ice structure. From these results we conclude that rain and warm weather events which serve to rapidly melt the snowpack and increase the level of S_{PAR} transmitted through the ice, predicted to become increasingly common in the Arctic, could cause significant depletion of algal biomass and possibly early termination of the bloom if they occur late in the spring. However, the occurrence of such events early in the season, when the ice temperatures are sufficiently low, would likely not have the same impact.

ORGANIC MATTER SOURCES AND CYCLING IN SOILS, SEDIMENTS, PEATS AND COAL: A COMPARATIVE REVIEW USING ROCK-EVAL ANALYSES

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Rock-Eval analyses, a well-established screening tool for petroleum source rocks, are increasingly being used for the characterisation of organic matter (OM) in recent sediments and soils. However, much of the interpretation of data is based largely on fossil OM, which may or may not be applicable to recent materials. Here we compile trends from 30 lake sediment cores, taken from temperate to polar regions across Canada, 9 marine sediment cores, 1 sphagnum moss peat core and a collection of cuttings from a coal outcrop in the Northwest Territories, in addition to soil data from over 100 sites from the literature. Using Rock-Eval 6, ratios involving the ratios of produced CO and CO_2 (OICO and $OICO_2$, respectively) are robustly related to the initial source of OM in the system, indicating that while these ratios have been largely neglected in fossil OM, they are of great importance in recent materials. Based in part on these ratios, clear trends of OM quality are observed with increasing degree of remineralisation/ degradation across all sites, with more degraded sites experiencing lower hydrogen indices (HI) and/or higher oxygen indices (OI). In particular, there is a significant increase in the degree of OM remineralisation with latitude, indicating that over an annual basis, the vast majority of the OM produced during the open water season is degraded. There is a similar increase in remineralisation rate with water depth in marine sediments. On the other hand, the more polar sites show a much larger temporal increase in primary productivity, indicating that these sites are experiencing the effects of a warming climate to a much greater extent.

"THE ROAD TO MELIADINE:" EXPLORING PAST, PRESENT, AND FUTURE MINING ENCOUNTERS IN THE KIVALLIQ REGION, NUNAVUT

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The (re)development of industrial mining ventures in the Canadian Arctic has attracted a rapid influx of capital to remote northern communities, profoundly shaping both the environmental and human dimensions of Arctic landscapes. Industrial mining has become the greatest economic driver within the Nunavut Territory, presenting both opportunities and challenges for northern communities. As part of ArcticNet's project examining, "Adaptation, Industrial Development, and Arctic Communities," my research focuses on historical, contemporary, and future mining encounters in the Kivalliq Region of Nunavut. The northern community of Rankin Inlet originated in 1957, with the opening of the North Rankin Nickel Mine, and most people stayed even after its closure in 1962. The mine brought about immense changes for many Inuit peoples in the region, who left traditional subsistence economies and adapted to wage labour and settlement life. This short encounter with mining remains a strong affectual relationship, with the Rankin Inlet community in general and older Inuit workers in particular, asserting their identity as miners. With the growth of contemporary mineral development in the Kivalliq Region, including Agnico-Eagle Mines Ltd.'s Meadowbank mine, and the upcoming Meliadine gold project, mining has (re)emerged as a significant, yet poorly understood driver of socio-economic change in the region.

Employing an ethnographic research methodology, through participant observation and semi-structured interviews, my research reframes mineral development as a "cultural encounter" among multiple actors, asserting the importance of place, cultural identity, and alternative visions for the future. Far from viewing place as static, my research theorizes place as a process of becoming through embodied practices with mineral development. By following the new and shifting relationships that are daily experienced across multiple sites of encounter: including the home, community, and mine site, my research explores how the community of Rankin Inlet is speaking back to the opportunities offered by mineral development amid memories of historical mining encounters still present on today's landscapes, and thwarting any easy conception of benefits and impacts. With the growth of industrial mining in Nunavut there is a need to better theorize the negotiation of difference in cross-cultural relationships, thereby allowing for a more meaningful response to claims for greater Inuit participation in economic development initiatives. Such a cultural-geographical analysis will provide insight for both contemporary and future development in the Canadian Arctic, weaving an alternative story of past, present and future mineral encounters.

THE OFFSHORE DIET OF THE EASTERN BEAUFORT SEA BELUGA POPULATION AND THE ENERGETIC EFFECTS OF CLIMATE CHANGE

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As the most abundant Arctic cetacean with a circumpolar distribution, beluga whales (*Delphinapterus leucas*) are an important indicator species for Arctic climate change. The Beaufort Sea beluga population is one of the world's largest and is an important traditional food to the subsistent lifestyle of people from the Inuvialuit Settlement Region. During the summer, belugas migrate from the Bering to the Beaufort Sea and segregate by sex, reproductive status, and size into different habitats based on sea ice concentration. The differences in habitat use are defined largely by beluga length and predict their diets and exposure to mercury. Comparison of fatty acid profiles have revealed Arctic cod (*Boreogadus saida*), a sea ice associated fish, to be an important prey, but the contribution of other prey to the diet of Beaufort Sea belugas remains unknown. Diet is the main pathway of contaminant exposure to belugas. High levels of contaminants in belugas are of concern to Inuvialuit subsistence hunters, especially given the temporal increase in mercury observed in this population.

Changes in sea ice as a result of climate change may have indirect effects on the primary production and trophic couplings of Arctic food webs, which are predicted to affect prey availability to belugas. Declines in prey availability combined with other stressors such as contaminants may have an overall adverse impact on the health of beluga populations. My first objective is to identify the seasonal diet of the Beaufort Sea beluga population. I will collect and survey the abundance and distribution of prey species in the offshore pelagic ecosystem of the Beaufort Sea using a fish trawling program anticipated to receive support from the Beaufort Regional Environmental Assessment. Beluga tissues will be sampled during summer subsistence hunts and information on sex, physical condition, and life stage will be recorded. I will also collaborate with the North Slope Borough during the subsistence harvests of the Alaskan Inupiat people to identify the spring and fall diet of the belugas. Partnered harvests collections will help provide a more complete seasonal dietary context. Stomach contents of belugas, stable isotopes, and fatty acid profiles will be used to establish food web linkages and determine prey contribution to beluga diet. My overall objective will be to provide a better description of diet for future comparisons to assess the impacts of climate change on the Beaufort Sea beluga population and marine ecosystem.

DOES ENHANCED WINTER SNOW ACCUMULATION AFFECT TUNDRA CARBON AND NUTRIENT DYNAMICS DURING THE GROWING SEASON?

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In the Arctic, climate warming and precipitation changes are predicted to be largest during the cold season where precipitation mainly falls as snow. Snow effectively insulates soils from extreme cold air temperatures, resulting in warmer soil temperatures and enhanced microbial activity, stimulating soil nutrient mineralization and CO_2 production. Increased snow fall may therefore significantly increase winter carbon losses from tundra ecosystems. In addition, changes in winter soil microclimate may potentially carry over into the following growing season and further impact ecosystem carbon balance through warmer summer soil temperatures, changes in soil moisture, deepened active layer and enhanced nutrient availability.

Our study site is located in mesic birch hummock tundra at Daring Lake, NWT, Canada (64°E 52'N, 111°E 35'W). Here, we investigate seasonal carry-over effects of snowfence-enhanced snow accumulation on ecosystem respiration (Re), gross ecosystem production (GEP), net ecosystem exchange (NEE), and bulk soil respiration (Rs), measured bi-weekly during July and August. We also report results of a common leaf litter (*Betula papyrifera* var. *neoalaskana*) decomposition study in controls and deepened snow over a five year period using litter bags.

Enhanced winter snow accumulation did not affect growing season soil active layer depth, soil temperatures or moisture. Nonetheless, a doubling of bulk soil respiration rates was observed in snowfenced plots throughout the summer, despite no direct temperature or moisture carry-over effects present. Secondary carry-over effects such as priming of organic material or increased nutrient availability during winter and spring may have stimulated summer soil microbial activity leading to enhanced bulk soil respiration. No clear effect was observed for other gas fluxes. After five years of in-situ incubation, the common leaf litter substrate had lost ~50% of the initial mass. Much to our surprise, we observed no significant effect of experimentally deepened snow on litter decomposition. As summer soil microclimate was similar between controls and snowfenced plots, this indicates that changes in winter microclimate, i.e. warmer soil temperatures under elevated

snow, did not impact litter decomposition, suggesting that surface litter decomposition may be negligible during winter. In conclusion, enhanced snow accumulation during winter may stimulate summer bulk soil carbon emissions despite having no effect on summer soil microclimate. In contrast, winter surface litter decomposition seems unaffected by deepened snow and warmer soil temperatures.

PTARMIGAN IN A CHANGING ARCTIC - DISTRIBUTIONAL PATTERNS AND BROWSING BY PTARMIGAN IN NORTHERN ALASKA

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Rock and Willow Ptarmigan (*Lagopus Muta, L. lagopus*) are ubiquitous in northern Alaska, yet little is known about their distribution, habitat-associations, or movement patterns. These species are likely to play an important ecological role in the arctic, and strongly influence the growth and architecture of arctic shrubs by browsing them. The objectives of this study were to a) quantify ptarmigan distributional patterns with respect to shrub cover, snow-free ground, latitude, and year, and b) determine the prevalence and intensity of ptarmigan browsing and subsequent effects on willow growth in northern Alaska. Aerial surveys were conducted in spring 2011 and 2012 across a mosaic of arctic habitat types to obtain estimates of ptarmigan occupancy. Occupancy was positively related to shrub cover and snow free ground. In areas with at least 40% cover of shrubs, occupancy of ptarmigan or their tracks was >80%, indicating that tall shrub patches, usually associated with riparian areas, had a high probability of being visited by ptarmigan. Occupancy was higher in 2012 than 2011, and decreased with increasing latitude. Browsing surveys of Salix alaxensis, a common early-successional willow, were conducted along the Noatak and Sagavanirktok Rivers in June 2011. 66% of randomly selected willows had been browsed by ptarmigan over the winter, with an average of 36% of buds removed by ptarmigan. When willows were re-visited in June 2012, ptarmigan-browsed stems had decreased in height, whereas un-browsed stems increased in height. Ptarmigan are widespread and abundant in northern Alaska, where they congregate around patches of tall shrubs. These birds are likely to influence, and in turn be influenced by the rapid expansion of woody shrubs in the arctic.

BIOPHYSICAL MODELING AND MONITORING IN THE CANADIAN HIGH ARCTIC WITH RADARSAT-2

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Knowledge of biophysical variables such as soil moisture content and vegetation cover in the Canadian High Arctic is an important step towards understanding energy fluxes and nutrient cycling, active layer depths, vegetation, and formation of wetlands over large time scales. Hydrologic variables also exert important controls on arctic geomorphology and ecosystem dynamics. Information gathered from synthetic aperture radar (SAR) is ideal for modelling and monitoring these biophysical properties across large and remote areas such as the Canadian High Arctic. SAR has a number of benefits, including the ability to record imagery at night and through cloud cover, capabilities not shared by optical sensors, but extremely important in the Canadian High Arctic, where cloud cover is common, and there is no sunlight for much of the year. SAR backscatter data contains information on soil moisture, vegetation, surface roughness, and topography; if these parameters can be modelled accurately, then an operational methodology for determining biophysical variables in the Canadian High Arctic is feasible. Direct surface measurements of these variables are difficult and expensive to obtain, so this research would contribute significantly to environmental monitoring at high latitudes. The following objectives are addressed: (1) to examine the utility of multi-temporal, multi-angular, and fully polarimetric RADARSAT-2 SAR data for modeling soil moisture, surface roughness, and vegetation properties for a High Arctic watershed; (2) to establish the physical controls that affect SAR backscatter response in a high arctic environment; and (3) determine if SAR models of these physical controls/factors are of sufficient precision for implementation across different arctic watersheds and larger areas.

High resolution and fully polarimetric RADARSAT-2 SAR data were acquired at multiple dates throughout the spring and summer of 2009 and 2010 for the Cape Bounty Arctic Watershed Observatory, Melville Island, Nunavut. Similar data were acquired in 2011 for the area near Cape Collingwood, on the Sabine peninsula of Melville Island, Nunavut. The Cape Collingwood area consists of a range of different bedrock geological units, and is used

to validate the Cape Bounty models. Multiple field plots were examined at each study site and are representative of a range of soil moisture, soil texture, bedrock type, vegetation, and topographic conditions. Soil moisture data coincident with the SAR acquisitions were collected at each plot location. Other parameters, including vegetation cover and surface roughness, were also measured for each plot. Soil moisture, surface roughness, and vegetation characteristics collected on the ground are used to calibrate and model the relationship between the SAR data and soil moisture levels, local topography, and vegetation using an Artificial Neural Network (ANN). Maps of soil moisture (at multiple dates), surface roughness, and vegetation cover at large and small object scales will result from the final verified models. The methodology developed based on this research will be a step towards operational monitoring of these biophysical variables across different regions of the Canadian High Arctic.

DETERIORATION PATTERNS OF ICE ISLANDS ADRIFT IN THE CANADIAN ARCTIC

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Ice islands are large, tabular icebergs whose creation can be enhanced by climate change via weakening and collapse of Arctic ice shelves and floating glacial tongues. An increased rate of ice shelf break up has caused a greater frequency of ice island observations in industrially-active waters. At the same time, offshore natural resource exploration, development and transportation are increasing in the Canadian Arctic. Ice islands are formidable hazards to offshore activity due to their extensive surface dimensions and mass, yet the processes affecting ice island deterioration have been less studied in comparison to 'traditional', non-tabular icebergs. A collaborative project to survey, monitor and analyze processes affecting drift and deterioration of ice islands in the Canadian Arctic was undertaken in 2011. Project field sites were established on three ice islands, all of which were initially part of the larger, original Petermann Ice Island (PII) which calved from Northwest Greenland in August 2010 with an approximate surface area of 250 km^2 and mass of 22.5 billion tonnes. Satellite imagery (RADARSAT-2) was acquired for two of these PII 2010 fragments: PII B (Baffin Bay) and PII-Ba (Lancaster Sound), every 8 to 12 weeks since September 2011. Both PII-B and PII-Ba display three distinct deterioration patterns: 1) 'edge wasting', 2) 'major break-up' or 3) sub-satellite image resolution 'disintegration'. These modes were first identified by Ted Scambos of the National Snow and Ice Data Center (Boulder, CO) during while studying deterioration of tabular Antarctic icebergs. Both surveyed ice islands experienced one large break-off event, where 33% (20 km^2) and 7.2% (1.5 km^2) of surface area was lost from PII-B and PII-Ba, respectively. Thickness measurements (averages of 79 m (PII-B) and 88 m (PII-Ba) taken by ground penetrating radar in October 2012 were used to estimate the decrease in volume and mass. An estimated 1.6 billion tonnes of ice separated and drifted south through Baffin Bay after the November 2011 PII-B fracturing event. 'Edge-wasting' and 'disintegration' events also caused approximately 8.1 km^2 of detached ice from PII-B (e.g. growlers, bergy bits or smaller, yet still sizable, ice island fragments) to drift independently in Canadian Arctic waters. Throughout the study period, 88% of the ice islands and associated fragments remained within a 1.0-2.9 length-width ratio class. This is similar to the 79% within this ratio class observed in the Western Canadian Arctic during the 1980s. This supports the idea that these patterns of deterioration are applicable to ice islands in that region as well. This research will lead to further work on the prediction of the location of ice island break off events. Most importantly, the ability to forecast and locate ice hazards can mitigate the risks associated with collisions between ice islands and ships or oil and gas infrastructure, thereby protecting the sensitive Arctic ecosystem.

DEVELOPING A CIRCUMPOLAR MONITORING FRAMEWORK FOR ARCTIC FRESHWATER BIODIVERSITY

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Arctic freshwater ecosystems are facing unique challenges through the interaction of natural and human-induced stressors such as climate change and industrial development. Much is unknown about the biodiversity of Arctic freshwaters, although it is believed to have already been affected by climate change. A pan-Arctic monitoring strategy is critically needed to improve abilities to detect and understand ongoing and future changes in Arctic freshwater ecosystems. The challenging issues that Arctic freshwater monitoring must address include: the large diversity of Arctic freshwater ecosystems, varying levels of stressor impacts across the Arctic, lack of historical baseline research and monitoring coordination, and poor among-country standardization of sampling protocols. In response, the Arctic Council's Freshwater Expert Monitoring Group of the Circumpolar Biodiversity Monitoring Program (Conservation of Arctic Flora and Fauna) has developed a framework for monitoring Arctic freshwater biodiversity that will lead to regular reviews of the state of freshwater ecosystems across the circumpolar Arctic. The parameters of primary focus for the monitoring framework are classified by Focal Ecosystem Components (FECs), which are biotic or abiotic factors that are ecologically pivotal, charismatic or sensitive to changes in biodiversity. FECs are placed in the context of expected ecosystem change through the development of testable impact hypotheses that outline a cause-effect framework regarding how change in environmental and anthropogenic stressors is expected to affect FECs. These prediction statements provide both guidelines for future scientific data collection and a focus for management decision-making. Here we discuss the design of the proposed monitoring framework and the development of impact hypotheses that focus on climate change effects. We emphasize the connectivity between science, monitoring and management necessary to implement the framework across the Arctic.

THE OCEANOGRAPHIC DYNAMICS OF A SUB-ARCTIC FJORD - LAKE MELVILLE: AVATIVUT, KANUITTAILINNIVUT

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We are studying the influence of changes in the fresh water discharge on the dynamics and ecosystem of Lake Melville and how they interact with long-term climatic variability. We will use these studies to determine possible future scenarios for the impact of natural and anthropogenic factors on the lake ecosystem and people and communities of the region. We will discuss the overall goals of our program and present new results.

Lake Melville is large and complex sub-Arctic fjord that is a major outlet for freshwater on the Labrador coast. Although it has been the subject of exploration for centuries, we still know relatively little about its oceanography. The fjord is tidally choked, leading to intense flows at the entrance (the Narrows) of well over 5 knots. We will review the role of mixing and seasonal cycles in determining water properties in the lake and how changing climatic and freshwater condition influence the oceanography and sea-ice dynamics. We will present some historical data for the Lake together with results from oceanographic work done in 2012. We will compare our current measurements with results of a high resolution, variable element, coupled ocean-ice model for the Lake. The long-term exchange between the Labrador Sea and Lake Melville will be studied with this high-resolution ocean model. The implications of interannual ocean and atmospheric variability on the Lake ocean ecosystem will be addressed.

MONITORING NEARSHORE ARCTIC FORAGE FISH WITH A NESTING SEABIRD: USING PREY OBSERVATIONS AND CHICK QUALITY TO ASSESS TEMPORAL VARIATION

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Arctic Basin fish populations off northern Alaska are experiencing reduced sea ice, increasing water temperatures and the threat of commercial exploitation. Our knowledge of these fish species has been limited by logistical constraints on sampling, hindering our understanding on how they will respond to ongoing environmental change.

We examined factors affecting the availability of nearshore fish in the western Beaufort Sea by utilizing the Black Guillemot (*Cepphus grylle*), a piscivorous seabird. Research was conducted in 2011 and 2012 at a Black Guillemot colony on Cooper Island, 35 km east of Point Barrow, as part of a long-term study of the species. Guillemots breeding at the colony provision their young from approximately 20 July to 10 September, allowing assessment of prey type and availability during the period of sea ice retreat and late summer open water. During the chick-provisioning period parent guillemots sample marine waters within a 30-km radius of the island, diving as deep as 25 m to obtain prey. We assessed daily variation in prey through observations of provisioning parents and monitoring of daily changes in weight for all nestlings on the island.

In both 2011 and 2012 we found Arctic Cod (*Boreogadus saida*), a species typically associated with sea ice or adjacent cold water, was the primary prey at the beginning of the nestling period but not recorded after the sea surface temperature (SST) of adjacent waters exceeded approximately 4^{o} C. In 2011 this occurred on approximately 4 August 4 and in 2012 on approximately 24 August. In both years the disappearance of Arctic Cod was associated with a decrease in guillemot chick growth rates, in some cases resulting in death. After the disappearance of Arctic Cod, Four-horned Sculpin (*Myoxocephalus quadricornis*) was the primary fish provided to young. While a lower quality fish than Arctic Cod, high nestling growth rates were maintained during periods when sculpin were the principal prey, but rapid increase and decreases in SST were associated with decreases in availability and nestling growth.

Our observations demonstrate that seabird diet and nestling growth can provide an important tool in assessing forage fish availability in northern Alaska where traditional fish sampling techniques are limited. The findings also demonstrate the short-term temporal variation in prey availability that upper trophic level marine predators are encountering in late summer in the nearshore Alaskan Arctic due to the loss of sea ice.

HEAT LOSS FROM THE ATLANTIC WATER LAYER IN THE ST. ANNA TROUGH (NORTHERN KARA SEAS): CAUSES AND CONSEQUENCES

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The CTD sections occupied in 1996 and 2008-2010 across the St. Anna Trough (SAT) in the outflow of the Barents and Kara seas into the Arctic Ocean show a distinct horizontal density front deeper than ~50 m overlying the SAT eastern slope. This front is compatible with a sheared flow along the SAT eastern flank that favors vertical mixing, enhanced Atlantic Water (AW) heat loss, consistent delay in freeze-up onset during fall and reduction of sea-ice thickness during winter. This flow is consistent with (i) a persistent northward subsurface current of ~20 cm/s that was measured in the SAT eastern slope in 2009-2010, (ii) model simulations, and (iii) geostrophic velocity calculations. Our estimates of the upward vertical heat flux from the AW layer (>100 W m^{-2}) suggest that the SAT can be referenced among the Arctic Ocean regions with the most efficient AW heat loss.

GRAPHICAL MODELS OF CO-MANAGEMENT FRAMEWORKS: APPLYING A BAYESIAN DECISION NETWORK TO THE SUBSISTENCE HUNT OF EASTERN HUDSON BAY BELUGA

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Wildlife management in the Arctic requires addressing complex environmental problems and integrating knowledge across disciplines. Co-management approaches that involve stakeholders in policy-shaping by combining science, traditional knowledge and socio-economic considerations are increasingly common. However, it is often challenging to summarize this multifaceted information in a helpful format for decision makers. We use the subsistence harvest of eastern Hudson Bay beluga to illustrate the potential of Bayesian Decision Networks (BDNs). These graphical models represent a set of variables linked by probabilities, and are ideal to combine traditional knowledge and empirical data into the same structure. Starting from existing population estimates, we examine the influence of biological hypotheses (e.g., population growth), uncertain parameters (e.g., struck-and-lost rates) and management decisions (e.g., quota allocation, timing of hunt). Outcomes can be evaluated under different sets of priorities: economic, conservation, and even social (e.g., whether hunters have to travel far from home). This framework allows us to calculate how much would be gained from obtaining « perfect » information about a given parameter. Moreover, the graphical representation provides an intuitive means to explore relationships in the system for people usually left outside of the modelling exercise (managers and resource-users). Yet, the potential of BDNs for environmental science is largely unexploited. Beyond our case study, we suggest participatory approaches in which models are elaborated directly with co-management partners in a collaborative process that fosters better understanding of the situation by all parties.

21ST CENTURY METHODS TO DERIVE AND DELIVER COASTAL INFORMATION: IMPROVED EMERGENCY PREPAREDNESS IN CANADA'S ARCTIC

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Environment Canada and other Federal agencies have important roles in terms of emergency preparedness in the Canadian Arctic. As there are many opportunities for economic development in Canada's North, including increased shipping and exploration activities, the need to integrate up-to-date, multi-source, complex data for emergency preparedness is critical. Baseline coastal information, such as shoreline form, substrate and vegetation type, is required for operational prioritization, coordination of on-site spill response activities, wildlife and ecosystem management. The eSPACE project interprets oblique digital HD videography acquired using rotary-wing aircraft flying at low-altitude as training and validation for the development of coastal classification from satellite image analysis. The georeferenced video product is processed using a GIS and interpreted to identify shoreline characteristics, coastal habitats and resources at risk. Object-based Image Analysis (OBIA) is being employed to interpret various satellite data including Radarsat-2, TerraSAR-X, and SPOT 4-5, to map and classify coastal areas including the intertidal zones and backshore. These methods have been applied to six pilot sites including the mainland Beaufort coastline and Banks Island, sections of the Northwest Passage and communities with active coastal areas. The resulting outputs, existing biological and socio-economic data, and graphics will be combined in a coastal sensitivity GIS application with links to online web services for emergency responders, Arctic communities and regulatory agencies. In addition, a web-based application tool-kit is being developed to capture, view and analyze data generated from research projects to inform regional environmental assessments. These tools will allow communities, researchers, managers and regulators to more effectively plan, assess and respond to increased industrial development activities in the arctic.

ENVIRONMENTAL HEALTH RISK MANAGEMENT IN NUNATSIAVUT: NEGOTIATING CLIMATE CHANGE AND HEALTH INFLUENCES OF SEA ICE USE

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Concern that the rate and magnitude of environmental change may exceed the adaptive capacity of some individuals or groups, and result in negative health consequences, has led to a proliferation of research on climate change vulnerability and adaptive capacity in

Inuit regions. Despite these efforts, our understanding of individual-scale climate change vulnerability and processes of individual and collective adaptation remains quite basic. Key questions remain about the determinants of adaptive capacity for individuals related to the use of local environments, and role of local institutions. Further, while many communities are concerned about the impacts of environmental change and individual and collective capacities to respond, the concepts of vulnerability and adaptive capacity being used are based in epistemic traditions far from the daily lived experience and approach to balancing environmental risks of Inuit hunters and land-users. This disjuncture creates an opportunity; environmental risk-benefit management approaches used by Inuit can form a valuable lens for investigating adaptation to environmental change, including the factors driving the use of different safety strategies and the roles of institutional and informal support for land-based travel. As such, we used a community-based participatory research approach to examine risk-benefit management strategies for safe sea ice travel in Nain, Nunatsiavut.

This mixed methods project used a case study approach. We conducted two focus groups with expert sea ice users; twenty-two interviews with community members; three key participant interviews and several meetings with Nain Ground Search and Rescue (NGSAR) and local police representatives; and participant observation during sea ice trips between July 2010 and May 2011.

We found that risk-benefit management processes involved long and short-term strategies comprising of travel skills, knowledge gathering and sharing, preparing, and managing 'trouble events'. We articulate the relationship between these elements in a conceptual model of risk-benefit management for safe sea ice use. Differences in application of strategies primarily varied according to years of travel experience, and to a lesser extent gender. Some adjustments to strategies associated with changing environmental conditions were reported, including increased knowledge gathering and sharing by very experienced travellers, and increased preparation and risk avoidance among some sea ice users with no differences between groups. Results also demonstrate the importance of informal support and community-based SAR for sea ice safety. Most participants reported the need to improve community health and safety for sea ice travel, and suggestions for change could be understood using the model of risk-benefit management.

These results demonstrate that adaptation of safety strategies varies according to experience and gender; that informal and SAR support are key to safety; and that the lens of daily land-use risk-benefit management practices is valuable for illuminating how different individuals in Inuit communities are responding to environmental change through their environmental practices. These results corroborate and add to our understanding of climate change adaptation, and can be used to inform interventions aimed at strengthening the capacity of individuals in northern communities to maximize benefits and minimize risks associated with sea ice use.

PHYSIOLOGICAL BUT NOT BEHAVIOURAL SENESCENCE IN ARCTIC SEABIRDS

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Within a given taxonomic group, survival typically declines with latitude. The usual explanation is that challenging abiotic factors are more common at high latitudes than in the benign and stable climate of the tropics. Similarly, in the classical free radical theory of aging, the higher metabolic costs of sustaining a constant internal temperature in the face of harsh arctic environments are predicted to increase the production of free radicals and oxidative stress, leading to higher rates of mortality among high-latitude individuals. Despite the prediction that survival should decrease at higher latitudes, the longest-lived wild birds (albatrosses), mammals (bowheads/arviq) and animals in general (quahog clams Arctica islandica) live at high latitudes. To examine senescence in two long-lived arctic seabirds (akpa/thick-billed murres Uria lomvia and tateraaq/black-legged kittiwakes Rissa tridactyla), I attached a variety of miniature loggers to known-age birds to measure behaviour and used respirometry and endocrinology to measure physiology. Twenty different behavioural measures, from feeding rates to allopreening to dive depth, showed no variation with age. In contrast, several physiological measures (metabolic rate, immune function and the endocrine stress response) all declined with age. The harsh northern environment apparently causes wear-and-tear leading to physiological deterioration, whereas the abundance of food may mask any decline in behavioural traits, especially those linked to foraging.

SEA ICE LOSS AND THE CHANGING ATMOSPHERIC CO2 UPTAKE CAPACITY OF THE ARCTIC OCEAN: INSIGHTS FROM THE SOUTHEASTERN CANADA BASIN

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The drastic decline of Arctic sea ice – with its accompanying changes to the Arctic marine ecosystem, energy and freshwater balances, vertical transport, and biogeochemistry – is expected to have a strong impact on the air-sea exchange of CO_2. While much work has focused on the continental shelves and their increasing role as atmospheric CO_2 sinks, less is known about the deep basins. Initial estimates predicted a significant increase in CO_2 uptake as these areas became ice free (Bates et al. 2006), but more recent evidence has shown that they may in fact have very little potential to absorb atmospheric CO_2 (Cai et al. 2010). Given the expansion of ice-free areas into the deep basins in recent years, it is becoming vitally important that we improve our understanding of carbon cycling in the central Arctic Ocean.

In late summer 2009, a cruise onboard the CCGS *Amundsen* was conducted in the southeastern Canada Basin as a joint effort between ArcticNet and GEOTRACES. During the cruise, partial pressure of CO_2 in the surface seawater (pCO_{2sw}) was measured continuously, while vertical profiles of carbonate system chemistry, nutrients, and temperature/salinity were collected at four discrete stations. Detailed observations of sea ice conditions were also obtained.

Underneath heavily decayed ice, we found surprisingly high pCO_{2sw} (300-320 µatm), considering that water temperatures were low and the surface water was strongly influenced by ice melt. To assess the potential for this surface water to absorb atmospheric CO_2, we ran a simple model that simulated melt of the remaining ice and exposure of the surface water for 100 days. The results of this simulation showed that the surface water had very little potential to absorb atmospheric CO_2; in fact, we found a significantly weaker (by ~60%) uptake capacity than had been observed the previous year by Cai et al. (2010) in the southwestern Canada Basin. While regional variations in water mass composition may partly explain the relatively low CO_2 uptake capacity in our area, it is also possible that our observations reflect a decrease in the Canada Basin's ability to act as a CO_2 sink. Such an interpretation compliments the emerging theory that as the Canada Basin becomes increasingly ice free, pCO_{2sw} in the shallow mixed layer will rapidly equilibrate with the atmosphere, inhibiting further CO_2 uptake.

Although climate change will impact the marine Arctic marine carbon cycle in many ways, our evidence shows that we can expect only a weak increase in atmospheric CO_2 absorption by a seasonally ice-free Canada Basin.

ADAPTATION PLANNING IN THE INUVIALUIT SETTLEMENT REGION: SUMMARY AND RECOMMENDATIONS FROM A WORKSHOP ON FOOD SECURITY AND FOOD SAFETY

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In view of the rapid ecological, social, political and economic changes in the Arctic, the development of adaptation options has become a priority on the agenda of communities. The 2007/8 Inuit Health Survey (IHS) documented the factors contributing to Inuit health, health transition, and the Inuit spirit of thriving and resiliency in the face of the pressures of changes in all segments of life. Six communities of the Inuvialuit Settlement Region (ISR) participated in the IHS and the results have recently been made available. Results of ArcticNet funded research on food security in ISR have identified community specific situations and needs.

On July 11-12, 2012, the Inuvialuit Regional Corporation invited researchers from the University of

Ottawa, University of Northern British Columbia and University of Toronto together with ISR community representatives, local and Northwest Territories government stakeholders to discuss adaptation strategies for the region. The working group developed a vision and missions, and formulated concrete activities to guide future research and intervention to improve food security in ISR.

The vision developed by the group is "to empower communities to promote health, well-being, and environmental sustainability in the Inuvialuit Settlement Region". The missions include: building capacity within communities; promoting the use of traditional foods to address food security and retaining the quality of Inuvialuit diet; conducting research to better understand the linkages between diseases and contaminants in traditional foods, market foods and lifestyle choices; and promoting affordable housing allowing more household income to improve food security. Programs with concrete activities to fulfill the vision have been developed in the following areas: harvest support and traditional food sharing; education and promotion; governance and policy; research; and housing.

It is recommended that future research and intervention projects be based on the issues discussed during this workshop. Community involvement is a key element in developing future research in the ISR.

FOOD INSECURITY IS COMPOUNDED BY INCREASED MERCURY AND LEAD EXPOSURE AMONG INUIT IN THE CANADIAN ARCTIC

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Background: Food insecurity is high in the Canadian Arctic, and has been related to poor nutrient status among adult Inuit. Food safety issues such as exposure to environmental contaminants, such as mercury (Hg) and lead (Pb) is another concern but the relation between food security status and contaminant exposure is unknown.

Objective: To study the relationship between exposure to Hg and Pb and the status of food security in a Canadian adult Inuit population.

Methods: A cross-sectional survey was conducted among 2 595 Inuit adults from 36 communities from Inuvialuit Settlement Region, Nunavut and Nunatsiavut in Canada. Data on household composition, traditional food harvesting and consumption, socio-economic indicators was collected. Food security was assessed using the 18-item USDA questionnaire. Blood Hg (B-Hg) and Pb (B-Pb) levels were measured. ANOVA and multiple regressions were used to explore the relations between exposure and food security.

Results: B-Hg and B-Pb levels were higher in participants living in food insecure households and answering positively to the question "In the last 12 months, were there times when the food for you and your family just did not last, and there was no money to buy more?". When controlling for age, sex, smoking, drinking, country food preference and the presence of an active hunter, there was a positive association between B-Hg and B-Pb and increasing household food insecurity.

Discussion: As food insecurity, poor nutrient status and exposure to contaminants are public health concerns in the Canadian Inuit, there is a need to understand the interdependent dynamics behind these issues in order to promote food security and safety.

INTEGRATING MARINE ECOLOGICAL PROCESSES OF THE CANADIAN ARCTIC ENVIRONMENT WITHIN A COMMUNITY-BASED MODELING FRAMEWORK

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The Canadian Arctic Archipelago (CAA) and its adjacent seas (i.e. Beaufort Sea, Baffin Bay and Hudson Bay) is a vast network of complicated channels, shallow shelves and slope areas, with a biogeography ranging from highly-stratified oligotrophic regions up to biological hotspots of sustained productivity. In addition to extreme seasonality, biogeochemical mechanisms across the CAA are obviously related to specific bathymetric features, sea ice dynamics and transient regimes in atmospheric forcings. Given the inherent heterogeneity of the physical regime, the ecology of both sea ice and pelagic environments must be considered when modeling the structure and function of the marine food web in the CAA; so must be benthic processes in certain areas where fluxes of organic matter and nutrients

transiting via the bottom boundary layer constitute the main energy pathway. The goal of the present project is to assemble within a unified virtual library the multiple ecosystem models currently available for the CAA, or in ongoing development. This will be accomplished through the Framework for Aquatic Biogeochemical Models (FABM, http://fabm.sourceforge.net/), a community-based open-source program that aims at facilitating the coupling between any kinds of geochemical-ecosystem modules and a given hydrodynamic model. Here, we test the aptitude of FABM to be applied to Arctic waters by constructing a modular sea ice-pelagic-benthic ecosystem model (with a complete microbial sub-component) that has been coupled with the 1-D model General Ocean Turbulence Model (GOTM) version 4.1. In particular, we explore the potential advantages of using a multi-nutrient ecosystem model with variable C:N stoichiometry as based on the "internal stores" of planktonic state variables; and the implications for productivity and energy partitioning (e.g. biomass increase, respiration, vertical losses) across the lower food web. Realistic simulation scenarios with prescribed horizontal advection, tides, sea ice concentration, and meteorological forcings, for an ArcticNet mooring station located on the margin of the eastern Mackenzie Shelf (Beaufort Sea), were developed for the year 2008 and 2009 – two contrasting years in sea ice persistence and ecosystem productivity. Model outputs were further compared with field observations (e.g. downward carbon export) collected as part of the IPY-CFL, ArcticNet and Malina programs conducted in Beaufort Sea during those two successive years. We conclude by underscoring that the comparison of mooring datasets to the current empirical-based modeling effort is a fruitful approach to tackle the complexity of biophysical processes and propose realistic scenarios of future ecosystem functioning in the CAA on seasonal and inter-annual scales.

OBSERVATIONS BENEATH PETERMANN ICE ISLAND–B (PII–B) IN THE CANADIAN ARCTIC

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A number of tabular ice islands (10s of kilometers across) are currently adrift in the Canadian Arctic as a result of the collapse of several ice shelves and floating glacier tongues. These ice islands may drift for several years, but can also ground on shoals for extended durations, or drift to southern latitudes where they pose a hazard to shipping and offshore industries prior to deteriorating in warmer waters. Grounded and free floating ice islands deteriorate by different processes, with grounded ice islands eroding through the complex interaction of near-shore currents with the seabed and the underside of the ice island. Understanding this process requires direct observations in the vicinity and, importantly, beneath ice islands. This work presents initial measurements of ice draft and ocean conditions beneath the partially grounded Petermann Ice Island–B (PII–B; 69º 37' N, 65º 46' W) in October 2011. We used a combination of three-dimensional digital terrain mapping sonar systems, including an interferometric sonar mounted on UBC-Gavia, a small Autonomous Underwater Vehicle (AUV), to map a 500 m x 500 m portion of the underside of PII-B (90 km^2) in conjunction with a sidewall survey conducted by a surface vessel-mounted multibeam sonar. This survey revealed a pronounced submarine ice 'skirt' extending beyond the subaerial ice cliff, indicating intense surface wave erosion of the exposed sidewall. The draft of the ice island keel increased from 40 m depth at the sidewall to approximately 65 m at a distance of 500 m from the ice edge with a relatively uniform basal topography. Estimates of surface roughness show the underside of this ice island to be smooth compared to the sidewalls. UBC-Gavia also measured several water properties (i.e., temperature, conductivity, chlorophyll-a, turbidity, and water velocity) along transects in the cavity beneath the ice island. Vertical water column profiles and nutrient samples were collected from a support vessel at stations located 100, 200 and 400 m from the ice island, both upstream and downstream, along the primary axis of current flow. Variations in salinity, stratification and other ocean properties are apparent among the stations due to ice island presenting an obstacle to current flow. The combined mapping surveys produced a three dimensional

map of this portion of the ice island that allow the water properties to be placed in the context of their complex geophysical setting. The combination of traditional vertical profiling from surface vessels and innovative AUV-based measurements presented here provide a better understanding of a complex overhead ice environment, and the methods could be transferred to investigations of submarine melting and ice mass loss in similar complex environments, such as under floating glacier tongues and ice shelves.

MERCURY BIOMAGNIFICATION IN MARINE ZOOPLANKTON FOOD WEBS IN HUDSON BAY

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The biomagnification of mercury within lower trophic level food webs, including zooplankton, governs the exposure of more commonly monitored organisms, yet, comparatively little research has been done on them. We present a comprehensive data set of total (THg) and monomethylmercury (MMHg) concentrations, and isotopic signatures ($\delta^{15}N$ and $\delta^{13}C$) for zooplankton taxa representing four distinct food webs. This data was collected over a period of eight years (2003-2010) on research icebreaker cruises in Hudson Bay (including Hudson Strait and Foxe Channel). $\delta^{15}N$ values were found to range from 3.4 to 14.0 ‰, implying trophic levels ranging from 1 to 4, and THg concentrations ranged from 5 to 242 ng g^{-1} dw. Mercury was found to biomagnify within zooplankton food webs, and the importance of trophic ecology to assessments of biomagnfication, particularly within zooplankton food webs, is highlighted.

LATE GLACIAL AND HOLOCENE VEGETATION AND CLIMATE HISTORY FROM EASTERNMOST BERINGIA (NORTHERN YUKON TERRITORY, CANADA)

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During the late Wisconsin glacial episode (28–10 cal ka BP), the Bering land bridge connected the unglaciated parts of Alaska and the Yukon Territory with eastern Siberia to form an extensive continuous landmass known as Beringia. Beringian environments are of particular interest, because they served as glacial refugia for various taxa and enabled the migration of plants, animals, and early humans between Eurasia and North America. The northern Yukon Territory was the easternmost boundary of Beringia and in close vicinity to the Laurentide Ice Sheet (LIS). So far, Beringian climate and environmental history are poorly characterized at its easternmost edge. Little is known about vegetation and temperature dynamics northwest of the collapsing LIS close to the Arctic Ocean.

Lake sediments from Trout Lake in the northern Yukon Territory have recorded sedimentation, vegetation, summer temperature and precipitation changes since ~16 cal ka BP.

Pollen spectra and quantitative climate reconstructions (transfer functions: MAT and WAPLS) indicate that herb-dominated tundra persisted until ~14.7 cal ka BP with mean July air temperatures ≤5°C colder and annual precipitation 50 to 120 mm lower than today. Temperatures rapidly increased during the Bølling/Allerød interstadial towards modern conditions, favoring establishment of *Betula-Salix* shrub tundra. Pollen-inferred temperature reconstructions recorded a pronounced Younger Dryas stadial in east Beringia with a temperature drop of 2.5 to 3.0°C below modern conditions and low net precipitation of 90 to 170 mm but show little evidence of an early Holocene thermal maximum. Sustained low net precipitation and increased evaporation during early Holocene warming suggest a moisture-limited spread of vegetation and an obscured summer temperature maximum.

Northern Yukon Holocene moisture availability

increased in response to a retreating Laurentide Ice Sheet, postglacial sea level rise, and decreasing summer insolation that in turn led to establishment of *Alnus-Betula* shrub tundra from ~5 cal ka BP until present, and conversion of a continental climate into a coastal-maritime climate near the Beaufort Sea.

CANADA AND THE ARCTIC COUNCIL: ENTERING THE CHAIRMANSHIP

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As part of the panel on Arctic Security - A Changing Geostrategic Reality, this presentation will examine the role played by the Arctic Council and Canada's role in it. Canada played a critical role in the creation of this body. The Arctic Council has now assumed a central role in arctic governance. Canada will resume the chairmanship of the council in 2013. What role has a Council played in improving arctic security? What can Canada do as chairman to further strengthen international security in the region?

IMPACTS OF MINERAL DEVELOPMENT IN THE ARCTIC: A 10-YEAR REVIEW OF THE MONITORING AND IMPACTS OF THE VOISEY'S BAY DEVELOPMENT ON INUIT, NUNATSIAVUT COMMUNITIES AND THE ENVIRONMENT

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Large scale environmental development projects, such as that associated with the Voisey's Bay nickel mine in northern Labrador, are reported to represent potential benefits for communities in terms of access to wage earning employment, encouraging training and skills development particular to the industry, and providing individuals and communities with great flexibility and autonomy associated with enhanced socioeconomic status, among other things. However, large developments and the changes they bring to the land, lifestyles and livelihoods also represent potential negative impacts to the health and well-being of individuals, households and communities. Large-scale developments hold the potential to further dislocate individuals from the land and sea which currently provide significant health and well-being benefits. Previous research has identified the disassociation from environment as one of the major health issues facing Inuit today.

In the context of ongoing social, cultural, economic and environmental change already taking place in Nunatsiavut, human induced environmental change such as the Voisey's Bay development can both strengthen and stress community well-being. Ten years after the signing of the Voisey's Bay Inuit Impacts and Benefits Agreement (IBA), it is therefore both timely and critical to better understand the biophysical, socioeconomic and health impacts of the Voisey's Bay project as an example of the true impacts and benefits of mineral development in Arctic regions. At a high level, identifying the knowledge known, lessons learned and key gaps will support decision-making with respect to possible future developments in Nunatsiavut and elsewhere. It will also allow us to better track potential impacts and further optimize benefits of development for Inuit in the future. The Nunatsiavut Government, in cooperation with Memorial and Trent Universities are undertaking a collection, review and analysis of data documenting the relationship between the development of the Voisey's Bay mine project and the environment and well-being of Nunatsiavut communities and beneficiaries. This holistic approach to socioeconomic, health and environmental assessment, monitoring and follow-up will be extremely valuable in understanding the true impacts and benefits associated with Voisey's Bay and therefore equip the Government and residents of Nunatsiavut and other Arctic regions in future IBA and development discussions.

DMSP BACTERIAL METABOLISM AT THE ICE-WATER INTERFACE DURING THE SPRING MELT PERIOD IN ARCTIC

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The alarming decline of the Arctic sea ice cover should affect the global productivity and the dynamics of algal and bacterial communities with unknown consequences on the biogeochemical cycles. Dimethylsulfoniopropionate (DMSP) plays important roles in the microbial cycle of both carbon and sulfur as well as being the precursor of the climate cooling gas dimethylsulfide (DMS). Currently DMSP data in Arctic are scare, limiting our understanding of DMSP dynamics in the ice and in the water column, especially during the melt period. During the Arctic-ICE project (Arctic marine ice-associated Ecosystem in a changing environment), we determined the contribution of sea ice algae to the DMSP pool in the water column in Allen Bay during two springs: May-June 2010 and 2011. In addition, we determined the bacterial metabolism of DMSP during the spring melt period in May-June 2012 in the Resolute Passage. DMSP concentrations in the bottom sea ice and in the water column were determined by gas chromatography while the microbial cycling of DMSP was characterized using a radioisotopic tracer method (35S-DMSP). In this study, we measured the temporal variations in sea ice and water column algal taxonomic composition and DMSP concentrations, separating particulate (DMSPp) and dissolved (DMSPd) fractions. Results show that DMSP concentrations at the bottom sea ice were very high during the ice algae bloom, with maximums respectively of 15000 nmol L^{-1} and 6000 nmol L^{-1} for DMSPp and DMSPd. The concentrations in the sea ice diminished during the melt period following the draining of brines in the underlying water column. The release of ice algae in the water column during mid-May contributed to 100% to the total water column pool of DMSPp before the development of a phytoplanktonic bloom. A large quantity of DMSPd was also disappeared from the sea ice but it was not observed in the water column, suggesting effective sinks for this reservoir of sulfur. In light of these results, the bacterial utilisation of DMSP was thus investigated in further detail and showed highest bacterial affinity for DMSPd in brines compared to the water column bacterial communities underneath the ice (864 to 2376 d^{-1} vs 1 to 5 d^{-1}). In addition, the proportion of DMSP cleaved into DMS by bacteria (DMS yield) was higher in the brines (5.46±0.86%) than in the water column (2.39±0.67%), and presented a significative difference between the two environments (t-test, $p<0,001$). These results suggest that very active bacterial remineralization of DMSPd occurs within the bottom of the sea ice where bacteria use DMSP predominantly as a source of sulfur. The predicted disappearance of the Arctic sea ice cover could lead to significant modifications of the cycling of DMSP and the marine production and atmospheric ventilation of DMS in the near-future.

CSI HUSKY LAKES: EVALUATION OF HYDRO-CLIMATIC DRIVERS OF CONTAMINANT TRANSFER IN AQUATIC FOOD WEBS IN THE HUSKY LAKES WATERSHED, NORTHWEST TERRITORIES, CANADA

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Climate change in the Arctic has the potential to affect mercury concentrations ([Hg]) in freshwater fishes. Mercury can accumulate in apex-predator fish muscle to concentrations exceeding those considered safe for subsistence consumption by humans. Fish species such as Lake trout are typical apex-predators of Arctic lakes and can be a significant source of food for local indigenous peoples. The influence of abiotic factors, which are climate influenced, and biological parameters on Hg accumulation in apex-predators are not well understood. Further, a good understanding of sources of Hg to and processes within water column and food webs is still lacking. Lacking is also information on fish movement within and among lakes, which can affect [Hg]. Our study aims to investigate the interactions of water column, food webs and Hg transfer in four freshwater systems in the Inuvialuit Settlement Region (Canada). The selected Big, Yaya, Noell, and Husky Lakes systems represent a range of water column and ecological characteristics, as well as Hg delivery (marine-, riverine- or freshwater-derived). We investigate how those characteristics affect Hg transfer and fractionation. All lakes are frequented by the Inuvialuit communities Inuvik and Tuktoyaktuk for subsistence fishing. Our sampling

locations and target species will be determined by local people during TK interviews. Sampling includes tissues from harvested fishes, non-target fishes, and food web compartments (periphyton, zooplankton, and benthos). Biological parameters of fishes (age, length, weight, diet) are recorded and invertebrates separated by species. The possible movements of fishes within and among lakes will be investigated using otolith microchemistry. Sample analysis includes total Hg (THg), monomethylHg (MeHg), and stable isotopes of carbon ($\delta^{13}C$), nitrogen ($\delta^{15}N$), and Hg (δxHg) and otolith microchemistry. Hg IRs are analyzed by multicollector inductively coupled plasma mass spectrometry (MC-ICP/MS). Hg mass independent fractionation (MIF; $\Delta^{199}Hg$) and mass dependent fractionation (MDF; $\delta^{202}Hg$) will be calculated and evaluated against conditions in the water column, food web transfer and the potentially difference in Hg delivery. [THg] detected in harvested fishes will be compared to consumption guidelines. In-lake food web transfer of MeHg will be evaluated against abiotic conditions and related lake productivity. We will present an update on this multidisciplinary study and discuss our preliminary findings with particular focus on implications for future research efforts in a changing Arctic environment.

UNDERSTANDING THE FEEDING ECOLOGY OF BOWHEAD WHALES IN NUNAVIK USING STABLES ISOTOPES, TRACE ELEMENTS AND INUIT KNOWLEDGE

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The feeding ecology of bowhead whales (*Balaena mysticetus*) has been studied previously in the Eastern Canadian Arctic, but little is known about this species in Nunavik waters (coastal water off Northern Québec). Most studies conducted on the species to date have gathered quantitative scientific observational data with little inclusion or consideration of existing Inuit knowledge (IK). IK has been shown to be valuable in helping understand local and long term patterns in behaviour and ecology of many other Arctic species. Combining the two approaches provide insights into the ecology of this relatively rare Arctic cetacean. Analysis of chemical tracers such as stable isotopes contained in the inert keratinous tissue of baleen plates has provided insights into understanding habitat use and diet of individual whales over periods of 15 years or more. This mixed methods study aimed to understand the seasonal feeding ecology of bowhead whales using stable carbon and nitrogen isotope ratios and a new approach including the analysis of 26 trace elements in baleen plates from bowhead whales hunted in Nunavik waters, along with IK interviews with hunters and elders from Nunavik communities. Preliminary results show that bowhead whales are present in Nunavik waters. Quaqtaq (Northern Diana Bay, marine areas near Cape Hope Advance and Naujaat Island) and Kangiqsujuaq (Joy Bay, Whitley Bay and Wakeham Bay) were noted as important feeding areas for this species in summer months. The bowhead whales were more often observed feeding in deep open water areas close to shore where strong wind and current occurred. These characteristics are typically present in areas deemed as highly productive. Almost half of the participants identified the presence of other animals and bowhead prey in the areas where the whales fed. IK holders in communities reported that small shrimp-like crustaceans and fishes were primary items in the bowhead diet in these locations. Trace elements and stable isotopes showed variation indicating temporal changes in diet and movement among different feeding areas. The mixed methods approach used in this study proved valuable in assembling a more diverse knowledge base on the species than has existed previously.

A NETWORK OF MILLENNIAL TREE RING CHRONOLOGIES FOR CLIMATE RECONSTRUCTIONS FROM THE MARGIN OF THE EASTERN CANADIAN ARCTIC

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Climate is a large scale phenomenon and climate reconstructions from the northern boreal forest are useful to understand past climatic trends and evaluate the importance of the recent warming in the Arctic and

at larger scales. Annually-resolved, millennial-long tree ring chronologies from the northern boreal forest would be especially useful for precise reconstructions of climatic trends at time scales varying from decades to several centuries, based either on tree ring width, wood density, or isotope ratios in wood cellulose. However, because of the relatively short longevity of trees, the remoteness of many areas, and the frequent fire disturbances, very few millennial tree ring chronologies have been developed across the North American boreal forest. As a part of the ARCHIVES project (http://archives.ete.inrs.ca/), the objective of this study is to develop a network of highly replicated millennial tree ring chronologies using tree remains preserved in the littoral zone of lakes in the eastern Canadian taiga. Cross-validation among local chronologies will enable identification and removal of local growth disturbances such as those caused by wildfires. Validated chronologies will then be averaged to provide a robust regional chronology to be used for climate reconstructions.

Criteria were developed to identify sites that have experienced uninterrupted development of the riparian forest for several centuries and a continuous transfer of tree stem remains across the forest-lake interface. It has been established that old black spruce (*Picea mariana* Mill. BSP.) stands with some balsam fir (*Abies balsamea* L. Mill.) within riparian forests growing on moderate leeward slopes provide such conditions. Other important characteristics are an abrupt forest-lake transition and a littoral talus less than 5 m from the shoreline to ensure excellent wood conservation protected from wave and ice erosion. In total, 2571 tree remains have been sampled along 6300 m of shoreline in 6 selected lakes with these characteristics. Cross-dating of tree ring width series among specimens was successful, with a success rate of about 69% of the analyzed samples. Diagnostic tree rings (light and narrow rings), which are often produced by trees during unfavorable vegetative seasons, were useful cross-dating tools. Dating of samples with charcoals enabled the detection of 8 wildfires that have affected to various degrees the riparian forest stands and their respective growth trends during the last millennium. Piecewise regressions were used to understand the influence of past wildfires on recruitment rates of tree remains in the littoral zones and on regeneration periods of the riparian forests during the last millennium. So far, the master chronology, built using tree remains from all sites, spans 1375 years (AD 637-AD 2011). All local chronologies span the entire last millennium with high to very high replication. Together, these chronologies form the longest tree ring record ever built from the boreal zone of Eastern North America and provide a useful dataset for climate reconstructions.

AN ANSWER TO THE MYSTERY OF THE MISSING ARCTIC COD?

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Arctic cod represents a keystone species of the Arctic marine ecosystem that transfers up to 75% of the energy between lower trophic levels and top predators. In the Canadian Arctic, adult arctic cod are known to school in shallow coastal areas during the ice-free season, but total biomass of these schools cannot support the energetic requirements of predators and most individuals must have a different distribution pattern. Previous studies partly addressed this "mystery" of the missing arctic cod and revealed the formation of immense aggregations over the continental slope of the Canadian Beaufort Sea during winter, mostly in the lower Atlantic waters (>200 m). However, distribution of the mature individuals in the area during the ice-free season remains poorly documented despite the ecological importance of the species. As part of large environmental research efforts, hydroacoustic surveys were conducted from 2009 to 2012 in the Canadian Beaufort Sea with multi-frequency echosounders (Simrad EK60) and a fisheries sonar (Simrad SX90) to test the hypothesis that adult arctic cod school in shallow waters and near the surface during summer and fall. Instead, the acoustic surveys detected scattered epipelagic aggregations of young-of-the-year (YOY) arctic cod in the top 100 m. Larger individuals (age 1+) formed a distinct layer in the Atlantic waters, over the continental slope in bottom depth areas ranging from 200 to 400 m, similar to their winter distribution. Deployments of mid-water and benthic trawls within these aggregations in 2012 allowed echo-validation. These hydroacoustic studies highlight the importance of the continental slope as a year-long refuge for adult arctic cod in the Canadian Beaufort Sea. The interest for the offshore hydrocarbon resources of the Beaufort Sea, especially of the continental slope area, has recently increased. As arctic cod distribution is closely related to the slope and water masses, a better knowledge of the species is needed to anticipate its response to the combined effects of the ongoing increase in anthropogenic activities and warming of the Arctic Ocean.

LIFE ON PERMAFROST IN NUNAVIK: COMMUNITY PLANNING EMPOWERMENT

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In almost every village's territory (category 1 lands of the NQJBA) there are stretches of ice-rich and/or poorly-drained permafrost terrain. Some of them are found in already built areas, some others extend in the surroundings of villages where expansion has to take place. Therefore there is an important need for land management plans that properly take into account the permafrost conditions.

Our intent is to support community members, actual and upcoming, in their acquisition and mastering of key permafrost knowledge and in mastering tools of land management for them to make their decision and planning.

Progresses were made recently to improve land management planning in Nunavik's communities through the experience in transfer of permafrost knowledge gained in Salluit. This transfer led to the recent community decision to adapt foundation techniques to variable permafrost conditions and to expand the village according to a tightly designed land management plan. From that experience, the Kativik Regional Government (KRG) has undertaken to launch a series of regulations, a good practice guide and a training program for managing municipal operations in all its communities. More experience is also currently gained in the course of ongoing research projects at CEN in five other communities where permafrost mapping is done: Tasiujaq, Kangirsuk, Akulivik, Puvirnituq and Inukjuak (RAC by CEN-Ouranos and Giberyen's Ph.D. thesis in prep.). The present project will further develop methodologies from this previous projects and work towards their implementation.

Inuit have a high level of knowledge of the land and it is important to create links between this knowledge, sub-surface ground conditions, applications to construction and terrain sensitivity to human impacts. The communities are asking for this kind of projects and they will participate in tailoring the pedagogical approach to their needs and advise on the pedagogy to be used in educating members of the upcoming generation of decision-makers. In October 2010, KSB Inuit commissioners have voted to support the development of hands-on scientific learning activities integrating a community-based environmental program in the High-School Science and Technology curriculum.

Our methodology is one not only of training and knowledge transfer, but it also will be designed with the decision-makers, managers, schools and regional players. Their knowledge on existing problems and their expectations together with our scientific knowledge will be the basis of this project. Together we plan to develop training and tools that will allow locals to best address local and regional challenges. Therefore meetings, field excursions, workshops, and school participation will be at the core of this project.

TRACING THE TERRIGENOUS SOURCES OF POC AND DOC IN THE ARCTIC RIVERS OF THE HUDSON BAY USING LIGNIN BIOMARKERS, Δ13C AND Δ14C

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With increased warming in the Arctic, there is the potential for vast amounts of soil organic carbon (SOC) to enter the system and ultimately change the input of terrigenous and petrogenic carbon entering coastal seas. By understanding changes occurring within the carbon cycle we can begin to assess the potential feedbacks and concerns that may arise as global temperatures increase. The Hudson Bay and its latitudinal extent is an important region due to its temperature gradients which influence vegetation, freeze/thaw cycles and ultimately the hydrology and inputs of carbon into the Hudson Bay. Lignin reaction products from vascular plant tissues have distinct isotopic signatures and, when coupled with stable carbon isotope analysis, enhance the source specificity of biomarkers. This project

looks at quantifying and potentially tracing the terrigenous sources of POC and DOC through 15 Arctic rivers of the Hudson Bay using lignin biomarkers, δ13C and Δ14C.

Samples were collected during the 2010 field season from the CCGS Amundsen during Leg 1A of the Expedition. Both dissolved (DOC) and particulate (POC) phase organic carbon were collected from 15 major rivers of the Hudson Bay along with the extraction of a permafrost core and/or soil sample at six of these sites. All samples have been analyzed for C/N ratios, Δ14C, δ13C and δ15N isotopes. Box core samples were also analyzed in order to observe these signatures presence on the ocean floor. Lignin biomarker analyses were conducted using isotope-ratio-monitoring gas chromatography/mass spectrometry (irm-GC/MS) that has been shown to enhance the source specificity of biomarkers when coupled with stable carbon isotope analysis and lignin phenol ratios are well correlated with tundra and taiga vegetative sources.

Due to the nature of permafrost soil regimes, SOC including POC stored in permafrost have been used to trace origins of terrigenous OC entering the Hudson Bay. The age and amounts of POC in arctic rivers have been known to help quantify permafrost thaw and the release of ancient carbon into the system while DOC may reflect changes to plant ecology. Preliminary results show that there are differences between concentrations and composition of lignin biomarkers in all samples. This data set shows not only compositional changes between dissolved and particulate phase but also the differences coinciding with geographical location with the west having greater concentrations of both phases. Compositional differences are evident in permafrost and soil, not only between sites but also down the soil profile. There are latitudinal differences in the lignin ratios coinciding with ecozones and regional vegetation. We are presently analysing selected samples for Δ14C to determine the relative amounts of recent and ancient terrigenous carbon components presently entering the Bay. These data provide baseline signatures which we will use to estimate the current contribution of OC released from permafrost/soil to Hudson Bay's organic budget.

INVESTIGATIONS OF GEAR MODIFICATIONS TO REDUCE THE BYCATCH OF GREENLAND SHARK IN TURBOT LONGLINE FISHERIES

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The Greenland Shark, *Somniosus microcephalus*, is captured incidentally in Turbot (*Reinhardtius hippoglossoides*) longline fisheries prosecuted in Cumberland Sound and in Baffin Island fjords found within the Arctic Circle (e.g., Pond Inlet and Clyde River). There are several uncertainties with regard to Greenland Shark abundance, distribution, and life-history. However, the general life-history characteristics exhibited by sharks, including slow growth, late maturity, and low reproductive capacity, result in high vulnerability to overfishing and the Greenland Shark is listed as Near Threatened by the International Union for the Conservation of Nature and Natural Resources (IUCN). The current study was carried out in Cumberland Sound to investigate whether longline gear could be modified to reduce the bycatch of Greenland Shark without substantially reducing the capture efficiency of Turbot. Gear modifications tested were 1) an increase in gangion length and the interval between gangions, and 2) the introduction of a commercially available hook (i.e., SMART hook) that incorporates electropositive metals and a magnetic material that have been shown to act as deterrents to shark attacks and predation.

A total of 15 Greenland Shark from three length categories (<3 m, 3-4 m, and > 4 m) were captured in overnight (~12 hours) longline sets. All sharks were alive and in good physical condition when hauled to the surface and they were observed to swim away under their own control when released. All six Greenland Sharks that were captured during the SMART hook experiment were captured on SMART hooks (5 of the 6 sharks) or in the SMART hook section/replicate (1 of the 6 sharks) of the experimental longline. These results indicate that SMART hooks were not a practical solution for reducing the bycatch of Greenland Shark in the Cumberland Sound Turbot longline fishery. When longlines were configured with a greater gangion length (i.e., 1.8 vs. 0.6 m) and the interval between gangions was increased (i.e., 5.5 vs. 1.8 m) compared to the typical configuration in commercial Turbot longline fisheries, there was not only an increase in the mean capture efficiency of Turbot, expressed both as the number of fish/100 hooks and the number of fish/100 m of longline, but also a decrease in the bycatch of Greenland Shark. These results are encouraging, however additional studies are required.

COLONIALISM, COMMUNITY CONSULTATION, AND INUIT EMPLOYMENT IN AN ARCTIC MINE, 1970-2002

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The Polaris Mine (75˚N, 96˚W) operated on Little Cornwallis Island in Nunavut from 1982 until its closure in 2002. Polaris was owned and operated by Cominco, one of Canada's international mining giants at the time. Cominco began development of Polaris in the early 1970s and throughout the development stage they engaged in community consultation - something new in the mining industry up to this point. This paper will examine Cominco's exertion of colonial authority through the relationship that Cominco developed with the community of Resolute Bay (as the "partner" community to the mine site); the relationship was formed through the consultation process and the lack of employment opportunities offered to Resolute Inuit at Polaris. I argue that due to the colonial nature of hinterland resource extraction the people of Resolute Bay had minimal involvement with the industrial development of Polaris, which strongly influences the attitudes they hold toward Cominco and the mine site today.

Though the Cominco consultation process included reports and updates on the plans and progress of development, it was not negotiation and the people of Resolute did not have decision making power or much opportunity to voice their opinions even though the development occurred in a traditional use area of Resolute Inuit. This research is based on oral histories with former Polaris mine workers and community members of Resolute Bay. Many of those interviewed felt betrayed and ignored by Cominco, which promised employment to the community that never materialized. They felt that their concerns regarding the surrounding environment were not taken seriously, and their worries about the impacts on hunting were ignored. Furthermore, throughout the tenure of Polaris, only 10% (of 350 total employees) of the mine's total workforce at peak employment were Inuit, and only 10 individuals from Resolute Bay were employed at Polaris. The rest of the Inuit employee population came from other areas in the Eastern Arctic. Due to this low percentage of workers from the community, Resolute Bay, as a community, received very little economic benefit from the mine. This is not to suggest that residents of Resolute were not interested in working at the mine; in fact, many desired to work there and the community was hopeful to see more residents employed. However, Inuit faced many challenges to gain employment at the mine and to maintain their employment. While interviewees generally responded positively to their experience working at Polaris, they indicated that Inuit were usually the first to lose their jobs, and some interviewees recalled discrimination on the job and in the accommodation facilities that made life at the mine difficult.

This study demonstrates colonialism being inscribed through the appropriation of private capital, without adequate benefits flowing to Inuit in the eastern Arctic. The process of consultation and the difficulty of gaining employment at Polaris have left the community of Resolute Bay with ongoing environmental concerns and negative feelings of betrayal and marginalization toward Cominco.

LIFE HISTORY, ANNUAL ROUTINE AND VERTICAL DISTRIBUTION OF AN ARCTIC FJORD POPULATION OF THE CHAETOGNATH PARASAGITTA ELEGANS

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The chaetognath species *Parasagitta elegans* (var. *arctica*) comprises a substantial portion of the Arctic mesozooplankton biomass and is likely to be an important consumer on copepods. However, few studies have focused on its life history adaptations and ecological role. Here we report results of a year-long study of the ecology of *P. elegans* in a high-Arctic fjord (Billefjorden, Svalbard – 78°N), with particular focus on its annual routine and seasonal vertical distribution. An analysis of the monthly size-frequency distribution data revealed the presence of three size cohorts in the fjord year-round; Cohort 0 (age 0+ years, 1.9 mm-14.3 mm), Cohort 1 (age 1 year+, 13.0 mm-29.7 mm) and Cohort 2 (age 2 years+, 29.2 mm-34.2 mm). Cohort 0 emergence took place in May, at which time members of both Cohorts 1 and 2 frequently possessed seminal receptacles full of sperm, indicating high spawning potential. The smallest individuals (≤6 mm) were only captured from May-August, suggesting an extended summer spawning period. Cohort 0 abundance peaked during July, in shallow water (0-50 m), where the phytoplankton bloom occurred shortly before, likely attracting high densities of small copepod prey here. In all three cohorts, the largest growth occurred from May

to June. During the remaining months, growth rates of Cohorts 0 and 2 were comparably low, negligible or slightly negative, Cohort 1 however grew relatively rapidly from February to April. We hypothesise that timing of reproduction (and Cohort 0 emergence), peak growth, and seasonal vertical distribution of *P. elegans* newborns are all finely tuned to seasonal availability of small copepod prey. Future work should elucidate what are the major prey items for the various size cohorts, and model their impact on the Arctic marine ecosystem.

THE ESTUARINE MIXING BEHAVIOUR OF TERRESTRIALLY DERIVED DISSOLVED ORGANIC CARBON AND ITS RELATIONSHIP TO COLORED DISSOLVED ORGANIC MATTER IN TWO HUDSON BAY ESTUARIES

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We investigated the changes in absorption and fluorescence of colored dissolved organic matter (CDOM) during estuarine mixing in Hudson Bay. Data for this study were collected during the ArcticNet expeditions in 2009-2012. The simple mixing curve model explained 80-90% of the CDOM removal in nearshore waters in the Neslon and Great Whale estuaries. At higher salinity (> 23 PSU) important deviation from the conservative mixing line revealed mixing with the interior of the basin. The summer percent removal was 20% greater than in early spring when the bay was still ice covered. The removal of CDOM from simple salinity-CDOM relationships was estuary-specific. Terrestrial CDOM was removed to a much higher degree in the Nelson estuary than in the Great Whale estuary, suggesting different removal processes. The shallow and wide shelves in the Great Whale area allowed the incoming freshwater mass to spread far away from the source. Our finding demonstrate the need to conduct DOM sampling under varying conditions to accurately quantify the removal of terrestrial DOM in estuaries and its subsequent flux to the basin.

A TIME-SERIES ANALYSIS OF POLYNYA GEOMETRY IN NORTHWESTERN HUDSON BAY, 1980-2012

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It has been hypothesized, modeled, and alluded to in the literature that there is an annually variable polynya in northwestern Hudson Bay; however there has not been an observational study to clarify the spatial and temporal characteristics of this feature. As a dynamically-forced polynya, there is potential to have effects on water stratification, introduction of vertical mixing, altered bay-wide heat flux, and increased spring-time insolation to the euphotic zone. This polynya has been identified as a target for increased research.

This analysis uses Canadian Ice Service Weekly Regional Charts from 1980-2012 in a Geographic Information System (GIS) to extract information from multiple variables and time periods. By using provided sea ice thickness, concentration, and ice type we are able to produce a gridded Relative Pseudo Ice Thickness (RPIT) product that highlights anomalies in ice thickness—a feature indicative of a dynamically-forced polynya. Three decades of satellite-era data across the winter and spring seasons now provide a 'climatology' of the sea ice from formation through melt each year. By harnessing the long time scale, frequent sampling intervals, and high data quality we produce an algorithm that may be transferred to other regions for polynya geometry refinement. Findings discussed highlight polynya geometry, interannual variability, forcing mechanisms, and suspected systemic impacts from this feature.

THICKNESS OF SEA ICE, ICE ISLANDS, AND ICE SHELVES IN THE HIGH CANADIAN ARCTIC

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The high Canadian Arctic is the focus of national and international attention, however, little is known about ice conditions apart from ice concentration, type, and drift which are observable from satellites. The Canadian Arctic Sea Ice Mass Balance Observatory (CASIMBO) attempts to gather additional data, particularly of ice thickness, to further study ice mass balance changes and to provide information in preparation of shipping and

offshore activities in the Northwest Passage and Beaufort Sea. Here we present results from extensive airborne, electromagnetic ice thickness surveys performed in 2011 in various regions of the high Canadian Arctic including the Beaufort Sea and Northwest Passage. These show that there are still significant amounts of hazardous multiyear ice and heavily deformed first-year ice of considerable thickness. For example, ice thickness in Viscount Melville Sound was more than 5 m on average over numerous 1 km long sections of the flight track. Ice thickness surveys north of Ellesemere Island performed since 2004 provide a longer-term perspective of recent ice thickness change. Our results show significant thinning, with mean regional thicknesses of only 3.9 m in 2012, 0.9 m less than in 2004. We also surveyed the thickness of several ice islands and the Ward Hunt Ice Shelf, and show that thicknesses of up to 60 m can be measured by means of our airborne, frequency-domain electromagnetic sounding method. Ice islands in Viscount Melville Sound and the Beaufort Sea had thicknesses well over 30 m. Despite our best efforts and using the best available airborne platforms, and due to the vast size of the high Canadian Arctic, we also show that our efforts still fall short of a complete regional assessment of ice thickness in the region, and that logistics and funding need to be improved to establish a truly Canadian sea ice observation system for better provision of essential ice information.

HARBOUR SEALS AND DECLINING ICE IN WESTERN HUDSON BAY: WILL CLIMATE CHANGE BE BENEFICIAL?

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The decline in ice cover is occurring at a rate that exceeds forecasts by global climate change models. This will have a significant impact on Arctic marine mammals, particularly species that require ice as a platform for various activities such as feeding, resting and reproduction eg polar bears, ringed seals. Polar bears, and ringed seals, in Hudson Bay occur near their southern limit where climate changes are expected to be expressed first. A decline in the ice-covered season is having a negative impact on polar bears and is expected to negatively impact ringed seals as well. Harbour seals also occur in Hudson Bay, but current their current distribution is quite limited. It has been hypothesised that if numbers of ringed seals declined as a result of loss of ice, then harbour seals might become numerous enough to replace them in the diet of polar bears. We examined the movement patterns and dive behaviour of harbour seals in the western Hudson Bay, a seasonally ice-covered region in northern Canada. Seventeen individuals were captured in the Churchill River estuary in 2001 and 2002 and equipped with satellite-linked radio transmitters. During the ice free period, seals followed a general central place-foraging strategy making repeated trips between their haul-out site in the Churchill River estuary and near-shore areas (<20 km) near the river mouth and estuary. As ice started to form along the coast of western Hudson Bay: animals remained significantly farther from the Churchill River haul-out site and from the coast, and performed longer and deeper dives. However, throughout the entire tracking period, irrespective the presence of ice, all animals restricted their movement to a narrow band of shallow coastal waters (<50 m depth) along a 600 km stretch of the western Hudson Bay coastline, centered on the Churchill River haul-out site. This natural self-limitation to nearshore shallow waters will restrict the potential for an increase in population size and when combined with the fact that harbour seal pups are leaner than ringed seal pups will limit their potential to replace ringed seals as a primary prey for polar bears.

THE LAPTEV SEA POLYNYA PROJECT: THE SIBERIAN PERSPECTIVE OF THE CIRCUMPOLAR FLAW LEAD SYSTEM

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The aim of our multi-disciplinary project is the investigation of polynya processes in the Laptev Sea area of the Siberian Arctic and their consequences for the atmosphere, ocean processes, and ice formation. Our approach comprises field campaigns, long term observations, and numerical modelling. Three winter expeditions (2008, 2009 and 2012) and five summer expeditions (2007, 2008, 2009, 2010, 2011) have been carried out. The focus of the winter expeditions lies on in-situ measurements of oceanic and atmospheric quantities at the polynya edge as well as remote sensing measurements of ice properties across the polynya. The focus of summer expeditions is on hydrographical and biogeochemical measurements in ice free parts of the Laptev Sea. Two permanent buoy moorings yield important long term information about oceanographic processes.

Modelling studies include a polynya model, ocean/sea-ice models, and atmospheric models with resolutions down to 5km. Process studies and long term studies of sea ice are done using active and passive microwave sensor data (SAR, QuikSCAT, SSM/I, AMSR) and thermal infrared data (MODIS, AVHRR). Different approaches have been applied for the quantification of sea ice production in the Laptev polynya system and its contribution to the Arctic sea ice budget.

A STUDY OF THE DYNAMICS OF THE NORTH WATER POLYNYA USING DIFFERENT SATELLITE DATA SETS AND METHODS

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The North Water polynya (NOW) forms recurrently between Ellesmere Island and northwest Greenland and is one of the largest and therefore most important polynyas in the northern hemisphere. An investigation of NOW dynamics for the period 1978-2011 has been performed using sea ice concentration (SIC) data from the passive microwave satellite sensors (AMSR-E, SSM/I, SMMR). From SIC data we derived the total polynya area (POLA) and the open water area (OWA). Results are compared between different satellite sensors and to the PSSM method. Sensitivity studies are performed with respect to a SIC threshold defining the POLA. The dynamics of the ice bridges located at Smith Sound and at Robeson Channel is investigated.

Using a SIC threshold of 70%, a relatively large difference in the mean polynya area is found between AMSR-E and SSM/I for the overlapping period of both sensors (2001-2011). While AMSR-E data yield a mean polynya area of 78000 km², SSM/I data show 89000 km². Besides this overestimation, SSM/I data show an increase of 10000 km² for the last decade for the NOW area compared to the whole data period. A comparison between the PSSM method and the chosen SIC threshold for AMSR-E data shows good agreement. The dynamics of the ice bridge located at Smith Sound has a large influence on the formation of the NOW, while an ice bridge at Robeson Channel cannot be clearly identified.

ANNUAL VARIATIONS IN GROWING SEASON LENGTH IN A WARMING ARCTIC: CHANGES AT ALEXANDRA FIORD, ELLESMERE ISLAND, NUNAVUT

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One of the standard predictions for high latitudes under global warming is that the length of the melt season (growing season) will be extended by earlier snow melt and later freeze-up. Some of the best evidence for the lengthening of the growing season comes from remote sensing studies, where the date of snow melt or the increase of NDVI has been shown to be occurring earlier over the past few decades. However, there are few, clear site-based studies that have examined annual variations in the length of the melt/growing season. This is partly due to: a) lack of a clear definition of the melt/growing season in Arctic tundra; and b) lack of climate, soil temperature and snow depth data. In this study, we use the long-term data set of climate and plot-based temperatures and snow depths maintained at Alexandra Fiord, Ellesmere Island, Nunavut since 1992 to determine whether the length of the melt/growing season has changed. Standard climate variables (solar radiation, air temperatures, wind speed and direction) have been measured at two automatic climate stations since 1989. Air, surface and soil temperatures and snow depth have been measured daily in experimental warming and control plots since 1992 in two plant communities. Snow depth, snow melt dates and plot temperatures during the summer have been measured in three other plant communities at the site, and the measurements made in nearly all years. Average annual air temperature at this site has increased by ~3.5°C since the 1970s, and increases are recorded in all four seasons, although they are most

pronounced in fall and winter. Soil temperature in a wet tundra community has also increased significantly over the same time period. In addition, there has been significant increases in net primary production at the site since 1980. However, our preliminary analysis of annual snow regimes from one of the study sites indicates that the snow melt date and snow depth have not changed significantly since 1992. As snow melt date is generally considered the start of the growing season, it appears that there has been no increase in the length of the season through earlier snow melt. In this presentation, we will determine whether this preliminary pattern in the snow regime is found at the other sites and if so, attempt to determine the factors that explain the lack of a response in the length of the melt/growing season at this High Arctic site.

AULLAK, SANGILIVALLIANGINNATUK (GOING OFF, GROWING STRONG): A COMMUNITY-LED ENHANCEMENT OF THE COMMUNITY FREEZER PROGRAM FOR IMPROVED MENTAL HEALTH, NUTRITION AND INTERGENERATIONAL SKILLS TRANSMISSION IN NAIN, NUNATSIAVUT

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"*Aullak, sangilivallianginnatuk*" (Going off, Growing Strong) is a unique, culturally appropriate pilot program being led by the Nunatsiavut Government and the Community of Nain. It was launched in March 2012 in response to community demand for intergenerational transmission of harvesting skills, in recognition of the exceptional mental health benefits of land-based activities for youth at risk, and in response to the reported challenges in accessibility to wild foods due to climate and environmental variability and change. It builds upon the successful operation of a community freezer program in Nain. This action and outcome-oriented project focuses on the implementation of a youth harvesting pilot project to enhance the long-term availability of wild foods through the freezer program by training the next generation of harvesters while addressing mental health and wellness issues among youth at risk. To date, youth activities have included large and small trips with experienced hunters (74 youth days out on the land), wild food cooking and movie nights, and distribution of wild foods to elders. We are monitoring the success or 'impact' of the pilot program through: stakeholder engagement, formal outcome assessment, and rigorous documentation and tracking of program activities. Program evaluation and reflection is currently being carried out together with the youth by asking the youth to complete a short questionnaire before and after each trip and to document their activities and experiences using trip log questions. Preliminary indicators of success include: enhanced navigational skills (weather change and safety), bonding with hunters and elders (helping shoot partridges, delivering country foods), reinforcement of current skills (fishing, gutting a seal, shooting a gun), introduction of new skills (shooting a gun, long-distance travel, building a smoke house), and provision of new experiences (seeing a polar bear, shooting and eating partridge).

ON THE RELATIONSHIP BETWEEN THE DECLINE IN SEA ICE AND THE SIZE, STRENGTH AND SHAPE OF THE POLAR VORTEX

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Amplification of Arctic temperature has been well documented in 1000-500 hPa pressure levels, but the impacts of Arctic amplification on large-scale changes to atmospheric circulation in the Arctic and beyond are only partially understood. A measure of the climatology of Arctic atmospheric circulation is the stratospheric polar vortex. This perennial stratospheric circulation feature is known to interact with tropospheric circulation – influencing blocking, cyclone development and the development of extreme cold events, particularly over Eurasia in late winter and early spring. Although variability in the vortex climatology prior to 2002 and the impact of vortex dynamics on specific extreme events have been studied, the relationship between recent record lows in summertime sea-ice extent and the stratospheric polar vortex remain relatively under studied. In this paper, we identify and quantify changes in the stratospheric polar vortex, explore relationships with sea ice extent, and

provide the basis for detailed exploration of linkages between Arctic atmospheric circulation and mid-latitude climate in the context of sea ice and upper atmospheric dynamical phenomena.

A climatology for the stratospheric polar vortex is developed from 1979-2011 based on the maximum gradient of potential vorticity versus equivalent latitude between 50-80°N, constrained by a proximal zonal wind speed maximum. This climatology is investigated for trends and variability in strength, area, location and symmetry. In addition, relationships between shifts in the vortex position and strength and periods of high, moderate and low sea-ice extent are investigated. Previous findings are corroborated – there is variability, but no significant trend in the seasonal mean strength, area, and symmetry of the stratospheric polar vortex. However, a displacement away from the pole and an accompanying decrease in area and strength over the NW Atlantic and Hudson Bay is observed over the last several years, particularly in Spring. Estimates of potential vorticity parameter distributions, and lagged correlations with sea ice extent are presented to further characterise correspondence between changes in vortex geometry and sea ice conditions, and to advance understanding of surface, troposphere, stratosphere coupling during low-ice conditions.

ARCTIC SECURITY - A CHANGING GEOSTRATIGIC REALITY

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In the face of the rapidly changing physical reality of the Arctic has also come a drastically changing geopolitical transformation. As the ice recedes international attention on the arctic region is expanding. As a result the nature of arctic security is also transforming. This panel will discuss and debate the changing nature of the emerging arctic security regime.

This presentation will discuss the most recent developing international security trends. What are the most recent defense expenditures for arctic oriented defense capabilities? What have the arctic and non-Arctic states military forces currently doing in the region? What actions have been taken to improve security cooperation? What actions have been hindering international security cooperation?

There is no consensus on the developing trends that are now reshaping the new geopolitical reality of the arctic region. The panelists have strong and differing opinions on the meaning and ramification of these new trends. To facilitate discussion, each panelist will be given 5-7 minutes to make an introductory comment on each of these five main issues areas. Once each panelist has spoken an open discussion both between the panelists and with the audience will be held. It is the intent of this panel to have a vigorous debate on these developing processes to better understand what is needed to ensure that the arctic is developed in a cooperative and secure manner.

A NEW INSHORE SEABED MAPPING CAPABILITY IN NUNAVUT

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A significant fraction of ArcticNet coastal scientific objectives cannot efficiently be met using the existing CCGS *Amundsen* seabed mapping capability. Due to the prohibitive cost of the platform, its oversubscribed use, and its deep draught and limited manoeuvrability, many sciences objectives in shallow, poorly or uncharted coastal waters cannot be safely and economically met.

Through a collaborative partnership between the Government of Nunavut (GN), ArcticNet and the Canadian Hydrographic Service, a UNB-owned multibeam and subbottom profiling capability has been installed on the GN's new 20m long fisheries research vessel, MV *Nuliajuk*. The vessel winters in Glovertown, NL, transiting north each year. A 300 kHz multibeam and a 3.5 kHz profiler, optimized for depths less than 200m, has been installed in a dedicated blister alongside a Furuno FCV-30 38kHz fisheries sounder.

The platform has a core commitment to fisheries science objectives in Nunavut waters for about 6 weeks in the open water period off Baffin Island. Other science and nautical charting objectives in Nunatsiavut and Nunavut can however, be addressed in the shoulder periods on either side of this. In addition, subject to berth availability, the mapping capability can be run concurrent with the fisheries program.

The fisheries research programs seek additional information on seabed habitat for targeted species including

Greenland Halibut, Northern and Striped Shrimp, and soft shelled clams. The bottom roughness and bottom backscatter strength observations can significantly aid in habitat interpretation and classification, a science objective of ArcticNet's Coastal Landscape Project 2.4. More fundamentally however, bathymetric data are lacking for the majority of the Baffin Island inshore region, so that safe passage of the vessel is compromised. As such, new corridors of 100% coverage multibeam can be obtained to expand nautical charting coverage. This allows future access for community, commercial, research, tourism and military vessels (Science objectives of ArcticNet's Seabed Mapping Project 1.5).

At time of writing, the 2012 field season is still underway. So far, the mapping has been utilized for a dedicated Nunatsiavut program (Lake Melville; ArcticNet's Nunatsiavut Nuluak Project 4.6), and the vessel is currently undertaking clam habitat mapping and navigational corridor definition in the Qikiqtarjuaq region. Geoscience mapping objectives are scheduled for several previously-uncharted inlets on the Cumberland Peninsula and shipping corridors and archaeological investigations are planned focused around Kekerton Island in Cumberland Sound.

CASCADING ECOLOGICAL IMPACTS OF CLIMATE CHANGE: TEMPORAL ADVANCES IN SUMMER SEA ICE BREAK-UP ARE CORRELATED WITH INCREASED PREDATION OF COLONIAL-NESTING BIRD EGGS BY POLAR BEARS

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Polar bears (*Ursus maritimus*) are adapted to use sea ice as a platform to hunt seals and other marine mammals. In some Arctic regions advances in the seasonal break-up of sea ice have reduced the amount of time available to bears to capture seals and amass the fat reserves they require to sustain themselves on shore during the ice-free season. Longer periods on shore could lead to an increased use of alternative food resources by bears experiencing energtic shortfall. In this study, we examine polar bear predation of common eider (*Somateria mollissima*) and thick-billed murre (*Uria lomvia*) nests in the Canadian Arctic. Observations from two long-term research stations indicate that bear sightings during birds' nest incubation period have become more numerous and that the presence of bears is negatively correlated with early summer sea ice coverage. Between 1988 and 2002 bear observations were rare at the two colonies (averaging < 2 days per nesting season with bears present); however, since 2003 bear attendance has risen considerably (averaging >10 days per nesting season). Bears were observed consuming eggs on multiple occasions and nest predation by bears has resulted in near total reproductive failure at one of the colonies in two of the last three breeding seasons. We supplemented these observations with data collected at >180 eider colonies distributed across Hudson Strait in 2010, 2011 and 2012. These years had among the lowest early summer sea ice coverage estimates on record in our study area. Bear sign was observed on >33% of eider colonies and we estimated a positive association between colony size and the probability of encountering bear sign. Eider nesting success on colonies where bear sign was present was less than one quarter that observed on colonies when bear sign was absent, indicating that egg predation by bears could be an emerging conservation concern for colonial nesting birds in a rapidly warming Arctic.

VERTICAL LAND MOTION, SEA-LEVEL FINGERPRINTING, AND PROJECTIONS OF RELATIVE SEA-LEVEL CHANGE IN NORTHERN CANADA

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Globally, sea level is projected to rise this century, but locally, the amount of sea-level change that will be experienced can be significantly affected by vertical land motion and by the redistribution of glacial meltwater ("sea-level fingerprinting"). As reported by the 4th Assessment Report of the IPCC (4th AR), process-based models project up to ~60 cm of global sea-level rise to the year 2100. As well, an additional 10 to 20 cm of sea-level rise due to poorly understood ice-dynamical effects was not ruled out. In contrast, some recent "semi-empirical" projections suggest amounts exceeding one meter of global sea-level rise. To make local relative sea-level projections, constraints on vertical land motion are needed. Past sea-level changes in Arctic Canada are primarily due to vertical land motion caused by the delayed response of the Earth's mantle to surface unloading during retreat and collapse of the continental ice sheets at the end of the last ice age. Thus, sea-level change over the past one or two millennia provides an approximation to present-day vertical land motion. As well, Global Positioning System (GPS) instruments installed on bedrock give a direct measurement of vertical land motion, but observations as yet are limited. Sea-level fingerprinting is important in the Arctic because of the proximity to the Greenland ice sheet, an important source of global sea-level rise. Proximity to Arctic ice caps and ice fields is also important for a number of Nunavut communities and coastal sites that have potential to be developed by the resource industry. Here, the elastic crustal response to nearby ice cap changes can affect local projections of sea-level change significantly. Building on previously reported work for a small number of Nunavut and Northwest Territories communities, we determine projections of relative sea-level change to the year 2100. Despite the large magnitude of projected global sea-level rise, vertical land motion, combined with sea-level fingerprinting, is sufficiently large that some localities in northern Canada are unlikely to experience sea-level rise in the 21st century.

SENSITIVITY STUDY OF OCEAN MIXING UNDER SEA ICE USING MULTI-COLUMN OCEAN GRID IN CLIMATE MODEL

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Climate model simulations of ocean mixing and vertical heat and salt fluxes under sea ice are severely deviated by the high spatial variability at subgird scales in the polar oceans. A multi-column ocean grid (MCOG) scheme is implemented in a coupled sea ice-ocean model to separately solve the vertical mixing caused by different brine rejection and heat flux under open water lead and sea ice cover in a grid cell. By comparison with Control simulation using regular single column ocean grid, the MCOG simulations show slightly improvements of the sea ice extent and thickness, but significant improvements on ocean mixing, e.g., mixed layer depth (MLD), vertical profiles of salinity (S) and temperature (T). Separate heat fluxes alone will improve simulated T and not S, but separate brine rejection alone will improve both T and S. The most improvements are shown when consider all brine rejection as in lead. The improvements are more noticeable in winter than summer, reflecting that salinity is the main control of ocean mixing in the Arctic. The model errors of winter MLD are also reduced. The improvements in vertical S profile in MCOG simulations are consistent in the upper 150 m which includes the upper mixed layer and the halocline in the Arctic. The monthly mean MLD in the Arctic Basin area in March matches better with observed climatology in the MCOG simulations, correcting the excessive deep mixing in the Control simulation.

ARCTIC FOOD SECURITY AND CLIMATE CHANGES: TOWARDS A QUANTITATIVE INTEGRATED APPROACH TO ENHANCE DECISION-MAKING CAPACITY

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Food security exists "when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). In Arctic communities, food security relies on both country foods harvested from local resources as well as imported foods acquired from the store. The use of country foods may overcome some financial and logistical difficulties presented in relying on imported food if local resources remain accessible. Accessibility of country foods is mostly driven by the abundance and distribution of wildlife in the vicinity of communities and hunters' ability to physically access hunting grounds safely. Climate changes are expected to

be most significant and extreme in the Arctic. Climate-induced changes in habitat of wildlife species, predicted by many current climate change models, may modify the abundance and distribution of wildlife, potentially affecting the accessibility of key species for consumption by residents of Arctic communities. Several local and government initiatives on community adaptation have taken the form of workshops, monitoring programs or case studies with specific thematic foci (wildlife, economy, health, etc…). Although they have generated a great deal of data, the approach to understanding this information in an integrated manner for food security has been predominantly qualitative to date. Many have been arguing for more rigorous approaches to the integrated modeling of arctic systems and highlighted the need to bring together the wildlife, climate and health research communities in this effort. Developing a quantitative approach to integrating the different components determining food security status at a higher level and dealing with more complex systems will result in a more critical understanding of the risks that climate change may bring to communities. For communities experiencing and facing future pressures on their food security, an integrated model based tool to support decision making on the topics of food security and wildlife management is critical. This project has developed a general conceptual framework to be used as a foundation upon which (1) to generate such an integrated quantitative tool, while dealing with inherent complexity, and (2) to engage partners into a multidisciplinary collaborative effort to support decision-making and adaptation.

FAO. 1996. Rome Declaration and World Food Summit Plan of Action. Rome. Available at: www.ffao.org/do- crep/0003/X8346E/xx8346e02.hhtm#P1_110

UNDER-ICE NOISE IN EASTERN BEAUFORT SEA: ICE DRIFT FORCING, FRACTURING AND FORMATION OF LEADS

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Eastern Beaufort Sea underwater noise was recorded from September 2005 to October 2006 at two stations, 300 km apart, on Mackenzie shelf break and Amundsen Gulf mouth. The region was ice-covered (> 90%) from November to mid-June. The regional under-ice background ambient noise, from a myriad of undistinguishable sources integrated over large ranges, was estimated daily for 3 acoustic bands and correlated with measured wind, in situ mean currents and large-scale ice speed as potential forcings. Correlations were observed between wind and ice drift, and ice drift and surface layer current. Ambient noise level was correlated with all these three variables. The ambient noise correlation with the large-scale ice drift suggests a connexion with the southern part of the large Beaufort gyre. Ice cracking, shearing and colliding add strong transient events above the general ambient noise level. An example of the opening and closing a ~500-km long lead along the large-scale offshore plume of multi-year ice moving along the shelf, is used to evidence the different types of wideband noise and tones, of variable duration, related to these events. Some tones are repeated with a period corresponding to waves and can sometime be confounded with marine mammal songs. These ice noise events are occurring all along the winter, and the most energetic ones correspond to lead openings.

INUVIALUIT AND ECOLOGICAL KNOWLEDGE TO EXAMINE EFFECTS OF LAKE ENVIRONMENT ON ARCTIC CHAR GROWTH AND HEALTH

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Over the past five years, Arctic Char growth and health has been studied in collaboration with the two Inuvialuit communities of Sachs Harbour and Ulukhaktok

NT. Regional increases in climate variability outside the range of historical locally observed conditions, in combination with the resulting effects on the local environment, flora, and fauna, has lead to impacts on local fish habitats. Local residents will have to adapt to the outcomes of these effects, including altered access to fishing locations, changes to size of char, and the changes in the quality of this country food. The purpose of this community-driven research is to understand how a changing environment may affect Arctic Char and to create an Arctic Char community-based monitoring (CBM) plan for Sachs Harbour. This presentation focuses on one aspect of the larger project outlining the mixed methods research design integrating both Inuvialuit Traditional Knowledge (ITK) and ecological knowledge used to examine the effects of the lake environment on Arctic Char growth and health.

The mixed methods research design brought together a range of data collection methods and analyses. The local expert fishers were directly involved in the research design, the determination of study locations, and environmental and ecological parameters for scientific sampling. Scoping sessions and semi-directed interviews were conducted with local fish and environment experts. The lake environment was sampled for water quality, depth and temperature profiles, ice thickness, ice on-off dates, and zooplankton abundance and size. Arctic Char were sampled for length, weight, sex, maturity, otoliths, stomach contents and parasite loads. Arctic Char otoliths were examined for individual age and annual growth. By determining similarities and differences in fish habitat within and among the study lakes on Banks Island, interpretation of the resulting patterns supported either lake-specific or regional climate-driven changes in Arctic Char growth. Shifts in growth of individual char presumably translate to alter population productivities, thus likely affecting success of fishing.

The mixed methods approach resulted in a synthesized and in-depth understanding of lake environment affects on Arctic Char growth. We learned that Capron Lake had 1/20th the volume but five times higher zooplankton productivity than Middle Lake. Ice-off dates are similar for all three study lakes, however, Capron Lake exhibits ice-on dates 10-20 days earlier than the other two lakes likely leading to a shorter growing season. Despite their close proximity (30 km apart) Capron Lake char had significantly lower parasite loads. The oldest chars captured in Capron Lake were also significantly smaller (shorter) than the oldest chars captured in Middle and Kuptan lakes ($p<<0.001$), however, Capron Lake contained the largest (longest) char captured of all three lakes. The results of this study indicate that lake environment has a substantive direct effect on Arctic Char growth and health. Additionally, this work identifies lake habitat parameters that should be included in community-based monitoring of the Arctic Char resource.

ARCTIC MARITIME BOUNDARY DISPUTES: LESSONS AND OPPORTUNITIES

Kolodkin, Roman

Ambassador Extraordinary and Plenipotentiary to the Kingdom of the Netherlands

In 2011, Russia and Norway concluded a boundary treaty for the Barents Sea, where the two countries had previously disputed 51,000 nautical square miles of oil-and-gas rich seabed. This leaves just one significant unresolved Arctic maritime boundary: in the Beaufort Sea between the United States and Canada. The Russia-Norway treaty, and the negotiations leading to it, offer important lessons to the United States and Canada. For instance, the treaty creates a joint hydrocarbon regime for any oil and gas reserves that straddle the new boundary. This panel will bring the leading experts on the Russia-Norway treaty to Canada where they will interact with leading Canadian and US experts, in a focused effort to promote cross-fertilization of the latest best practice in Arctic boundary negotiations.

THE ARCTICONNEXION PROGRAM : BRIDGING NORTHERN COMMUNITIES AND ARCTIC RESEARCH

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Arctic environments are currently undergoing unprecedented changes and northern communities are the first to experience their impacts. In the past decade, growing efforts have been undertaken to involve Inuit people into arctic research process in order to build capacity in northern communities. Since indigenous and scientific communities are characterized by different ways of knowing, describing and interacting with

the environment, the general state of collaboration is undermined by a disconnect and mutual misunderstanding barriers. A lot of work is still needed to establish an effective collaborative research framework, especially in the field of environmental sciences. The first steps towards resolving this disconnect are three fold: to address differences between Science and local ways of knowing, to share perspectives on northern social and environmental issues and to build a dialogue-based approach merging research and communities interests into a collaborative environment. Fortunately, a growing number of stakeholders are now recognizing the need for a shared understanding of the North and are currently developing proactive projects. Nonetheless, no large-scale organized platform exists to facilitate experiences and knowledge transfer across researchers and northern residents and institutions.

ARCTIConnexion is a network built on the experience and genuine engagement of a group of student researchers conducting projects within northern communities. Our team is working with the scientific community to make Arctic research teams more aware of Inuit culture and social values (breaking barriers) and to equip them with key tools for the development of research projects grounded in a collaborative approach (building bridges). Since its official launch in January 2012, the organization raised funding and created connections with Inuit communities, northern institutions, scientific research groups and the public. ARCTIConnexion's ongoing projects include workshops with research teams on Inuit culture, communication of research findings with Northern communities, round tables with research leaders and Inuit representatives and the instauration of Inuktitut courses for research teams. In addition, we have recently launched a permanent web platform offering online resources on Inuit cultural and social issues and an overview of ongoing collaborative research projects. Finally, our team is currently designing a virtual course with graduate students mentoring alumni of the Environmental Technology Program of Pond Inlet.

ARCTIConnexion is based at the Université du Québec à Rimouski and collaborating with Centre for Northern Studies where it benefits from large audiences within the scientific community in the province of Québec. We are also looking to expand our network by including researchers, institutions and individuals from all allegiance on a national scale.

THE HARPER GOVERNMENT AND ITS PLANS FOR ARCTIC SECURITY

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As part of the panel on Arctic Security - A Changing Geostrategic Reality, this presentation will begin the panel with a discussion on the evolving nature of Canadian arctic security with an evaluation of the Harper government's efforts to develop a comprehensive security framework of security in the region. What has been its impact of its focus on the international sovereignty and security dimensions of arctic security? How well has it achieved its objectives? Has its actions provided for strengthening of Canadian arctic security?

SHRUB COVER AND THE CARBON DIOXIDE SINK STRENGTH OF CANADIAN LOW ARCTIC TUNDRA

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Arctic tundra vegetation is expected to respond to climate change in many ways. One of the most demonstrable responses in recent decades is an increase in shrub cover at a variety of locations in the circumpolar Arctic. These vegetation changes will result in altered land-atmosphere exchanges of energy and greenhouse gases, such that important climate feedbacks may occur. In this study we test the hypothesis that greater shrub cover will increase carbon dioxide (CO_2) sequestration from the atmosphere, thus resulting in a negative feedback on climate change. Net ecosystem CO_2 exchange (NEE) was measured using the eddy covariance technique from 2010 – 2012 at three tundra sites representing a gradient in shrub cover in the Canadian low Arctic. All sites were growing season sinks for CO_2 in all years. During peak growing season (July) NEE was negative at all sites, showing CO_2 sequestration, with greater sequestration associated with greater shrub cover, height and biomass. Seasonal NEE followed a similar, but weaker, pattern, as it was confounded by differences in growing season moisture and temperature. Summer moisture seems to play a dominating role in determining this pattern. Our results support the

hypothesis that as shrub abundance continues to increase in tundra ecosystems. Thus, the CO_2 sink strength of Arctic tundra will likely increase, at least during the growing season, initiating a negative climate feedback. However, the influence of summer moisture conditions and shrub-related impacts on winter NEE could have an important role in limiting this response.

PROTECTING CANADIAN SOVEREIGNTY IN THE NORTHWEST PASSAGE

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As part of the panel on Arctic Security - A Changing Geostrategic Reality, this presentation will consider the international ramifications of the Canadian efforts to develop, protect and promote its arctic sovereignty and security in the Northwest Passage. How have Canadian efforts to protect its arctic sovereignty and the Northwest Passage impacted on Canadian arctic security? What has Canada been doing beyond the efforts to control this region within the international legal environment?

PIONEERING ON THE BEHALF OF INUIT: PLANNING CANADA'S FIRST HIGH ARCTIC MINE

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The mid-twentieth century brought radical change to Canada's Arctic as Inuit transitioned from a nomadic lifestyle to settlement living. John Diefenbaker's 'roads to resources' policy of the late 1950s increased attention on the development of northern oil, gas and mineral resources. Inuit were to move from subsistence hunting and trapping to an industrial economy. There are a number of examples of this relocation of culture in the eastern Arctic; among them, the construction of the Distant Early Warning Line (1956-57), the North Rankin Nickel Mine (1957-62) and the Nanisivik lead-zinc mine at Strathcona Sound near Arctic Bay (1976-2002). Planning for Nanisivik commenced in the early 1970s. It is the focus of our attention.

As Canada's first high Arctic mine, Nanisivik was trumpeted as a 'pioneering project', both socially and technologically. The 1974 Strathcona Agreement between Mineral Resources International Ltd. and the Government of Canada created Nanisivik Mines Ltd. The federal government held an 18% interest in the company in return for an investment of $18.3 million. Indian Affairs and Northern Development Minister Jean Chrétien stated upon signing the agreement that the enterprise was to 'ensure that the maximum benefit flows to the residents of the region' through employment and participation in Nanisivik's planning and management. The opening of the mine followed the passage of the American tanker SS *Manhattan* through the Northwest Passage in 1969, an event that once again made Canadian sovereignty in the Arctic a national concern.

The archival record of the project's development, held by the Library and Archives of Canada, contributes significantly to our understanding of the project's development and provides us with insight into the federal government's attitudes, in practice, with respect to the Inuit role in northern development. The record, while revealing a range of motives, ideological assumptions and concerns at play, reveals that Inuit were thought of primarily as labour, without regard to factors that might impinge upon and affect their participation as people making one of the most dramatic and rapid cultural transitions in all of recorded history. This, despite a wealth of research being conducted at the time that pointed to the serious problems of many Inuit attempting to adapt to settlement living and industrial culture. Contrary to the stated objective of consultation, the archival record and the oral testimony of Arctic Bay residents make it clear that Inuit were minimally involved in planning the project and that social issues with which the government and company ought to have been concerned were ignored. The legacy of the project for residents of Arctic Bay, suggestive of lessons relevant to current proposals for mineral development, was an empty basket.

ORGANIC CARBON RELEASE FROM COASTAL EROSION ON ICE-RICH PERMAFROST COASTS: A COMPARISON OF THE SOUTHERN LAPTEV SEA AND THE SOUTHERN BEAUFORT SEA

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Arctic permafrost coasts make up about one third of the global coastline and are likely to witness some of the most dramatic changes linked to changing environmental conditions in the 21st century. Increasing sea level, warming sea temperatures, longer open water season and increasing open-water area all bear the potential to increase the frequency of storm surges impacting the coasts and inducing coastal erosion. The consequences are obvious to the human eye in the form of threats to community and industry infrastructure, especially on ice-rich coasts like the southern Laptev Sea and the southern Beaufort Sea but they are also palpable in the impact on sediment and nutrient pathways in the nearshore zone. Coastal erosion delivers annually just as much particulate organic carbon to the ocean as rivers do if not more. These large quantities of carbon are released from the coast throughout the thaw season, contrary to arctic rivers which unleash most of their sediment laden during the spring discharge peak. The current knowledge on carbon release from coastal erosion is scarce, despite the availability of these quantitative estimations at the global level. Coastal erosion, ground ice contents, coastal geomorphology vary greatly spatially and make it difficult to estimate the amount of organic carbon being released locally as well as its impact on the nearshore environment. I this study, we show results from two studies conducted in the southern Laptev Sea, along the shore of the Bykovsky Peninsula, and in the southern Beaufort Sea, along the Yukon Coastal Plain and show the challenges associated with the computation of carbon budgets for coastal areas. We selected these two areas because they are both ice-rich, yet of a very different stratigraphic nature, one being made of syngenetic ground ice (Laptev Sea), the other of epigenetic ice (Beaufort Sea). We emphasize the need to consider the whole coastal stratigraphic column, including its subaqueous part, in the computation, as well as the role of coastal thermokarst, the inclusion of ground ice and difficulty in finding adequate geospatial datasets to perform envelope calculations.

EFFECTS OF CLIMATE ON THE TIMING OF THE SPRING AND FALL MIGRATION OF MIGRATORY CARIBOU

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Major effects of climate changes are expected in northern environments including the change in the timing of natural processes. Snow melt is expected to occur sooner, river and lake ice-free periods to last longer and the length of the growth season to increase with an earlier peak of productivity. Migratory caribou, Rangifer tarandus, is a central species of the northern environments. They leave the boreal forest in spring to reach more productive calving grounds and summer ranges to the north, performing the longest migration among terrestrial mammals. In the fall they return south to winter ranges. Caribou are currently facing changes in their habitat and modifications in snow cover, lake and river ice-free periods and food availability could directly impact the timing and course of their migration. In Northern Quebec and Labrador, two herds of migratory caribou, the Rivière-George herd (RGH) and the Rivière-aux-Feuilles herd (RFH), range over one million squared kilometres. From over one million individuals in the 1990's, the two herds are actually declining. Here we attempt to assess how climate affects the timing of the spring and the fall migrations of the two herds. We used NAO index and a Canadian Regional Climate Model (CRCM4) with a 45 km resolution to obtain meteorological data that could be related to caribou locations observed at the starting and ending dates of the migrations. Effects of climate (temperature, precipitation, snow cover) were tested on the phenology of 700 spring migration paths and 800 fall migration paths recorded during the last two decades. Preliminary analyses suggest that departure and arrival dates are mainly affected by temperature rather than precipitations. Spring migration departure dates seem delayed when caribou experienced harsh winter conditions: there was a negative effect of March mean temperatures on RFH departure dates and a negative effect of April mean temperatures and a positive effect of winter NAO on RGH departure dates. Caribou arrived later on calving grounds when they encountered colder temperatures in May for RFH and in June for RGH. For the fall migration caribou from RGH started their migration later when August was warmer and arrival dates seemed to be negatively affected by November mean temperatures and positively affected by

December precipitations. For RFH, only the arrival dates seemed to be delayed with colder December temperatures. Thus, climate seems to have an impact on timing of the spring and fall migrations. In the actual context of the worldwide decline observed in most caribou herds, it is necessary to identify what are the environmental factors that affect Rangifer populations. Our study will help to understand how climate influences spring and autumn migrations and to estimate how expected climate changes will affect migratory caribou.

THE FUTURE OF CITIZEN SCIENCE AND SOCIAL MEDIA IN POLAR DATA MANAGEMENT

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The Polar Data Catalogue has evolved to be an invaluable data resource for ArcticNet Scientists and also an important infrastructure component of the ArcticNet program. Using international standards for interoperability, it allows discovery of not only data preserved for ArcticNet scientists but also data resident in other repositories around the globe, such as the National Snow and Ice Data Centre in Boulder, Colorado, the Meteorological Service of Norway and, potentially, the Group on Earth Observations <earthobservations.org> registry.

With the creation of a new landing page that is a revision of the Canadian Cryospheric Information Network 'State of the Cryosphere' outreach site, we have ventured into new areas of citizen science and incorporation of social media in information discovery, delivery and management. We include sections that highlight Twitter feeds, Google Polar News, Ask the Expert resources, Kid's Corner and a Polar RADARSAT image that is changed for every visit. A development underway is to include a variation of the "Geo-Wiki" < http://www.geo-wiki.org > that will permit upload of Geo-tagged photos, video and textual information by authorized users.

We discuss the evolution of these new tools within the Polar Data Catalogue and what they imply for involvement of the northern communities in the management and utilization of information about their environment.

RECENT WARMING IN KANGIQSUALUJJUAQ, NUNAVIK : MORE SHRUBS, MORE TREES, LESS BERRIES?

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In the context of recent warming, shrub cover increase has been reported from a growing number of Low Arctic sites. Trees could colonise the tundra whereas berry producing plants (generally prostrate shrubs) could be negatively affected by this structural shift. A combination of studies on shrub cover change, tree growth and recruitment as well as berry productivity were conducted at and above the treeline in the vicinity of Kangiqsualujjuaq, Nunavik (58°42'39''N, 65°59'43''W), a region underlain by discontinuous permafrost and subjected to extensive warming since the 1990s.

Our repeat photography study of shrub cover change reveal a marked reduction of open tundra with less than 10% shrub cover (from 45% of the landscape in 1964 to 29% in 2003). Dwarf birch was the main species responsible for this shift. Areas with continuous vegetation (>90%) also increased from 34 to 44% of the landscape and areas with discontinuous shrub cover tended to infill over the study period. The detailed study of tree colonisation and growth show that even if larch (*Larix laricina*) and black spruce (*Picea mariana*) are present at treeline, only larch trees showed a recent increase in growth rate and had seedlings commonly found colonising above the treeline. According to our tests of seeds collected in 2011, larch and spruce seeds are comparable in their germinability and dissemination potential. The ability of trees to colonise the tundra above treeline that offers a range of seedbeds from dense birch or ericaceous shrubs, mosses, lichens, to few bare sites, can depend if seeds are sensitive to chemicals produced by the established plants. Our first laboratory results highlight that spruce seeds are unable to germinate when exposed to *Empetrum nigrum* and *Vaccinium uliginosum* leachates whereas larch seed germination rate was reduced. We were not able to quantify allelopathic relations in the field but we found a disproportionate number of larch recruits in three seedbeds (lichen, mineral soil and liverworts). Clearly biotic interactions impact tree dynamics at treeline.

In this context of increased shrub and tree abundance, the productivity of three species of berry plants was evaluated under a range of conditions, open tundra, shrub cover and tree cover. In all cases, there tended to be

more fruits in open habitat yet there were no significant differences. In forest patches, *E. nigrum* produced similarly under tree cover compared to open habitats. Under shrub cover *V. uliginosum* productivity did not differ significantly than in open tundra whereas *V. vitis-idaea* did very poorly. Finally we measured shoot elongation of *E. nigrum* under the various covers and found longer elongation of branches under shrub or tree canopy. There was also a significant increase in growth in recent years corresponding to the measured warmer temperatures. The observed "shrubification" near Kangiqsualujjuaq is modifying the growth of berry plants, especially under dense cover, some berries are produced even under shrubs and trees but total productivity tend to be higher in open tundra.

"WE THOUGHT IT WOULD LAST FOREVER": THE SOCIAL SCARS AND LEGACY EFFECTS OF MINE CLOSURE AT NANISIVIK, CANADA'S FIRST HIGH ARCTIC MINE

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In 2004 and 2005 over $50 million worth of industrial and residential infrastructure was demolished at the Nanisivik mine and town site, in Canada's eastern high Arctic, despite sustained pleas from the nearby community suffering from critical infrastructure shortages. From the moment Breakwater Resources Ltd. announced the closure of Nanisivik in 2001, residents of Arctic Bay petitioned the company and Government of Nunavut to either find an alternate use for the site, or in failing that, to transfer much-needed infrastructure to Arctic Bay. Existing analyses have deemed that this pioneering mine failed to deliver on its promises of socio-economic development for the local community. This study illustrates that, considering the events during Nanisivik's closure and post-closure phases in particular, we must also deem this experimental mine a failure that stands in contradiction to current expectations around the sustainability of mining ventures, and socially responsible mine closure.

Socially responsible mine closure is receiving increasing attention and recognition as a critical component of mining operations, particularly as concerns the contributions to sustainable development and the maintenance of the 'social licence' of such enterprises. Primarily this is expressed as full life cycle planning for mines, including planning through closure. This logic, which draws from sustainability principles, posits the necessity of social, environmental and economic considerations as central to good practice mine closure. What is less understood is how these principles may clash in significant ways, such that the social implications of closure are not simply viewed as subordinate to the economic and environmental implications of closure, but are so fully unaccounted for that lasting and to some extent unexpected legacy effects arise.

Drawing from interviews with Elders, former mine workers, hunters and other residents of the nearby community of Arctic Bay, as well as analysis of documents including Nanisivik closure submissions, public hearing transcripts, and media reports, we pay express attention to the social and community concerns with closure planning and process. A range of the material and non-material social effects on the community of Arctic Bay are revealed, including extensive disappointment, and in some cases resentment, over the handling of the mine's closure, ten years after operations ceased in 2002. Perhaps more surprising is discontent with the company and government's misunderstanding of what future uses were foregone as concerns buildings and infrastructure, as well as valuable equipment.

These understandings are critical in view of the central role that mineral exploration and mine development already occupies within Nunavut's economic development strategy. Nanisivik's limited contribution to Arctic Bay's development capacity, and the community's economic challenges post-closure, indicate need for expanded guidelines for mine closure planning. Existing closure regulation should be expanded to address the means of realizing improved, community-driven social outcomes at closure. These might include: the fate and transport of materials, the use of infrastructure post-closure, and the conditions that provide for future use and economic development at former mine sites.

PRELIMINARY STUDY OF NEMO AND ITS USE IN THE ARCTIC IRIS PROCESS

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Ocean and sea-ice variations during 1979-2007 are simulated with a fine-resolution ocean and sea-ice model based on Nucleus for European Modeling of the Ocean (NEMO). The model domain covers the Arctic and most part of the North Atlantic Oceans, encompassing regions 1 to 3 of the ArcticNet Integrated Regional Impact Study (IRIS), namely Baffin Bay, Beaufort Sea and Hudson Bay. The preliminary simulation uses an averaged seasonal cycle of lateral boundary condition representing the climatology, but is driven by the inter-annually varying surface forcing taken from version 2.0 of the Common Ocean Reference Experiment (CORE). Focusing on IRIS regions 1-3, model simulated sea-ice extent, thickness and drift and other physical parameters are evaluated with available observations. We also present plans for additional experiments that will improve our understanding of regional- and small-scale processes within the three IRIS regions, and highlight the role of the NEMO model in providing an integrated framework that complements existing field observations and traditional knowledge, and enables long-term planning, in keeping with the IRIS mandate and mission.

WHERE ARE THE CARIBOU? THE CURIOUS CASE OF KING WILLIAM ISLAND, NUNAVUT

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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, a small hamlet on King William Island (KWI) in the Kitikmeot region of Nunavut. During February 2010 research planning meetings, caribou health and its connection to community health and well-being was raised as a clear local research priority. In developing funding proposals to follow up on these local interests, we undertook an extensive literature review to learn about any caribou research conducted on or near KWI. Where are the caribou? This simple question quickly became complicated to answer. We were trying to identify which caribou live on, migrate across, or are accessible from KWI, and to understand the geographic extent of these herd ranges based on available publications (including peer-reviewed and grey literature). But what emerged in this case was a significant gap in research relating to caribou on KWI. Although Elders in the planning meetings insisted there were caribou on KWI year-round, and described up to four different kinds of caribou in the region, the majority of studies either did not include KWI in their study area or suggested that there were no caribou present on the island. KWI is essentially left blank on the majority of herd range maps. Furthermore, the majority of caribou research undertaken in the Kitikmeot and Kivalliq Regions of Nunavut is heavily reliant on biological research methods, and fewer studies have sought out Inuit perspectives. Thus it became no easy task to attempt to characterize the status of caribou research around KWI. What we found were inconsistent means of classifying caribou populations, and differing methods of monitoring and assessing herds, which influence the accuracy, effectiveness, and variability of geographic representations of caribou across northern Canada. In this presentation, we will highlight the findings of our review, including the challenges relating to classifying, monitoring, and representing the status of barren ground caribou herds. In addition, we will share preliminary results from our 2011 and 2012 summer research in Gjoa Haven, involving Inuit experts through interviews and Elder-youth land camps to learn about caribou from local perspectives. Initial analysis of our findings suggests that there is a notable absence of caribou on KWI beginning in the early 1970s. Inuit experts also state that several herds returned from the mainland and nearby islands in the mid-1980s and, more recently, a non-migratory population has become established on the island. We highlight the need to better understand Inuit ways of knowing and assessing caribou populations, and we present some local concerns related to hunting quotas, economic and subsistence value, and wildlife co-management practices.

AVIAN-DRIVEN ALTERATIONS IN SEASONAL CARBON CYCLING OF AN ARCTIC TUNDRA POND IN WAPUSK NATIONAL PARK (MANITOBA, CANADA)

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Arctic ponds provide important habitat and resources to support abundant waterfowl populations. However, concerns have been mounting regarding the effects of increased waterfowl on eutrophication and biogeochemical cycling. Previous studies of waterfowl disturbance in arctic freshwater ecosystems have largely relied on conventional 'snapshot' limnological measurements (e.g., TP, TKN, chlorophyll *a*, DOC, etc.), but have yet to incorporate both multi-seasonal and biogeochemical measurements (e.g., carbon isotopes and carbon fluxes) that can potentially provide further insights. These aspects are critical because hydrolimnological conditions of Arctic ponds may vary substantially over seasonal timescales and they are important in global carbon dynamics, serving as sources, sinks and transformers of carbon. Over the last ~40 years, coastal regions of Wapusk National Park (Manitoba, Canada) have witnessed rapid increases in the density and nesting area of the Lesser Snow Goose population (LSG). In this study, we use a combination of limnological measurements (e.g., chemical analyses of nutrients, ions and alkalinity) and water (δ18O and δ2H) and carbon isotope tracers (δ13CDIC and δ13CPOM) to compare seasonal patterns of hydrolimnological and biogeochemical conditions between 15 shallow ponds (LDCF ponds) that currently have only low (if any) disturbance from the LSG population with one highly-disturbed pond (WAP 20).

Using contemporary hydrolimnological measurements (e.g., δ18O, δ2H, TKN, TP, DOC, chlorophyll *a*), only small differences could be identified between the highly disturbed WAP 20 and the LDCF ponds. The similarity of water isotope tracer values in both WAP 20 and the LDCF ponds suggest little difference in pond hydrology. Seasonal patterns of variation in concentrations of TKN and DOC imply ample supply to meet productivity requirements in both the LDCF ponds and WAP 20, and for TP in the LDCF ponds. Whereas, a large decline in TP concentrations during mid-summer in WAP 20 in comparison to the LDCF ponds suggests higher phosphorus demand in WAP 20.

In contrast to mostly similar hydrolimnological behaviour, carbon isotope biogeochemistry measurements reveal distinctive carbon dynamics in WAP 20. During mid-summer, a decrease in δ13CDIC values in WAP 20 may be a consequence of intense benthic algal carbon demand in the presence of high pH. In other studies, these conditions have been suggested to promote 'chemically-enhanced CO_2 invasion', which leads to strong kinetic carbon isotope fractionation and implies that WAP 20 acted as a carbon sink at this time. High carbon demand at WAP 20 is also suggested by a mid-summer δ13CPOM value that is isotopically-enriched. In contrast, the LDCF ponds exhibited typical seasonal carbon isotope behaviour under conditions of increasing productivity when carbon is in relatively low demand, indicating that they were sources of carbon to the atmosphere. Overall, results suggest that high levels of waterfowl disturbance have the potential to alter biogeochemical cycles in arctic ponds and cause them to switch from net sources to net sinks of carbon.

THE ARRIVAL OF THE ASIAN TIGERS INTO THE ARCTIC: NEW CHALLENGES

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As part of the panel on Arctic Security - A Changing Geostrategic Reality, this presentation will consider the impact on arctic security of the increasing interest of the Asian states. In particular what can be expected of the increased participation of China, South Korea, Japan and Singapore in the region on circumpolar security?

A TRANSITION FROM CMIP3 TO CMIP5 FOR CLIMATE INFORMATION PROVIDERS: THE CASE OF SURFACE TEMPERATURE OVER EASTERN NORTH AMERICA

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Created in 1995, Coupled Model Intercomparison Program (CMIP) encompassed a set of climate modeling experiments in order to study present and future climate. Phase three of CMIP (CMIP3), performed with coupled atmosphere-ocean general circulation models, included "realistic" emission scenarios for both past and present climate forcing. Results considering these emission scenarios (e.g. climate change, impact and adaptation studies) along with climate model evaluation are distributed through the Intergovernmental Panel on Climate Change (Fourth Assessment report).

Starting in 2011, the release of new data constituting the Coupled Model Intercomparison Project - Phase 5 (CMIP5) database is an important event in both climate science and climate services issues. Although users' eagerness for a fast transition from CMIP3 to CMIP5 is

expected, this change implies some challenges for climate information providers. The main reason is that both experiments were performed in different ways regarding radiative forcing and hence continuity between both datasets is partially lost.

The objective of this research is to find a metric that is independent of the amount and evolution of radiative forcing, hence facilitating comparison of these two experiments for surface temperature over eastern North America. We focus our result over specific regions, e.g. Hudson Bay (IRIS3), Northern Quebec (IRIS4) and Labrador Sea. The link between CMIP3 and CMIP5 data sets is explored through pattern scaling and scaling factors. While the former explores the relationship between local and global mean temperature anomaly for a certain time frame, the latter describes this relation analyzing the entire climate trend throughout the twenty first century.

As a response to the global mean temperature change, both CMIP experiments show very similar warming patterns, trends and climate change uncertainty for both winter and summer. This similarity between datasets, which may escape users when they are provided with a single radiative concentration pathway, needs to be stressed by climate information providers. Scaling factors proved to be effective in making climate change information independent of radiative forcing with the exception of the lowest CMIP5 scenario.

VALIDATION OF ADIPOSE LIPID CONTENT AS A BODY CONDITION METRIC IN SOUTHERN BEAUFORT SEA POLAR BEARS

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Polar bears (*Ursus maritimus*) from subpopulations including the southern Beaufort Sea (SB) have shown body condition declines associated with rapid climate warming and declines in their sea ice habitat. These body condition changes appear to be predictors of measured changes in population health, including reduced litter mass and size, survival, and overall population size. Several body condition metrics have been investigated in polar bears including morphometric measurements. However, none of these metrics would easily be applied to generating comprehensive circumpolar and (retrospective) long-term temporal assessments of polar bear body condition. Here, we use a quantitative *in vitro* biochemical metric, adipose lipid content, which has been proposed previously for this purpose. Adipose biopsy samples (n = 584) were collected from the rump of anesthetized SB polar bears from 2004 to 2011 to more fully develop and assess the adipose lipid content approach relative to accepted body condition metrics and accepted measures of health outcomes. We also investigated the method as applied to remote biopsy samples (n = 69 from 2011 and 2012) from which we would otherwise not be able to assess accepted condition metrics. We quantitatively extracted lipid from these samples, along with the NIST Standard Reference Material SRM1945 (whale blubber homogenate) and gravimetrically determined adipose percent lipid. For n = 61 extractions of SRM1945 (~50 mg), we found high accuracy of lipid content readings, being on average within 90% of the certified 'total extractable organics value'. Good precision was also achieved (14% relative standard deviation). As the polar bear biopsies were of very low weight (10 to 300 mg), we tested the sensitivity of the extraction by repeatedly analyzing SRM1945 and measured similar lipid content across this range of weights. For the polar bear capture biopsies, we found lipid content of 42.91 ± 0.73% (± SEM). Focusing on adult females, lipid content was positively related to subjective 'fatness index', body weight, and Quetelet Index, indicating that lipid content may be a useful metric for captured polar bears. Additionally, cub-of-the-year weight and length was correlated with their mother's adipose lipid content, suggesting that lipid content is related to health outcomes. For the remote biopsies, we found low lipid content (21.81 ± 1.60%) compared to the capture biopsies. In the larger capture biopsies, we found differences in lipid content between inner and outer biopsy sections (54.76% versus 33.74%), which may partially explain lower lipid content in the more superficially sampled remote biopsies. Thus, this metric may not be very informative for remote biopsies or the remote biopsy sampling method may require further refinement.

SEASONAL VARIATION IN SOIL NITROGEN AVAILABILITY ACROSS A FERTILIZATION CHRONOSEQUENCE IN MOIST ACIDIC TUNDRA

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Changes in global climate may result in altered timing of seasonal events including the timing of the spring-thaw and fall freeze-up. In addition to this changing seasonality, arctic environments are experiencing overall increases in nutrient availability caused by climate warming resulting in alterations of plant species composition, such as the observed increases in the abundance of deciduous shrubs. Changing species composition may have large effects on nutrient dynamics in the surrounding ecosystem because of documented differences in how particular plant species influence soil nutrient availability. Although we have some idea of how plant identity influences soil nutrients, soil biogeochemical processes are strongly seasonal, and we have a poor understanding of how plant identity, or nutrient levels, may influence these seasonal patterns. We examined the responses of moist acidic tundra to experimentally increased soil nutrient availability and the accompanying increase in shrub abundance at the Arctic Long Term Ecological Research (LTER) site at Toolik Lake, Alaska. We examined a chrono-sequence of long-term fertilization experiments, composed of experiments fertilized for 5, 15 and 22 years, which has resulted in increasing shrub density with time since fertilization. The fertilized plots receive both nitrogen (N, 10 g/m2/yr) and phosphorus (5 g/m2/yr) annually following snowmelt. In the 2011 growing season we measured variation in soil available N weekly, including measures of ammonium (NH4), nitrate (NO3) and total free amino acids (TFAA). We found that differences between fertilized and control plots depended strongly on both the seasonal timing of measurements, as well as the duration of the fertilization treatment. Early in the growing season fertilization resulted in large increases in available soil N (both NH4 and NO3) across the entire chronosequence. As the season progressed, however, older fertilized plots show evidence of N saturation, where higher levels of available N are maintained throughout the season. In plots which had only been fertilized for 6 years, however, differences in available soil N between fertilized and control plots were not sustained; high N demand resulting in immediate uptake of available N likely reduced concentrations in fertilized plots. We also show strong seasonal variation in the various forms of soil available N. We found early-season peaks in TFAA, substantially higher in fertilized than control plots, likely resulting from crashes in soil microbial biomass immediately post-thaw. Although previous studies have shown no effect of fertilization on microbial biomass during summer, fertilized plots may have higher winter microbial biomass (resulting in a larger crash in the spring). Peaks in TFAA are followed by peaks in NH4, suggesting a conversion of organic to inorganic nitrogen in the soils. In summary, we found that seasonal patterns and forms of nutrient pulses in this arctic ecosystem are strongly affected by overall soil nutrient availability and the accompanying changes in plant community composition. Increased understanding of potential changes in seasonal biogeochemical events is important for predictions of ecosystem productivity in this changing northern climate.

A POTENTIAL ROLE FOR CHARS IN ARCTIC MONITORING AND REPORTING IN CANADA

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This presentation outlines the potential role that Canadian High Arctic Research Station (CHARS) could play in the development of an ecosystem monitoring and reporting program for Arctic Canada. The immediate need for effective monitoring of arctic ecological change as a key component of successful adaptation has been widely identified, and is fundamental to anticipating gradual change and potential tipping points, and for making informed, proactive management decisions. Implementing such a program is complicated by the ecological diversity and spatio-temporal variability of the components and drivers of marine, freshwater, coastal and terrestrial ecosystems, multi-scalar and evolving natural and anthropogenic stressors, and is constrained by the vast areas to be monitored, costly and difficult access, and the low density of long term monitoring locations.

In the face of these difficulties it is proposed that CHARS could facilitate environmental monitoring for the Canadian Arctic through implementation and/or coordination of the following key actions.
1. Work with the arctic science community to develop a world-class environmental monitoring station at CHARS that will implement ecosystematic, comprehensive, and hypothesis-based environmental research and monitoring, develop best practices and provide training opportunities for Northerners, coordinate these approaches across the network of arctic research stations and vessels, and use these data to develop ecological models that can be applied broadly to predict and validate change in arctic ecosystems.
2. Work with northern governments presently conducting environmental monitoring to coordinate and integrate the results of ongoing programs.

3. Work with industry and regulators to provide baseline monitoring in resource rich areas to support cumulative effects monitoring and modelling, and the establishment of regional thresholds for Valued Ecosystem Components.
4. Work with educators and communities to build on ongoing community–based monitoring initiatives and traditional knowledge sources, so that this information can contribute meaningfully to a national synopsis of arctic ecosystem condition and change.
5. Optimize the strategic use of remote sensing tools for reaching out from limited ground monitoring locations to broad areas of the Arctic.
6. Build on and support the Circumpolar Biodiversity Monitoring Program (CBMP), including monitoring design, and data management and distribution, and in particular, the ongoing international monitoring designs and approaches presently being developed by the CBMP Marine, Coastal, Freshwater, and Terrestrial Expert Monitoring Groups.
7. Collect and assess all available data and develop a defensible and repeatable 5 year synthesis of the condition of arctic ecosystems (State of the Canadian Arctic Report) that can inform Canadians and global circumpolar partners of emerging important ecological issues in the Canadian Arctic.

Given these identified challenges, the successful implementation of a useful and sustainable environmental monitoring program for Canada's Arctic will require coordinated contributions from communities, academia, industry, and governments. The historic problem has been that no single group has a sufficiently broad mandate to coordinate these roles for a common purpose. It is proposed here that CHARS can provide such a facilitation role, working with all northern partners towards the goals outlined in this presentation.

EXAMINING THE EFFECT OF CATCHMENT DISTURBANCE ON NUTRIENTS AND BIOLOGICAL COMMUNITIES OF ARCTIC LAKES (SEWARD PENINSULA, ALASKA)

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The importance of catchment processes on the limnology of Arctic lakes is becoming a more prominent issue as the extent of permafrost degradation increases under warmer temperatures. Geochemical modification of soils and surface waters as a result of thawing permafrost could highly influence nutrient inputs to Arctic lakes and ponds, which normally have low ionic concentrations due to limited groundwater contributions and a nutrient-poor active layer. Observations of the Seward Peninsula, Alaska, have identified increased areas of permafrost collapse, as well as increasing development of floating mat vegetation along lake margins. In addition, rapid expansion of shrubs and recent introductions of spruce into tundra environments have also been documented. Increased shrub density in lake catchment areas may influence biogeochemical cycles, organic matter inputs, carbon cycling, and modify nitrogen dynamics. Thus, the Seward Peninsula, Alaska, is an excellent area to examine the influence of increased inputs from a number of catchment area disturbances on the biotic communities of lakes.

Here, we utilize a multi-proxy paleolimnological approach from two characteristic lake systems, one with visible signs of permafrost degradation and floating mat vegetation along the shoreline, and another with significant shrub growth within its catchment zone, to characterize the relationship between different sources of nutrient inputs and biological communities in an area undergoing environmental change. Sediment cores were collected during summer 2011, using an Uwitech gravity corer, and analyzed for chironomids (Diptera:Chironomidae), diatoms, organic carbon and nitrogen elemental and stable isotope composition, and cellulose oxygen isotope composition. Biostratigraphic reconstructions from both lakes displayed a reduction of cold-water indicators in recent sediments, suggesting a warming climate in this region. In addition, a significant shift in chironomid assemblages was observed to coincide with an increase in $\delta^{15}N$ and decline in $\delta^{13}C_{org}$, reflecting higher productivity associated with greater nutrient availability in the macrophye-dominated lake with visible slumping of the shoreline margins. The dominant chironomid taxon was also significantly correlated ($r^2 = 0.84$) to $\delta^{15}N$ in sediments, suggesting that a major driver of the trophic shift in this system is related to nutrient availability rather than solely temperature. The shrub-dominated system showed a similar reduction of cold-water indicators, but no major shift in assemblages possibly due to differences in the source and behaviour of nutrients in the shrub-dominated catchment. Consequently, retrogressive thaw slumps likely result in increased benthic production and higher available nutrients, which leads to the alteration of the aquatic trophic system.

DISSOLVED ORGANIC MATTER INPUT FROM SEA-ICE MELT INCREASES HETEROTROPHY IN ARCTIC SURFACE WATER COMMUNITIES

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The Arctic polar ecosystem is strongly impacted by global warming. During the last decade, the combined temperature increase and albedo effect have led to a decrease in sea-ice extent much faster than predicted by climate models, reaching a record minimum of 4.1 million km^2 in fall 2012. Impacts on Arctic ecosystems are already documented and impacts on the global carbon cycle are anticipated as sea-ice covers 13% of the earth's surface and is an important habitat for abundant and diversified prokaryotic communities able to remineralize the large pool of labile dissolved organic matter (DOM). Consequently, a better characterization of the effect of sea-ice melt on surface water prokaryotic communities is central to understanding potential changes in Arctic ecosystems and global carbon cycling.

The aim of our study was to evaluate the impact of sea-ice melt, in particular the input of DOM, on prokaryotic activity in surface waters.

Microcosm experiments simulating the addition of DOM during sea-ice melt were carried out in Resolute, Nunavut in May 2011 and May 2012. In each triplicate experiment, surface waters were enriched with different concentrations of sea-ice DOM (i.e. different volumes of filtered sea-ice) and incubated in the cold for 168 to 216 h. Prokaryote abundance, apparent cell size and DNA content were measured by flow cytometry and the production/uptake of dissolved organic carbon and nitrogen (DOC and DON) was calculated from DOC and DN measurements in the experimental microcosms.

An unexpected result from this study is that the initial addition of sea-ice DOM filtered through 0.22 µm resulted in a significant increase in prokaryote abundance (from 2.2 ± 0.1 10^8 to 3.1 ± 0.2 10^8 cell L^{-1} vs 4.5 ± 0.5 10^7 cell L^{-1}), itself correlated to the volume of filtered sea-ice added. This reveals that very small size prokaryotes (< 0.22 µm) are abundant in Arctic sea-ice. These cells, estimated at ca. 3.1 ± 0.4 x 10^9 L^{-1} in bottom sea-ice, are poorly described and neglected in Arctic microbial studies.

In both experiments, prokaryote growth was significantly higher after enrichment with melted sea-ice DOM. In the experimental control, DOC production exceeded DOC uptake whereas in all sea-ice enriched microcosms, DOC uptake exceeded DOC production. Uptake rates of DOC and DN were positively correlated with the level of sea-ice DOM enrichment.

These results demonstrate that the addition of sea-ice DOM increases prokaryotic growth and DOC and DN uptake in surface waters, suggesting that sea-ice melt in the Arctic could lead to major changes in the global carbon cycle by enhancing heterotrophic microbial activity.

Keywords: global warming, microbial activity, sea-ice, heterotrophy, Arctic, flow cytometry, prokaryotes

REDUCING GANGION BREAKING STRENGTH OF GREENLAND HALIBUT (REINHARDTIUS HIPPOGLOSSOIDES) LONGLINE GEAR TO REDUCE GREENLAND SHARK (SOMNIOSUS MICROCEPHALUS) BYCATCH IN THE CUMBERLAND SOUND

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Due to deteriorating sea ice conditions caused by climate change, turbot (*Reinhardtius hippoglossoides*) fishing during the winter months in the Cumberland Sound has experienced all time lows in the last number of years. To increase fishing opportunities for turbot, a summer fishery has been proposed for the Cumberland Sound area and is also being considered for deepwater fjords along the northeast coast of Baffin Island (i.e., within the Arctic Circle). A challenge to developing a successful summer fishery is bycatch with more Greenland shark (*Somniosus microcephalus*) captured in the summer than in the winter causing problems for fishers. Sharks can depredate hooks, decrease turbot CPUE and cause gear damage or loss. Sharks are vulnerable to overfishing due to their k-selected life history strategy and interactions with fishers can lead to mortality which can threaten local population abundance over time. To develop an efficient and sustainable summer turbot fishery, finding a way to reduce shark capture and entanglement rates without effecting turbot catch rates is imperative.

Due to the large size difference between the bycatch and target species, modifying the gear by reducing gangion breaking strength was proposed as a method to reduce Greenland shark capture rates. To test if this gear modification has an effect on targeted and non-targeted species capture rates, three experimental breaking strength gangions were fished with a control. The experimental treatments were monofilament gangions of 50, 100 and 200lb breaking strength. The control was a braided nylon gangion of 200lb breaking strength which is representative of traditional gear used by local longline fishers. Using longline sets of 400 hooks with a consistent pattern of alternating gangion types at 20 hook intervals, 12 experimental longline sets were fished. I hypothesized that with decreasing breaking strength shark catch rate would decrease as using weaker material would allow sharks to bite through gangions more easily and perhaps lead to an increased chance of the shark breaking off the line during haulback. No effect was predicted for turbot catch due to the smaller size and weak jaw strength of this species. Set locations were chosen arbitrarily in the Cumberland Sound in NAFO Area OB at 3 depth strata ranging from 685-1278 m. All sets were completed in August and September 2012 from a 19.8 m research vessel. Results and discussion are to follow. If the hypotheses hold true then efforts to incorporate gangions with reduced breaking strength into commercial turbot fisheries within coastal waters of Nunavut will be pursued. Modifying gear to increase capture efficiency and sustainability will assist in increasing employment opportunity and economic growth in coastal Arctic communities.

PARTICULATE ABSORPTION IN THE BOTTOM LAYER OF FIRST-YEAR SEA ICE IN THE CANADIAN ARCTIC: CHARACTERIZATION AND SEASONAL TRENDS

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Little information exists on the spectral absorption properties of algal (a_{ph}) and de-pigmented (a_d) particulate matter in sea ice. During the International Polar Year - Circumpolar Flaw Lead system study (IPY-CFL), we collected a dataset on ice algal spectral absorption characteristics and taxonomic and pigment composition within the bottom 3 cm of first-year sea ice from April to June 2008. The a_{ph} data compared surprisingly well with select phytoplankton a_{ph} models, given that the models were extrapolated well beyond their limits to ice algal chlorophyll *a* (Chl a) concentrations. On average, a_d contributed 7 and 50% to total particulate absorption during bloom and post-bloom periods, respectively. Diatoms numerically dominated the ice algal community for most of the study and subsequently, controlled absorption characteristics until the post-bloom when flagellates increased in abundance. Seasonal progression in a_{ph} revealed an increased pigment package effect, determined through an increase in the spectral ratio, aph(674:440 nm), towards peak bloom as algae shade-acclimated to increasing concentrations in the ice. This was followed closely by an increase in the spectral ratio, a_{ph} (500:470 nm), which highlighted an increasing contribution of photosynthetic carotenoids (PSC) to the algal pigment composition, confirmed through a significant regression with the pigment ratio, PSC: Chl *a*. The ice algal community rapidly light-acclimated during the post bloom period as a_{ph} (674:440 nm) and thus, pigment package effect, decreased coinciding with increases in the pigment ratio, photoprotective carotenoids: Chl *a*, and Chl *a* specific absorption in the ultraviolet (UV) wavebands (330 and 360 nm). The latter highlighted an inferred production of the photoprotective UV absorbing mycosporine-like amino acids. These results show that measurements of ice algal spectral absorption properties will not only improve their parameterization in bio-optical models, but also can provide valuable information on the photophysiological state of ice algal community.

THE EFFECT OF LAKE MORPHOMETRY ON THERMAL HABITAT USE AND GROWTH IN ARCTIC CHARR POPULATIONS: IMPLICATIONS FOR UNDERSTANDING CLIMATE-CHANGE IMPACTS

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Oxygen stable isotope temperature reconstruction methods were used to estimate mean experienced summer temperatures from growth zones within individual Arctic charr otoliths sampled from lakes with contrasting morphologies but proximate locations. For either lake, otolith-estimated temperatures were not significantly related to back-calculated growth. Significant negative effects on back-calculated growth were observed due to increasing air temperatures in the smaller and shallower lake, owing to warmer surface and littoral waters and a limited amount of preferred cool-water habitat availability. A similar relationship was not observed in the larger and deeper lake and indicated that because of better behavioural thermoregulation opportunities in the cooler, deeper lake, resident Arctic charr were not as vulnerable to the impacts of temperature warming. Young-of-the-year fish from the smaller lake additionally demonstrated reduced growth in the subsequent year when exposed to high first year temperatures, whereas no significant correlation was found for young-of-the-year from the larger lake. Results here provide evidence for differing climate-influenced growth outcomes depending on lake size and morphometry with both factors acting to influence fish densities in available preferred thermal habitats. Also important for determining site-specific temperature warming impacts are other lake and population attributes including upstream catchment area and life-history strategy.

FEEDBACKS BETWEEN SHRUBS AND TEMPERATURES ACROSS NORTHERN CANADA

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Shrub species are the largest plant life form in tundra ecosystems; therefore, changes in the abundance of shrubs will likely feedback to influence biodiversity, ecosystem function and climate. Air temperatures are linked to shrub growth, and in turn, shrub canopies have been hypothesized to influence ground temperatures by trapping snow in winter and shading soils in summer. However, the direction and magnitude of shrub-temperature feedbacks and generalizable relationships across shrub species, soil types and regions have yet to be identified. We present data from shrub tundra in the Yukon, NWT and Northern Quebec. We found both positive and negative relationships between growth and early summer air temperatures and many individuals that did not exhibit climate-sensitive growth. Summer soil temperatures were cooler under shrub canopies; however, there was no clear relationship with canopy height. In contrast, we found a significant relationship between canopy height and winter temperatures. The difference in the minimum winter soil temperatures at 5 cm depth under shrub versus open tundra was ~1°C greater for every additional 10 cm of canopy height, despite differences in air temperatures, snow pack, soil characteristics and species composition between sites. Our results highlight the variable nature of growth-climate relationships for shrub species among tundra regions and the important influence of canopy cover on soil temperatures. By combining data in this manner across regions, we will be able to better estimate the relative magnitude of positive and negative feedbacks of shrub increases to climate warming, improving estimates of future vegetation change and permafrost stability.

ARCTIC MARITIME BOUNDARY DISPUTES: LESSONS AND OPPORTUNITIES

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In 2011, Russia and Norway concluded a boundary treaty for the Barents Sea, where the two countries had previously disputed 51,000 nautical square miles of oil-and-gas rich seabed. This leaves just one significant unresolved Arctic maritime boundary: in the Beaufort Sea between the United States and Canada. The Russia-Norway treaty, and the negotiations leading to it, offer important lessons to the United States and Canada. For instance, the treaty creates a joint hydrocarbon regime for any oil and gas reserves that straddle the new boundary. This panel will bring the leading experts on the Russia-Norway treaty to Canada where they will interact with leading Canadian and US experts, in a focused effort to promote cross-fertilization of the latest best practice in Arctic boundary negotiations.

PAN-ARCTIC GENETIC POPULATION STRUCTURE OF THE ARCTIC COD BOREOGADUS SAIDA

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The small gadid fish *Boreogadus saida* is a foundational ecosystem component found widely in arctic and boreal waters. It is largely unknown whether the species exist as a genetically homogenous panmictic population, or as assemblage of genetically divergent populations. The answer to this question has important implications for the management of potential effects related to human activities as well as understanding how climate change will impact distribution, abundance and phenology. Here we report analysis of the genetic population structure of *Boreogadus saida* working with samples collected from the western North Atlantic to the eastern North Pacific as well as the Laptev and Greenland seas. Analysis of ten microsatellite DNA loci indicate that *Boreogadus saida* appears to be structured, at least in a regional context, into three large scale groups. Differentiation is noted between populations sampled west and east of Resolute Bay and a third large scale group is made up of samples collected from the Laptev and Greenland seas. Work in progress suggests that there also may be differentiation at the local (within region) scale. We will discuss how environmental and geophysical conditions may have served to shape population structure, however further work is still required to gain a thorough understanding of this question.

INVESTIGATING ASSOCIATIONS BETWEEN MACRO- AND MEGAFAUNA COMMUNITIES ON THE BEAUFORT SHELF AND SLOPE --- WITH APPLICATIONS FOR FUTURE MONITORING USING BIOLOGICAL SURROGATES

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The Beaufort Sea is a region facing rapid climatic changes and increases in fossil fuel exploration. Reduced ice cover and shifts in timing of plankton productivity in the surface ocean will alter the delivery of organic matter to depth and ultimately affect diversity and ecosystem processes on the seafloor. While this area remains relatively pristine, it is important to collect baseline data to describe patterns of diversity and community structure, to develop a foundation for monitoring long-term trends and informing future management decisions. It is therefore important to characterize spatial patterns in the distribution of benthic organisms in the region and evaluate the ability of the current sampling gear and sampling designs to provide an accurate representation of species diversity and abundance at a given point in time.

Video imagery, from cameras on remotely operated vehicles, stationary observatories and towed sleds, has been proposed as a preferred method to increase the frequency and spatial coverage of monitoring while minimizing post-cruise processing and the destructive impact of traditional benthic sampling – box corers, grabs and trawls. Monitoring and mapping of benthic diversity and community structure from video imagery requires that the visible epifauna act as a surrogate for the entire benthic community. To date, the epi-benthic megafauna has not been demonstrated to be a useful predictor of macro-infaunal communities at medium to large spatial scales. If significant associations in diversity and community structure can be quantified between visible epi-benthic megafauna and macro-infauna, video imagery may be a useful tool to rapidly identify large scale benthic community patterns many areas of Canada.

We will present our analyses of 1) the ability of current sampling schemes and gear to detect benthic spatial structure and 2) the spatial patterns of diversity of the epi-

benthic megafaunal and macro-infaunal communities on the Beaufort shelf as well as associations between them. Our research is aimed at developing requirements for future benthic monitoring with video imagery on the Beaufort Shelf with potential applications to the management of other soft-bottom continental shelf-slope environments.

OCEAN AND SEA-ICE VARIABILITY IN THE ARCTIC OCEAN AND CANADIAN ARCTIC ARCHIPELAGO: HIGH-RESOLUTION MODEL SIMULATION AND ASSESSMENT WITH OBSERVATIONS

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High-resolution ocean and sea-ice models have been developed for the Arctic and North Atlantic Oceans by the Canadian inter-departmental CONCEPTS program. These models are based on the Nucleus of European Modelling of the Ocean (NEMO). Driven by realistic atmospheric forcing datasets, several simulations have been carried out for the recent decade. The performances of these hindcast simulations, in terms of sea-ice distribution and motion, ocean current and hydrography, are evaluated with available satellite and in situ observations, including those from ArcticNet. Identified biases in the model solutions help further improvement of key parameterizations included in the models. Analyses of model results lead to new understanding on forcing mechanisms for volume flux through the Canadian Arctic Archipelago. Examples of applying model results to estimate the dispersion of potential oil spills will be also be presented.

FUTURE DIRECTIONS IN INUIT EDUCATION RESEARCH: A ROUNDTABLE DISCUSSION

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Inuit Qaujisarvingat: Inuit Knowledge Centre (and the Amaujaq National Centre for Inuit Education) at Inuit Tapiriit Kanatami (ITK) will convene a working session on Inuit Education Research at the 2012 ArcticNet Annual Scientific Meeting. During ITK's work with regional partners to develop First Canadians, Canadians First: National Strategy on Inuit Education, it became evident that there is a wide gap in research on Inuit education, there is a shortage of material that examines education trends for Inuit, and there has been little collaboration with Inuit to date. This session will be formatted as a roundtable discussion bringing together individuals, both Inuit and non-Inuit, with a history and familiarity of Inuit education research and practical experience in Inuit education to discuss the current state of Inuit Education Research. The goal of this session is to develop and explore themes in Inuit Education Research and the results will help guide the agenda and planning of an Inuit Education Research Forum which is supported by ArcticNet and will take place early 2013. Ultimately this work will inform the development of an innovative action plan for a future Inuit education research program, including ArcticNet's future call for education research.

PHOTOTROPHIC AND HETEROTROPHIC RESPIRATION ASSOCIATED WITH CRYPTOENDOLITHIC MICROORGANISMS, ELLESMERE ISLAND, CANADIAN HIGH ARCTIC

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Cryptoendolithic microbial communities composed of cyanobacteria, algae, fungi, and heterotrophic bacteria are widespread in the Canadian high Arctic, inhabiting sandstone and evaporite outcrops that provide space for growth, moisture retention, and protection from climatic extremes. Microbial activity predominantly occurs during summer months on Ellesmere Island when air temperatures are above freezing, rainfall is frequent, and solar insolation is continuous. In order to better understand and attempt to characterize this microbial activity, we conducted field-based studies of carbon fluxes using a cavity ring-down spectrometer for measurements of both CO_2 concentrations and $\delta^{13}C$. Measurements were collected during summer months in 2011 and 2012, both from incubation chambers containing subsamples taken from outcrops as well as

from chambers secured directly to exposed rock faces. In addition to ambient baseline conditions, we conducted perturbation experiments to determine how microorganisms respond to microenvironmental changes (i.e. moisture and sunlight) and how this affected CO_2 uptake and release.

Under dry, sunlit conditions, measurements of CO_2 or $\delta^{13}C$ from chambers showed no notable differences when compared to outside air (387–390 ppm; -9.40– -8.82‰). Upon wetting, CO_2 concentrations in the chamber increased to 448–662 ppm, with a concomitant decrease in $\delta^{13}C$ values (-15.30– -10.4‰). Placing these same chambers under dark conditions resulted in further increased CO_2 flux from the rock, which subsequently decreased when exposed to sunlight. Cyclic transitioning from light to dark produced repeatable results. These results suggest that microbial activity is activated by moisture, and that respiration rates outpace photosynthesis – even under conditions optimum for photosynthesis – due to an unaccounted for source of carbon, causing a net flux from the cryptoendolithic environment to the atmosphere.

The cryptoendolithic microbial community was characterized by 454 pyrosequencing, which showed that Cyanobacteria comprise up to 44% of the total population near the rock surface. In contrast, heterotrophic Actinobacteria and Alphaproteobacteria dominate at depth beneath the photic zone. Evaluation by scanning electron microscopy showed both the presence of living microorganisms as well as organic matter morphologically similar to bacteria coating mineral surfaces deeper within the rock. The latter are believed to be associated with ancient colonization or incorporation during sediment deposition, providing a rich energy source for modern heterotrophy that can explain the net release of CO_2. These coatings are absent in the top several millimetres of exposed rock faces and we hypothesize that the coatings are fully oxidized to CO_2 as they are exhumed toward the rock surface. If this organic matter is ancient and our observations of respiration outpacing photosynthesis are representative, then these communities are likely a long-term (millions of years) net source of carbon to the atmosphere, a rare phenomenon among ecosystems at the surface of the Earth. In light of predictions of warmer and wetter summer periods in this region of the Canadian high Arctic, this pool of organic carbon – combined with predicted increased cryptoendolithic microbial activity – may result in even higher CO_2 fluxes in future years.

CHANGE AT THE MARGIN OF THE NORTH WATER POLYNYA, BAFFIN BAY, INFERRED FROM ORGANIC MATTER RECORDS IN DATED SEDIMENT CORES

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The North Water (NOW) polynya is one of the most productive marine environments in the Arctic. With Arctic sea-ice cover a prominent control in the production of marine organic matter (OM), polynyas are likely to be sentinels of the effects of recent change in ice climate. We collected six sediment cores from the NOW, dated them using ^{210}Pb, corroborated with ^{137}Cs where possible, and analyzed down-core profiles of OM (kerogen (Rock-Eval 6 analysis), total organic carbon (TOC), total organic nitrogen (TON), $\delta^{13}C$ and $\delta^{15}N$). The down-core records were examined for evidence of recent (past 150 years) change.

Sediment OM bulk concentrations (TOC and TON) displayed exponential decreases with water depth reflecting water-column remineralization processes, whereas OM composition (e.g., $\delta^{13}C$ and $\delta^{15}N$) showed no such relationship. Using a model to account for sedimentation rate and sediment surface mixing, we found that cores from the interior of the NOW showed no significant change between pre-1900 sediments and post-1900 sediments, and little variance among cores. In contrast, a core from the northwest boundary of the region showed evidence of increased marine organic carbon input, and two cores from the southeast boundary showed evidence of decreased terrigenous carbon input. In addition, the cores at the southeast boundary, on the slope off Greenland, witnessed a significant decline in sedimentation rate during the same time interval. We interpret the change in OM in the boundary cores in the context of change in regional ice climate and runoff. Our results suggest that the margin of this polynya is more vulnerable to change than the interior, and thus is a better location to seek evidence of change. Furthermore, the diversity of settings within NOW indicates that change must be understood at sub-regional scales.

A NECESSARY VOICE: THE IMPORTANCE OF ENGAGING AND INCLUDING INUIT YOUTH IN NORTHERN RESEARCH AND POLICY

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The importance and value of youth voices are frequently overlooked in climate change published research and policy development. A number of successful and interesting projects that work with children and youth are outlined in grey literature, but to date, there has been no published climate change research that has specifically focused on youth or as to how youth can contribute to climate change research. Engaging and involving the next generation of leaders in climate change research and policy is necessary in order to meaningfully and purposefully address this gap in research and practice. This presentation will discuss a case study that aimed to begin to address this gap through conducting research with Inuit youth (12-25 years old) in Rigolet, Nunatsiavut, Labrador to explore youth observations and perceptions of climate change in their community. The study was part of the Changing Climate, Changing Health, Changing Stories project in Rigolet, a multi-year, community-driven project dedicated to using qualitative methods and digital media to study the impacts of climate change on health and well-being. Data were collected through in-depth, semi-structured interviews to explore youth observations and perceptions about changes in the land, snow, ice, sea, weather, hunting, and trapping in and around the community, and the subsequent impacts on their lives and culture. The participants, ranging in age from 12 to 25, reported witnessing substantial climatic and environmental changes throughout their lives. Five main themes emerged: the ways in which climate and environmental changes are altering travel conditions and access to hunting; the impact of these changes on Inuit culture; the concern that youth have for Elder well-being in the face of these changes; the strong emotional responses youth expressed because of these changes; and youth-identified adaptation strategies. The results indicated that Rigolet youth have valuable knowledge, experience, and ideas with the potential to enhance climate change adaptation policies and research. Considering the results of this study, as well as the significant socio-cultural, socio-economic, and climatic changes facing Northern youth, their families, their culture, and their communities, researchers and political leaders at all levels have an obligation to effectively educate, engage, and include this group in future climate change work, research, dialogue, and policy. Not only does including youth in early stages of adaptation planning create a potential for these strategies to be longer lasting, but involvement from the beginning also ensures that adaptation strategies are inclusive of multiple voices and perspectives. Effective and meaningful strategies to engage youth could include participation in community planning discussions, involvement in all stages of the research process, and providing information and opportunities for involvement in climate change work. Future research is necessary to expand on youth observations of climate change as well as to identify potential roles that youth could play in climate change research and policy.

PATCHY DISTRIBUTION OF MELOSIRA ARCTICA IN ARCTIC FIRST-YEAR SEA ICE: CHALLENGES AND IMPLICATIONS

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First-year ice sampling at 21 stations located in the Canadian Arctic Archipelago around Cornwallis Island, Nunavut, Canada in May 2012 revealed not only rich algal communities in the lower ice layers but a significant sub-ice community, observed only once, at a nearshore station in Wellington Channel. This Arctic sub-ice community was dominated by the well-known filamentous colonial centric diatom, *Melosira arctica* Dickie, and occurred in cm long mucilage-rich strands. This widespread taxon across the entire Arctic regions has been often reported, however, associated epiphytes are poorly known. These epiphytes were commonly observed and consisted mainly of two pennate diatoms, *Synedropsis hyperborea* (Grunow) Hasle, Medlin & Syvertsen and *Pseudogomphonema arcticum* (Grunow) Medlin, with occasional occurrence of small solitary cells of *Chaetoceros* less than 10 µm in size. Interestingly these epiphytic pennate diatoms form small tuft colonies themselves adhering to the cell wall of

M. *arctica*. In addition to these epiphytes, some solitary pennate diatom cells, namely *Entomoneis paludosa* var. *hyperborea* (Grunow) Poulin & Cardinal, *Haslea crucigeroides* (Hustedt) Simonsen, *Nitzschia longissima* (Brébisson ex Kützing) Grunow and *Pleurosigma stuxbergii* Cleve & Grunow, were observed crawling over the colonial curtain formed by M. *arctica*. Bottom ice and sub-ice habitats pose different challenges and selective pressures to the diatom species colonizing these environments. Suggestions for why *Melosira* assemblages can become dominant under certain conditions will be offered.

OBSERVING THE SNOW AND MELT POND PROPERTIES IN THE CANADIAN BEAUFORT SEA

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Helicopter-borne Ground-Penetrating-Radar (GPR) has been providing in real-time snow depths and ice thicknesses of low saline ice and complemented the Electromagnetic-Laser (EM) and Video-Laser data sets to document the winter and summer ice and snow properties found in the Canadian Beaufort Sea. During winter surveys the GPR compliment the EM observations consisting of snow+ice thicknesses as it monitors snow depth separately. In summer surveys the presence of melt ponds is affecting the ice thickness observations as the laser reflects from the surface of the melt ponds and thus EM sensor data include the melt pond depths when they are present.

During the ArcticNet summer survey of 2011, a large 10 km x 10 km floe northeast of the ice breaker "*Amundsen*" stationed at Stn. B1S1 was surveyed with EM-laser, GPR and Video-laser sensors. Analysis of the data shows the melt pond fraction seen in the video data (flown at 100 m) can also be seen in the GPR and EM's laser brightness data collected during low flying surveys lines (5-6 m). The GPR melt pond's return is a much stronger and clearly distinguishable response than that from the surrounding pack ice and thus provides a reliable method to determine the melt pond fraction along the survey line where the EM-laser system measures the "ice thicknesses" that includes the melt ponds. Similarly the Laser from the EM-Laser system also provides a good indication of the melt pond fraction along the survey line as its laser brightness over melt pond versus pack ice are different. The data on the melt pond fraction enables one to estimate what fraction of the EM ice thickness is actual ice and what is fresh water of the melt ponds.

Although GPR sensor was not flown all the time during the 2011 summer survey as there was no snow to sample; the original task of the GPR. It now appears that the GPR should be used during summer surveys as well as it complements the EM-laser sensor data in determining the present of melt ponds. Further research should be done on the melt pond such as the collection a CTD profiles of melt ponds as the GPR may also be able to distinguish if a melt pond has a bottom or has melted through the ice cover. All data and publications of the helicopter surveys are available from the new DFO website: http://www.bio.gc.ca/science/research-recherche/ocean/ice-glace/index-eng.php.

THE EFFECTS OF WARMING AND NUTRIENT ENRICHMENT ON BLOOM-FORMING CYANOBACTERIA IN SUBARCTIC LAKES

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Climate warming and eutrophication are thought to favour cyanobacterial dominance in phytoplankton communities at temperate latitudes, but little is known about the sensitivity of northern lakes to these effects. Bloom-forming cyanobacteria are known to be largely absent from cold polar waters, however a warmer climate may result in alteration of habitat structure, the onset of thermal stratification in summer and changes in prey-predator interactions. A warmer, wetter climate might also favour increased nutrient mobilisation and loading from the watersheds surrounding northern lakes. The development of noxious cyanobacterial blooms in response to higher concentrations of soluble reactive phosphorus coupled with strengthened thermal stratification is well documented in temperate lakes. This study addressed the hypothesis that similar processes may occur in the future in Subarctic lakes, with impacts on water quality.

The first part of the study examined limnological characteristics and cyanobacterial communities in 16 Subarctic lakes and permafrost ponds during summer 2011 and 2012. The second, experimental part was performed to test if the ongoing climate warming and eutrophication will have a stimulating effect on cyanobacterial populations originating from these lakes. The field sampling was performed in lakes and ponds within different landscape types of the discontinuous permafrost zone of northern Quebec, and included vertical profiling of temperature,

chlorophyll fluorescence, dissolved oxygen, salinity, and pH with a Yellow Spring Instrument (YSI) 6920. Water samples for standard chemical analysis (DOC, TP, TN, SRP, anions), phyto-, bacterio- and zooplankton analyses, as well as for the HPLC pigment analysis were taken at the surface, in the middle of the water column and at the bottom of each lake or pond. Two field experiments (in August 2011 and 2012, respectively) were performed in sixteen 20L mesocosms (Cubitainer). In the first experiment, water from a shallow rock-basin lake containing the natural phytoplankton community was filtered through 50 µm Nitex to removed zooplankton and then exposed to increased temperature (inside a greenhouse) and increased nutrients (daily supplements with 2 µg L-1 of PO42--P). In the second experiment, water was sampled from a permafrost thaw lake, and the same procedure was employed to examine the effects of warming and phosphorus enrichment on its phytoplankton communities, particularly the cyanobacterial populations.

Our analyses of summer phytoplankton from the permafrost thaw lakes revealed that these waters contain diverse communities, with more than 15 cyanobacterial species. There were low concentrations of potentially toxic, bloom-forming cyanobacteria such as *Anabaena* sp. and *Microcystis* sp. that could indicate the onset of community shifts. The results from the first experiment show that the combined effect of higher temperature and higher phosphorus concentration caused an increase in picocyanobacterial biovolume, which doubled over 12 days. There was also a response by the *Anabaena* population, which tripled in biovolume during this period.

These results show that bloom-forming cyanobacteria are already present in Subarctic lakes and that higher temperatures and phosphorus enrichment may cause an increase in their abundance. The stratified thaw ponds of Nunavik are excellent model systems to evaluate these climate-related processes in the changing northern environment.

SURVIVAL AND DEMOGRAPHY OF MIGRATORY CARIBOU IN NORTHERN QUÉBEC AND LABRADOR

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Two major hurdles currently hinder the conservation efforts of Rangifer populations across their circumpolar distribution. The first is the lack of data, specifically reliable population size estimates, that are a fundamental piece of the puzzle for the management of any population. The second is that many populations have undergone widespread declines in recent decades. Thus increasing the need for a better understanding of factors affecting population dynamics past, present and future. The two populations of migratory caribou in northern Québec and Labrador, the Rivière-aux-Feuilles herd (RAFH) and the Rivière-George herd (RGH), have been declining for approximately 10 and 20 years, respectively. We monitored radio-collared caribou in each population for over 20 years and calculated adult male and female survival rates, as well as yearling survival since 2008. Adult female annual survival for the RAFH has been low but relatively constant at ca. 85% in recent years, while adult male survival has varied between 50 and 90% since 2008. For the RGH, adult female annual survival has remained between 60 and 80% since 2007 while adult male survival has been constant around 50%. We combined annual estimates of recruitment, sex ratio and survival with population estimates dating back 10 to 20 years to predict changes in population size. Our technique is able to confirm the latest census data which suggest a decline for the RAFH and a dramatic crash for the RGH. The model we developed offers a simple and cost effective method to calculate survival rates and estimate population size.

CARBON POOLS AND TRANSFORMATIONS IN SUBARCTIC THAW PONDS BETWEEN SUMMER AND WINTER

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Global warming has accelerated the formation of thaw ponds in subarctic and arctic regions. These ponds are sources of greenhouse gases (GHG) to the atmosphere, and are net heterotrophic due to large terrestrial carbon inputs and high light extinction, which promote bacteria but limit primary production. Still much is to learn on carbon pools and transformations in this climate-relevent and abundant class of aquatic systems among the seasonss, especially in winter. We measured seasonal variations in the concentration and bioavailability of terrestrially derived dissolved organic carbon (DOC), and estimated

how this carbon is transformed to different heterotrophic carbon pools, including bacteria and zooplankton biomasses. Measurements of phototrophic carbon pools and productivity were also conducted. There was little difference in the concentration of DOC between sampling periods but the type of carbon changed from winter to summer. Winter DOC was less aromatic, indicating a small input of terrestrial compounds. Although summer DOC had a strong terrestrial signature, it was more biologically available. Bacteria production followed changes in DOC bioavailabilty, and was highest in summer. Phototrophic biomass in these ponds was equal to heterotrophic biomass but as the algae were mostly composed of mixotrophic species, it is likely that they used bacteria rather than solar energy as an energy source in such light-limited environment. Primary production represented 23% of the total pond productivity in summer in the epilimnion and merely 2% in the hypolimnion. No primary production occurred in winter due to the absence of light under the ice and snow. Carbon stable isotope analyses indicate that zooplankton in these ponds were using the phototrophic and possibly metanotrophic carbon sources rather than the terrestrial carbon sources. All our results point to a strong heterotrophic energy pathway where bacterioplankton dominate the production of new carbon in both seasons, explaining the observed high GHG emissions from thaw pond ecosystems.

TALL SHRUB TUNDRA VEGETATION AND DRIVERS OF CHANGE

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Vegetation changes in shrub tundra may have wide-ranging consequences, as this tundra type covers vast areas of the circumpolar arctic and holds climate regulatory functions. Tall shrubs are typically found in areas with favourable environmental conditions, such as in riparian habitats, and serve important ecological functions in northern ecosystems. Biodiversity associated with tall shrubs is often higher and distinctly different than in vegetation lacking shrubs, making riparian shrub vegetation important biodiversity hotspots in northern ecosystems. Tall shrub tundra vegetation, however, includes components labile to change. The shrubs have been shown to clearly respond to both abiotic and biotic environmental drivers. The shrub patches often have adjacent to them short-statured herbaceous vegetation, and the shrubs and the meadows form a two-state vegetation mosaic. Such tall shrub tundra vegetation is an important locus for current vegetation changes in the arctic, including shrub expansion. However, variation in tundra tall shrub plant communities and drivers of vegetation state are currently not fully understood.

We conducted observational and experimental studies in low-arctic Norway to target riparian tall shrub tundra, relating vegetation to biotic (i.e. herbivores) and abiotic (i.e. temperature) drivers of change. We found previously un-described compositional variation in tall shrub tundra vegetation. Moreover, we documented strong and rapid plant community responses to abundances of two key arctic herbivore types; small rodents and reindeer, and quantified the relative strength of summer temperatures and ungulates on large-scale tall shrub distribution and expansion potential. The previously unforeseen rate at which these plant communities responded to altered herbivore pressure suggests using tall shrub tundra as a bell-whether of change in low-arctic ecosystems. While many of the results clearly relate to herbivory or climate as drivers, some variation remains unexplained warranting future research focus on this highly dynamic part of tundra ecosystems. Our results suggest that in tall shrub tundra spatially variable biotic interactions are likely to modify forcing by climate, calling for an ecosystem approach when studying change in tundra ecosystems.

THE OVERLOOKED IMPORTANCE OF COMMUNICATION PROCESSES IN DISSEMINATING CONTAMINANTS RESEARCH TO INUVIALUIT

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Northerners continue to receive information about contaminants and the potential impacts on wildlife and human health, but years of considerable effort disseminating this complex information have resulted in only general awareness, and often confusion, about contaminants issues. This project investigates the

overlooked importance of perceptions of environmental risk communication in the assessment of message reception, comprehension, and compliance. Past communication work has focused only on message content (*what*) and target audience perceptions of the hazard itself while disregarding how audiences perceive the communication processes, such as communication methods (*how*) and communicators/ sources (*who*), which are the primary resources of information about a hazard. Therefore, the ways that risk communication is approached and carried out may be of significant importance to how an environmental hazard is perceived.

To address this knowledge gap, this project explores the value of understanding the role of communication processes among target audience members in the construction of messages and communication strategies about environmental health risks, such as long-range atmospheric and oceanic contaminants in Arctic communities. Specifically, it considers risk perceptions of contaminants and contaminants communication in the Inuvialuit community of Sachs Harbour, NT, using contaminants research conducted through the International Polar Year's Circumpolar Flaw Lead System Study, Phase II of ArcticNet, and the Northern Contaminants Program.

Additionally, the construction of the research process warrants further consideration. To best inform Northerners about contaminants research, the voices in the community need to be heard; it must not be assumed that the best way to communicate results to communities is known without consulting the community members themselves. Thus, we consider participants' knowledge and perceptions of contaminants research and how research is communicated to communities, and examine current communication methods used. From a community perspective, we discuss how contaminants research, using mercury as an example, can be communicated to communities in accessible, understandable, and relevant ways, and uncover the crucial roles that trust and relationships play in message construction, reliability, and retention.

AN ASSESSMENT OF KILLER WHALE ORCINUS ORCA RAKE MARK OCCURRENCE IN THE EASTERN CANADA-WEST GREENLAND BOWHEAD WHALE BALAENA MYSTICETUS POPULATION

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The killer whales' (*Orcinus orca*) increasing occurrence and residence time in the eastern Canadian Arctic is in part attributable to a decrease in sea ice extent associated with global climate change. This predator is known to prey on bowhead whales (*Balaena mysticetus*) of the Eastern Canada-West Greenland (EC-WG) population, but their population impact is unknown. In the present study, photographs of bowhead flukes from five regions (Cumberland Sound, Disko Bay, the Foxe Basin, Isabella Bay, and Repulse Bay) were analyzed to estimate the occurrence of rake marks (scars caused by killer whale dentition) in the EC-WG population; 10.2% of 598 identified whales bear rake marks. To date, this is the most accurate estimate for the EC-WG population. Findings indicate that Repulse Bay (Nunavut) and Disko Bay (Greenland) where primarily adult bowheads segregate seasonally have a higher rate of rake marks than the nursing groups of the Foxe Basin. Killer whale predatory events to younger whales may result in more successful attacks, leaving fewer calves and juveniles to be captured by photography. Long-living adult bowhead whales may also have greater time periods to acquire rake marks. More research is needed on Arctic killer whale feeding ecology, group size(s) and composition, as well as their seasonal and regional abundance(s) in the eastern Arctic to quantify their impact to EC-WG population recovery.

MODELLING SPATIAL VARIATION IN THE DENSITIES OF DIFFERENT AVIAN GUILDS IN THE NORTHERN ARCTIC ECOTONE

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A diversity of avian taxa breed throughout the Northern Arctic Ecotone of Canada including ducks, geese, shorebirds, passerines, gulls, terns, and guillemots. This ecotone contains a mosaic of rock, gravel, tundra, and water along with topographic variation, and each avian guild prefers habitat with different combinations of these features. Although the general habitat preferences of these birds are known, few attempts have been made to quantify spatial variations in the densities of each guild over a broad spatial scale. In this study we take advantage of high resolution satellite imagery to stratify the landscape into 9 different habitat types and extrapolate population densities of each avian guild across our study area among the Coxe Islands at the Northern tip of the Mellville Peninsula, Nunavut. Landscape stratification was based on different combinations of three indices: the Normalized Difference Vegetation Index, a measure of photosynthetic activity; the terrain ruggedness index, which is based on the standard deviation in elevation; and an index for the amount of standing fresh water. To determine the density of each avian guild within each stratum we employed distance sampling where randomly placed transects were walked and every species observed was recorded along with its distance and bearing from the transect. These data were used to calculate density taking into account sightability. Density estimates for each avian guild (passerines, shorebirds, marine birds, and geese) within each stratum were then extrapolated across the study area. Results from this study will be discussed with a focus on the implications of our results for the Arctic peregrine falcon, which relies on many of these species for prey.

FLYCATCHER: AN ALGORITHM FOR PROCESSING INSECT VISITATION DATA FROM TIME-LAPSE CAMERAS

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Arctic pollination biology is poorly understood, but may have influences on fruit and seed production in the arctic, as both plants and insects react to increased temperatures and longer growing seasons. Therefore, characterizing and understanding how these interactions change over time is important for understanding ecosytem responses to climate change. In recent studies of pollination biology, there has been a growing interest in automated techniques for observing plant-pollinator interactions. These methods have gained popularity because of the large amount of time and effort required to observe pollination interactions manually, as well as the relatively low cost of digital cameras and storage space. Several methods, such as motion-sensitive, time-lapse, or video observations of flowers have been used by researchers to observe insect visitation. Time-lapse observations generate large sets of images which can yield detailed information on visitation rates while minimizing storage space and power consumption, but must be manually processed to identify when insect visitation takes place.

I will present an image-processing algorithm implemented in MATLAB which has the potential to be used in a wide variety of time-lapse monitoring situations, both in pollination biology or similar camera-based behavioural studies. It uses a trained classification system to identify differences between images, splitting them into distinct categories of red-green-blue change. While this method does not completely remove manual observations, it will partially automate the process of identifying insects visiting flowers in large image datasets, and has the potential to provide fine scale monitoring over long periods of time. This algorithm is currently being tested on a large time-lapse photo dataset of flower observations from Alexandra Fiord, Nunavut, and some of the preliminary results will be shown.

RESEARCH IN ACTION: IMPROVING ACCESS TO UNIVERSITY EDUCATION IN THE CANADIAN ARCTIC: LEARNING FROM PAST EXPERIENCES, LISTENING TO THE INUIT STUDENTS AND DEVELOPING TOOLS AND POLICIES

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The goal of this communication is to present the results of an Action Research Project on Inuit participation in University education throughout Inuit Nunangat. This research is based on a survey conducted amongst Inuit students with university experience and focus groups conducted in Arviat, Inuvik, Iqaluit and Kuujjuaq. In addition, in-depth interviews were conducted with a selected sample of Inuit students. All the activities were conduced with Inuit researchers.

We will present results on the following activities:

1) A summary of Inuit students' needs and experiences with postsecondary programs or courses allowing a better understanding of educational paths and university successes from the point of view of the Inuit (based on findings from survey, interviews and focus groups)
The research team has also developed an action component in the research with two activities:
1) Building of different scenarios to improve access to university education for Inuit and Northerners in Inuit Nunangat through two workshops convening Northern education stakeholders in Ottawa and Kuujjuaq.
2) Creation of a website presenting Inuit students experience through short videos, providing information on programs and linking existing and potential Inuit students through an interactive forum.

This research provides evidence-based data on Inuit students' university experience and will promote a national discussion amongst providers of university programs in Inuit Nunangat, Northern institutions and Inuit organizations in order to develop a more coordinated effort in university program delivery and curriculum development.

This research is funded by ArcticNet and conducted in partnership with the Kativik School Board, Nunavut Arctic College and Nunavut Sivuniksavut.

PROCESSING OF HIGH RESOLUTION POLARIMETRIC SAR DATA TO SUPPORT MAPPING AND MONITORING OF ARCTIC ENVIRONMENTS

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Remote Sensing has the capacity to provide accurate high resolution information of the sea and land surface in an automated and standardized way. In particular satellites equipped with Synthetic Aperture Radars (SAR) enable regular mapping and monitoring. Their all-weather and day and night observation capability are important advantages in the Arctic due to high cloud coverage rates and low illumination during the winter period. Since the early 1990s a fleet of different SAR-sensors is in space providing a huge archive of EO data that can be utilized to assess changes that occurred over more than two decades.

Since then DLR participates in this development by operating the German Processing and Archiving Facilities of ESA's ERS-1 /2 and ENVISAT missions. In 2007 the German Earth Observation satellite TerraSAR-X was launched that provides high resolution SAR data. Since 2010 it is flying together with its twin satellite TanDEM-X in close formation enabling single pass interferometry. The primary mission goal is the generation of a global digital elevation model in outstanding quality and resolution that allows classifying the shoreline and land's topography at an unprecedented level of detail.

Beside the archiving, processing and provision of standardized level 1b SAR products DLR is engaged in the development of higher level products. In particular the utilization of polarimetric information and change detection techniques are focuses of such developments. The higher level products shall be developed and proved in collaborative application projects.

The proposed presentation shall provide information and ideas about the intended higher level products, their generation and provision and will be supplemented by exemplary products. The processing capability is DLR's contribution to a Canadian-German cooperation between Environment Canada (NWRC), the University of Wuerzburg and DLR. Application aspects of this collaboration are subject to a separate presentation by Tobias Ulllmann.

HIGH SCHOOL STUDENT-LED RESEARCH EXAMINING PEATLAND VEGETATION-PERMAFROST RELATIONSHIPS IN THE HUDSON BAY LOWLANDS, MANITOBA, CANADA

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Global climate models indicate that temperatures are rising, and as a result, permafrost active layer thickness (ALT) is expected to increase as the climate warms. Developing a model that relates ALT to vegetation and soil indicators will contribute greatly to our understanding of climate change impacts and will facilitate greater participation by citizen scientists in environmental monitoring. The objective of this research was to develop a model elucidating the relationships between changing active layer thickness, soil moisture, and vegetation cover

in the Hudson Bay Lowlands of Manitoba, Canada, by engaging students as citizen scientists. In this study, a selection of sub-arctic sites representing the eight most common fen and bog vegetation communities in the Churchill region were studied. Between 1999-2012, two 50m parallel transects were sampled at 2 m intervals at each site. At every interval, ALT was measured twice, using a steel probe inserted to the permafrost Within 1x1-m quadrates at each interval percent cover of all plant life and percent surface area of standing water were visually estimated, and water depth was measured. Percent cover of individual plant species was recorded within 1x1-m quadrats at two randomly selected quadrats within each transect. Analyses of n=3172 ALT measurements determined that mean ALT for fen communities (96.6 cm; SE = 1.5) was significantly greater than mean ALT for bog communities (57.2 cm; SE = 1.2); $p<0.001$. Logistic regression analysis of ALT as the dependent variable and vegetation cover types as independent variables using Akaike Information Criteria cumulative weights (w) to assess the relative importance of cover types determined that water depth (w=1.00), % lichen cover (w=1.00), % moss cover (w=0.95), and % tall shrub (w=0.88) were the most important predictors of ALT. Percent bare soil cover (w=0.36) and % medium height shrub cover (w=0.57) were the least important predictors of ALT. There was a significant inverse association between lichen cover (specifically *Cladina stellaris* and *Flavocetraria nivalis*) and ALT ($R2 = 0.252$, $p = 0.007$), particularly in sedge bulrush poor fen communities, where plots with lichen present (mean ALT = 75.5 cm) had significantly thinner ALT than sites with no lichen present (mean ALT = 85.1 cm). Notably, analysis of single-parameter and multi-parameter models indicated that % water cover alone (w=1.00) was more important than other models as a predictor of ALT. Ongoing analysis will help reveal relationships between ALT, vegetation, and environmental indicators, as well as provide a standardized annual sampling protocol to detect changes in ALT in response to climate change. This approach has effectively engaged 179 students so far in research design, hands-on field ecology, and data analysis. This student-led process has greatly inspired all participants, raising awareness for arctic ecosystems while effectively training young citizen scientists.

SATELLITE CHANGE DETECTION TECHNIQUES AND OBJECT-BASED ANALYSIS TO IDENTIFY PERMAFROST SLOPE DISTURBANCES AT CAPE BOUNTY, MELVILLE ISLAND, NUNAVUT

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Active layer detachments (ALDs) are a form of permafrost disturbance that represent translational landslides of soil, vegetation and other surface material in the seasonally thawed or thawing active layer. Factors attributed to the increasing occurrence of ALDs across the Arctic include changes to thermal, hydrological and geotechnical conditions, all of which can lead to slope failure. This study is based on an area of recent and well-documented ALD activity in the Canadian High Arctic where ground-based field mapping of disturbances was available. Extensive slope failures occurred at Cape Bounty during 2007/8 due to substantially higher than normal air temperatures accompanied by major rainfall events. These conditions resulted in thickening of the active layer, slope destabilization and the formation of a large number of ALDs. This study used IKONOS satellite imagery acquired pre- and post-disturbance (2004, 2010) in combination with vegetation index differencing and object-based analysis, to semi-automatically identify landscape change associated with ALDs to determine the suitability of the approach for mapping permafrost disturbances. Additional questions investigated the relationship between ALD morphology and size on detection accuracy.

A Normalized Difference Vegetation Index (NDVI) was computed for each of the two dates and then subtracted generating a NDVI difference map. Using areas where vegetation was removed as a proxy for the presence of ALDs, a multi-resolution segmentation algorithm (eCognition software, Trimble) was used to threshold the NDVI difference map into objects to demarcate regions of similarity (potential ALDs). To discriminate between disturbed and undisturbed zones a NDVI threshold was applied removing false positives. The thresholded image was then verified with a disturbance inventory collected during the 2009 and 2010 field seasons. It is important to note that this methodology was not optimized with field-based information but instead maintained a semi-automatic detection approach to maximize the applicability of this method where field verifications are not possible.

These methods were successfully applied to the study area achieving 43% detection accuracy when identifying all ALDs. Morphometric characteristics were used to separate

ALDs into two forms, elongate and compact and individual accuracies were assessed. Elongate ALDs, with a detection accuracy of 67%, are typically more destructive, moving substantially more material downslope and over longer distances altering hydrologic connectivity and posing a greater risk for infrastructure. By contrast, compact ALDs are associated with minimal downslope sliding distances (<1 m to several metres) and result in little to no extension in the scar zone and thus limited downslope material movement. The method used in this study detected only 7% of compact disturbances indicating that morphology and size are important variables when detecting ALDs.

These results collectively show promise for the semi-automated detection of slope disturbances in permafrost settings. Recognition and classification of disturbances is an important primary task for assessing potential risk during the planning of infrastructure, and is also useful to determine potential changes to ecosystems and surface water quality. Additionally, this semi-automated detection approach could provide a means to complete large-scale assessments of Arctic regions by identifying areas with disturbance and susceptibility to permafrost degradation.

CURRENT ICE MOTION OVER PENNY ICE CAP, BAFFIN ISLAND, NUNAVUT

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Canadian Arctic glaciers and ice caps have experienced accelerated mass loss within the last decade. Satellite gravimetry measurements suggest that the glaciers on southern Baffin Island are currently the second highest contributor to global sea level rise outside of the major ice sheets, although little is currently known about the detailed patterns on the ground. Here we focus on the dynamics of Penny Ice Cap, the southernmost large ice cap on Baffin Island (~66°N). While a number of studies have quantified surface mass losses from the ice cap, the velocity structure of the ice cap is largely unknown. In this study velocities over Penny Ice Cap are computed using Radarsat-2 satellite imagery to provide a first estimate of ice cap-wide velocities and quantify ice loss due to calving into the ocean. Satellite-derived velocities are compared to in-situ measurements of ice motion and ice flux is calculated at Coronation glacier for which ice thickness data is available. The velocity map generated provides a key input for modelling the glaciers' future contribution to sea level rise under a warming climate.

ASSESSING SPATIOTEMPORAL VARIABILITY IN THE MESOZOOPLANKTON USING A NEWLY DEVELOPED PLANKTON IMAGING SYSTEM: FIRST RESULTS FROM THE BAYSYS 2012 EXPEDITION TO HUDSON BAY

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Arctic mesozooplankton transfers the bulk of energy and carbon from primary producers to the vertebrate fauna of the Arctic Ocean (fish, marine mammals, seabirds). The traditional methods used to capture zooplankton (i.e. nets) integrate or roughly stratify the water column, and do therefore not provide the necessary resolution for studying the fine-scale vertical distribution of key zooplankton components. In particular, zooplankton often form thin layers over only a few centimeters of the water column, which are critically important for the dynamics and fate of primary production, as well as for prey supply of upper trophic levels. The lack of resolution from traditional zooplankton samplers can be overcome with devices such as the newly developed "Lightframe On-sight Key species Investigation" (LOKI) system, capable of in situ optical imaging of zooplankton species. This device allows to determining the exact vertical distribution of organisms in the water column, as well as corresponding environment data (e.g. T, S, Chl *a*) by taking photographs of each particle that flows through the device. We will use the LOKI to assess the spatiotemporal variability in the coupling between primary and secondary production in the Canadian Arctic Ocean. Here we provide a first evaluation of the LOKI based on our experiences during the Hudson Bay cruise as part of the BaySys 2012 expedition in September. Furthermore we will give an outlook on the next steps of the project that will include the development of extensive databases for the automatic taxonomic classification of zooplankton using machine learning algorithms and the determination of vertical abundance and biomass profiles in order to quantify the role of these organisms in controlling primary production.

SPATIAL AND TEMPORAL PATTERNS OF NET ECOSYSTEM EXCHANGE OF CARBON DIOXIDE AND ECOSYSTEM RESPIRATION AT THE CAPE BOUNTY ARCTIC WATERSHED OBSERVATORY, MELVILLE ISLAND, NUNAVUT

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While studies across latitudinal gradients have shown decreasing values of net ecosystem exchange of carbon dioxide (NEE) in more northern tundra ecosystems, little is known about the factors that regulate NEE in the higher latitude Arctic systems. We have been exploring the spatial and temporal controls over NEE at the Cape Bounty Arctic Watershed Observatory (CBAWO) since 2008. NEE was measured at the ecosystem-scale using the eddy covariance technique in 2008 - 2010 and 2012 in an area of relatively homogeneous mesic tundra, which comprises roughly 40% of the vegetation cover in the large watersheds being studied at CBAWO. In each year, NEE measurements were started before snowmelt and continued until at least late July, the approximate end of the growing season. In conjunction with carbon flux measurements, we also monitored air and soil temperature, radiation, precipitation, soilmoisture, and thaw depth. Over the four summers, average June air temperature varied little (2.6 to 3.5 degrees C) while July air temperature varied from 6.6 to 9.0 degrees C, giving rise to significant differences in NEE across the different years. In July 2008, June temperatures were slightly warmer, and July temperatures were slightly above average; NEE was -6.3 g C m^{-2}. While our tower flux measurements provide a good measure of NEE for mesic tundra, they do not measure carbon exchange in polar semi-desert areas and wet sedge tundra. Static chamber measurements during previous growing seasons suggest that these systems are relatively strong sources and sinks for carbon, respectively.

In 2012, we deployed eight ADC Automated Carbon Exchange (ACE) systems to help quantity the contribution of these other vegetation types to the net carbon balance. Four chambers were deployed with opaque chamber lids, and four with transparent lids. Measurements of NEE (in the transparent chambers) and ecosystem respiration (opaque chambers) were made every 30 minutes from early June to late July. Interestingly, July 2012 was the warmest July on record since we started measurements of NEE at CBAWO (8.7 degrees C, not including 2011 (9.0 degrees) when we did not make flux measurements). Ecosystem respiration showed a strong diurnal pattern most likely related to variation in soil temperature. Full growing season data from the ACE systems will be used to partition ecosystem respiration from the NEE measurements made at the flux tower, and allow us to explore in more detail the environmental factors influencing both spatial and temporal variations in ecosystem respiration with much greater temporal frequency than we could do with our previous static chamber measurements.

GLOBAL WARMING EFFECTS ON ARCTIC AND SUBARCTIC UNDERWATER SOUNDSCAPES AND MARINE MAMMAL FREQUENTATION FROM AN ACOUSTIC OBSERVATORY

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The effects of the steady recession of the Arctic ice cap and the associated lengthening of the ice-free season on the underwater soundscape and the presence of marine mammal species was estimated from the analysis of multi-year time-series of broadband acoustic recordings at 50-m depths in eastern Beaufort Sea and southeastern Hudson Bay in 2005-2007. An ambient noise extraction algorithm was developed to obtain the annual time-series of the natural soundscape over a 0-4 kHz bandwidth, exclusive of transient sounds due to biological or physical sources. During winter, the ice cover lowers by ~10 dB the envelope of the ambient noise spectra below 1 kHz, by isolating the water mass from noise generated by wind and precipitation during the open water season. The expected rapid shrinking of the ice cover in coming decades will alter the exceptionally silent ambient soundscape of the Arctic Ocean and Subarctic seas, to which many arctic species are adapted, through an larger exposition to natural surface

sources, followed eventually by increased destination and intercontinental shipping.

The same acoustic time-series were used to monitor the timing of the frequentation by vocal marine mammal species in relation with the timing of the ice cover, which provides a seasonal solid platform to pagophilic species, such as seals, or acts as a moving barrier limiting the free access to the habitat for whales. The results show a close association of beluga, bowhead and bearded seal call densities with the first signs of ice breakup in spring, evidencing the action of the seasonal ice cover on the utilisation of the habitat by these species. Such PAM (passive acoustic monitoring) observatory appears as an efficient means for systematically tracking the expected changes in the utilisation of the Arctic and Subarctic ecosystems due to the lengthening of the open water season.

GLACIAL ISOSTATIC ADJUSTMENT IN NORTHERN CANADA: IMPROVING INNUITIAN AND LAURENTIDE ICE SHEET RECONSTRUCTIONS USING RELATIVE SEA-LEVEL AND GPS DATA

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An extensive set of relative sea-level (RSL) curves is available for northern Canada, and in this study we use these data in a glacial isostatic adjustment (GIA) model to improve knowledge about the regional ice sheet history. As a starting GIA model, we use the ICE-5G ice sheet reconstruction, and an Earth model with a viscosity profile that approximates VM2. First, RSL predictions using ICE-5G/VM2 are compared to 130+ RSL curves throughout the entire region. The fit of the reference model to RSL data is variable, but regional trends of RSL over- and under-prediction are evident. Accordingly, the area as a whole is divided into five sub-regions to allow each region of the GIA model to be modified based on the overall fit of the model with the data. For example, RSL is over-predicted west of Hudson Bay, while RSL is under-predicted on the Boothia Peninsula and the south-western Canadian Arctic Archipelago (CAA). This observation suggests that the ice load may need to be reduced and increased, respectively, in those two regions. To improve the ice model, we compute the goodness of fit between the model and the data for a range of ice load scaling factors. The Hudson Bay region misfit is minimized for scaling factors between 0.75-0.8, suggesting that a 20-25% load reduction is necessary for the central Laurentide Ice Sheet. This change to the ice thickness improves the fit by more than 50% compared to the reference model. Conversely, the misfit on the Boothia Peninsula and in the south-western CAA is minimized for ice load scaling factors of 1.15-1.2. Similarly, we consider three other sub-regions: south and north Baffin Island, and the Queen Elizabeth Islands (QEI). On southern Baffin Island, RSL is under-predicted by the reference model, indicating the ice thickness may need to be increased. The spatial pattern of the fit of the reference model to the data is more complex on northern Baffin Island, suggesting that fewer, but more detailed, changes to the ice load are required. The final sub-region, the QEI, is approximately coincident with the boundaries of the Innuitian Ice Sheet (IIS). Ice cover across the QEI in the reference ICE-5G model is discontinuous, and trends of RSL under-prediction on Ellef Ringes, Ellesmere, and Devon Islands suggest thicker or more extensive ice is needed. We therefore include a more regionally continuous representation of the IIS in the ice sheet reconstruction. We also compare predicted present-day vertical land motion rates to available GPS observations in northern Canada. At two locations west of Hudson Bay, the predicted uplift rate for the preferred GIA model is improved to within 0.5 mm/yr of the observed rate, compared to a 2+ mm/yr difference for the reference model. The use of both RSL data and vertical GPS rates as model constraints allows a better understanding of the ice sheet history and present-day uplift in northern Canada. Particularly at locations without constraint from GPS, improvements to estimates of GIA-induced vertical land motion are needed for sea-level projections in northern communities.

LATITUDINAL COMPENSATION IN GROWTH AND METABOLIC RATE OF CANADIAN YOUNG-OF-THE-YEAR ARCTIC CHARR

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Arctic charr, *Salvelinus alpinus*, exhibit the widest natural distribution of all salmonids, extending from northern New England (43˚N) to northern Ellesmere Island, NU (83˚N) in North America. Acquiring an understanding of how Arctic charr populations vary along their present latitudinal gradient is vital to modelling their response to predicted rises in global mean temperature. The existence of countergradient variation (CGV), defined as genetic variation that counteracts the negative influences of physical environment thereby minimizing phenotypic variability along a gradient, has been debated in many ectothermic species. CGV in growth and metabolic rate were examined among young-of-the-year (YOY) Arctic charr populations along a ~27˚ latitudinal gradient in central and eastern North America. To assess CGV in growth, fork lengths were standardized by the thermal opportunity for growth based on experienced temperatures derived using otolith thermometry. Metabolic rates were inferred from otolith and muscle tissue carbon stable isotopes using a mixing model. Results supported CGV in both growth and metabolic rate, where northern populations demonstrated faster growth and higher metabolic rates compared to southern populations. Comparison of relationships between fork length and metabolic rate within regions were largely consistent with CGV in metabolic rate. Results suggest that differences in growth on regional and latitudinal scales may be attributed to intrinsic differences in metabolic rate. High metabolic rates in salmonids have been associated with social dominance and aggression, contributing to enhanced establishment of territories, increased prey acquisition and growth. We suggest that reduced predation risks in the north have promoted high metabolic rates. CGV is thought to have relevance in predicting the response of organisms to climate variability and change. Where poleward migrations of species, populations and genotypes are predicted, northern individuals may have a competitive advantage owing to a higher capacity for growth and more aggressive behaviour. Under limited food or high predation scenarios, however, northern individuals may be at a disadvantage. Elucidating the specific contributions of phenotypic plasticity and genetic variability to the observed latitudinal compensation gradient will be critical to more accurately predicting the responses of Arctic charr to climate change necessary for the adaptive, sustainable management of stocks in many parts of the geographic range.

QUANTIFYING CONTAMINANT LOADINGS, WATER QUALITY AND CLIMATE CHANGE IMPACTS IN THE WORLD´S LARGEST LAKE NORTH OF 74° LATITUDE (LAKE HAZEN, QUTTINIRPAAQ NATIONAL PARK, NORTHERN ELLESMERE ISLAND, NUNAVUT)

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Human activities have elevated global atmospheric concentrations of greenhouse gases to levels that have resulted in an unequivocal warming of the Earth's climate. This is especially true in the high Arctic, where in the past century average annual temperatures have increased at almost twice the global rate. Human activities have also resulted in unprecedented releases of contaminants to the environment, many of which make their way to the high Arctic via the atmosphere. Unfortunately, in many regions of the high Arctic, it is largely unknown how much change has already occurred since the beginning of industrialization and what the current state of Arctic ecosystem health is in general. We have begun a Northern Contaminants Program/ArcticNet/Parks Canada research partnership to monitor contaminant loadings, water quality and climate change impacts (e.g., levels of productivity) in the world's largest lake north of 74° latitude (Lake Hazen, Quttinirpaaq National Park, Northern Ellesmere Island, Nunavut). In late May 2012, we collected water samples at 15 depths throughout the deepest part of the water column (270 m) in Lake Hazen for analyses of a suite of physical, water chemistry (e.g., nutrients, cations, stable isotopes, dissolved O_2, dissolved inorganic carbon, pCO_2, N_2O, CH_4, etc.) and contaminant (e.g., mercury) parameters. We also collected 9 sediment cores from 3 different locations in the deep zones of Lake Hazen. Sediment core analyses will provide a long-term record of environmental change, including trends in long-range atmospheric transport and deposition of contaminants, rates of glacial melt in the Lake Hazen watershed, and changes in algal community composition over time in Lake Hazen. We will present some of our interesting emerging results, which will: 1) provide a detailed baseline dataset from which all future water monitoring of Lake Hazen can be compared to, and

2) help assess impacts of climate warming and contaminant deposition in the high Arctic.

COMPARATIVE STUDY OF IMPACT OF CLIMATE CHANGE ON THE CANADIAN ARCTIC AND HIMALAYAN GLACIER DYNAMICS

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Glaciers have been retreating worldwide since the end of the Little Ice Age (1550- 1850), but in recent decades they have begun melting at very high rates. The prolonged periods of day and night over the North and South polar regions are not existing in the Himalayan region. But the outflow of cold from the Himalayas produces a steeper temperature gradient due to their extremely high altitude and proximity to the highly energetic tropical environment. Outside the polar region, Himalaya has the maximum concentration of glaciers. 9.04% of the Himalaya is covered with glaciers, with 30-40% additional area being covered with snow. The formation of glaciers in the geographically and climatically different environments of Arctic and Himalayan glacier ice itself accounts for the varying characteristics of ice.

This study is an attempt to compare the response of the Glaciers to the Climate Change located in the two entirely different Glacial regions i.e. Arctic and Himalayan regions. Himalayan region has a highly sensitive ecosystem. The Himalaya is the highest but the youngest mountain belt of the earth running in actuate shape for about 2500 km. It has more than 90 peaks above 6000 m and contains about 50% of all glaciers outside of the polar environments. Weather patterns are becoming more unpredictable and extreme dry seasons become dryer and wet seasons wetter. The loss of glaciers from the greater Himalaya and Tibet is dramatically affects the global air circulation and cause severe climate alteration in the region bringing more disasters. Himalayan glaciers are retreating at rates ranging from 10 to 60 m per year, many small glaciers (<0.2 sq.km) have already disappeared. Vertical shifts (permanent snow line) as great as 100 m have been recorded during the last fifty years. Observed changes like more frequent avalanches, more crevasses and exposed rock faces where there used to be snowfields earlier. Glaciers in the eastern and central regions of the Himalaya appear to be retreating at accelerating rates, while glaciers in the western Himalayas are more stable and could be growing.

Satellite data showed sea level had risen by an average of 3.3 mm/year between 1993 and 2006. In Canadian Arctic region, climatic impacts on permafrost are complicated by local variations in orography, moisture and surface type. With future warming, it is inevitable that large areas of permafrost will eventually disappear. The flow of large Arctic outlet glaciers is fast and variable, with speeds of several hundreds of metres a year being common. Ice thickness changes resulting from short-term, local redistribution of glacier mass are differentiated from mass-balance trends due to climate forcing. The available records of Canadian Arctic climate, including instrumental data, visual observations and various sources of long-term proxy data demonstrate that climatic variability in the Canadian Arctic is very much greater on time scales of decade or longer than is the case for year to year variations, which differ little from inter-annual variations recorded at low latitude.

ARCTIC MARITIME BOUNDARY DISPUTES: LESSONS AND OPPORTUNITIES

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In 2011, Russia and Norway concluded a boundary treaty for the Barents Sea, where the two countries had previously disputed 51,000 nautical square miles of oil-and-gas rich seabed. This leaves just one significant unresolved Arctic maritime boundary: in the Beaufort Sea between the United States and Canada. The Russia-Norway treaty, and the negotiations leading to it, offer important lessons to the United States and Canada. For instance, the treaty creates a joint hydrocarbon regime for any oil and gas reserves that straddle the new boundary. This panel will bring the leading experts on the Russia-Norway treaty to Canada where they will interact with leading Canadian and US experts, in a focused effort to promote cross-fertilization of the latest best practice in Arctic boundary negotiations.

LAND COVER CHARACTERIZATION OF ARCTIC ENVIRONMENTS BY MEANS OF POLARIMETRIC SYNTHETIC APERTURE RADAR (SAR) AND DIGITAL ELEVATION MODEL (DEM) DATA

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Remoteness, inaccessibility and circumference of the arctic pose a challenge to derive continuous and area wide information of the earth surface and its temporal dynamic. With respect to expected changes in the arctic eco- and geosystem, forced by changing climate conditions, remote sensing imagery and remote sensing image analysis techniques can aid identification and quantification of the present state and occurring changes. In special active imaging synthetic radar systems (SAR) are suitable for monitoring of arctic environments, since the operation is independent from insolation or shadowing of clouds. SAR data may therefore be acquired with constant quality during the whole year, even during the winter.

Sensors of contemporary space borne radar platforms - such as Radarsat 2 (R2), TerraSAR-X (TSX) or TanDEM-X (TDX) - are capable to acquire SAR data with high spatial resolution of large areas with one single acquisition. These sensors can thereby measure polarimetric radar data (PolSAR) by coherently changing the state of polarization of the emitted or received electromagnetic wave. The application of PolSAR is one of the primary ways to estimate the type of backscatter of a target, to relate this information with the type of coverage and therefore to describe the land surface in a physical way.

Beside this the helix orbit configuration of TSX and TDX allows to preform single-pass SAR interferometry (InSAR), which is used to generate a three-dimensional global digital elevation model (DEM) with a spatial resolution of about 12 meter and a vertical accuracy of 2 meter. Availability of this DEM, processed by the German Aerospace Center (DLR), is scheduled for 2014. The elevation data can be used to characterize the morphology of a landscape by derivation of topographic model features, for example slope, aspect, or convexity.

Objective of our work is to develop higher level products of PolSAR and DEM data that abet the characterization and accurate classification of arctic surface features for large areas. For this purpose we show 1) different methods, how to derive polarimetric information of copolarimetric SAR data in an optimized way, 2) first outcomes from numerical topographic analysis and 3) preliminary results from combined PolSAR and DEM classification for test sites located on Banks Island (Beaufort Sea, Northwest Territories) and in the Mackenzie Delta Region (Beaufort Sea, Northwest Territories). The evaluation of these results is based on sample data collected during a ground-truth campaign in 2012.

Presented project is a Canadian-German cooperation of NWRC, DLR, AWI and the University of Wuerzburg. The work is in addition funded by the Elite Network of Bavaria within the Framework of the Individual Elite Graduate Program.

THE 2009 NORTH WATER ANOMALY: MECHANISMS OF ARCTIC AMPLIFICATION

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Arctic amplification is the observation that near surface air temperatures in the Arctic are increasing more rapidly than the global average in recent decades. Although anthropogenic climate change is considered the main driver behind the phenomenon, the underlying mechanisms and their relative importance remain a matter of debate. Changes in atmospheric and oceanic circulation, influences of cloud cover and water vapour, as well as the diminishment of snow and sea ice, figure prominently in Arctic warming discussions. In 2009 an atypical ice configuration prevented the transport of multiyear ice from the Arctic Ocean into Baffin Bay. The Nares Strait ice arch resulted in record low ice conditions in northern Baffin Bay in June 2009, which was followed by very high regional sea surface temperatures (SSTs) in July. This research shows that reduced surface albedo and enhanced solar insolation, both proposed mechanisms of Arctic amplification, were factors in the genesis of the SST anomaly. The increased sensible heat imparted to the upper ocean during this time may have contributed to subsequent record high surface air temperatures in the region.

SEASONAL CHANGES OF CHROMOPHORIC DISSOLVED ORGANIC MATTER (CDOM) QUALITY: A COMPARISON OF LARGE ARCTIC RIVERS

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Large watersheds surrounding the Arctic basin contain ~ 50% of the global soil organic carbon and deliver over 10 % of the annual global river discharge to the world's ocean, yet little is known regarding seasonal fluctuations in the quantity and quality of terrigenous dissolved organic matter (tDOM). Given the pace of climate change in the Arctic, a good constraint on such fluctuations is paramount to understand the role that a warming climate may play for tDOM inputs into the Arctic Ocean and the global carbon budget. To better understand such changes the optical properties of colored DOM (CDOM) were studied in five large Arctic rivers over several seasonal cycles as part of the PARTNERS project. Based on the optical parameters determined during this study, peak discharge CDOM has a higher molecular weight, is predominately aromatic in nature, and is largely derived from fresh terrestrial plant material. During base flow the CDOM pool shifts to a lower molecular weight, is less aromatic, and has a greater microbial imprint, particularly in the Mackenzie River. Differences in CDOM quality between the rivers could be explained by differences in their individual watershed characteristics, where an abundance of lakes resulting in longer residence times likely govern the higher microbial imprint observed in the Mackenzie. This may be important in a warming climate where increased precipitation rates and permafrost erosion will likely lead to a higher proportion of open water within a watershed with longer DOM residence times, allowing for longer exposure times to microbial and/or photochemical processes.

TOTAL AND METHYLATED MERCURY IN THE BEAUFORT SEA: THE ROLE OF LOCAL AND RECENT ORGANIC REMINERALIZATION

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Mercury, especially monomethylmercury, is a contaminant of concern in Arctic marine ecosystems due to its ability to biomagnify and its neurotoxicity. Monitoring since the 1970s has indicated that total and methylated mercury concentrations in Arctic top predators such as belugas and seals frequently exceed the safe consumption limit for humans, raising concerns over risks to Northern people who consume these species, and to the species themselves. While extensive studies have been conducted on mercury in the Arctic's atmosphere and biota, far less is known about the distribution and dynamics of mercury species in the Arctic Ocean. Here we present vertical profiles for total mercury (Hg_T) and total methylated mercury ($MeHg_T$; sum of monomethylmercury and dimethylmercury) from the Beaufort Sea of the Arctic Ocean at locations with differing sea ice conditions. The concentration of Hg_T ranged from 0.40 to 2.9 pM, with a surface enrichment that can be attributed to a combination of sea ice-modified atmospheric deposition and riverine input. The concentration of $MeHg_T$ ranged from <0.04 to 0.59 pM, with a sub-surface peak occurring at the same depth as a nutrient maximum with lower dissolved oxygen which is consistent with the recent findings in the Pacific Ocean, Southern Ocean, and Mediterranean Sea. However, unlike the interior ocean regions, the nutrient maximum in the Beaufort Sea is predominantly an advective feature produced over the Chukchi Shelf. Based on the short lifetime of monomethylmercury in seawater, we propose that the $MeHg_T$ profile in the Beaufort Sea reflects the local, short-term remineralization of labile organic matter, and not the larger signal of organic remineralization advected from the Chukchi Sea in the halocline. The finding that $MeHg_T$ is produced locally, reflecting recent strength of organic matter cycling, not only explains wide variance in $MeHg_T$ in seawater and biota over time and space, but also implies that $MeHg_T$ could be used as an indicator of the recent export flux of labile organic matter.

IDENTIFYING INDICATORS FOR MONITORING ARCTIC MARINE BIODIVERSITY IN CANADA

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Arctic marine biodiversity is under growing pressure from climate change and resource development, among other stressors. Under the Arctic Council, the Conservation of Arctic Flora and Fauna (CAFF) working group has agreed to coordinate efforts to detect and understand

long-term change in Arctic marine ecosystems and key biodiversity elements. Arctic Council ministers formally endorsed the Circumpolar Biodiversity Monitoring Program (CBMP)-Marine Plan at their May 2011 meeting in Nuuk, Greenland. The goal of the CBMP-Marine Plan is to improve our ability to detect, and understand the underlying causes of, long-term changes to Arctic marine ecosystems as well as develop authoritative assessments of key elements of Arctic marine biodiversity. Overall, the intention is to inform decision making regarding responsible development and conservation in key marine regions of the circumpolar Arctic.

As an initial step towards understanding changes occurring to Arctic marine biodiversity, the CBMP-Marine Plan calls for the construction of marine biodiversity baselines for indicators of sea-ice biota, plankton, benthos, marine fishes, seabirds, and marine mammals. In Canada, the CBMP-Marine Plan suite of indicators was evaluated to identify which exhibit the greatest potential for monitoring changes in Canadian Arctic biodiversity, based on current or existing information and monitoring programs. Indicator lists have been recommended for each trophic level, and are accompanied by a discussion about sources of uncertainty, and sources of data. In a few instances, different indicators than those found in the CBMP-Marine Plan were recommended. Further work is recommended, including the need to evaluate the ability of the indicators to detect the signal from the noise, and real change from natural variability, using the available data. Also, although TEK was not explicitly addressed in the CBMP-Marine Plan, it is an essential source of knowledge in the Canadian Arctic and should be incorporated in any future Canadian effort to monitor Arctic marine biodiversity.

ARCTICNET'S SCHOOLS ON BOARD PROGRAM - FROM SHIP TO SHORE; ARCTIC FIELD EXPERIENCES FOR HIGH SCHOOL STUDENTS AND TEACHERS

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Schools on Board is a scientific outreach program of ArcticNet, a Canadian led international network of scientists and researchers conducting climate change research in the Arctic. The program provides both authentic and simulated science experiences to high school students and teachers from across Canada. The goal of the program is to communicate ArcticNet's efforts in arctic climate change research, increase awareness and knowledge of the changes in the Arctic, and to inspire the next generation of researchers and scientists.

Highlights of the program include a ship-based field program where each year a small team of students and teachers join the team of scientists on board the CCGS *Amundsen*. On board the ship, scientists deliver presentations and demonstrations, facilitate group discussions, oversee science experiments, and facilitate hands-on fieldwork experiences. In addition to the field program, Schools on Board co-hosts an Arctic Climate Change Youth Forum (ACCYF) with a high school in conjunction with a national or international meeting. This event is organized by a student planning committee and is held every two years. The ACCYF provides a mechanism for high school students to learn and voice their thoughts and opinions about Arctic issues. Schools on Board also promotes scientific outreach within the ArcticNet science community by providing guidance and information to graduate students to conduct their own outreach initiatives and facilitating connections between them and schools.

This presentation will provide an overview of Schools on Board current programming and highlight its impact and importance. Key components of the program that make it successful will be shared. This presentation will also include an introduction to 'Schools on Tundra', a pilot field program scheduled to take place in 2013. This program is being planned in partnership with Churchill Northern Studies Centre and will provide new, exciting learning opportunities for high school students and teachers.

CHANGES TO THE PETERSEN ICE SHELF AND EPISHELF LAKE, NORTHERN ELLESMERE ISLAND, SINCE 2005

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Petersen Ice Shelf is a remnant of the Ellesmere Ice Shelf that formed 4000 to 5500 yrs BP, and had an area of 48.40 km^2 in 1959. The ice shelf remained stable until 2005, when it had its first large-scale calving event, resulting in a loss of 8.07 km^2. This break-up occurred in tandem with the complete loss of the nearby Ayles Ice Shelf and the loss of multi-year landfast sea ice (MLSI) that previously bordered the front of the Petersen Ice Shelf

and provided a buffer from the effects of wind and waves. Based on backscatter analysis of Radarsat-1 imagery during the time of the break-up, a channel opened between the ice shelf and the coastline, causing the epishelf lake (a freshwater layer dammed behind the ice shelf but underlain by marine water) to drain, resulting in the loss of this unique freshwater ecosystem. Since the 2005 drainage event an ephemeral region of freshwater had formed at the back of the ice shelf, but backscatter analysis and field measurements (conductivity profiles and ice cores) have confirmed this region is now dominated by sea ice. The reformation of the epishelf lake has been hindered by ice break-up, open water events and the presence of a drainage channel between the ice shelf and the southern coast of the bay.

Since 2005 the Petersen Ice Shelf has undergone two additional break-up events in summers 2008 and 2011, resulting in an area of 24.81 km^2 in spring 2012. According to ground penetrating radar (GPR) measurements conducted in May 2011, the ice shelf has a mean thickness of 29 m, with the thickest areas (>100 m) occurring at the front of tributary glaciers feeding in from the north, and thinner regions (<20 m) occurring at the back of the ice shelf and along its southern extent (adjacent to the former epishelf lake area). These ice thickness measurements were combined with surface velocities derived from speckle tracking to reveal a present day area-averaged input of 7.89 to 16.96 cm yr^{-1} from the tributary glaciers. This input is counteracted by a mean surface ablation of 1.31 m yr^{-1} (between 2011 and 2012), suggesting strongly negative mass balance conditions on the ice shelf. Based on these past and present observations it is unlikely that Petersen Ice Shelf will continue to persist long into the future, or that the epishelf lake will reform.

HYDRO-ECOLOGICAL RESPONSES OF ARCTIC UPLAND LAKES TO A CHANGING CRYOSPHERE

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A growing number of national and international monitoring, research and scientific assessment efforts focusing on the Arctic (i.e., Arctic Climate Impact Assessment (2005), International Polar Year (IPY 2006-10); the Arctic Report Card (NOAA 2011); the Snow, Water, Ice, Permafrost Assessment (AMAP-SWIPA 2012)) are providing increasing evidence that the region is being significantly altered and highly susceptible to the effects of a rapidly changing and increasingly variable climate. Over the past six years have been the warmest period recorded in the Arctic, the extent and duration of snow cover and sea ice have decreased across the Arctic, and the southern limit of permafrost has moved northward in Canada and Russia (SWIPA 2012). Such observed and further projected changes/shifts in climatic regimes in the Arctic will have far-reaching first- and second-order impacts on the hydrology and ecology of northern/Arctic freshwater ecosystems. Freshwater systems and related hydro-ecological processes are particularly sensitive to changes in climate and cryospheric regimes. Moreover, hydrological and ecological processes may change either gradually or in an abrupt manner when environmental / ecosystem thresholds are exceeded.

The lake-rich landscape east of the Mackenzie River Delta, NWT provides a unique opportunity to assess current and projected impacts of climatic and cryospheric change in the region. Large-scale permafrost degradation (i.e., increased depth of seasonal active layer and/or shoreline thermokardst slumping) is predicted to increase with the effects of climate warming, along with enhanced addition of geochemical loadings (e.g., carbon, nitrogen, phosphorus) to the freshwater environment. In addition, changes in the timing and duration of lake-ice characteristics in conjunction with altered landscape geochemical loadings are projected to dramatically affect under-ice and open- water oxygen regimes, 1^o and 2^o production relationships, and carbon dynamics.

Under ArcticNet, we have been conducting a series of integrated hydrological and ecological field and experimental studies assessing the impacts of landscape and lake-ice related cryospheric changes on the hydrology, geochemistry, and food web responses of upland Arctic lakes, and have been testing new technologies for monitoring freshwater lakes systems in the North. In this presentation, we will discuss, integratively, our key findings to date and provide an update on our new satellite-controlled multi-sensor buoy and instrumented mooring system for monitoring lake-ice and related water quality parameters. Insights into future program components currently being planned / implemented will also be discussed.

WHAT KILLED THE CARIBOU? A CARIBOU SNOW INVESTIGATION (CSI)

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This paper will both re-visit and explore the reasons behind the decline of caribou on Bathurst Island in the mid-90's. Several years ago, Miller and Barry (2009-*Arctic*, 62:175-189) suggested that their demise was due to exceptional snowfall or possibly freezing-rain and basal ice formation. Having no access to climate data from Bathurst Island at the time, they relied heavily on climate data from Resolute Bay, Cornwallis Island for their analysis, a distance of about 145 km away. Since that study, we have undertaken extensive snow survey work in the middle of Bathurst Island at Polar Bear Pass (75°43'N 98°40'W) covering a range of ground (slopes, wetland, valleys, plateau). We have also have examined the long-term climate data from an automatic weather station (AWS) which was initially placed at this central location in the mid 80's by Claude Labine (Campbell Scientific, Canada). Based on our snow and limited climate data (there are gaps in the record) and recent articles exploring the loss of arctic ungulates (caribou/muskox) from other polar countries, I, as an arctic hydrologist formulate a few other ideas of what may have triggered the kill-off of caribou on Bathurst Island.

EXPERIMENTAL WARMING INCREASES TUNDRA PLANT AND SOIL C, N, AND P POOLS, WITH DISPROPORTIONATE EFFECTS OF BETULA GLANDULOSA AND ERIOPHORUM VAGINATUM

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Arctic tundra vegetation biomass has been increasing over the past several decades in correlation with climate warming. Meanwhile, soil nutrient availability has been projected to increase with climate warming, which would strongly contribute to increases in vegetation biomass. Nonetheless, warming experiments have not consistently demonstrated effects on soil nutrient availability. In order to more accurately predict vegetation responses to warming and its potential non-linear feedbacks, it is important to understand the effects on both plant and soil nutrient pools, as well as the underlying mechanisms.

Here we investigate the impact of warming on plant and soil nutrient pools using 7 year experimental greenhouses located in mesic birch hummock tundra at Daring Lake, NWT, Canada, and using a litter decomposition laboratory incubation. First, we explore warming treatment effects on the productivity, biomass, and C, N, and P tissue concentrations of seven common vascular plant species, mosses, and lichens and examine the impact of warming on both above- and belowground plant nutrient pools, and soil organic and inorganic nutrient pools. Secondly, using the results of the incubation experiment, we explore the relative importance of changes in environment and litter chemistry in contributing to the greenhouse treatment effects on nutrient pools.

We found that total aboveground vegetation biomass increased by 35% in the greenhouses, with strong increases in deciduous shrubs, evergreen shrubs, and graminoids, and strong declines in lichens. The most positively responsive species were *Betula glandulosa*, *Ledum decumbens*, and *Eriophorum vaginatum* with increases in total biomass of 62%, 78%, and 72% respectively. Nonetheless, tissue N concentrations declined significantly in most species and tissues (e.g. age-differentiated leaves and stems, and size-differentiated roots), and therefore the total aboveground N pools increased by only 21%. Organic soil total C, N, and P pools did not differ between the two treatments, and warming effects on soil inorganic and organic nutrient pools were not consistent. Lastly, nutrient return from decomposing litter was more strongly affected by species and tissue chemistry than by temperature or moisture.

We conclude that warming has enhanced the total amount of N and P in tundra plants and organic soils combined, but that this effect is not evident in the soil during the growing season since the nutrients had been rapidly acquired by the vegetation biomass. With decreases in plant nutrient concentrations, it is clear that increased photosynthesis is outpacing nutrient uptake, leading to a dilution in tissue N and P, and low soil nutrient pools. Lastly, changes in species abundances with warming, and particularly that of *Betula* and *Eriophorum*, are more important at driving increases in nutrient availability than the increases in temperature alone. Altogether, these results demonstrate a positive impact of warming on total plant and soil nutrient pools and highlight the importance of individual species at driving these responses.

Poster Abstracts

TEMPORAL SEQUENCING OF ANNUAL SPRING RUNOFF IN FOUR MAJOR ARCTIC-DRAINING RIVERS

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The influx of freshwater to the Arctic Ocean has the potential to influence global climate through modification of the intensity of the thermohaline circulation. Freshwater influx can also have impacts on the Arctic cryosphere and marine and terrestrial biota. At the same time, rate of change in the Arctic climate is significantly higher than other parts of the globe. This emphasizes the importance of understanding climate-discharge linkages in Arctic-draining rivers, which are the dominant source of freshwater input to the Arctic Ocean. To date, no research has collectively evaluated trends in the magnitude and sequential timing of the spring freshets – the dominant hydrologic event occurring on these nival river systems – or of the atmospheric circulation patterns that control them. To address this, historic daily discharge data from selected hydrometric stations within the four largest Arctic-draining watersheds (Mackenzie, Ob, Lena, Yenisei) have been analyzed to extract the timing, magnitude and characteristic shapes of the spring freshet hydrographs. Results of the analysis are based on daily discharge data from the Mackenzie River mainstem (from 1973 to present) and daily Russian discharge data (from 1930s to present). Discussion of results focus on: the temporal sequencing of spring discharge at stations draining directly to the Arctic Ocean along the Mackenzie, Ob, Lena, and Yenisei rivers; the discharge linkages with controlling patterns of temperature and precipitation; and the major atmospheric teleconnection patterns associated with extreme high and low flow years. The findings of this study provide a basis for subsequent investigation of the relative contribution of major river sub-basin flows entering the Arctic Ocean, and the climatic factors that control them.

ECOLOGICAL CLASSIFICATION AND HIGH-RESOLUTION SATELLITE MAPPING OF HIGH ARCTIC VEGETATION ON THE SABINE PENINSULA, MELVILLE ISLAND, NUNAVUT

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Conducting large-scale field vegetation studies in the Canadian High Arctic is extremely challenging due to the vast land area, remoteness, and harsh conditions encountered. Satellite remote sensing provides the only feasible means of characterizing biophysical variables of arctic vegetation at landscape and regional scales. Biophysical remote sensing of high arctic vegetation has relied heavily upon the Normalized Difference Vegetation Index (NDVI), which has shown strong and robust relationships with many high arctic vegetation biophysical variables. However, until recently, it has not been possible to test indices fundamentally different from NDVI in the Canadian High Arctic for large spatial extents and at fine spatial scales.

As such, the objectives of this research were to integrate detailed field vegetation measurements with high-resolution WorldView-2 multispectral satellite imagery to: 1) test various spectral vegetation indices suited to characterizing the sparse and fragmented nature of high arctic vegetation community composition and cover; and 2) develop ecologically meaningful classifications of vegetation community composition and cover for the Sabine Peninsula, Melville Island, Nunavut (76°27' N, 108°33' W).

A stratified random sampling scheme was developed from descriptive vegetation observations and an unsupervised classification of WorldView-2 multispectral

imagery (2 m spatial resolution), collected in July 2010. Vegetation was sampled throughout July and August 2011, coincident with a WorldView2 multispectral dataset acquired on July 16, 2011. Plant species composition and cover were sampled using 1 m2 quadrats (n = 49) according to International Tundra Experiment (ITEX) protocols for community baseline measurements. Vegetation reflectance measurements were collected for 29 of these quadrats with an ASD FieldSpec Pro spectroradiometer.

Multiple vegetation indices were selected for testing using two approaches. First, broad-band indices were derived from vegetation reflectance spectra using a combinatorial approach, testing all possible combinations of normalized two-band indices similar in form to NDVI. Second, narrow-band indices were developed from original field spectra using a biophysical approach based on known relationships between spectral absorption features and foliar chemical concentrations.

In order to develop relationships between plot vegetation reflectance, vegetation community types and percent cover, regression analyses were used to relate spectral vegetation indices to vegetation composition and cover, grouped by plant functional type. While vegetation community type was initially determined according to the unsupervised classification of remotely-sensed imagery, clustering analysis was performed on vegetation quadrat data to determine whether spectrally separable classes identified by the unsupervised classification corresponded to ecologically meaningful and statistically separable vegetation classes.

Regression models were applied to the satellite imagery to generate high-resolution surfaces of plant functional group cover, total vegetation cover, and vegetation community type. These products were validated with field data using a variety of accuracy measures.

CONDITION AND STRESS IN WESTERN HUDSON BAY RINGED SEALS: WHAT CORTISOL AND BLUBBER THICKNESS CAN TELL US ABOUT A SEAL HEALTH

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Ringed seals (*Phoca hispida*) in the Canadian Arctic are subject to a variety of environmental and anthropogenic stressors (eg. disease and predation) that stand to potentially compromise population health and survival. Typically, animals exposed to chronic stressors initiate a stress response resulting in cortisol production, which then results in physiological and behavioural changes designed to maintain homeostasis under the influence of the stressor. A prolonged stress response, however, will have negative impacts on the health of the animal, which in ringed seals includes a decrease in blubber thickness. Ringed seals depend on their thick blubber layer for thermoregulation and energy storage. Although blubber thickness will change seasonally based on reproductive status and food availability, a healthy individual is consistently able to maintain a level of insulation that will minimize heat loss and allow the body to allocate energy resources to physiological processes other than thermoregulation. To examine links between stress levels and poor physiological condition, we measured cortisol levels and blubber thickness in western Hudson Bay ringed seals. Blubber samples and morphometric data (n=538) were collected by Inuit hunters during the fall subsistence hunts in Arviat, Nunavut between the years of 1999-2011. Blubber cortisol concentrations were measured using a new methanol based homogenization and extraction technique followed by LC/MS/MS analysis. Blubber thickness and cortisol levels are being assessed along with covariates year, sex and age class (<1, 1-5 and >7 years old) to determine how segments within the population may be impacted differently by chronic stress. We predict Western Hudson Bay ringed seals will show an increase in stress hormone levels concurrent with a general decrease in blubber thickness and subsequent increase in stress hormone levels over the past 12 years. This could be attributed to the dramatic changes to the arctic environment such as increased temperature, loss of sea ice, rising sea levels, changes in season lengths etc. Chronic stress can affect reproduction and survival, and effects on individuals often manifest at the population and ultimately ecosystem levels. Understanding how the physiological condition of this ecologically and socioeconomically important species has changed over time in response to cumulative ecological stressors is essential for development of wildlife management strategies in the Canadian arctic region.

THE EVOLUTION OF RETROGRESSIVE THAW SLUMPS ON HERSCHEL ISLAND, YUKON TERRITORY

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Previous periods of thermokarst and retrogressive thaw slump activity can be identified morphologically and stratigraphically, as well as through changes in vegetation patterns. Retrogressive thaw slumps are a common thermokarst landform in areas of ice-rich continuous permafrost like the Yukon coastal Plain. Former retrogressive thaw slumps are usually marked by open vegetated depressions with a well defined (low) headscarp that faces downslope. In locations like Herschel Island in the northern Yukon, there are numerous active and stabilized retrogressive thaw slumps. In many cases, the new slumps form in the floor of a stabilized slump, and this is referred to as polycyclicity. The headwall of an active retrogressive thaw slump provides natural permafrost exposures from which considerable cryostratigraphic information can be obtained. In a polycyclic retrogressive thaw slump, the previous cycle of thermokarst is marked by a well defined thaw unconformity and truncated structures (e.g. ice wedges) overlain by massive debris flow deposits containing blocks of organic material. However, the geomorphic details about a former slump's transition from an active to stabilized state are difficult to determine from surface patterns and natural exposures alone. By employing ground-based remote sensing, shallow permafrost structures (e.g. debris flow and ground ice units) connecting active slumps and previously stabilized headwalls upslope can be mapped. Using ground-penetrating radar, electrical resistivity methods, and surface vegetation datasets, the evolution of four previously disturbed landscapes with active thaw slumps in the Thetis Bay and Collinson Head areas of Herschel Island (Yukon Territory) are compared.

The aims of this presentation are to: 1) map ground ice, truncated ice wedges, and debris flow deposits between active slumps and previously stabilized headwalls; 2) describe the geomorphic processes leading to stabilization; 3) compare the results of objectives one and two for 4 slumps and comment on the fate of active thermokarst. Along the entire coast, the amount of retrogressive thaw slumps has approximately doubled since the mid-twentieth century. Since these features are characterized by large massive ground ice bodies, often several metres thick and hundreds of metres in extent, the risk of accelerated permafrost degradation due to climate warming is evident. In this study, we present information on former thaw slump transitions (active to stabilized states), current thermokarst retreat rates, as well as predictions on how modern slumps might evolve when they approach previous stabilized headwalls. An improved understanding of retrogressive thaw slump evolution is important for assessing the potential impacts of a warmer Arctic on the island's natural and cultural resources.

SEA ICE MOTION WITHIN THE BEAUFORT GYRE

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The Beaufort Gyre (BG) is one of two predominant patterns of sea ice motion within the Arctic Ocean. Sea ice within the BG rotates anticyclonically around the Canada Basin, and its surrounding seas, under the influence of the Beaufort High. The BG, in terms of sea ice, acts as the dynamic link in the momentum balance between the atmosphere and ocean. Under atmospheric, oceanic, coriolis and internal forces the BG rotates sea ice anticyclonically out of the high arctic and westward through the Beaufort, Chukchi and East Siberian Seas. After this southern pass through the marginal seas, sea ice is returned northward to the high Arctic where it is either re-circulated within the BG or exported to the Transpolar Drift Stream. Recent studies have shown occasional cyclonic reversals in the BG and a general weakening of the gyre over time. Historically sea ice has recirculated within the BG for up to 10 years, allowing the ice to age and thicken through years of dynamic and thermodynamic growth. However with recent climate induced changes to the arctic icescape the residence time of sea ice within the BG is expected to have already shortened. The reduction in residence time is believed to be a result of the increase in ice drift speed. Recent studies have shown that ice drift speeds across the entire Arctic have significantly increased over the last 30 years. This change is attributed to reductions in ice extent and concentration which increase the mobility of sea ice and to reductions in ice thickness and strength which make the ice more dynamic and hence even more mobile. Reductions in extent, thickness and concentration are greatest in the marginal seas, which comprise a significant portion of the BG. Hence we expect that ice motion in the BG, specifically in its southern pass through the marginal seas has been significantly increasing in recent years. In this study we use a combination of historic ice motion data from both ice beacons and passive microwave satellites to characterize the BG spatially and assess how ice drift speeds vary within the BG. Initially

we define the spatial extent of the BG and analyze its variability in size and location. Past work has unveiled the variability in the size of the BG but we expand on these methods and analyze the BG in greater detail. Once the BG is defined we can analyze the speed at which ice drifts within the BG and conclusively test our theory on increased sea ice drift within the BG.

'MY WORD:' STORYTELLING AND DIGITAL MEDIA LAB: THE EVOLUTION OF AN INUIT-OWNED DIGITAL MEDIA AND RESEARCH ORGANIZATION

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Understanding that current and projected alterations in weather, temperature, snow, ice, wildlife and vegetation patterns in the Arctic and Sub-Arctic regions will most likely cause negative health impacts for individuals and communities in the North, there has been increasing research conducted examining the connections between climate change and Inuit health and well-being. There is a wide recognition that this research needs to be community-driven, community-directed, and participatory, ensuring that Inuit are leading the process and enhancing and expanding community research capacities. Recognizing the dual need for locally-appropriate and culturally-relevant adaptation strategies and the development of research capacities in the community, in 2009 the Rigolet Inuit Government in Rigolet, Nunatsiavut, Labrador undertook an innovative plan to develop the first Inuit-run centre dedicated to digital media (digital storytelling and PhotoVoice) and research (qualitative and quantitative). Since its inception, the 'My Word': Storytelling and Digital Media Lab has developed expertise in numerous areas: facilitating digital storytelling and PhotoVoice workshops; consulting on research proposals, designs, and methods; conducting interviews and surveys; filming, editing, and producing videos; consulting with multiple stakeholders for research and adaptation goals and strategies; disseminating information through print and digital media; and presenting at national and international conferences. The 'My Word' Lab also has also developed particular research capacities for climate-health research and health adaptation strategies. This poster will explain the evolution of the 'My Word': Storytelling and Digital Media Lab, and discuss the opportunities and challenges in setting up a research and capacity-development organization such as this. Details will also be shared about the specific services offered by the 'My Word' Lab, and the future directions and visions for the organization. The 'My Word' Lab stands as an example of community-created and community-run research and capacity development, and can inform the creation of other community-driven research initiatives.

METHYLATED MERCURY (HG) SPECIES CONCENTRATIONS AND DISTRIBUTION IN THE ARCTIC OCEAN AND LOWER ATMOSPHERE.

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Gaseous mercury (Hg) is a persistent pollutant and can be transported over long distances to remote areas as far as the Arctic. The organic form monomethylmercury (MMHg) is a potent neurotoxin and readily available for uptake by biota. The concentrations of Hg in Artic marine mammals and fish are among the highest in the world and often above the consumption guideline of 0.5µg g^{-1}. Hg contamination of the Arctic ecosystem has direct repercussions for local communities who rely on the wildlife for their traditional diet and raises serious health concerns. The key factor determining the concentration of Hg in biota is the concentration of MMHg in water. MMHg and dimethylmercury (DMHg), another important organic Hg species, are formed mainly at the sediment-water interface and in anoxic pockets in the water column. However, the sources, behavior and fate of methylated Hg species in ocean waters, particularly at the air-water interface, are still unclear and not completely understood. In this study we present methylated Hg concentrations in both ocean water and air from various locations in the Canadian Arctic Archipelago. The samples were collected during two consecutive ArcticNet expeditions (summer/fall 2010 and 2011) in the Canadian Arctic on board the CCGS *Amundsen*. First evidence of the presence of methylated Hg species above the Arctic Ocean is reported here. MMHg and DMHg concentrations were detected at trace levels in air, averaging 2.5 ± 2.6 pgm^{-3} (range <0.5-7.8 pgm^{-3})

and 3.7 ± 2.9 pgm^{-3}(range <0.5-11.3 pgm^{-3}) respectively. MMHg concentrations in water (average 35.8 ± 39.25, range 0.7-150.9 pgL^{-1}) are within the range of previously reported values. A clear spatial variation was observed in the concentrations of methylated Hg, both in air and water. Radiation seems to be an important environmental parameter influencing the presence of MMHg in the atmosphere. Redox properties and prevailing biological conditions in the water column are also investigated to explain the spatial and vertical distribution of methylated Hg species in arctic marine waters. These results suggest that air-water exchange can be an important mechanism influencing the geochemical cycling and concentrations of methylated Hg species available for bio-uptake in open Arctic Ocean.

USE OF DIGITAL PHOTOGRAPHY TO DETECT PLOT LEVEL CHANGES IN GREENNESS ACROSS ONE GROWING SEASON IN RESPONSE TO PASSIVE WARMING AND MOISTURE GRADIENT

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High Arctic ecosystems are experiencing some of the earliest and most extreme changes in climate including increases in both temperature and shifts in precipitation patterns. With these changes, growing season length is expected to increase, allowing for greater primary productivity and plant growth. These expected trends are demonstrated in large-scale, multi-year satellite images of terrestrial arctic ecosystems through an increase in greenness. This phenomenon was examined at a smaller scale to better understand the ability of multispectral and digital photography to detect influences of environmental factors such as temperature and moisture. Additionally, methods of multispectral and digital photography were compared. At the plot level, the use of multispectral cameras can be difficult and often cumbersome to standardize changing light conditions and vegetation types. Thus, the use of digital photography may be a less expensive and more time efficient alternative.

To examine the influence of temperature and moisture on vegetation greenness over one growing season in a coastal tundra ecosystem, long-term passively warmed plots were photographed six times over the growing season in 2012. Plots were sampled over a natural moisture gradient present in the lowland. Plots across this gradient have been passively warmed using open top chambers (OTCs) for the past 29 years as part of the International Tundra Experiment (ITEX). Images were taken at four sites representing three moisture classes, ranging from dry to wet tundra. Within each site 20 photos were taken, 10 from within the OTCs, representing the temperature treatment, and 10 in surrounding control areas. A sample of multispectral images was compared to a sample of digital colour images taken within 30 seconds of one another for accuracy of digital greenness predictions.

Predicted results include: (1) digital images will accurately estimate plot greenness, (2) plot greenness will be greater in the treatment plots when compared to the control plots, and (3) moisture class will influence greenness differently at different times throughout the growing season.

PALEOCLIMATIC RECONSTRUCTION OF THE CENTRAL BAFFIN ISLAND REGION, NETTILLING LAKE, NUNAVUT.

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The Canadian Arctic has been affected by rapid fluctuations of its natural environmental state. However, the paleoclimate history of some regions, including the Nettilling Lake area, remains poorly known and documented. Nettilling Lake is located in what is believed to be a " hinge " zone between northern Quebec and Labrador, which has shown a high resilience to recent climate changes, and the Canadian High Arctic, which has already shown marked and amplified responses to recent climate change. In order to fill a very important knowledge void in the Arctic, this research uses physical, chemical and biological properties preserved in lake sediments to reconstruct past environmental conditions of aquatic ecosystems and their watersheds. The overall goal is to reconstruct past climatic variability to help predict regional scenarios of climate warming impacts on freshwater and to provide insights into the coupling between the sedimentation processes observed in Nettilling Lake and the Penny Ice Cap melt rates.

For this purpose, a one-meter long, laminated sedimentary sequence has been retrieved from a small

bay in the northeastern part of Nettilling Lake during the summer 2010. This sampling area was chosen based on the hypothesis that incoming glacial meltwater from the nearby Penny Ice Cap will leave a strong climate signal that will be reflected in the bay's sedimentary processes. The sediment core was scanned for a series of non-destructive (X-ray, XRF, magnetic susceptibility) and destructive (LOI, grain size, water content, thin sections, diatoms) analyses. Radiometric AMS 14C and 210Pb – 137Cs dating have been used to establish the core chronology. Low rates of productivity in Nettilling Lake result in low organic matter content and difficulties of accurate dating. Thus, radiocarbon ages seem apparently too old due to the "reservoir age effect". However, 210Pb and 137Cs analyses allow to establish a chronology for the upper part of the core. Preliminary results yield correlation between geochemical profiles (Si, Ti, K, Ca) and melt rates from the Penny Ice Cap since the 19th century. Moreover, discontinuous laminations in the core suggest strong variations in sediment inputs and of environmental conditions in Nettilling Lake's watershed.

LONG-TERM IMPACTS OF ANTHROPOGENIC DISTURBANCE TO THE ICE-WEDGE/ VEGETATION THERMAL REGIME

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The role of ice-wedges in shaping arctic ecosystems has been largely overlooked despite the fact that they can constitute up to 50% of the top 3 m of permafrost ground volume and are vulnerable to changes in the active layer. The Canadian High Arctic is already experiencing the greatest temperature rise due to climate change and as such, active layer depth is projected to increase substantially. Since ice-wedges are likely in equilibrium with maximum thaw depth, any increase in active layer should cause subsidence over the ice-wedge and provide a source of groundwater in an otherwise polar desert. Due to ice-wedges' abundance and widespread distribution, changes in active layer depth should result in significant alteration of the geomorphic and vegetational landscape. What form the polar landscape will take in the near future will depend on the balance of competing forces - increased ice-wedge thermokarst (melt) versus the stabilizing effect of increasing vegetation cover in high latitudes, both of which are predicted by global warming. This balance remains unclear as analyses of biotic/abiotic interactions at the landscape scale are missing from most geomorphic literature. We hypothesize that subsidence and water release from polar desert ice-wedges will lead to a wet meadow alternative stable state of the ecosystem that persists due to altered feedbacks.

Our goal is to describe how altered feedbacks influence ice-wedge thermokarst in high arctic polar deserts and change the geomorphic and ecologic characteristics of the landscape. This study involves three field seasons near Eureka, Ellesmere Island, Nunavut. Our primary area of interest is a now defunct tundra airstrip in use from 1947-1951. We will characterize impacts on the long-term development of the landscape resulting from anthropogenic disturbance to the ice-wedge/vegetation thermal regime. To do this, we will create a probabilistic model of how the polar desert can be predicted to change when feedbacks are altered. Probabilistic modeling of system dynamics will utilize Bayesian networks constructed with Netica software and variables will be informed from field season data. The model will run on a local (2 hectare) spatial scale with variables informed by data collected from the field. Permafrost dynamics will be characterized using probingand high-frequency Ground Penetrating Radar (500 MHz) to map the near-surface details of ice-wedges and active layer. Vegetation will be measured using quadrat sampling for species richness, abundance, and functional group change. Soil data and hourly microclimate data are currently being collected as well. The site will be spatially assessed using ArcGIS for interpolation between data points, and non-metric multidimensional scaling will be used to determine which variables significantly affect the landscape composition.

Climate warming and anthropogenic disturbances to the ice-wedge/vegetation system may cause rapid landscape change in a way that remains unclear. This study will create a novel conceptual model of the ice-wedge/ vegetation thermal regime in an effort to address scientific and practical conservation questions for the Arctic. The data and analyses of this study will provide critical information for government and industry partners who wish to minimize their impacts on fragile arctic ecosystems.

ARCHIVES: THE ANALYSIS OF PAST CLIMATIC AND HYDROLOGICAL VARIABILITY AT THE SUBARCTIC INTERFACE

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The ARCHIVES project is a university research initiative in partnership with the hydro-power industry. The main objective of this multidisciplinary initiative is to study the hydrological and climatic variations of the last millennium in the northern boreal region of Quebec. The study is based on the use of several natural archives such as tree rings (living and subfossil trees) which offer the best temporal resolution and a great potential for spatial interpretation, proportion and maximal heights of ice-scarred trees which are directly linked with spring flood variability, and finally, lake sediments, which are good indicators of watershed hydrology. ARCHIVES is articulated around three sub-objectives. The first one is to analyse climate and hydrology spatiotemporal variability of the past 200 years. This retrospective climate analysis will be done on grids (0.5º by 0.5º), which cover the climate spatial variability of the northern half of Quebec. The second one deals with the hydroclimatic exploration of the last millennium. It is based on the construction and analyses of long tree ring series obtained from fossil tree trunks found on the floor of boreal lakes, and of long sedimentary sequences from lakes. The third sub-objective is to compare spatio-temporal climate reconstructions with climatic simulations of the Canadian Regional Climate Model (CRCM) over a 150 years period. The general aim of the comparison is a cross-validation and interpretation of the climatic variables in terms of atmospheric circulation. This poster presents the aims and the organisation of ARCHIVES and the main results obtained up to date on each sub-objective. Over the past two decades, three episodes of "high waters" were identified. Variations have a large range, but all are part of a general rising trend in water supply since 1850. The last optimum that reached the 20th century levels was the Medieval Optimum around 1000 yr AD. Known as a thermal warm period, it coincided with peaks in precipitations. To give an historical perspective to hydroelectric potentials, the past 150 years reconstructions indicate an augmentation of about 30% of water flow, although the depleted past 30 years correspond to a negative incursion of about 20% as seen over the long period. Such ranges must be taken into consideration for infrastructure and resources management planning.

SMARTICE: SEA-ICE MONITORING AND REAL-TIME INFORMATION FOR COASTAL ENVIRONMENTS

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Sea ice is an integral component of the Arctic coastal environment. For Inuit, sea ice is a central part of their culture, community and livelihood. Recent changes in Arctic climate have led to dangerous sea ice conditions for Inuit travel and hunting, particularly during the dynamic freeze-up and break-up periods. For northern resource industries and marine shipping, sea ice represents added operational risk. More dynamic sea ice conditions make route planning less predictable and increase the chance of delay and added cost. Where traditional Inuit and marine shipping routes overlap, additional planning is needed to avoid breaking safe travel ice.

If recent warm winters in the eastern Arctic are an indication of future conditions, then sea ice will become increasingly more dangerous for travel, especially for inexperienced travellers, while traditional knowledge of safe routes will be less reliable. At the same time, northern resource extractive industries are expected to grow significantly, leading to increased year-round shipping and greater potential for conflicting sea ice use (i.e., travel through vs. travel over). The key to avoiding such conflicts and ensuring safe and efficient winter travel for both Inuit and industry is the availability of user-defined sea ice information at appropriate scales and frequencies.

SmartICE represents a potential community-university-industry collaboration that integrates adapted technology, remote sensing and Inuit Knowledge to promote safe travel for all stakeholders in northern coastal environments. Specifically, it seeks to address the information needs of stakeholders using networks of in situ sensors that generate daily observations of changing sea ice conditions at hazardous travel locations, particularly during freeze-up and break-up, combined with user-based satellite image classifications of sea ice state. The variables of interest for navigation over or through sea ice are ice thickness, concentration and roughness. Safe travel for snowmobiles over sea ice requires continuous, smooth ice that is at least 15 cm thick, whereas ridged, rough sea ice many metres thick is the most difficult for shipping to navigate through. The main elements of a SmartICE information system are: (i) A network of in-situ sensors that measures sea ice thickness at designated locations

and transmits daily data to a central server; (ii) Repeat satellite imagery from which sea-ice surface conditions (concentration, roughness, water content) are mapped following user-defined classification systems; and (iii) Information technology that integrates in situ and remotely sensed sea ice data to generate raw and processed digital products that match the needs of user groups, from ice navigation managers to Inuit ice experts to recreational ice users. While community participation in SmartICE is key to addressing local needs and conditions, the program is intended to augment and integrate Inuit sea ice knowledge, not replace it.

SmartICE is a climate change adaptation tool and technological innovation of ArcticNet's Nunatsiavut Nuluak project. It is also linked to the Nunatsiavut Government's SakKijânginnatuk Nunalik (Sustainable Communities) initiative. SmartICE is partnering with LOOKNorth, a Canadian Centre of Excellence for Commercialization and Research in remote sensing technologies in support of natural resource industries in Canada's North.

DYNAMIC SEASONAL BIOPHYSICAL PROVINCES IN THE BEAUFORT SEA USING REMOTE SENSING DATA

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The Arctic Ocean ecosystem is experiencing significant changes such as a drastic reduction in seasonal sea-ice cover. These changes are likely to modify the physics, biogeochemistry and ecology of this unique environment in ways that are yet to be understood. We investigated temporal and spatial linkages between physical and biological parameters to infer the boundaries of biogeochemical areas in the Canadian Beaufort Sea. Sea-surface temperature (SST) from NOAA (AVHRR) data and phytoplankton biomass data (Chl-a) from NASA (SeaWiFS) collected over seven years (1998-2004, monthly and 1 km resolution) were used in a cluster analysis to define four biogeochemical provinces in the Beaufort Sea during the summer season. There is a high inter-annual variability in the monthly mean Chl-a in all provinces. Spatial differences in SST between provinces were not significant. The SST and Chl-a temporal trends for the four provinces showed a positive trend for Chl-a. This new partition can be used as a template for extrapolating results derived from discrete ship sampling to larger areas, and could be considered as an important tool in marine biogeochemistry and fisheries oceanography.

THE DREAM OF A NORTHERN UNIVERSITY

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A university located north of the sixtieth parallel in Canada has been a goal for many people over the last fifty years, yet Canada remains the only circumpolar nation without a university in the region. Our research explores the history of post-secondary education in the Northwest Territories and Nunavut from approximately 1960 to 1999 and reveals the political and social uncertainty surrounding the direction of education during this time. A comprehensive history of post-secondary education and the northern university concept within these two territories has received scant attention from academics, authors, or government. Our research demonstrates the ways in which competing visions for a northern university have been, and continue to be, directly linked with competing visions of the future of the Canadian north: southern English Canadian nationalism, resource exploitation, the wage economy, Indigenous self-determination, and southern university expansion and research initiatives have all been contributing factors in the evolution of post-secondary education in the north. Moreover, our research has drawn together previously fragmented histories to reveal the ways that diverse actors and organisations attempted to create and impose their visions of a northern university. The debate around a 'bricks-and-mortar' northern university is ongoing and our research brings attention to the questions and concerns of the past in order to inform present and future dialogue around post-secondary education in the north.

INFERRING THERMOKARST LANDSCAPE DYNAMICS IN THE RECENT PAST USING LACUSTRINE SEDIMENTS: TOWARDS A "PAN-HUDSONIAN" PERSPECTIVE

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Thermokarst (thaw) lakes are widespread in northern Canada and particularly vulnerable to climate change. Moreover, these freshwater landscapes can play a vital role in biogeochemical cycles by transferring to the atmosphere vast amounts of organic carbon (formerly trapped in permafrost), thus contributing a positive feedback to climate warming. Yet, little is known about the hydrological and limnological evolution of these freshwater basins, how they have responded to environmental change in the recent past and how they will evolve in the future.

The Hudson Bay region has experienced severe warming episodes over the last decades, and projected increases in temperature and precipitation for the late 21st century are significant. Thermokarst lakes along the coast of Hudson Bay are typically less than a few meters deep and are thus susceptible to becoming ephemeral, which would have associated ecological consequences. Lack of baseline hydrological and limnological information impedes assessment of future water resource availability and biogeochemical fluxes in this region. To address this knowledge gap, paleolimnological investigations are being conducted. Findings will generate new knowledge of the hydrological and limnological behavior of thermokarst lakes in central Canada, over a range of temporal and spatial scales, and provide the basis to anticipate how these aquatic ecosystems will respond to ongoing climate change and variability.

Here, we focus on a suite of paleolimnological tools that are being developed for down-core reconstructions in Wapusk National Park (WNP) in the western Hudson Bay Lowlands (HBL). In September 2012, surface-sediments were obtained from 37 lakes in WNP, which span a vegetation gradient from the boreal forest to the arctic tundra. Surface sediments will be analyzed for a suite of biological (diatoms, pigments) and geochemical (organic carbon and nitrogen elemental and stable isotope composition, cellulose oxygen isotope composition) indicators. Biological and geochemical data in the surface-sediments will be compared to hydrological (water isotope composition) and limnological (water chemistry) data collected during the last three years to inform and constrain paleohydrological and paleolimnological reconstructions.

Paleolimnological reconstructions in WNP will be compared to lithostratigraphic and biostratigraphic data obtained in thermokarst lakes spanning a comparable latitudinal gradient along the southeast coast of Hudson Bay, near the villages of Kuujjuarapik-Whapmagoostui and Umiujaq (Nunavik, northern Québec). This broad-scale approach aims to generate a pan-Hudsonian perspective of hydrological and limnological variations of thermokarst lake systems in the recent past. This multi-faceted integration of paleolimnological records is being facilitated by collaborations through ADAPT (Arctic Development and Adaptation to Permafrost in Transition), a new Canada-wide research program focused on diverse aspects of thawing permafrost conditions in the Canadian Arctic.

QUANTIFYING PEAK FRESHWATER ICE ACROSS THE NORTHERN HEMISPHERE USING A REGIONALLY DEFINED DEGREE-DAY ICE GROWTH MODEL

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Freshwater ice is a major component of the cryosphere, and a key component of the North, as well as important to numerous physical, ecological, and socio-economic processes. As found in analyses of temporal trends, freshwater ice is highly variable due to climatic influences such as air temperature. Given the importance, concern has been raised over the future changes to freshwater ice given the predicted changes in climate. Small-scale studies have explored freshwater-ice thickness and phenology using detailed models that require large input datasets, however, a large-scale quantification has not been performed, as the input data required are not yet readily available at the hemispheric scale.

A common approach to estimating ice thicknesses at smaller scales is to use a simplified degree-day index, and this study employs the Stefan equation as the basis for a degree-day ice-growth model, driven by the European Centre for Medium-Range Weather Forecasts 40-year re-analysis (ERA-40) gridded daily air temperature data (1952-2002) and ice-growth coefficients. These coefficients have previously been defined to account for surface insulation and exposure, varied by water-body type. This study advances the definition of ice-growth coefficients, to spatially stratify by hydro-climatic region, water-body type and lake size. Hydro-climatic regions are defined using a two-step clustering method and high-resolution Climate Research Unit Climatology (CRU CL 2.0). The degree-

day ice-growth model is calibrated and validated with 46 large lake and reservoir observation sites, 130 small to medium lake and reservoir observation sites and 256 river observation sites. Employing a 14 hydro-climatic region definition, model validation achieved an r^2 of 0.45 for large lakes and reservoirs, 0.73 for small to medium lakes and 0.44 for rivers (p-value < 0.001 for all).

The average areal extent and volume of peak freshwater (river and lake) ice is then quantified across the Northern Hemisphere for the period 1958-2002, using the degree-day ice-growth model and ice-growth coefficients defined. The model is driven by ERA-40 gridded daily air-temperature data, and the Global Lakes and Wetlands Database (GLWD) is employed to spatially define rivers and lakes. Results indicate that the total area covered by freshwater ice, during peak seasonal thickness, north of the January 0oC isotherm (excluding the Greenland ice sheet) is 1.7x106 km^2 and the total freshwater-ice volume is 1.6x103 km^3. Such values complete a hemispheric quantification of major cryospheric components (the others, for example, snow, glaciers or sea ice, have been previously evaluated) and provides a reference dataset for assessing future climate-related changes. This project is part of ongoing research funded in part by ArcticNet.

HEALTH RISKS IN RINGED SEALS ASSOCIATED WITH A POINT SOURCE RELEASE OF PCBS AT A MILITARY STATION IN ARCTIC CANADA

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Despite the widespread contamination of aquatic food-webs by polychlorinated biphenyls (PCBs), few studies have unequivocally demonstrated adverse effects specifically attributed to this industrial chemical on marine mammals. Causal evidence linking PCBs to toxic effects in free-ranging marine mammals is generally confounded by the highly complex contaminant mixtures to which they are exposed. Elevated levels of PCBs have been measured in ringed seals (Pusa hispida) from the north Labrador coast. Although long-range transport of PCBs through air and ocean currents deliver PCBs and related compounds to Labrador, local sources of PCBs from military facilities along the Labrador coast also exist. Saglek, a former 'Pole Vault' military radar station, is one of two sites where PCB releases have contaminated the adjacent marine environment. Approximately 25% of ringed seals sampled from 2009-2011 had levels of PCBs that exceed health effects thresholds for another pinniped species, the harbour seal (*Phoca vitulina*). In order to evaluate the implications for ringed seal health, we developed quantitative real-time PCR assay to evaluate the mRNA expression of contaminant-sensitive endpoints, including transcripts encoding the aryl hydrocarbon, thyroid hormone, estrogen, and retinoic acid receptors. Preliminary results show that higher mRNA expression of the AhR receptor and thyroid receptor are correlated with increasing levels of PCBs. The combination of gene expression endpoints, contaminant profiles, and insight into habitat use and feeding ecology afforded us a unique opportunity to explore source, transport, fate of PCBs in a coastal area, and assess the effects of PCBs on the health of ringed seals. Results are relevant not only in terms of the health of the ringed seal population, but also the local Inuit who rely heavily on seals and fish for their subsistence.

IRON TO IRE? INDIGENOUS ADAPTATION AND RESISTANCE TO SOCIOCULTURAL AND ECOSYSTEMIC CHANGE

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The rapid growth of mineral exploration and development activity is reshaping the economic and social geography of the Eastern Arctic and, in concert with other drivers of social and environmental change, transforming the territory. In light of growing contemporary interest in Inuit lands by extractive industries, there is an ethical and ecological imperative to ensure open and transparent dialogue regarding the potentially transformative impacts of development. This project will examine the public dialogue surrounding the future sociocultural and ecosystemic impacts of the most ambitious industrial endeavor in the Arctic to date, the open pit iron ore mine at Mary River on Baffin Island. Contributing to ongoing research on industrial change and adaptation in a wider ArcticNet project, "Adaptation, Industrial Development, and Arctic Communities," this study will examine

technological innovations being developed through a partnership comprising IsumaTV, NITV (Nunavut Independent TV Network), seven Baffinland community Hamlet Councils, and various Canadian scholars, out of which "Digital Indigenous Democracy" (DID) was created. Led by Inuit filmmaker Zacharias Kunuk, this initiative seeks to transcend spatial and linguistic obstacles to indigenous participation in industrial development and to enhance solidarity in the face of change. Archival research and fieldwork for this project will be conducted principally in Igloolik, a hamlet in the Qikiqtaaluk region of Nunavut whose inhabitants, by virtue of their proximity to the site (at 155 km from the mine, it is the nearest out of all eleven potentially impacted communities), will inevitably be compelled to adapt to a web of modifications in landscape, economy, social structure, and culture.

This research project will take an interdisciplinary approach to address two overarching themes: (1) ecosystemic and sociocultural sustainability in the Arctic with Igloolik as one possible example of Inuit response to change, and (2) technological innovations forging indigenous solidarity, democracy, and linguistic preservation worldwide. First, we critically examine past and present relations between modern industrial activities, multidimensional representations of knowledge, and Inuit Quajimajatuqangit (IQ) as they pertain to nature and society in Igloolik. Of particular interest will be responses to concerns mentioned in the Nunavut Impact Review Board assessment and elsewhere over ecological damage, food security, long-term economic stability, and cultural integrity related to the Mary River project. This analysis will be based on impact assessment documents, maps and charts, interviews with community members and businesspersons, media coverage, and oral histories. Second, this project will engage with emerging technological platforms like DID, which aim to spur increased sharing of knowledges, stories, experiences, and support between indigenous and/or marginalized communities, groups, and individuals across the globe. The results of this study will provide important insight into Inuit engagements with and resistance to large-scale industrial development, and the creative ways in which affected communities are adapting to change.

BEAUFORT REGIONAL ENVIRONMENTAL ASSESSMENT

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The Beaufort Regional Environmental Assessment (BREA) is a partnership among Inuvialuit, industry, governments, regulators and academia to prepare for oil and gas activity in the Beaufort Sea. Through multi-stakeholder committees, the BREA is building a regional knowledge base to inform regulatory processes and project-specific environmental assessments related to oil and gas activity in the Beaufort Basin. This is being achieved through the implementation of a targeted research program and working groups that are addressing key regional issues including cumulative effects assessment, information management, regional waste management, oil spill preparedness and response, socio-economic indicators, and climate change. For more information visit BeaufortREA.ca.

COMMUNITY-DRIVEN RESEARCH ON H. PYLORI INFECTION: MAKING MICROBIOLOGY DATA MEANINGFUL IN INDIGENOUS ARCTIC COMMUNITIES

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The Aklavik *H. pylori* Project is a community-driven project examining the highly-prevalent bacterial infection (*Helicobacter pylori*) in an Indigenous community in the Northwest Territories. As part of a research program led by the Canadian North *Helicobacter pylori* (CANHelp) Working Group, this project brings together health care providers, community members, and researchers to address community concerns regarding health risks from this infection, in particular, its association with stomach cancer. Supported by the Hamlet council and local Gwich'in and Inuvialuit governments, the project targets several Inuit and First Nations research priorities, with data sharing and knowledge translation being central to these aims. Community members expressed interest in knowing more about the genetics of *H. pylori* and how the organism

lives, functions, and spreads. In 2011, we received a CIHR "Meetings, Planning, and Dissemination" grant to develop an innovative strategy for making microbiology research results meaningful to community members.

Early in the planning process, the Aklavik Health Committee indicated that rather than simply receiving information from researchers, they wanted the community to participate in the design of data dissemination materials; they also wanted university researchers to learn more about daily life and culture in Aklavik. Community leaders spoke about the importance of showing youth opportunities for education and employment in the fields of science, medicine, and community health.

We developed an exchange program that facilitates sustained contact between two community members (BLK, PDE) and three University of Alberta researchers (SC, AC, MK). Two researchers (SC, MK) traveled to Aklavik in September 2012 to meet with community members and organizations, recruit youth for the exchange project, and experience life in Aklavik. In October 2012, two community members (BLK, PDE) will travel to Edmonton to visit the CANHelp microbiology lab to learn how the H. pylori bacteria and DNA were isolated, characterized, and analyzed, and how to interpret the microbiology results. They will also meet with and observe the work of the public health researchers in the CANHelp offices.

During November-December 2012, the two community members will guide Aklavik's grade 10 general science students in developing data dissemination materials for educating community members about *H. pylori* microbiology research. The classroom activities will augment and reinforce concepts from the general science curriculum, and explore how local cultural values and knowledge can be incorporated into community-based scientific research.

The resulting dissemination materials will be used to help present Aklavik *H. pylori* Project results to other interested Arctic communities. Evaluation of this exchange program will be used to improve CANHelp Working Group collaborative research methodologies and knowledge dissemination initiatives.

PERMAFROST DISTURBANCE IN THE HIGH ARCTIC: VEGETATION RECOVERY, SUCCESSION PATTERNS, AND ECOSYSTEM EFFECTS OF ACTIVE LAYER DETACHMENT SLIDES AND RETROGRESSIVE THAW SLUMPS

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Climate change and thawing permafrost is expected to increase the extent of land surface disturbances in the Arctic In the High Arctic, these disturbances commonly take the form of active layer detachments (ALD) and retrogressive thaw slumps (RTS). This research examines the dynamics of these disturbances and the recovery of tundra ecosystems over long time scales. Expanding on previous research analyzing the landscape effects of permafrost disturbances at Hot Weather Creek, located on the Fosheim Peninsula, Ellesmere Island, the objectives of this project are twofold: 1) To determine if an increase in the rate of ALD formation has occurred in the past 20-50 years and 2) To determine if the patterns of tundra ecosystem recovery have remained stable over the past 20 years. Data collected provides a continuation of the recovery record of vegetation and other ecosystem variables following stabilization, allowing for a direct comparison of the short- and long-term effects of land surface disturbance in a High Arctic ecosystem.

Initial research was conducted during the summer of 1994 with multiple ALDs classified into age categories. Four age categories are included in analysis: 1) slides that have occurred since 1988 will determined from air photo analysis; 2) slides that occurred in 1988; 3) an intermediate group including detachments dated to have occurred between 1975 and 1988; and 4) the oldest disturbances, which occurred prior to 1975. A return to these sites in 2012 expands the historical record to provide a more complete timeline of vegetation recovery following land surface disturbance to determine if the patterns at both the ALD and landscape scale have changed.

Methodology followed closely with past sampling procedures, to allow for comparison and statistical analysis. Data collection includes sampling and classification of both vegetation and environmental variables. Haphazard plots located across a series of transects that traversed specific zones within each disturbance were established, where vegetation and soil properties were be measured. A direct comparison of vegetation percent cover between 1994 and 2012 will be presented.

Net ecosystem exchange was also measured using the eddy covariance method. During the peak growing season, a flux tower was established within disturbed terrain to determine the effects of disturbance to measure CO_2 fluxes. Partitioning of wind direction allowed the comparison of fluxes with undisturbed terrain. Preliminary analyses indicate greater variation in gas fluxes associated with disturbed areas.

COMPARING BENTHIC MINERALIZATION PROCESSES AND COMMUNITY STRUCTURE WITHIN DIFFERENT COLDWATER CORAL DENSITIES

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Corals from the photic zone of temperate and tropical waters have been well studied and coral fields are recognized as biodiversity hotspots. However, the biology and ecology of deep-water corals remain unknown, particularly in cold regions such as the Canadian Arctic. In this study, we investigate the impact of coldwater coral densities on benthic ecosystem functioning. More specifically, we try to understand how coral fields from Davis Strait and Baffin Bay modify benthic mineralization processes and community structure. We hypothesize that benthic fluxes are higher and communities are more diversified in regions characterized by important coldwater coral densities due to the increased quantity of organic matter exported towards the sediment resulting from decreased current speed throughout coral structures. To test this hypothesis, incubations were realized with sediment collected during 2012 Larsen expedition in the Canadian Arctic and stable isotope ratios of C (δ13C) and N (δ15N) were determined from samples of sediment and fauna.

CARIBOU VS CLIMATE CHANGE : STATUS QUO IN SHRUB ABUNDANCE ?

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The rapid climate changes have increased the primary productivity of some arctic and subarctic regions. Part of this increase is explained by the increase in shrub abundance or shrub growth. At the same time, caribou herds, the largest arctic herbivore, are declining in the entire polar circle. Thus, reduced browsing pressure and enhancement of growing conditions could lead to a major shrub expansion in the Northern ecosystems. Large caribou populations, however, could keep in check or even reduce shrub expansion by their browsing. In Nunavik, studies have shown a marked expansion of *Betula glandulosa* at the forest-tundra ecotone, where caribou presence in summer is low. In the Rivière-aux-Feuilles herd summer range, high browsing pressure could prevent shrub expansion. In 1975, the Rivière-aux-Feuilles herd was estimated at 56,000 individuals, but their numbers reached 628,000 in 2001. Last inventory found 430,000 individuals in 2011, a population size producing a potentially high browsing pressure. We hypothesized that this huge population could have stabilized or even reduced shrub abundance, despite climate changes. To assess shrub cover changes, we compared a 1972 mosaic of multiple aerial photos to a 2010 satellite image of Deception Bay, Nunavik, Canada (62.08°41'N, 74.41°52'O). All pictures were taken in summer (between July and September for the photos of 1972, on August 8th for the satellite image of 2010) and were evaluated with grids composed of 900 m^2 cells. Shrub cover was evaluated for a total of 5,600 cells (± 5km^2), with seven cover classes ((0) 0%, (1) 1-5%, (2) 6-25%, (3) 16-25%, (4) 26-50%, (5) 51-75%, (6) 76-90%, (7) 91-100%). We used a linear mixed-effect model to assess differences in shrub cover of each cell between 1972 and 2010. We found no difference in shrub cover between 1972 and 2010, with mean cover class of 0.36 (±0.02) and 0.37 (±0.02) for 1972 and 2010, respectively, which corresponds to less than 5% shrub cover for the 5 km^2. Of the 5 km^2 covered by our analysis, 4 km^2 (80% of the cells) did not show variation in cover class. Although this stable state could have been caused by the heavy caribou browsing pressure observed at the site, we cannot rule out the hypothesis that climate changes did not influence shrub growth. Temperature, however, increased in Salluit, a nearby inuit village, by 3°C between 1979 and 2006 and by 1.5°C for the short period of 2002-2007. Increases in shrub abundance reported in Nunavik were located closer to the treeline on discontinuous permafrost while our site is part of the herbaceous arctic tundra and characterized by continuous permafrost. This shrub expansion was caused by *Betula glandulosa*, a dwarf shrub present at our site. Its low height at higher latitudes could have reduced our detection potential, thereby reducing our chances of finding cover changes. Moreover, it is possible that *B. glandulosa* prevents the increase by competition of taller *Salix* shrubs that would have been easily detected by our method. Our results show that the observed increase in shrub abundance near treeline in Nunavik cannot be directly extended to northern Nunavik.

A DECADE OF CLIMATE SCENARIOS - THE OURANOS CONSORTIUM MODUS OPERANDI

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Many countries as well as international organizations are in the process of organizing to provide so-called climate services to their constituents. Climate services are usually understood as the analysis and interpretation of climate information for the benefit of end-users. Climate information includes past observations but also projections from climate models. Ouranos is a nonprofit consortium launched in 2002 that has acquired the human resources and infrastructure required to provide climate services, mostly on the topic of regional climate change, to its governmental, academic and private partners. This paper discusses the experience and insights acquired over its ten years of existence on building climate scenarios for impact and adaptation studies. Most of our work is aimed at making climate science digestible and useful for end-users, and the paper describes approaches that are tailored to the needs and level of climate expertise of different user categories.

VIRUSES OF HIGH ARCTIC ICE SHELVES: A RESERVOIR OF UNKNOWN DIVERSITY

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Viruses are the most abundant biological entities in aquatic environments, typically numbering 10-100 million particles per mL. They have a significant impact on biogeochemical and ecological processes where they facilitate nutrient cycling, help maintain microbial biodiversity, and mediate microbial mortality. They are also believed to be the greatest reservoir of genetic diversity however, little is known about their presence in ice-based ecosystems which are dominated by microbial life. This study investigates the viral metagenomes of cyanobacterial mats from melt water ponds on two Arctic ice shelves (Markham and Ward Hunt ice shelves) using high-throughput sequencing. Bioinformatic analysis of more than 150,000 sequences for each viral metagenome has revealed that over 80% of them are previously unknown. Cyanobacterial mat sequences related to known viruses were mostly similar to either single-stranded DNA (ssDNA) viruses, bacteriophages (mostly from the Siphoviridae family), or phycodnaviruses (viruses that infect marine or freshwater eukaryotic algae). The putative functions of these sequences mainly belong to genes that are involved in DNA metabolism, structural proteins, and lysogeny. Understanding of the viral diversity present in these cyanobacterial mats is critical due to the vulnerability of Arctic ice shelves to climate change.

ARCHAEAL AND BACTERIAL DIVERSITY IN NUNAVIK THAW PONDS AND IMPLICATIONS FOR GREENHOUSE GAS EMISSIONS FROM PERMAFROST ECOSYSTEMS IN TRANSITION

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Impacts of climate change have been reported to be rapid and increasingly severe in northern ecosystems. One major consequence is the increase in size and number of permafrost thaw ponds. Although these ecosystems may play a major role in circumpolar and global biogeochemical cycles, little is known about the microbial ecology of these biogeochemical hotspots. In this study, we aimed at describing microbial (bacteria and Archaea) diversity in thaw ponds at both the local and regional scales as well as linking patterns in bacterial diversity with community metabolism (e.g. respiration) and ecosystem functions (methane emissions). We further aimed at identifying the microbial taxa involved in greenhouse gases emissions. We hypothesize that diversity and activity of microbial communities are determined by the local environmental conditions (temperature, pH, organic matter). We further hypothesize that thaw ponds functioning are dependent

on the microbial community structure and the metabolic performance of key taxa (e.g., methanotrophs and methanogens). To test these hypotheses, we sampled a set of thaw ponds in subartic Québec that vary in terms of their main limnological characteristics. Bacterial respiration as well as methane emissions have been determined for a subset of the lakes. In parallel, microbial community composition will be evaluated by 454 pyrosequencing of the ponds bacteria and Archaea and the presence and expression of genes of interest will be assessed using clones libraries.

CHARACTERIZATION OF MASSIVE GROUND-ICE AT BYLOT ISLAND, NUNAVUT

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In ice-rich permafrost can contain massive ice of different origin. Typically massive ice has a gravimetric ice content of at least 250%, and a minimal thickness of 1 meter (Permafrost Subcommittee 1988), Massive ice exposures were found in the Qarlikturvik valley at the southwest end of Bylot Island (Nunavut) by localizing active-layer detachments slides. This ice was first interpreted as a relict glacier ice buried under glacio-fluvial sediments (Fortier et al. 2009). Remnants of glacier ice represent potential sources of information on past climates and geomorphologic processes at the time of ice formation. These bodies of massive ice were associated to different episodes of Pleistocene glaciations (early Pleistocene to late Pleistocene/early Holocene) by the topographic position in the valley, the geomorphic context, the depositional setting and age of the overlying deposits, This project research focuses on reconstruction of climatic and environmental conditions on Bylot Island based upon Pleistocene–aged permafrost ground-ice. Here, we present the first part of the project, the characterization of buried glacier ice, with a particular focus on cryostratigraphy, cryofacies and ice crystallography in order to highlight its origin. High-resolution images of the internal structure of the frozen cores were obtained using micro-computed tomography (CT scan). This technique allowed to quantitatively assess the volumetric content of ice, gas and sediment entrapped in the ice. In addition, crystallographic analyses of the ice samples were undertaken using a polariscope in order to assess the crystals characteristics, and the patterns of gas and sediment inclusion. Two of our study sites differ greatly in their appearance. Examinations of ice cores samples from one site located in the valley revealed sediment-free, clear to cloudy ice, with interlocked crystal boundaries and small spherical gas inclusions (mm). Afterwards, ice exposures from a 500-m plateau bordering the valley shows debris-rich banded ice facies, similar to those found on contemporary glaciers such as Matanuska Glacier, in Alaska. At both sites, the upper contact of the ice body with the overlying sediment shows an abrupt thaw unconformity, which is usually an indication of buried ice. This study will help to develop an identification-key for buried glacier ice and enclosing sediments.

A FIRST LOOK AT THE SUBMERGED POSTGLACIAL SEA-LEVEL RECORD OF EASTERN BAFFIN ISLAND, NUNAVUT

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This project aims to reconstruct the submerged postglacial sea-level history of eastern Baffin Island, Nunavut (NU). While there has been extensive research on raised sea-level indicators in the eastern Canadian Arctic, few studies have considered submerged shorelines. Records of isobases (lines connecting locations of equal postglacial emergence over a given time interval) and modeling of isobase trends suggest that postglacial lowstand geomorphic features should be present along the eastern fringe of Baffin Island. A few such indicators have been reported without supporting data in the literature. This study uses multibeam sonar and subbottom data to map and interpret lowstand indicators along the coastline of the Cumberland Peninsula, eastern Baffin Island. Multibeam sonar creates high-resolution bathymetric maps and shaded-relief images, ideal for recording seabed morphology and detecting submerged landforms. Subbottom sounders provide a profile of the subsurface sedimentary sequence. When seabed bathymetry is combined with subbottom acoustic profiles, a third dimension is added to the interpretation of observed seabed features.

Within the larger survey program, the objective of this project is to map lowstand sea-level indicators in fjords and on the inner shelf, to measure their depth and morphology, and to determine the age at which these features were

formed. The ideal submerged sea-level indicators are morphological features formed by deposition along the coastal interface (e.g. beaches, deltas, boulder barricades) or by erosion of coastal bedrock (e.g. wave-cut terraces, sea cliffs) [few of the latter are expected in this region as submerged features]. These indicators mark the depths of former sea levels and thus can add to the understanding and modeling of glacial-isostatic adjustment following the retreat of the Laurentide Ice Sheet. To temporally constrain the lowstand event, radiocarbon ages will be obtained for organic material sampled by coring submerged depositional features in the summer of 2013.

Multibeam and shallow subbottom surveys were conducted off the east coast of Baffin Island aboard the Nunavut research vessel MV Nuliajuk in October 2012 and follow-up surveys are planned for 2013. To date, we have identified five locations with lowstand geomorphic features at present depths of ~15 to 43 m along the northern and eastern coast of the Cumberland Peninsula. These include submerged boulder ridges at the lips of shore terraces in Broughton Harbour and Channel near Qikiqtarjuaq, NU, two submerged deltas in Boas Fjord and two more in unnamed inlets near Dundas Harbour and in Exeter Sound.

Palaeo-sea-level research provides important baseline data to support projections of future sea levels under various climate-change scenarios. The results from this study will extend the record of isostatic tilting from raised shoreline indicators and help to constrain and validate geophysical models of glacial-isostatic adjustment. From these results, the study will contribute to a better understanding of the crustal response to complex glacial loading and unloading patterns in this region and help to refine local sea-level projections for coastal communities. These local sea-level projections provide important guidance for the management of coastal hazards, erosion, and development.

CLIMATE CHANGE AND MENTAL HEALTH: LOCAL VOICES, GLOBAL IMPLICATIONS

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Climate change is being identified as one of the most significant health challenges of the 21st century. While there is burgeoning research examining physical health implications, fewer studies consider the impact of climate change on mental health and well-being. Yet, these climate-related mental health issues are expected to be profound, cumulative, and dependent on the severity of the climatic and environmental changes. These mental health impacts from a changing climate are also anticipated to be unequally distributed, affecting peoples most reliant on local ecologies for sustenance and livelihoods and those living in remote or ecologically-sensitive regions, such as the Inuit in Canada's North.Drawing from in-depth interviews conducted through a multi-year, community-based, participatory case study in Rigolet, Nunatsiavut, Labrador, Canada, this research represents the first attempt to qualitatively explore the impacts of climate change on mental health and well-being in an Inuit context. Data for this work were gathered through over 85 semi-structured in-depth interviews and 112 questionnaires, from individuals of all ages and backgrounds living in Rigolet, as well as with Nunatsiavut health professionals and community-based health workers. From this research, participants reported that climate change impacts mental health and well-being through five interconnected ways: through a disruption in land activities due to decreased snow and ice stability and weather patterns leading to decreased mental solace and well-being; through increased family stress and reports of drug and alcohol usage due to more time in the community; through reports of increased suicide-related challenges self-identified to be linked to decreased land time and sense of a lack of purpose; through the compounding of underlying issues from rapid socio-economic-cultural transformations; and through the triggering and magnification of previous traumas.These findings are foundational to the emerging research on climate change and mental health globally and highlight similarities and differences in mental health impacts from different geographical locales. The results from this study call for further investigation and analysis of climate-related determinants of mental health and mental adaptive processes in Canada, throughout the Circumpolar North, and worldwide.

LIFE CYCLE, REPRODUCTION AND VERTICAL MIGRATION OF THE COPEPOD CALANUS HYPERBOREUS IN THE AMUNDSEN GULF, SOUTHEASTERN BEAUFORT SEA

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The copepod *Calanus hyperboreus* makes the bulk of the zooplankton biomass in the Arctic Ocean and deep areas of its peripheral shelf seas where it plays a key role in the trophic transfer of energy and in the biogeochemical carbon flux. As the only calanid species to reproduce in winter, important aspects of its life history traits remain poorly documented in the Canadian Arctic. As part of the Circumpolar Flaw Lead System study, we studied the life cycle, vertical migration and reproductive biology of *C. hyperboreus*, using time series of abundance, biomass, and egg production rates covering the period October 2007-July 2008 in the southeastern Beaufort Sea, with a strong emphasis on Amundsen Gulf. The overwintering copepodite stages (CIV, AF, CV, and CIII) displayed a classical pattern of seasonal vertical migration. They were distributed below 100 m depth from October to April before a quick ascent to the surface layer ahead of the precocious 2008 ice break-up and phytoplankton bloom. Within two months, the biomass dominant stages AF and CV were able to replenish their lipid reserves and initiated their seasonal migration to depth in July. The season of reproduction ranged from January to mid-April, at depth before the onset of primary production. *Calanus hyperboreus* females had a vigorous winter 2008 reproduction solely fuelled by lipid reserves (20-65 eggs f^{-1} d^{-1}) that led to high numbers of eggs and young nauplii NI-NIII in the water column in February-March. However, recruitment of copepodites CI in late May, which coincided with a strong phytoplankton bloom in Amundsen Gulf, was modest (13-21% of copepodites) compared to the sites off the western coast of Banks Island and in McClure strait (>75% of copepodites). Consequently, total abundance and biomass of this species did not increase during summer in Amundsen Gulf. As a mismatch between the first-feeding naupliar stage NV and food availability was unlikely under the favorable feeding conditions of April-May 2008 provided by the early onset of primary production, we surmise that a strong top-down control on the young developmental stages in late winter precluded later copepodite recruitment and population growth. The omnivorous copepod *Metridia longa*, found in high abundance in the parts of the gulf deeper than 200 m, was likely responsible for much of the predation on *C. hyperboreus* eggs and nauplii. We conclude that stronger predation pressure could counteract the potential advantages of climate-induced lengthening of the growth season and enhanced pelagic primary production to the population growth of the large herbivore *C. hyperboreus* over the deep parts of the Canadian Arctic shelves.

CHANGES IN GLACIER FACIES FROM 2004 TO 2011 ON DEVON ICE CAP, NUNAVUT, BASED ON BACKSCATTER VALUES IN ENVISAT ASAR WIDE SWATH IMAGERY

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Glacier facies represent regions of a glacier surface with distinctive surface characteristics (e.g., glacier ice zone, saturation/percolation zone, dry snow zone) that typically relate to spatial variations in surface melt patterns. Backscatter analysis of synthetic aperture radar (SAR) imagery can be used to discriminate glacier facies with different surface properties due to the distinctive reflected signal caused by the elementary scatterers on the surface. In post freeze-up (autumn) SAR imagery, the glacier ice zone and dry snow zone have a relatively low backscatter due to the greater penetration of the radar signal into the surface. Conversely, the saturation and percolation zones are identifiable based on their high backscatter due to the presence of ice lenses and pipes acting as efficient scatterers to reflect the signal. Temporal changes in the location of glacier facies are often interpreted as a climate indicator, with facies zones typically increasing in elevation over time in response to atmospheric warming (Colgan and Sharp 2008). In this study, ENVISAT ASAR Wide Swath imagery is used to monitor the progression of facies zones across Devon Ice Cap from 2004 to 2011. This data is validated against in situ surface temperatures, mass balance data, and Ground Penetrating Radar (GPR) surveys from the northwest sector of Devon Ice Cap. The backscatter images are orthorectified using a Canadian Digital Elevation Dataset (CDED) DEM to apply a radiometric terrain correction, which enables the return of calibrated sigma nought values. Based on these values, the backscatter imagery from autumn 2004 to 2011 shows the disappearance of the dry snow zone at high elevations and the general increase in elevation of the firn line over this

period. This is indicative of the anomalously high summer melt rates on Devon Ice Cap altering the surface properties of the ice cap and contributing to the increasingly negative mass balance.

KNOWLEDGE OF ARCTIC AND UNMANNED AERIAL VEHICLES

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Over the past 20 years, Shelton De Silva has been working on hydropower developments and environmental field projects funded by the Canadian Government Agency associated with SNC Lavalin and Stothert Power Corporation. He innovated and designed a "color coded" recognition system for first responders in the event of any CBRNE incident. He also innovated and designed an unmanned vehicle to combat wildfires and access the Arctic region for scientific investigations. In 2010 Shelton wrote a technical paper on how to combat wildfires creating moisture barriers using aerial and ground unmanned vehicles. In 2012 he wrote a paper "Balance of Arctic" how to use UAV's to collect data for scientific investigations. He also participated in oral and poster presentations in Canada and USA regarding the use of Unmanned Vehicles.

IMPACTS OF ENVIRONMENTAL CONDITIONS ON THE ASSIMILATION, RECYCLING AND NITRIFICATION OF AMMONIUM IN MARINE WATERS OF THE WESTERN CANADIAN ARCTIC

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As a limiting element for biological productivity, nitrogen occupies a central role in ocean biogeochemistry. Its distribution in the ocean affects (and is affected by) primary production and microbial processes, consequently impacting exchanges of biogenic climate-active gases between the surface ocean and the atmosphere. In the Arctic Ocean, the growth environment of living organisms is changing dramatically; the extent and thickness of sea ice are declining rapidly (affecting light and mixing regimes), freshwater runoff is increasing due to enhanced precipitation and glacier melt, the ocean is warming and acidifying. These multiple stressors are bound to alter nitrogen cycling and the structure and function of marine food webs, but these impacts are poorly quantified and understood. The goal of this project is to quantify rates of microbial ammonification, nitrification and ammonium assimilation as well as their sensitivity to environmental perturbations. Data were collected in fall 2012 during a joint DFO-ArcticNet expedition of the CCGS *Henri Larsen* in Baffin Bay and the Labrador Sea. Water samples from the surface and subsurface chlorophyll maximum were taken in different hydrographic regions and incubated with 15N-labelled ammonium under different conditions of light, pH and ammonium availability. At other stations, additional incubations were performed to establish vertical profiles of these rates. Post-cruise determination of ammonium assimilation, recycling and nitrification will be done by analyzing the isotopic enrichment of the organic matter retained on filters and of the dissolved inorganic nitrogen in filtrates with an isotope ratio mass spectrometer. The results will improve our understanding of the nitrogen cycle in cold waters influenced by rapid climate change.

IMPACTS OF ENVIRONMENTAL CHANGE ON BERRY PRODUCTIVITY IN THE KITIKMEOT REGION: A STUDY INTEGRATING COMMUNITY PARTICIPATION WITH SCIENCE

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Integration of Traditional Ecological Knowledge (TEK) with scientific data can improve our understanding of the changing environment in the Canadian arctic. Although recent efforts have been made to integrate TEK and science, there are still missing key components in Nunavut. By collaborating with Territorial education institutions, there is great potential to expand our knowledge regarding TEK and ecological processes such as berry productivity. The production of the culturally important berry species is heavily influenced by seasonal conditions such as temperature, precipitation, and soil moisture. Thus, berry productivity can be used as an indicator for environmental change making it an ideal subject for a long-term monitoring program. The main objectives for this study are to: (1) establish a long-term community-based monitoring program using the annual productivity of Vaccinium vitis-idaea (Kingminat, Cranberry), Empetrum nigrum (Paun'ngait, Crowberry), Vaccinium uliginosum (Kigutaginak, Blueberry) and

Rubus chamaemorus (Akpik, Cloudberry) in Kugluktuk, Nunavut and (2) compile TEK data regarding Inuinnaqtun berry vocabulary, berry ecology, traditional usages and stories into educational material. Together, these objectives will help us monitor and further our understanding of the effects of environmental change as well as stimulate socio-economic growth of local communities by engaging Inuit youth in science and technology.

SYNCHRONY BETWEEN BREEDING PHENOLOGY OF AN ARCTIC-NESTING INSECTIVORE AND ITS FOOD RESOURCES: INVESTIGATING THE EFFECT OF MISMATCH ON JUVENILE GROWTH RATE

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In seasonal habitats, wildlife breeding period must be timed with the availability of resources to maximize reproductive success. With the ongoing climate changes, a loss of synchrony between the reproductive phenology of predators and their prey might occur. Indeed, the timing of seasonal activities in response to global warming could differ between species at different trophic levels. For birds, it is important that the hatching period coincides with the peak in resources abundance to favor juvenile growth and survival. It is particularly difficult for migratory birds to predict local environmental conditions on their breeding grounds which may further increase the potential of a mismatch (desynchronization). This is even more likely at northern latitudes where the amplitude of climate changes is the highest. Few studies focused on this issue in northern passerines such as the Lapland longspur (*Calcarius lapponicus*), an abundant summer resident on Bylot Island, Nunavut. In this particular breeding population, we investigated the synchrony between hatching date and abundance of arthropods (i.e., biomass of insects and spiders) and evaluated how it could affect juvenile growth. As the critical growth period corresponds to the 10 first days spent in the nest, the Lapland longspur possesses a small window to achieve synchrony with the peak in food availability. Over five years, intensive nest monitoring was conducted and juvenile growth recorded. The seasonal change in the abundance of arthropods was estimated using pitfall traps. Across years, a high variability in the range of hatching dates between early and late breeders was found. Also, a relatively steep seasonal decline in clutch and brood size was observed, indicating that late breeders typically had fewer chicks to feed during brood rearing. No effect of hatching date on chick growth rate up to 10 days was detected, suggesting that the adjustment in parental breeding effort could compensate for the seasonal change in food availability. Negative effect of a mismatch on chick growth rate and survival could nonetheless happen after fledging, when juveniles start feeding by themselves. A better understanding of the relationships between breeding phenology, abundance of resources, parental investment and reproductive success is crucial to assess species capacity to deal with a modification of their environment caused by global warming.

INVESTIGATING LAND-BASED INJURY AND TRAUMA IN THE CANADIAN NORTH

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Unintentional injury and trauma rates are disproportionately high in Inuit regions, but there are major gaps in our understanding of the causes of injury and trauma, and in particular the role that environment may play. Investigating this issue has become more urgent, as environmental changes are predicted to exacerbate injury rates, and Inuit communities have already been reporting concerns about increasing accidents and anxiety associated with changing ice and weather conditions. In response to these concerns, this study investigated the role of environmental and other factors in search and rescue (SAR) incidents in Nain, Nunatsiavut. This collaborative mixed methods project used a case study approach. We analyzed Nain Ground Search and Rescue (NGSAR), Nain Royal Canadian Mounted Police (RCMP), and federal military SAR records spanning 1995 to 2010, and conducted three interviews and numerous meetings with NGSAR and police representatives between July 2010 and May 2011.

SAR data show 83 cases involving 218 individuals. Based on Nain population data and regional harvesting participation data, this represents an estimated average annual incidence rate of 19 individuals per 1000 requiring assistance through SAR. Ninety-six percent of cases documented in local records (NGSAR and RCMP) took place during the winter season when residents typically travel by sea ice, and data showed that weather and ice conditions were the most frequent contributing factor for cases. However, there were no temporal trends in the annual number of cases or the number of cases during the winter season. The estimated incidence rate was six times higher for males than females, and travellers aged 26 to 35 had the highest incidence rate among age groups. Intoxication was the least common factor associated with SAR incidents. In cases where health status was indicated, 35% of individuals or 21 people sustained minor to severe health impacts during winter travel in cases where health status was indicated, including three deaths. However, these impacts likely represent only a portion of injury and trauma sustained due to many land-based incidents likely being managed without SAR assistance.

These results indicate that environmental influences are critical factors contributing to health risk in Inuit communities, and that land-based health risk is associated with the use of sea ice in the winter months in particular. Results of this study also indicate that age and gender are important risk factors for SAR incidents. Our study also demonstrates issues of underreporting of land-based injury and trauma, and the inadequacy of current injury surveillance systems. Based on these results, there is an urgent need to gather cause-specific unintentional injury and trauma data in Inuit regions, and expand and improve monitoring of land-based incidents in particular.

UV-PROTECTIVE COMPOUNDS IN PHYTOPLANKTON AND ALGAE ASSOCIATED WITH A MELTING ARCTIC FIRST-YEAR SEA ICE COVER

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Mycosporine-like amino acids (MAAs) are small molecular weight (<300 amu) UV-absorbing molecules that have been identified in many high-light acclimated marine species. The production of these organic compounds is mainly attributed to algal and cyanobacteria communities, where they play an important photoprotective role as a sunscreen for harmful UV radiation (280 - 400 nm). Recently, it has been reported that these compounds are present in the Arctic marine ecosystem, but their production and role in sea ice-associated algal communities remains poorly known. In this work we seek to quantify MAAs in different ice-associated algal communities to determine where and when these compounds are produced. Sea ice, ice melt water (surface and under-ice melt ponds), and water column samples were collected from a landfast sea ice environment in Resolute, Nunavut, during advanced stages of melt (May 6 to June 24, 2011). Following extraction by methanol, the samples were analyzed for MAAs by high performance liquid chromatography with an UV-visible diode array detector. Due to the lack of appropriate standards and difficulty in structural identification at low concentrations, we were only able to identify "MAA-like" compounds based on matching chromatographic retention times published in the literature and on their absorption characteristics. No MAA-like compounds were detected in the ice algae samples in the bottom 3 cm of ice cores in early May, but MAA-like peaks (primarily at 332 nm and 300 nm) were observed later in the season. MAA-like peaks were present in all surface melt-pond samples with a novel high UV-absorbing peak centered at 363 nm (MAA 1). In contrast, algae in the bottom ice layer, in under ice-melt ponds and in the water column only showed traces of this compound at the very end of the sampling period (June 24, 2011). It is hypothesized that this molecule is unique to the brackish melt ponds and traces that are detected in other habitats are due to penetration of ice melt water into the bottom layers and mixing with the underlying water column. Though its molecular identity remains to be determined, the MAA 1 compound appears to be the primary contributor to UV protection for these algal communities. This preliminary work confirms the presence of MAA-like compounds in the unique Arctic sea ice environments and calls for further study on the molecular identities of these compounds and how their production responds to a changing light environment in the Arctic Ocean. An improved understanding of the production of these compounds may provide a sensitive indicator of the effects of climate change and stratospheric ozone depletion on ice-algal and phytoplankton communities.

A STABLE ISOTOPE CHARACTERIZATION OF THE NORTHERN HUDSON BAY FOODWEB

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Hudson Bay is one of the world's largest northern seas, and completely within Canadian jurisdiction, yet little is known about many components of its ecosystem. To provide a coarse-scale characterization of the food web of Hudson Bay during 2005-2008, we used carbon and nitrogen isotopes for 82 species ranging from kelp to whales. Harbour seals had the highest δN value, an index of trophic level, and kelp had the lowest δN value. Different habitats were delineated by δ13C values, with intertidal pools being the most enriched and estuarine habitats the most depleted. Freshwater influx affected δ13C values of animals at the base of the food web, such as Calanus, with most enriched values near the entrance to Hudson Strait and most depleted values near the large rivers of western Hudson Bay. The food web had a pyramid-like shape with isotopic variation highest near the bottom of the food chain and lowest near the top, as animals integrated isotope values over larger spatial distances. Arctic cod (*Boreogadus saida*) was the only species to show statistically-significant temporal variation, with more enriched δ13C in 2005-06 than 2007-08; such differences may be related to the timing of sampling relative to ice-off dates and reflect a switch from under-ice food webs to benthic food webs over the course of a given summer. Both Arctic cod and capelin (*Mallotus villosus*) appeared in the centre of the food web, highlighting their potential role as "keystone" prey. Diet of some fish in Hudson Bay is poorly known, and our data helped clarify potential roles. For instance, the banded gunnel (*Pholis fasciata*) occurred at a low trophic level, confirming its niche as an algae-eater. Carbon and nitrogen stable isotopes provide an overview of the Hudson Bay food web, and provide a baseline against which further changes can be monitored.

RECONSTRUCTION OF SEVERE DROUGHT YEARS OF THE PAST TWO CENTURIES FROM SUCCESSIVE LARGE FIRES IN A FIRE-PRONE LANDSCAPE OF NORTHERN QUEBEC

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The North American boreal forest is a fire-prone biome with large, severe and frequent wildfires. Extremely large fires (more than 100 km across) regularly recur during severe drought years in the most fire-prone regions. Consequently, fire size can be used as a proxy to reconstruct severe droughts of the past centuries. However, reconstructing the surface area of past fire is difficult because previous fires are often masked by later ones. In this study we overcame this problem by measuring the linear cover of overlapping fires rather than their surface area. Our sampling design comprised a 150 km long transect, subdivided into 75 adjacent 2-km x 1-km cells. Fire of the last 200 years in each cell where dated using standard dendrochronological methods. Episodes of postfire tree-establishment and the occurrence of fire were reconstructed from first tree rings and from fire scars in stems of more than 650 live individuals, snags and woody debris of jack pines (*Pinus banksania* Lamb.) and black spruces (*Picea mariana* (Mill.) BSP). Comparing fire years between pairs of adjacent cells allowed to reconstruct the linear cover of each fire along the entire transect. Preliminary results show that at least 11 fires larger than 6 km across (3 cells) occurred since 1800. Fires of 10 km occurred in 1847, 1910, 1917, 1921, 1938, 1955, 1983, 2002, 2005 and 2010. The largest fires of the last 200 years occurred in 2005 (52 km) and 1910 (50 km). Fire years of the last fifty years will be compared to instrumental series of temperatures, precipitations and drought indices to calibrate the reconstruction of past drought conditions. A simulation model of fire spread will also be used to reconstruct the surface area of fires from their linear cover.

LARVAL POLAR COD (BOREOGADUS SAIDA) AND SANDLANCE (AMMODYTES SP.) TROPHODYNAMICS IN THE WARMING BEAUFORT SEA

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As in most areas of the Arctic Ocean, the duration of ice-free season, river discharge and frequency of storms are increasing in the warming Beaufort Sea. These

rapid changes will impact the equilibrium of the marine ecosystem, and potentially lead to the replacement of artic fish by a temperate assemblage. In the arctic food web, polar cod (*Boreogadus saida*) is a key species dominating the fish community and channelling up to 75% of the energy from zooplankton to higher trophic levels. Recently, a boreal fish species appeared in the Beaufort Sea: sand lance (*Ammodytes* sp.) juveniles and larvae occurred in 2010, with a strong abundance in 2011. The settlement of a permanent sand lance population in the Beaufort Sea would considerably modify trophic interactions and could affect the polar cod survivorship through competition. The present study aims to elucidate the consequences of such potential invasion on polar cod early life history. Analysis based on larval period will permit to gain a perspective on the future arctic fish communities, because larvae's survival dictates the abundance of adults.

Fish larvae were captured in September and October 2011 with a double-square net (1-m^2 mouth aperture, 500 µm and 750 µm mesh oblique tows) along with their prey (50 µm and 200 µm mesh vertical tows) over 24 stations located on the MacKenzie Shelf and in Amundsen Gulf. At each station, the potential prey field was described and quantified to the lowest taxonomic level possible. The gut content of a larval subsample (42 polar cod and 42 sand lance) was dissected and prey were measured, counted and identified to the species for evaluating prey selectivity, feeding success and diet overlap. In a subsequent analysis, DNA barcoding will allow identifying Ammodytes larvae to the species, as morphological traits do not allow discriminating congeners during early stages. The otolith microstructure will be analysed for ~100 larvae per fish group to assess hatch date and growth history. Feeding habits and growth rate will be used as trophodynamic indicators. We predict that the arrival of a boreal pelagic fish in the Arctic will modify carbon fluxes among trophic levels and could impact populations of vertebrate predators.

DIRECT AND INDIRECT EFFECTS OF PREDATION ON LEMMINGS IN THE HIGH ARCTIC

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Wildlife populations are affected by large-amplitude, cyclic fluctuations of abundance and these have long fascinated ecologists because of the complex mechanisms involved in their regulation. Although both bottom-up (i.e. resources) and top-down (i.e. predation) forces have been shown to drive population cycles under some circumstances, there are still debates over which of these forces is primarily responsible for regulating lemming cycles in the High Arctic. Brown lemming (*Lemmus trimucronatus*) populations found on Bylot Island, Sirmilik National Park, Nunavut, are characterized by 3 to 4-year population cycles. Previous studies indicated that brown lemmings only consume a small fraction of the total plant biomass available at this site during winter, and thus food limitation is unlikely to drive these cycles. Furthermore, a related study demonstrated that, although quality of the snow cover may affect the amplitude of cycles, change in snow quality due to recent increases in temperature were not large enough to disrupt the cycles. However, results of these studies suggested that predation may be involved in generating lemming cycles on Bylot Island. Direct mortalities caused by high predation rate have often been identified as an initiating factor for population cycles. Predation may also be responsible for indirect effects which, through maternal effects, could potentially reduce recruitment of the prey. We will test the hypothesis that predation can drive brown lemming population cycles in the Canadian Arctic through a combination of both direct (i.e. lethal) and indirect (i.e. non-lethal) effects. We have excluded most predators over a large area (8 ha) with both a fence and a net, built in the summer of 2012, when lemming populations and their predators were in the low of the cycle. We are live-trapping lemmings in a grid located inside the exclosure and one outside it (control) three times each summer in 2012, 2013, and 2014 to estimate their abundance, survival and recruitment rate. The non-lethal effects of predation are measured by assaying the stress hormones (i.e. corticosterone) found in lemming faeces. We will first proceed with a validation to quantify the relationship between blood corticosterone and fecal corticosterone metabolites that are produced after a stressful event. Terrestrial predators (i.e. arctic fox, *Vulpes lagopus*, and short-tailed weasel, *Mustela erminea*) will be monitored with a combination of signs of predation in winter nests, snow tracks, live-traps (for weasels) and direct observations. According to our hypotheses, we predict that the abundance, survival and recruitment rate will be higher inside the enclosure than outside it during both peaks and lows. We predict that the stress of lemmings will be lower inside the enclosure compared to outside. Finally, we predict that stress of lemmings will be higher in years of high abundance and high predation rates

compared with years of low abundance and low predation rates. Preliminary results of the 2012 field seasons will be presented.

CHANNEL SNOWPACK AND MORPHOLOGY CONTROLS OVER SUSPENDED SEDIMENT TRANSPORT IN A HIGH ARCTIC RIVER

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Projected climate change is expected to have substantial impacts for Arctic ecosystems, especially with regard to altering the stability of the landscape and hydrological regime. These changes will have implications for suspended sediment transport in Arctic rivers, which in turn has potential impacts on downstream aquatic and coastal marine ecosystems as sediment acts as a substrate for both nutrients and contaminants alike. This study seeks to characterize the short term sediment transport dynamics through the West River (unofficial name) at the Cape Bounty Arctic Watershed Observatory (CBAWO) on Melville Island, Nunavut (74.91° N, 109.44° W), a river with nearly a decade of hydrological and sediment transport research that is unique in the Canadian Arctic. Specifically, this study attempts to understand the linkages between the roles played by channel snowpack, morphology and major sediment sources outside of the channel on erosion and the downstream transport of suspended sediment.

During the 2012 season, suspended sediment datasets were collected from a primary outlet station and six upstream locations to identify the sources and sinks of sediment in the various reaches of the West River. The amount of potential sediment available for removal was also compared to the timing and locations where the flow was isolated from the channel bed by snow and where it progressively reached the bed. Preliminary analysis suggests the West River is storing material in many reaches downstream of prominent sediment sources during the entire season, particularly during the snowmelt period when most sediment is transported.

The goal of this study is to understand the relationships between channel snowpack, channel morphology, and the timing of sediment movements in the West River. Demonstrating the link between these complex processes will improve our ability to predict the effects of perturbations such as land disturbances and resource development might have on have on suspended sediment transport and the delivery of nutrients and contaminants to downstream aquatic ecosystems. This will have broader implications for Arctic river research, as the sediment transport relationships gathered from this study can be used to explain similar dynamics elsewhere.

ASSESSMENT OF CLAW GROWTH-LAYER GROUPS FROM RINGED SEALS (PUSA HISPIDA) AS BIOMONITORS OF INTERAND INTRA-ANNUAL HG, Δ15N, AND Δ13C VARIATION

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The ringed seal (*Pusa hispida* (Schreber, 1775)) is a sentinel species of arctic marine mammals; therefore, methods to monitor its life-history changes are crucial to establish effective conservation strategies. We evaluate the potential use of claws of ringed seals as a proxy for counts of tooth growth-layer groups (age) and a biomonitor of total mercury burden (THg) and diet (stable isotope ratios expressed as δ15N and δ13C). The count of claw growth-layer groups was indicative of age up to 8 years and we infer differentiation of dark and light annuli as being associated with the spring moult. No differences of THg, δ15N, or δ13C were observed among flipper digits. The proximal claw annulus representing the most recent growth had δ13C values that were correlated to both muscle and liver δ13C, supporting the use of claws to monitor visceral δ13C. Claw log10THg from the proximate annulus was significantly correlated to liver and whisker log10THg, while significant interannual THg accumulation was observed in 18 of 32 seals ≥4 years, suggesting the claws receive and disperse Hg from active tissues of the body. Results support the use of claw tissue from ringed seal to provide a chronological record of inter- and intra-annual variations representing seal diet, contaminant load, and life history.

SOURCES OF VARIABILITY AND CHANGE IN THE RECENT CLIMATE RECORD OF LABRADOR

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Recent years have seen a number of unusually warm winters in Labrador, several of which have negatively impacted transportation and food/resource accessibility for many residents, raising concerns over regional climate change and variability. In order to better understand these events and their underlying cause, the recent temperature record is examined in detail using atmospheric reanalysis products and relevant station data. In addition to quantifying seasonal and annual trends, the influence of major climate drivers (e.g. internal and external sources of climate variability) is explored and their contributions to recent anomalies are quantified. The North Atlantic Oscillation (NAO) and Atlantic Multidecadal Oscillation (AMO) are identified as the dominant sources of climate variability in Labrador, with the winter NAO producing the largest and most predictable anomalies. Further analysis supports previous studies that identified the NAO as the primary contributor to warm periods in the late 1950s and early 60s and an unusually cold period in the late 80s and early 90s. Removing the influence of the NAO and other climate drivers greatly reduces the magnitude of recent warm anomalies. However, temperature trends in the residual data are amplified in most seasons; most importantly, trends in the winter residual are four times larger than the raw winter data, and become statistically significant. This suggests that climate change, obscured by natural variability in the raw data set, is beginning to exert an influence on Labrador. While climate change likely contributed only weakly to the extreme events of 2010-2011, it is gradually raising the probability of similar events in the future.

This research is a contribution to ArcticNet's Nunatsiavut Nuluak project (4.6), which studies the impacts of climate change, modernization and contaminants on the health of ecosystems and communities in and adjacent to Nunatsiavut, the Inuit Land Claims region of northern Labrador. Important goals of the overall project are to distinguish between the impacts of ongoing climate change and resource development at our study sites and to advance the science of monitoring for tracking the effects of these two system stressors. An understanding of the sources and influences of major climate drivers in Labrador is a critical first step in unraveling past and current climate change contributions to seasonal and inter-annual variability, especially for baseline years prior to resource development.

MOBILIZING INUIT TRADITIONAL KNOWLEDGE FOR ADAPTING TO THE HEALTH EFFECTS OF CLIMATE CHANGE

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The Lancet Commission (2009) identified climate change as the biggest public health threat of this century. The Canadian North is on the frontline of these changes, with these regions experiencing decreased snow and ice quality, stability and extent; increased frequency and intensity of storms and extreme weather events; increased seasonal temperatures; and changes to wildlife and vegetation patterns. Northerners—many who depend on the natural environment for their livelihoods and cultural identity—are particularly susceptible to the health impacts of climate change, and even subtle alterations to climate and environment can affect health and well-being. An identified priority for climate-health research and public health in Northern regions is, then, to identify strategies to assist communities to adapt to the health impacts of climate change, which are locally-appropriate and culturally-relevant, are based on Inuit traditional knowledge and wisdom, and are created in partnership with communities.

In response to this research need and priority, the Inuit Traditional Knowledge for Adapting to the Health Effects of Climate Change (IK-ADAPT) was launched in May 2012. Funded through the Canadian Institute for Health Research (CIHR), IK-ADAPT combines scientific research and Inuit traditional knowledge to develop an evidentiary base to inform policy and programming needed to adapt to the health effects of climate change. Working in partnership with communities across Northern Canada in the Inuvialuit Settlement Region, the Northwest Territories, Nunavut, and Nunatsiavut, as well as knowledge users at multiple levels, the project will work in partnership with Inuit communities to examine ways to preserve, promote, and disseminate Inuit knowledge in order to prevent, prepare for, and

manage the health impacts of climate change.

This poster will introduce the IK-ADAPT project and its community partners. A project overview describing the aims, scopes, participatory methodology, and preliminary findings will also be discussed. By examining how Inuit knowledge facilitates adaptation, and developing strategies for documenting and disseminating Inuit knowledge that are community-created and community-supported, IK-ADAPT aims to strengthen the evidence base for adaptation action, informing government and communities on ways to adapt while simultaneously promoting Inuit knowledge and skills transmission. The focus on Inuit knowledge for adaptation throughout this project reflects the continued importance of these knowledge bases as integral to health and well-being, and recognizes the need for including Inuit traditional knowledge in climate adaptation strategies.

GRAND LAKE LABRADOR : PAST DISCHARGE AND RECENT LIMNOLOGIC CHANGES

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The ARCHIVES has for objective to reconstruct pas hydro-climate variability of the Boreal region of Québec-Labrador over the past millennia using dendrochronology and varved lake sediment. Within this project, the sediments of Grand Lake, a deep (>300 m), 60 km long brackish lake were cored and analyzed. Clastic varves or fluvial origin are found in several cores located near the two main inflows at depth greater than 130m. These varves consist of two main units: a fine sand and silt rich layer (high energy / slow melt) and clay rich unit (low energy). The coarse unit can be graded of not, simple or finely laminated and the clay cap can be sometimes interrupted by silts layers. Instrumental discharge records over the period 1979-2010 are showing that the duration of the peak discharge (slow melt) controls in part thickness of the total coarse layer. Similarly we can relate the interrupted clay caps with late fall high discharge events. The depth of the lake, the presence of a chemocline and the very turbid inflows contribute to the exceptional preservation the sediments of Grand Lake. The direct relationship between these clastic varves properties and local and regional river discharge to develop an hydroclimatic reconstructions over the past 500 years.

MAPPING LANDSCAPE-SCALE DISTURBANCES IN THE NORTHERN MACKENZIE BASIN, NWT USING A 25-YEAR LANDSAT SATELLITE IMAGE ARCHIVE

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The Northern Mackenzie Basin in north-western Canada has ecological, cultural, and economic significance. This landscape is changing rapidly in response to natural and anthropogenic disturbances, as well as recent temperatures changes. To improve environmental monitoring and better inform decision making within NWT, the Cumulative Impacts Monitoring Program (CIMP) was established by Aboriginal Affairs and Northern Development Canada in partnership with a joint Aboriginal, territorial, and federal working group. Under the CIMP initiative, we are analyzing a 25-year archive (145 scenes) of 30 m resolution Landsat satellite imagery in an effort to scale-up previous CIMP disturbance mapping activities to an area covering 85,000 km^2 within the northern Mackenzie Basin. Change detection techniques will be used to determine the location, extent, and timing of vegetation disturbances caused by thaw slumping, draining lakes, storm surges, wildfires, infrastructure, and hydrocarbon and mineral exploration activities. The dense time series of images will also allow investigation of long-term, gradual vegetation changes resulting from warming temperatures in the region. Satellite change detection products (for the southern portion of the study region) will be analyzed and reported using a watershed framework, which will provide flexibility by using a hierarchy of nested watershed scales based on stream order. The geospatial products will be made available through the NWT Spatial Data Warehouse to assist planners and decision makers in better understanding large-area disturbance impacts on water quality, fish habitat, and caribou forage.

THE POLAR DATA CATALOGUE: A DYNAMIC TOOL FOR DATA SHARING AND DISCOVERY

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What is required to design, create, and maintain an online data portal? In this presentation, we will outline the components needed to build the Polar Data Catalogue (PDC), the public data and metadata repository and access website for the ArcticNet Network of Centres of Excellence, the Canadian International Polar Year program, the Canadian Space Agency, and a growing list of scientific research projects and programs in Canada and internationally.

The original archive that grew into the PDC had its beginnings in the 1990's, as the need for a data portal became apparent to members of Canada's cryospheric research community who sought a structured environment for sharing data with others. The response was formation of the Canadian Cryospheric Information Network (CCIN). Funding was secured to hire staff and purchase computer hardware, and a website and database were built to receive and hold the incoming datasets. Over the years, new ideas and partners have shaped the CCIN archive into the PDC, a much more capable, flexible, and usable system. A key driving influence was ArcticNet, whose researchers required a data management infrastructure for natural, health, and social sciences. Close collaboration with ArcticNet as well as IPY have resulted in a multi-sectorial data portal accessible to the public and increasingly available to Canada's northern communities.

Today, the PDC consists of a production system with redundant servers and 50 Terabytes of storage space for archived data. The paired production machines serve the PDC website and are configured for minimal downtime in the event of hardware or software failure. The portal website itself provides two functions - a password-protected interface for researchers to upload their metadata and data, and a public search tool for discovery and access to the uploaded data and information. Both applications are coded in Java, and the central database uses the newest version of Oracle, 11gR2. Additional functionality is provided by a new website with information on the Canadian cryosphere, and a new search tool, PDCLite, is for users with limited internet access. The entire system is duplicated in a remote location for use in the event of loss of the primary system, and additional copies are in place for development and testing of new functionality and configurations.

Operation of this system requires the technical expertise of Oracle Database Administrators and Developers; Web Developers who program in Java and use a variety of other computer languages and web technologies; and Systems Administrators who build and maintain the hardware, operating systems, and networks. In addition, Co-Op and Graduate Students join the team to undertake special projects, and program coordination, outreach, interaction with contributing researchers, and fund-raising are handled by the CCIN Director and Manager.

Our partners and collaborators keep the system alive and facilitate its growth and improvement over time. They provide financial support for salaries and computers, and they provide inspiration in the form of questions and requests for new capabilities which enhance the system for all who use it.

THE USE OF VISUALIZATION AND HYPERMEDIA TO REPRESENT INUIT KNOWLEDGE OF LANDS AND RESOURCES IN NUNATSIAVUT

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Space and place play an important role in the Nunatsiavimmiut knowledge system and way of life. Similarly, geographic information and the use of maps and Geographic Information Systems (GIS) are important in land and resource planning in Nunatsiavut. In this project, we use geography and geographic concepts as a starting point in linking Inuit knowledge (Nunatsiavut) with local decision makers, younger generations, and members of the scientific community. Mainstream GIS databases can have a rigid structure which makes the representation of complex and nuanced Inuit knowledge and the sharing of information between knowledge systems difficult. To address this challenge we have adopted a Geo-spatial ontology (knowledge mapping and related technologies) approach to visually and logically representing and

communicating Inuit knowledge, including concepts, terms and relationships.

In the first phase of the project, a content analysis of text in Our Footprints are Everywhere (OFAE 1977) has provided the team with a foundational understanding of local knowledge of caribou and other key subsistence species up to the 1970s. The results of the content analysis have been used to generate a detailed concept map about caribou, which in turn has been transformed into a preliminary formal ontology. Here we define ontology as a formal, computer-based, conceptualization of a specific knowledge domain.

The ontology developed is used to generate a Web-based visualization of the relationship between concepts, and between concepts and real world instances (e.g. place and Nain, river and Kogaluk River). The knowledge model is complex and comprises hundreds of concepts and relationships. Nested hierarchy and radial tree visualizations are used to present a large amount of information content with minimal screen area. Users can expand and collapse branches representing different aspects of the knowledge. Where additional information is available, links allow the user to view additional information in the form of maps, documents, images, and video.

The ontology and, consequently, the visualization can be readily extended as the knowledge model changes as a result of local residents' continued experience of the environment, new understanding of existing information resources or additional research.

We discuss the technical and representational challenges faced when visualizing a complex knowledge model. Additionally, the research raises questions about the most appropriate location for hosting the application. While there are efficiencies in using 'cloud' based services, local hosting may be more appropriate for maintaining control over sensitive information. Future research directions are outlined.

References: OFAE, 1977. Our Footprints Are Everywhere: Inuit Land Use and Occupancy in Labrador. Carol Brice-Bennett ed. Labrador Inuit Association. 380 p.

INTEGRATING AND TRANSLATING ARCTIC SCIENCE AND INDIGENOUS KNOWLEDGE FOR INFORMED POLICY AND DECISION MAKING

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Ecological changes, economic strains, cultural transformation and other factors represent multiple stressors for Indigenous peoples of the Arctic. More specifically, forced such as climate change and variability, and large scale resource development have the ability to dramatically impact the environment, culture and identity of Inuit and other residents of the North and ultimately the face of Canada. However, not all changes may be negative, and some new opportunities may be created. The challenges and opportunities created by these forces must be met head-on with sound policy and decision-making. The best available information, based on contemporary science and community and traditional knowledge (TK), must be used to inform policy decisions that contribute to sustainable development in the Arctic and the well-being of Arctic peoples. This research project has been investigating the Arctic policy landscape and how Arctic science, in its many forms, including ArcticNet projects, products and initiatives, are transformed and contribute to informing policy at many scales. A series of sub-projects have been undertaken to inform a strategic analysis of the Arctic policy landscape and identify key factors and processes that influence the science to policy process. To date, the project has involved case studies examining the role of Inuit Knowledge in the formation of Inuit-specific environmental protection legislation in Nunatsiavut, the development and implementation of the Northwest Territories Science agenda, the Inuit Circumpolar Council's consideration and development of a position on oil and gas exploration in the Arctic and community adaptation planning in Nunavut. Case studies are being initiated to examine the different ArcticNet 'IRIS' (Integrated Regional Impact Study) approaches to working at the science-policy interface in the four Inuit regions, and to conduct a quantitative analysis of the linkages between policy and knowledge during the first phase of the ArcticNet program. Finally, a survey is being conducted among decision makers at various scales and scientists in many fields to identify perspectives and perceptions of the factors influencing what science impacts policy and decision making at various scales in regards to Arctic community and environment issues. This series of sub-projects is contributing to our present knowledge of how to improve the use, translation and transfer of research

results and Traditional Knowledge into sound policy for the many pressures facing the Arctic today.

PARTNERING EARTH OBSERVATIONS FOR PEOPLE LIVING ENVIRONMENTALLY - ARCTIC COLLABORATIVE ENVIRONMENT (PEOPLE-ACE)

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The Arctic Collaborative Environment Joint Capability Technology Demonstration [ACE JCTD] is an internet-based, open-access, Arctic-focused, environmental research and decision-support system that integrates data from existing remote sensing assets, products from existing and new environmental models, and in-situ stations to provide monitoring, analysis, and visualization based on earth observation data and modeling. These products will be layered within Google Earth and integrated into a community-based collaborative communication and coordination environment available to anyone with access to the public Internet. The goal of the ACE JCTD is to enable local, regional, and international cooperation and coordination on long-term environmental planning and near-term actions in response to climatic and environmental changes occurring in the Arctic Region. The ACE system will be transitioned in early 2013 to the National Ice Center, a globally recognized provider of Arctic Environmental Products, and is jointly operated by National Oceanic and Atmospheric Administration [NOAA], the U.S. Coast Guard and U.S. Navy. ACE partners include National Aeronautics and Space Administration [NASA], U.S. European Command [USEUCOM], Von Braun Center for Science & Innovation [VCSI], North American Aerospace Defense Command [NORAD] / U.S. Northern Command [USNORTHCOM] and University of Alabama in Huntsville [UAH].

The Aurora Research Institute (ARI), with funding provided by the Von Braun Center for Science & Innovation (VCSI), is working to provide comprehensive public access to information on licensed research in the Northwest Territories from the past 58 years. ARI is providing data layers which will be displayed within the ACE JCTD system on maps and the 3D globe (Google Earth). Information will also be organized and linked based on the research objectives, researchers involved, and year(s) for which the research was licensed. In coordination with other projects currently in progress at ARI, users of the ACE JCTD system will be able to link to ARI's public database of licences for further information on any given licenced research project in the Northwest Territories.

SAKKIJÂNGINNATUK NUNALIK PHASE I: UNDERSTANDING OPPORTUNITIES AND CHALLENGES FOR SUSTAINABLE COMMUNITIES IN NUNATSIAVUT - LEARNING FROM THE COAST

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Nunatsiavut, the southernmost Inuit region in Canada, is a rapidly growing, dynamic region that is experiencing some of the most significant climate change impacts in the country. These changes are affecting infrastructure and community services, and are placing new pressures on community planning and development. Responding to these challenges and recognizing the opportunities associated with community expansion and a changing climate, the Environment Division of the Nunatsiavut Government, in partnership with the Joint Management Committee (JMC) of Nunatsiavut and University partners, have developed the SakKijânginnatuk Nunalik (Sustainable Communities) initiative. The overall goal of the initiative is to inform best practices and provide guidance for community sustainability in coastal subarctic environments under changing climatic and environmental conditions.

The objective of Phase I of the project (Taking Stock) was to understand current community priorities, challenges and opportunities through a series of workshops with a diversity of members including residents, leaders, and individuals involved in community services (RCMP, health workers, etc.) from each of the five coastal communities in Nunatsiavut. These workshops were held in January and June 2012. Specifically, the aims of these workshops were: (i) to document those places, spaces and activities in the community that are valued by residents and seen as important to maintain for the future; (ii) to reflect on

the challenges of recent community development and change in terms of addressing community needs, values and goals; and (iii) to identify some of the obstacles to and opportunities for building more sustainable communities that reflect Nunatsiavut residents' desires and goals.

While acknowledging local contexts and priorities, clear themes related to community sustainability emerged in workshops across the region:

- Infrastructure, housing and community development – enhance design (building lot and structure, water and sewer infrastructure), durability, cultural appropriateness, environmental suitability and life span of the built environment;

- Valued spaces and places – protect natural spaces, important buildings and landmarks, trails and roads (both traditional and modern), native vegetation and water bodies;

- Energy security – improved access to and reliability of energy (diesel, oil, and wood) and support alternative/ renewable energy and energy efficiency;

- Food security – support healthy families through improved access to affordable, high quality, diverse country and market foods;

- Transportation and emergency services – improve critical transportation and emergency infrastructure, including airports and wharfs; establish public transportation in larger communities; facilitate open discussion of a road network connecting coastal communities and Goose Bay;

- Safe communities – advance human health and support a healthy environment by addressing issues related to water, dust, contaminated sites, diesel generators, quarries and garbage dumps in and around communities.

These themes will shape Phase II of the initiative (Putting into Practice), which aims to adopt an integrated and holistic approach to the challenges and priorities identified by communities. It will explore innovative solutions and establish best practices in community development in the north, fostering resilient and sustainable coastal Inuit communities.

FIRST MEASUREMENTS OF DMSP IN ARCTIC MELT PONDS

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Current climate change is increasing the melting surface and period of sea ice in the Arctic. Arctic hosts phytoplankton and ice algae species which produce dimethylsulfoniopropionate (DMSP). This sulphured compound is the precursor for DMS, a climatically active gas involved in aerosol and high albedo clouds formation. Measurements were performed two consecutive years (2011 and 2012) in two ice camps in Resolute region (Nunavut). This study presents the first measurements of DMSP in Arctic melt ponds.

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In each of Canada's four Inuit Regions, there is an Inuit Research Advisor (IRA). In Nunavut, this position is housed by Nunavut Tunngavik Inc. (NTI) and is referred as the "Research Advisor". The IRA Program is funded jointly by ArcticNet, the Northern Contaminants Program (NCP), and Nasivvik Centre for Inuit Health in Changing Environments. The program has assisted NTI in expanding its research capacity and undertakings.

NTI, the holder of the Nunavut Land Claims Agreement (NLCA), has a central role in research occurring within the Nunavut Settlement Area (NSA). NTI's primary aim in all research undertakings is to ensure Inuit participation, leading to improved and more relevant outcomes that are respectful of Inuit culture and considers community realities. NTI's research interests are wide ranging, including climate change, social and cultural development, sustainable development, mental health, human health and wildlife research. As a member of NTI's research team, the Research Advisor works towards increasing communication between researchers and communities, ensuring the integration of Inuit interests and needs into research projects as well as building capacity at the regional and community levels.

The IRAs are a link between researchers and communities. They can connect you with community members and organizations, provide advice and direction on your research, and help facilitate community engagement, as well as assist with the communication of research results in the community and/or region.

Researchers are encouraged to connect with the IRA in the region they are working in.

A COMBINED GEOMORPHIC / GEOPHYSICAL TECHNIQUE FOR HIGH ARCTIC ICE WEDGE VOLUME ESTIMATION, THOMAS LEE INLET, DEVON ISLAND

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Ground ice represents a significant component of continuous permafrost substrates, in some regions comprising nearly 50% by volume of the upper several meters of the subsurface. Detecting discrete ground ice bodies and estimating their volumes remains a major challenge for northern environments, especially in the context of morphodynamic responses to warming climate conditions or infrastructure development.

One of the most common types of ground ice structures are ice wedges, inverted triangular deposits formed over hundreds to thousands of years via percolation of surface meltwater into open thermal contraction cracks. Typically, estimation of ice wedge volumes has relied upon natural exposures on coastal bluffs or direct sampling via drilling or coring. Exposures, though, are not found at the majority of sites containing ice wedges, and drilling can be both time-consuming and destructive. Thus, a more transferable, rapidly applied, and non-destructive method of deriving site-scale ice wedge volumes is required.

Previous efforts have combined remotely sensed image analysis with surface based geophysical surveys and geomorphic interpretation to estimate wedge volumes at the site scale. However, the width components used for volumetric calculations were derived by measuring distances between polygonal trough sediment ridges on low-resolution aerial images, which could thus lead to inaccurate ice wedge volume estimates.

Our work demonstrates the utility of ground penetrating radar (GPR) for more precisely determining their near-surface width, and correlates ice wedge margins with geomorphic indicators at the surface to produce estimates of wedge volumes using a combination of high-resolution aerial imagery and differential GPS (dGPS) surveys.

The study site was located near Thomas Lee Inlet, on north-central Devon Island in the Canadian High Arctic, where a well-developed network of oriented orthogonal ice-wedge polygons is formed in a floodplain deposit comprised of silts and sands. Ground penetrating radar surveys were conducted using shielded GPR antennas (GSSI Inc.) at center frequencies of both 200 MHz and 400 MHz, with survey transects crossing five ice wedges. Radar data interpretation was verified using manual augering, delineating the ice wedge margin to centimetre-scale precision.

Results of the GPR surveys reveal, contrary to typical convention, that the ice wedges were substantially narrower than their overlying polygonal troughs. Moreover, the wedge margins were almost perfectly correlated with very narrow (< 5cm) cracks at the surface, running parallel to the trough-bounding sediment ridges. The surface cracks were subsequently surveyed using dGPS, and plotted upon high resolution (10cm/pixel) aerial images using a Geographic Information System (GIS).

By assuming an inverted triangular shape and integrating along the length of the polygon trough, estimates of ice wedge volumes were produced. The results illustrate that wedge volumes may be overestimated by 120% if polygonal trough margins are used as a proxy for ice wedge width. Consequently, we thus recommend that any remotely derived ice wedge volumes should consider polygon troughs as maximum widths only, and adjust the volumetric calculations accordingly.

FJORD DYNAMICS AND GLACIO-MARINE INTERACTIONS ALONG NORTHERN ELLESMERE ISLAND, CANADA

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Ice shelves and glacier tongues have existed along the northern coast of Ellesmere Island, Canada for the majority of the past 4000 years; however, recent atmospheric warming has contributed to the collapse of many of these cryospheric features, as well as to the loss of rare ice shelf dammed lakes (epishelf lakes). Previous studies have primarily addressed subaerial processes as the causal factors for ice shelf breakup, but submarine and subglacial processes, including changes in ocean stratification, fjord heat flux, subglacial runoff, epishelf lake outflow, and basal

channel formation may strongly influence the integrity and fate of these systems. Despite the growing evidence of the importance of oceanic processes on glacier tongue mass balance in Greenlandic fjords, where as much as 80% of ice mass loss is due to melting by ocean waters, these processes remain poorly studied on related systems in the Canadian Arctic Archipelago (CAA). In addition, the recent sharp increase in mass loss from the glaciers and ice caps of the CAA, primarily in the form of meltwater runoff, suggest understanding the aquatic and oceanic factors contributing to ice shelf and glacier tongue integrity and epishelf lake formation is critical.

Here, we present results from an investigation of Milne Fjord, the last intact ice shelf-epishelf lake-glacier tongue system along the northern coast of Ellesmere Island, Nunavut. Milne Fjord is the site of the only remaining epishelf lake in the Arctic, a perennial freshwater layer overlying denser seawater that owes its existence to the integrity of the Milne Ice Shelf and input of meltwater runoff from the Milne Glacier catchment. Our two-year field sampling effort involved a combination of oceanographic and glaciological methods, including a 15-month under-ice ocean mooring deployment, through-ice oceanographic conductivity-temperature-depth (CTD) and current velocity profiles, and ice-penetrating radar surveys. We show the first (coarse) bathymetric survey of the fjord that along with ice thickness measurements constrains the geophysical dimensions of the system. Comparison of fjord ocean properties with offshore CTD profiles indicates there is free exchange of water under the ice shelf with the coastal ocean, suggesting there is no topographic sill at the fjord mouth limiting exchange. The mooring timeseries reveals episodic variations in temperature and salinity throughout the depth of the fjord during winter months, as well as an abrupt thinning of the epishelf lake from 13 m to 9 m depth. Remote sensing images from August 2012 show that the epishelf lake ice broke up temporarily, possibly altering the fjord surface stratification due to modified surface fluxes of mechanical and thermodynamic energy. Taken in the context of the widespread ice shelf collapse and epishelf lake drainage events that have occurred along this coast in the past decade, it appears the Milne Fjord system is on the verge of similar change. This study presents a glimpse of a unique system prior to its seemingly inevitable collapse, and provides a rare opportunity to understand how fjord dynamics and ice-ocean interactions contribute to the stability (or instability) of this and related systems.

DETERMINING GROWTH RATES IN RINGED SEALS, PUSA HISPIDA, THROUGH IMAGE ANALYSIS OF CEMENTUM LAYERS IN TEETH

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Counts of cementum layers have been used since the mid-1940s to determine the age of various species of mammals including elephant seals, *Mirounga angustirostri*, grizzly bears, *Ursus arctos*, polar bears, *Ursus maritimus*, and ringed seals, *Pusa hispida*. Cementum is the mineralized avascular connective tissue that surrounds the roots of teeth. Each annual deposition layer can be divided into a narrow strip, deposited in winter, and a wider strip, deposited in summer. Together these two layers represent a growth layer group, GLG. GLG widths in mammalian teeth have been correlated to growth rate, but little research has been conducted to examine possible ecological factors that influence individual growth rate over an extended period of time within a population. We are using image analysis to compare measurements of GLG width and estimate growth rates of ringed seals, *P. hispida*. Seal teeth were collected by subsistent hunters between 2005 and 2010 from Arviut and Sanikiluaq populations in the Canadian Arctic. GLG width was measured across five transects of bisected teeth using Image-Pro 7.0. Once data collection is complete these measurements will be corrected for age then arranged chronologically. Significant differences in cementum deposition during a particular year will be tested for correlations with various ecological data. A few a priori predictions for possible ecological correlates include: yearly ice melt and freeze dates, sea temperature, predator abundance, and diet composition. To date there are differences inGLG width at different years among a few different individuals, but this has yet to be substantiated throughout the entire population. This research applies a novel technique to examine the physiological patterns of mammalian populations, increasing our understanding the Arctic marine ecosystem.

PH EVOLUTION IN SEA ICE GROWN AT AN OUTDOOR EXPERIMENTAL FACILITY

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The pH of sea ice and brine was experimentally determined during initial ice growth and melt at the Sea-ice Environmental Research Facility (SERF), an outdoor experimental sea ice facility in Winnipeg, Canada. pH measurements were performed potentiometrically and spectroscopically at near-freezing temperatures. Vertical pH profiles from bulk ice cores revealed a consistent C-shaped pattern during columnar ice growth, with highest pH values (> 9) in both exterior (top and bottom) ice sections and in frost flowers, and lowest pH (~ 7) in interior ice sections. Brine pH typically remained below that of the source seawater pH (~8.4). The distinct differences between these ice features and the underlying seawater source demonstrates the effect of the natural freezing process and associated changes in the CO_2-carbonate system on the pH of the sea ice environment. Interpreting this effect provides new insight into the conditions leading to CO_2 exchange across the ocean-sea ice-atmosphere interface. A conceptual model of pH evolution in seawater, sea ice and brine, and frost flowers is proposed to explain the observed pH characteristics of seawater components during sea ice growth and melt.

ASSOCIATION BETWEEN ENVIRONMENTAL EXPOSURES AND H. PYLORI INFECTION IN A NORTHERN CANADIAN COMMUNITY

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Introduction. The role of environmental exposures in the acquisition of *H.pylori* infection has been a contentious issue in the scientific community due to difficulty detecting the live organism from sources outside of the human stomach. Some residents of Aklavik, Northwest Territories, have reported the belief that contamination of the natural environment with sources of the bacteria is responsible for the high prevalence of *H.pylori* (~60%, varying slightly by test method) in their community. This cross-sectional analysis aims to estimate the association between exposure to sources of biological contamination and prevalence of *H.pylori* infection in residents of a Canadian Arctic community. Investigated environmental sources include untreated water, dogs, cats, mice/mouse droppings or animal innards.

Methods. Residents of Aklavik, NT, participated in a community-based *H.pylori* research project. In 2008, participants were screened for *H.pylori* infection by 13C-urea breath test (UBT). Data on demographics, frequency of untreated water consumption, regular contact with dogs and cats, presence of mice or mouse droppings in the home and frequency of contact with animal innards were collected via structured interviews. Ascertainment of exposure to animal innards focused on the hunting-related activities of field dressing, cleaning, or preparing local game animals before cooking. Using logistic regression, odds ratios (OR) and 95% confidence intervals (CI) were estimated for the effect of investigated exposures on *H.pylori* prevalence. All estimates were adjusted for age, gender and ethnicity. In order to account for dependence of response probabilities across observations, given a contagious outcome and a study population that includes family groups, clustering of individuals in households was modeled as a random effect.

Results. Complete data on *H.pylori* infection status and environmental exposures was available for 203 individuals. The proportion of these individuals with *H.pylori* infection was 62%. In this group, 14% reported exposure to mice or mouse droppings, 74% reported caring for dogs, 10% reported owning cats, 71% reported having contact with animal innards and 66% reported consuming untreated water in the past year. A positive association was observed between prevalent *H.pylori* infection and exposure to mice or mouse droppings, with an adjusted odds ratio of 2.5 (CI: 0.78, 7.9). Minimal associations with *H.pylori* infection were observed for regular contact with animal innards (OR: 1.2; CI: 0.59, 2.2), consumption of untreated water (OR: 1.2; CI: 0.59, 2.24), regular contact compared to no contact with cats (OR: 0.96; CI: 0.32, 2.8), and regular contact compared to no contact with dogs (OR: 0.82; CI: 0.40, 1.7).

Conclusions. Our preliminary analysis shows a positive association between exposure to mice (or mouse droppings) and prevalent *H.pylori* infection, although the wide CI reflects uncertainty about the magnitude of this association, given the small number of people reporting evidence of mice in their homes. The wide CIs for the other

exposures examined leave room for doubt about the effects of these exposures as well, and provide justification for examining these associations in other similar communities. Further analysis will incorporate data from other Canadian Arctic communities.

PEOPLE OF A FEATHER: LESSON PLANS TO ACCOMPANY THE FEATURE FILM

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An educational package has now been released to accompany the feature film People of a Feather. This includes lesson plans that further explore Inuit culture, technology, filmmaking, the ecology of sea ice ecosystems, and energy solutions that work with the seasons of our hydrological cycle. Lesson plans are linked to high school curriculum in Canada and the US, with a particular focus on providing culturally relevant curriculum to northern communities. Through collaboration with Kakivik and the Nunavut Department of Education, the Arctic Eider Society will be brining these lesson plans to youth and teachers in the Baffin Region of Nunavut during Winter 2013.The educational version of People of a Feather is available at www.peopleofafeather.com/educational/ and please visit www.arcticeider.com for additional information about the ongoing charitable activities of The Arctic Eider Society.

SEASONAL SIGNATURES OF DINOFLAGELLATE CYST PRODUCTION IN HUDSON BAY BASED ON MONTHLY SEDIMENT TRAP DATA

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Phytoplankters, microscopic primary producers of oceans are capable of responding rapidly to environmental fluctuations due to their high cell replication rates. Fast phytoplankton growth maybe balanced out by equally fast consumption by herbivorous grazers. In high-latitude marine systems, seasonal fluctuations in plankton biomass are essentially linked to light regime controlled by the waxing and waning sea-ice cover. In addition, nutrient limitation in surface waters, seasonal temperature fluctuations and changes in freshwater inputs may play important roles.

In cold-water seas, many planktonic organisms cope with seasonal harshness by the production of benthic dormant stages. Dinoflagellates are a diverse group of single-celled plankton, constituting major marine primary producers, as well as herbivorous grazers of the microbial loop. Many dinoflagellate species produce highly resistant, organic-walled resting cysts that are archived in sediments and have been increasingly used to reconstruct past environmental conditions, e.g., sea-surface temperature and salinity, productivity, sea-ice cover and eutrophication. Marine sediment core sequences are characterized by slow accumulation rates and high mixing rates: the top centimeter of surface sediment from an arctic shelf may correspond to several years or decades of deposition. Consequently, sedimentary archives do not give direct information on long-term changes in seasonal bloom patterns or cues of annually recurring life-cycle events.

We used two particle-intercepting sediment traps moored in eastern and western Hudson Bay, respectively, to study monthly fluctuations in dinoflagellate cyst production from October 2005 to September 2006. The traps were deployed close to the seafloor and recovered during the ArcticNet annual expeditions onboard CCGS *Amundsen* in 2005 and CCGS *Pierre Radisson* in 2006. We document the seasonal succession of dinoflagellate cyst taxa, together with cyst species composition, diversity and fluxes and compare dinoflagellate cyst phenology to that of environmental parameters. This study is crucial to ongoing investigations that apply sediment dinoflagellate cysts to study long-term environmental change in Hudson Bay. Despite the challenges related to sediment trap studies in the Arctic and Subarctic, e.g., low particulate fluxes and disturbance by resuspended sediments, they provide a solid means to study the seasonal behaviour of cyst-producing dinoflagellates and help providing a firmer ecological foundation for sediment core studies.

RELATIONSHIPS BETWEEN ICEBERG PLUMES AND SEA ICE CONDITIONS ON NORTHEAST DEVON ICE CAP, NUNAVUT, CANADA

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This study investigates the impact of sea ice conditions on the production of iceberg plumes from two tidewater glaciers flowing from the northeast margin of Devon Ice Cap, Nunavut: Belcher Glacier and Fitzroy Glacier. These effects are quantified using a 12-year RADARSAT-1 satellite record from 1997-2008 that contains imagery from approximately every 1-2 weeks in the winter and every 1-4 days in the summer. Iceberg plumes identified in the satellite record are also compared with terrestrial time-lapse photography of Belcher Glacier from 2007-08. Together, these images enable determination of the date of annual sea ice retreat, the date of calving events, and the relative magnitude of iceberg plumes. The dates of calving events are further compared to climate and tidal data to ascertain the importance of external controls.

Results suggest that there is a strong relationship between iceberg plumes and the retreat of sea ice from the glacier termini, with the plumes caused by both the release of previously calved icebergs (ice mélange) and new glacier calving. Iceberg plumes are also sometimes observed at other times in the summer and in midwinter (occasionally on both glaciers simultaneously), with the events likely due to new glacier calving alone. Analysis of tides and air temperatures suggests that they provide a minor influence on the timing of iceberg plumes. Instead, it appears that changes in the presence of sea ice are dominant on seasonal timescales, although internal glacier dynamics likely play a significant role for winter plume events that occur when substantial thicknesses of landfast sea ice are present. The results of this study are important for determining the long-term evolution of tidewater glaciers in the Canadian Arctic.

THE POWER OF OBSERVATION – LINKING INUIT OBSERVATIONS OF ENVIRONMENTAL CHANGES WITH LOCAL CLIMATE RECORDS ACROSS 8 COMMUNITIES AND 3 REGIONS OF THE CANADIAN ARCTIC

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The Canadian Arctic is undergoing unprecedented changes linked to increased climate variability. As polar scientists seeking to understand current and future changes across the Canadian North, our research is often limited by a lack of historic ecological context under which these changes are occurring. However, Inuit across the Canadian Arctic are living in connection with their land, and have been experiencing and adapting to these changes for decades. Their knowledge and observations of change extend across all aspects of the northern landscape, providing critical insight into historic and current patterns of environmental variation, as well as mechanisms of change at multiple scales.

To inform and direct our groups' research on tundra vegetation change, we consulted Inuit Elders and knowledge holders from eight communities across three Inuit Regions of Canada (Nunavut, Nunavik and Nunatsiavut). Our objectives were to 1) document individuals' knowledge of change surrounding their community, with special emphasis on tundra vegetation and berry plants, 2) identify larger patterns of change among communities and across regions, and 3) identify climatic drivers of community-observed changes by comparing participant observations with local climate data from the recent historic climate records (1, 5 and 10 years prior to our interviews) in each community.

From 2007-2010, we interviewed 144 Inuit Elders and local knowledge holders from the following communities: Kugluktuk (17), Baker Lake (24), Pangnirtung (19) and Pond Inlet (15), Nunavut; Umiujaq (20), Kangiqsujuaq (17), and Kangiqsualujjuaq (9), Nunavik; and Nain (23), Nunatsiavut. Participants included 88 women and 56 men, who ranged in age from 44-92 years. All interviews followed the same semi-directed questionnaire, asking participants to share their knowledge of change within five broad environmental categories: vegetation, berries, animals, seasons, and climate/weather. We compiled participant responses into an "individual by observation" matrix, and investigated patterns of change using descriptive and multivariate ordination techniques.

To investigate potential mechanisms of change driving community observations, we are extracting local (Environment Canada) and high resolution gridded climate data (Climatic Research Unit dataset, University of East Anglia), and using daily/monthly mean temperature values to calculate additional climatic variables (mean winter/summer temperature and precipitation, sums of growing (>5°C), thawing (>0°C), and freezing (<0°C) degree days) considered relevant to our interview categories. These recent historic climate variables (1, 5 and 10 years prior to our interviews), along with future climate change prediction values for each community, will be incorporated into binary logistic and proportional odds models to determine their role in community-perceived changes. We will also be looking at the roles of gender, age and location in explaining community response.

Our analysis of community response data shows that Inuit and local knowledge holders are observing significant environmental changes, especially related to climate/weather (i.e. snow abundance), and vegetation (i.e. shrub abundance). However, the direction of change among communities is not always uniform, and appears to be more locally driven. We suspect that community-observed changes will be reflected in the local climate record, particularly with respect to shifting seasonal (winter/summer) temperatures, and growing/thawing degree day measurements.

LINKING THE CARBON AND MERCURY CYCLES IN THE BEAUFORT SEA USING A SEASONAL, ONE-DIMENSIONAL WATER COLUMN MODEL

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High mono-methylmercury (MMHg) concentrations have been reported in Arctic Marine mammals creating concern in northern communities that rely on these animals as a food source. Budgets indicate that the vast pool of mercury (Hg) in the Arctic Ocean cannot respond quickly to changes in anthropogenic Hg emissions and that rapid changes mercury concentrations observed in food webs cannot be explained by atmospheric Hg dynamics alone. Furthermore, recent advances have pointed to the water column as an important source of methylmercury and its production is likely seasonal. It has thus been hypothesized that physical, biogeochemical and ecological factors influence Hg cycling within the Arctic Ocean, likely changing the bioavailability of Hg and MMHg to food webs. However, the role and relative influence of many of these factors in relationship to the Hg cycle remains poorly understood and may be influenced by changes in Arctic climate.

In this study, we have adapted a 1D carbon-balance particle-flux model for a column of water in the Beaufort Sea to provide the platform for a Hg fate model. The carbon flux model is seasonal, and calculates nutrient, phytoplankton, zooplankton, and suspended particulate concentrations for 22 water layers with a combined depth of 120 m. The model relies on atmospheric forcing to calculate sea ice cover. Total Hg and total methylmercury are partitioned into particulate, phytoplankton, zooplankton, and chloride-associated pools and the transformation and transfer of Hg between pools is based on speciation rate constants and partition coefficients previously measured in the Arctic Ocean and elsewhere. The model considers photolytic, chemical, physical and organic transformations of Hg, as well as uptake by zooplankton via phytoplankton grazing. Exchange of Hg with the surface of the Ocean and the atmosphere including atmospheric depletion events (AMDEs) is evaluated using output from The Global/Regional Atmospheric Heavy Metals (GRAHM) model.

Predicted water column MMHg production rates were back-calculated and compared with previously published MMHg methylation rates. Initial results indicate good agreement between Hg concentrations in seawater, zooplankton and measured concentrations from the Beaufort Sea. Model simulations indicate Hg is drawn down from subsurface waters by settling particles shortly after the phytoplankton bloom but the majority of particulate Hg is released back into the water column above 50m. An increase in available nutrients in the shelf break area is predicted in many climate change scenarios, however the model indicates it will only marginally influence Hg concentrations in surface and subsurface waters.

INSIGHTS INTO THE TIMING OF SUBMARINE LANDSLIDE EVENTS ON THE BEAUFORT SLOPE FROM SEA LEVEL AND STRATIGRAPHIC MODELING.

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Submarine slides on the Canadian Beaufort continental slope represent a potential hazard to offshore oil and gas development. An assessment of the hazard includes developing an understanding of the timing of past events and the geological conditions under which they occurred. Existing conceptual models of late Quaternary stratigraphy of the Beaufort shelf and slope are quite generalized and based on a poorly constrained relative sea level curve. Numerical modeling techniques have been used to examine some of the previous assumptions about sea level and the timing of events on the slope. Modeling of glacio-isostatic adjustments and relative sea level history, based on ICE-5G ice sheet reconstructions, show that relative sea level would have varied considerably over the shelf in both cross-shelf and along-shelf directions. Relative sea level in the area in which submarine slides have been mapped, between Mackenzie Trough and Amundsen Gulf, are modeled to have been as low as 140 m below present sea level, as late as 14ka BP (calendar years). Stratigraphic modeling using SEDFLUX and the spatially variable modeled relative sea level indicates that deglacial outwash would have contributed to both vertical shelf aggradation (by 40-55 m) and horizontal shelf edge progradation (by approx. 10 km). Glacial outburst floods that have been documented to have occurred at approximately 12.5 ka and 11.5 ka BP may have contributed as much as an additional 2 km of progradation in single events of short duration, although stratigraphic modeling also supports substantial deposition at this time in Mackenzie Trough. These high rates of accumulation could have led to deposition of relatively unconsolidated deposits on the slope, making them susceptible to slope failure. This work therefore suggests that the submarine slides observed on the present day slope may have occurred more than 10 ka before present and provides a conceptual model for depositional events associated with lowstand conditions. Future work should focus on a detailed stratigraphic reconstruction of the outer shelf and slope to better constrain the ages of these events.

MUD EJECTIONS: CHARACTERIZING EMERGING SUBSURFACE FLOW PATHWAYS FROM THE DEEP ACTIVE LAYER TO THE SURFACE IN THE CANADIAN HIGH ARCTIC

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Unusually warm conditions during the past five years in the Canadian High Arctic have led to changes in the properties of the seasonal active layer and the uppermost permafrost. One phenomena associated with thick active layer formation during warmer years is the emergence of pressurized sediment slurries (mud ejections) at the surface, forming flows and local deposits on land and in water. The objective of this study is to investigate the hydraulic processes taking place within and beneath the active layer that generate these features, and the implications they have for creating pathways for water, gas and particulate matter from the subsurface. These processes are not well understood, but it is apparent that they represent a locally significant new source of sediment, solutes, nutrients, and gases to the ecosystem, sourced from materials that have been buried at depth for long periods of time. Further, these mud ejection features have been recently observed at sites across the High Arctic. These areas have very different bedrock and surficial sediments, and a better understanding of the spatial distribution of these processes is needed, particularly because these features are often associated with slope failures.

The primary study site in 2012 was the Cape Bounty Arctic Watershed Observatory (CBAWO) on Melville Island, Nunavut, with additional sampling on northern Melville Island and near Char Lake, Cornwallis Island. CBAWO is a continuous permafrost environment with a seasonal active layer that reaches a thickness of approximately 80 cm by late July. Systematic mapping of the mud ejections and sampling for sediment, water, and trace gases, was undertaken in the field. Active features were sampled in late July, and additional samples were collected from inactive relic deposits. One of the main goals of this project is to characterize the geotechnical, mineralogical, and biogeochemical properties of the sediment found in these features. These results are needed in order to better understand the behavior, properties and origins of these materials, and to identify the potential impacts on the surface ecosystem and water quality. Sediment characterization will be based on samples collected in the 2012 field season at CBAWO, including permafrost drill cores and soil pit samples, to systematically

sample the sedimentary profile. Gas sampling was also undertaken to explore the possibility of trace gases escaping from the subsurface into the atmosphere and to provide potential insights into the subsurface processes.

This project will constitute a systematic investigation of mud ejections, and will provide valuable information in the characterization of the processes and material fluxes of water, sediment, and gas associated with these features. In particular, it will advance our understanding of the impact of changing permafrost and active layer dynamics, and contribute to related research focused on slope disturbances and changes to surface ecosystem elements and water quality.

LINKING FEEDING AND MATING ECOLOGY IN BELUGA AND NARWHAL

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Beluga (*Delphinapterus leucas*) and narwhal (*Monodon monoceros*) are integral members of the Arctic ecosystem and are important species in the diet of local Inuit communities. They are also an economic resource for northern communities, as they provide ecotourism opportunities. Little is understood about the mating systems and feeding ecology of Arctic cetaceans. This information is essential for establishing conservation programs and minimizing the impacts of northern development.

Several mammalian species, including beluga, show sexual segregation in habitat selection and feeding behaviour. Sexual segregation in feeding habits can be linked to different energetic demands between the sexes, but it may also be influenced by mating strategy. Based on the information available on beluga and narwhal, we would expect their female promiscuity levels to be medium, and low, respectively. Species likely to exhibit a medium level of promiscuity, such as beluga, would segregate somewhat by sex, but not completely. Narwhal, who are likely to form harems and have the lowest levels of female promiscuity between the species, would most likely have a high degree of sexual segregation in feeding habits outside the breeding season, as harem-holding males associate with their female groups, and defeated males form male groups. The degree of sexual segregation in feeding habits would be reflected in the variability of the C14 isotope and the fatty acid composition.

We used fatty acid and stable isotope analysis to understand the feeding ecology of the three species. These techniques have been used to obtain information on trophic relationships, diet, foraging locations, and stock structure including those of marine mammals. The techniques assume that a prey's isotope and fatty acid signature are reflected in the tissues of its predator. We hypothesized that the degree of sexual segregation in the studied species would be evident in the degree of variability between the sexes in the C 14 isotope. Species with high female promiscuity would have higher levels of C14 variability between sexes than species with low female promiscuity. Promiscuity levels in the whale species was tested by collection and measurement of reproductive tracts, as species with greater female promiscuity have longer male and female reproductive tracts, and males have larger testicles. Testes samples were analyzed from beluga (n=105) and narwhal (n=120) harvested from across the arctic. Stable isotope and fatty acid samples were taken from beluga whales harvested in Sanikiluaq (n=46) and Arviat (n=49); samples from narwhal were collected in Pond Inlet (n=34) and Repulse Bay (n=31).

Results indicate differences between sexes in narwhal feeding patterns, but not in beluga. Relative testes sizes in beluga exceeded average testes size in narwhal, indicating that beluga may be a more promiscuous species than narwhal.

Our findings support the hypotheses that (1) Beluga are a more promiscuous species than narwhal, which likely form harems; and (2) differences in mating ecology are reflected in the feeding ecology of the species. These findings may be useful in the management of these species, in establishing protected feeding areas and developing quota systems.

THE TRANSFER OF TERRESTRIAL MERCURY TO FRESHWATER AQUATIC ECOSYSTEMS AT CAPE BOUNTY, MELVILLE ISLAND, NUNAVUT

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We are examining the impact of climate change on the release of terrestrial mercury (Hg) to two adjacent Canadian Arctic lakes (West and East) at Cape Bounty, Melville Island, Nunavut, which are undergoing climate-

related changes at different rates. The West catchment, for example, experienced numerous active layer detachments during the summers of 2007 and 2008 due to record 2007 summer temperatures and rainfall while the East catchment experienced only minor disturbances. To assess the impacts of climate-induced changes on the release of Hg from the lake catchments and the subsequent fate of this Hg once it enters the lakes, we measured concentrations of total Hg (THg) and methylmercury(MeHg; the toxic and bioaccumulative form of Hg) in the rivers and lakes between 2007-2010. To examine changes in Hg deposition to the lakes through time, we measured sediment Hg fluxes using dated sediment cores collected from the deepest point of each lake. Concentrations of THg and MeHg were similar among West and East rivers (7.8±4.0 and 7.2±4.8 ng/L, respectively, for THg and 0.04±0.02 and 0.05±0.03 ng/L, respectively for MeHg) and closely followed patterns in hydrological discharge, reaching over 20 and 0.15 ng/L, respectively, during high flow periods. Particulate-bound THg comprised most of the THg in both rivers (66±15% and 66±18%), and was correlated with concentrations of suspended solids ($r2=0.74$ and 0.17, respectively, $p\leq0.04$) indicating that catchment erosion released a great deal of particulate-bound terrestrial Hg to West and East lakes. Preliminary calculation of THg exports to the lakes indicate that West River exports are on average ~20% higher than those from East River (7.7±1.1 and 6.4±0.8 g/year, respectively). MeHg exports were low and similar among the two rivers (0.04±0.02 and 0.04±0.03 g/year, respectively). Detailed lake profiles were obtained in 2010 and demonstrated that unfiltered THg concentrations in West Lake are almost double those in East Lake (1.3±0.6 and 0.8±0.4 ng/L, respectively), while filtered THg concentrations are similar (0.5±0.5 and 0.4±0.2 ng/L, respectively), indicative of greater terrestrial Hg inputs from climate-induced erosion of the West catchment. MeHg concentrations, however, were low and similar in both lakes (0.01±0.01 ng/L). Using the lake Hg profiles and bathymetry measurements, 2010 lake Hg pools were calculated. THg and MeHg pools increased dramatically (48 and 129%, respectively) in West Lake in mid June during the high flow season and to a lesser extent in East Lake (19 and 84%, respectively). After the high flow season, Hg pools decreased substantially, suggesting that the majority of river Hg inputs either quickly settled to the lake bottom or flowed through the lake and out the outflow. Results from the West Lake dated sediment core demonstrate that sedimentation rates and THg fluxes increased dramatically in West Lake beginning in ~1950, primarily as a result of increased catchment erosion. East Lake core analysis is underway and results will be presented. Results to date highlight the dynamic connection between the terrestrial and aquatic components of the Hg biogeochemical cycle, both of which are sensitive to climate change.

DIMENSIONS OF SOCIO-CULTURAL SUSTAINABILITY: A LITERATURE REVIEW AND CONCEPT MAP FOR ARCTIC COMMUNITIES

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Effects of development without thorough consideration of socio-cultural context are particularly apparent in Northern and Indigenous communities. Commonly, the resulting change manifests in loss of traditional lifestyles, cultural strength and social stability. Inuit and other Arctic communities face large-scale challenges due to climate change, resource development and other forces, and it is essential that planning for the future includes appropriate consideration of not only economic and material goals, but also social and cultural ideals and objectives. A proliferation of sustainability projects at various scales continues to address social concerns as secondary to economic or environmental goals, rather than essential preconditions for sustainability, or a sustainability goal in itself. Though social sustainability is increasingly discussed in a variety of disciplines and in the growing body of sustainability literature, there is a lack of clarity in both defining the concept and identifying how it relates to other aspects of sustainability itself.

The objective of this study is to explore how socio-cultural aspects of sustainability are currently understood and addressed in the literature, and to identify relevant concepts and discourse in other fields of study that may be relevant for an exploration of this topic in northern Aboriginal communities. The study is predicated on the understanding that there must be a thorough appreciation of underlying socio-cultural principles in a particular context, as they inform interaction with the natural environment, and determine the capacity of communities

to adapt to change and plan for future sustainability. This is particularly relevant and important in Arctic communities today. As current and future threats change the natural landscape, it is urgent that socio-cultural principles, values and structures be identified and understood. These social and cultural dimensions of communities are foundational to creating appropriate, relevant and successful sustainability initiatives. This project is being conducted as part of the Nunatsiavut SakKijânginnatuk Nunalik (Sustainable Communities initiative in cooperation with the Nunatsiavut Government and the five Inuit communities of northern Labrador.

Peer-reviewed literature was searched using online databases, and search terms drawn from literature findings and trial searches. Over 200 articles were reviewed, and from that a conceptual map describing the development of key concepts and ideas in this field was developed.

There is a growing body of literature on social and cultural aspects of sustainability. However, there remains little consensus on the dimensions of these aspects, or the components of 'socio-cultural sustainability'. Perspectives vary between a focus on social sustainability as supportive of broader sustainability, and an understanding of the need to achieve sustainability within social and cultural structures themselves. Preliminary results of this literature review and conceptual mapping processes demonstrate that the majority of literature dealing with social and cultural dimensions as a primary focus comes from sociology and psychology, while other fields such as community planning and socio-ecology continue to address social concerns as secondary to economic or environmental goals. Overall, there is much more work to be done in further developing clarity in the field of socio-cultural sustainability, and this will contribute to more appropriate sustainability planning processes and ultimately, stronger communities.

A SYSTEMATIC REVIEW OF COMMUNITY-BASED MONITORING: DEFINITIONS, CONCEPTS, AND LESSONS LEARNED

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Long-standing and emerging initiatives such as the Sustainable Arctic Observing Network (SAON), the Northern Contaminants Program (NCP) and the Conservation of Arctic Flora and Fauna (CAFF), as well as the extensive peer reviewed and grey literature on Traditional Ecological Knowledge (TEK), recognize the value and benefit of engaging communities in environmental monitoring and observation activities in the Arctic. Within the current academic literature, a debate exists as to whether community-based monitoring (CBM) is truly 'engaging' communities and living up to the ideals and benefits of involving local residents in monitoring efforts and having their voice included in directing such programs. Current descriptions of CBM models and arrangements are often ambiguous and take on many different forms, ranging from community-directed monitoring initiatives that originate from residents' interests and needs to initiatives that simply involve community residents in some aspect of the data collection as assistants/ informants with little input into program design and what is 'measured'.

The objective of this study is to bring clarity as to how the term and concept of CBM is currently being used, as well as how it is understood as an approach/model in the existing literature. It is being done to identify trends and lessons learned to inform CBM activities in Arctic communities and potential future monitoring efforts under the SakKijânginnatuk Nunalik (Sustainable Communities Initiative) supported by the Nunatsiavut Government.

In this systematic literature review, publications were searched using 7 online databases and 3 agency websites. The peer-reviewed literature was searched in Scholars Portal, ProQuest, EBSCOhost, GALE, Medline, and Web Science. Grey literature was searched with both online databases and agency databases, including those of the United Nations and Environment Canada. A total of 165 peer-reviewed articles and 159 grey literature sources were retained for the final analysis.

Preliminary results indicate that there is no commonly accepted definition or model of CBM in the literature. The majority of CBM arrangements involve community members through training and participation as data collectors and informants. More attention needs to focus on the complexity of involving different knowledge systems, such as western science and local Indigenous Knowledge (IK) into CBM programs. Furthermore, few examples exist of CBM models or program evaluations from which to learn for the development of new initiatives. Therefore, more case studies are needed to document existing models of CBM programs and to show their use and utility in the Arctic and elsewhere. As CBM programs are currently being promoted throughout the circumpolar regions,

drawing on the strengths and addressing the gaps in the literature is recommended.

DISTRIBUTION AND CYCLING OF METHYLMERCURY IN SEDIMENTS ALONG CANADA'S ARCTIC MARGIN

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Mercury (Hg), and specifically the organic species methylmercury (MeHg), which is the form presenting the greatest toxic risk, is accumulating in Arctic marine food webs to levels that pose risks to top aquatic predators and northern peoples who depend on these for food. The MeHg concentrations are often presumed to reflect global emissions of anthropogenic Hg and/or enhanced atmospheric deposition within the Arctic. However, a growing body of evidence suggests that processes within the Arctic Ocean that convert Hg(II) to MeHg may in fact control the accumulation and distribution of Hg in higher trophic levels. Here, we examine the distribution of Hg and MeHg in 25 sediment cores collected along Canada's Arctic margin as part of IPY. We evaluate these distributions in the context of other oceanographic and sediment biogeochemical data, to determine processes important for the production and accumulation of MeHg in sediments.

Total Hg (HgT) concentrations measured in our Arctic margin sediment cores are generally similar to those reported previously for the sediments from the Arctic and elsewhere. However, cores from the Beaufort shelf/slope and Barrow Canyon in the northeast Chukchi Sea have unusually high HgT concentrations, providing a spatial pattern that is not inconsistent with the spatial patterns in Hg in the marine food web (e.g., beluga whales). High organic carbon (OC) content of the Chukchi and Beaufort sediments appears to be one factor underlying the high Hg concentrations, and a second factor is the unusually high ratio of Hg to OC. MeHg concentrations in the sediment cores were generally very low (≤0.1 ng/g) except for a few cores from the Chukchi Sea, which had average MeHg concentrations in the order of 0.67-0.97 ng/g. MeHg concentrations in the sediments are largely independent of both [HgT] and %OC, although there does appear to be a threshold in %OC below which MeHg accumulation is minor. The contrast between vertical profiles of MeHg and total Hg in the cores indicates that factors other than [HgT] must be at play. Among these, redox conditions, which are controlled by the availability of labile OC, appear to be important and will be examined using distributions of elements like Mn, Mo, Cd and Re, known to be sensitive to redox conditions.

ESTABLISHING BASELINE BIOPHYSICAL CONDITIONS IN LAKE MELVILLE IN SUPPORT OF AVATIVUT, KANUITTAILINNIVUT (OUR ENVIRONMENT, OUR HEALTH): THE 2012 FIELD CAMPAIGN

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Avativut, Kanuittailinnivut is a research and monitoring program developed by the Nunatsiavut Government with university partners (Memorial, Trent, New Brunswick, Harvard, Connecticut) to study the downstream impacts of a proposed hydroelectric development on Inuit community health and well-being in the Lake Melville region, central Labrador. The program focuses on developing an understanding of baseline conditions in and adjacent to the Lake Melville estuary and includes biophysical, social, health and economic research combined with Inuit Knowledge. Inuit use Lake Melville, a salt-water tidal extension of Hamilton Inlet, throughout the

year for fishing, hunting and traveling. Field activities for the biophysical component were initiated this summer in Lake Melville, while the community-based component will begin this winter.

During summer 2012, 32 stations, between Grand Lake and Groswater Bay at either end of Lake Melville, were sampled. The Nunatsiavut-based long-liner MV What's Happening served as the sampling platform, deploying boxcores, water samplers, CTDs, and phytoplankton nets. Preliminary processing of samples for time sensitive analyses for water and sediment were conducted within 24 hours of sampling at the North West River field station (Labrador Institute of Memorial University) at the head of Lake Melville. Sediment samples will also be analyzed for grain size and faunal and organic content. Seabed mapping was conducted off the mouths of the Goose River, Churchill River, Kenamu River and North West River using the Nunavut Government-owned fisheries research vessel MV Nuliajuk, equipped with a 300 kHz multibeam sonar and a 3.5 kHz sub-bottom profiler owned and operated by the Ocean Mapping Group at the University of New Brunswick. The bathymetric data will be used for oceanographic modeling, benthic habitat characterization and classification, and planning sampling programs. Two seabed anchored moorings, containing Acoustic Doppler Current Profilers and thermistors provided by the Oceanography Group at Memorial University, were deployed near the lake outlet in June, recovered and re-deployed in September, and will continue operating until late spring 2013.

Community-based research teams will be formed this fall to help guide and implement the community-based aspects of the program, including an ice-monitoring program. Ice monitoring will begin this winter, with community-based ice monitoring stations located on important hunting and travel routes across Lake Melville. Data from these stations will be made available to community members through online posts, local radio and social media. Documentation of the science and Inuit Knowledge of the biophysical processes in the Lake Melville region have been limited in the past, making baseline data collected during this project of critical importance for determining future effects of any potential development.

BIOCHEMICAL AND PHYSICAL CHARACTERIZATION OF MULTI-YEAR AND FIRST-YEAR ICE IN THE LINCOLN SEA (BETWEEN CANADA AND THE NORTH POLE)

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The declining Arctic sea ice extent will have a large impact on the Arctic ecosystem but which regions will be most affected and to what extent is still unclear. Primary production in the Arctic Ocean has been projected to increase as sea ice declines; however, these projections are based on data from the marginal seas over continental shelf regions rich in nutrients and covered predominantly by seasonal sea ice. Sea ice algae represent an important carbon input to the Arctic foodweb and therefore should be accurately represented in future projections of Arctic primary production, especially from the perennial sea ice zone (PIZ) which will likely experience the largest amount of change in the near future. During two collaborative CASIMBO/BIOTA campaigns, in May 2010 and 2011, 8 multi-year and 3 first-year ice cores were collected from the Lincoln Sea north of CFS Alert, Ellesmere Island, Nunavut. This region represents some of the thickest ice in the Arctic and one of the last refuges of MYI. Ice cores were cut into 0.1 m sections and analyzed individually for salinity, 18O, inorganic nutrients, DOC, total chl a and bacterial and protist abundances. Thicknesses of MYI cores ranged from 2.23 to 3.10 m and thicknesses of FYI cores were 0.93 to 1.60 m. Average total Chlorophyll a content for MYI cores was 5.76 µg (1.07-12.7 µg) and for FYI cores was 9.12 µg (range: 1.40-13.6 µg). Average total Chl a concentration for MYI cores was 0.335 mg m^{-3} (0.0648-0.645 mg m^{-3}) and for FYI cores was 1.22 mg m^{-3} (0.138-2.10 mg m^{-3}). Biochemical data from the ice cores could not be used as indicators for the age of the MYI. However, using ice microstructure texture analysis data in conjunction with biochemical data, it may be possible to identify annual growth layers. In 2012, 3 more MYI cores and 4 more FYI cores were collected from the the Lincoln Sea. Preliminary analysis of these cores will be presented and may provide sufficient additional data to conclude statistical relationships of the biochemical properties between MYI and FYI within the PIZ.

VARIABILITY OF PHYTOPLANKTON LIGHT ABSORPTION IN CANADIAN ARCTIC SEAS

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Phytoplankton light absorption spectra (aph(lambda)) were measured in the Canadian Arctic (i.e., the Amundsen Gulf, Canadian Arctic Archipelago, northern Baffin Bay and the Hudson Bay system) to improve algorithms used in remote-sensing models of primary production. The absorption by algae, dominated by picophytoplankton (<5 um), was not the major light absorption factor in the four provinces; the colored dissolved organic matter (CDOM) contributed up to 70% of total light absorption. During the fall, the low total chlorophyll a-specific aph*(443) (aph(443)/TChl a) coefficients of the Canadian High Arctic were associated with photoacclimation processes (i.e., the package effect) occurring in light-limited environments. Low light availability and high proportion of CDOM (absorbing strongly the ultraviolet) seem to allow the growth of phytoplankton with accessory pigments absorbing light at longer wavelengths. The ratio of photoprotective and photosynthetic carotenoids (PPC:PSC) was inversely proportional with the salinity and the cell size, and mostly decreases throughout the Canadian High Arctic during fall. In return, the highest TChl a-specific phytoplankton light absorption coefficients at the blue peak (aph*(443)) were observed in the Hudson Bay system from September to October (i.e., fall) as well as in the Amundsen Gulf from May to July (i.e., spring/summer). These results will ultimately allow the accurate monitoring of phytoplankton biomass and productivity evolution that is likely to take place as a result of the fast-changing Arctic environment.

ARCTICNET IN THE EASTERN CANADIAN ARCTIC: AN INTEGRATED REGIONAL IMPACT STUDY (IRIS).

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Through its IRIS initiative, ArcticNet is working on mobilizing the research results from its science program to inform policy and decisions that respond to climate change in the Canadian Arctic at national, regional, and local levels.

The Eastern Arctic IRIS team is working closely with ArcticNet scientists, Inuit organizations; local government, industries and northern networks to prepare a report that details the implications of ongoing change, primarily climate driven, for the region. The IRIS report will be written as a public document, consisting of a series of short, illustrated chapters. Its key findings and conclusions will convey an integrated vision of the impacts of climate change and modernization across the region. One of the main goals of the IRIS report is to synthesize the available knowledge that could help support Nunavut decision makers and policy analysts in their ongoing effort to address climate change and other change related issues at all levels. Furthermore, it is anticipated that this regional based report will contribute to and benefit from related climate change initiatives in the region such as the Nunavut Climate Change Impacts and Adaptation strategic framework (Upagiaqtavut), the Nunavut Climate Change Centre (NC3) website, and the Nunavut General Monitoring Plan (NGMP).

A Regional Science Meeting was held in Iqaluit from November 6 to 8, 2012 in order to bring together lead authors of the IRIS report to share and present their draft chapters to a wide range of decision-makers for feedback and discussion. Comments received at the meeting will help guide chapter writing and content, thereby making the report more effective and useful for the region.

QUATERNARY GEOLOGY AND PERMAFROST CHARACTERISTICS IN CENTRAL HALL PENINSULA

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The objectives of this project are to map the surficial geology, to better constrain the Quaternary history and

to characterize the properties of the permafrost in Hall Peninsula, north of Iqaluit. Particularly, the presence of weatherites, felsenmeers and feebly eroded bedrock outcrops suggest that cold base glaciers have covered the central part of the region during the Late Pleistocene. Also, the exact extent of Late glacial ice and the younger readvances of the ice front in the early Holocene, as shown by large moraines, still need some clarifications. In summer 2012, surveys and geochemical sampling were done over the territory. It appears that the central part of the peninsula is indeed covered by a non-eroded, rather deep (> 3 m), weatherite. In some places this in situ debris cover was eroded down to solid bedrock by glacio-fluvial meltwater channels. This central area is surrounded by an area where red till made of a mixture of weatherite and glacial debris covers the ground surface. Nearer to the coastal zone, extensive moraines are associated with glacial frontal positions. Many striations of different directions but of still unknown ages were found in the till-covered zones. Till lithological and geochemical analyses and mapping shall help in reconstructing ice flow patterns and transportation distances of glacial debris. Finally, two frozen permafrost cores were extracted intact from the weatherite cover in the central zone to analyse its unique properties. This poster describes the study area and presents preliminary research results.

SEABED MAPPING IN SUPPORT OF DOWNSTREAM-EFFECTS RESEARCH AND MONITORING IN LAKE MELVILLE, A SUBARCTIC ESTUARY IN CENTRAL LABRADOR

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Lake Melville is a salt water tidal extension of the Hamilton Inlet on the Labrador coast. The Hamilton Inlet system is the largest marine inlet in Labrador and includes Groswater Bay, the Narrows, Lake Melville, and Goose Bay. Groswater Bay is opened to the ocean constricting 55 km inland into shallow sill, The Narrows, restricting water flow into Lake Melville with a minimum depth of 30 m. Lake Melville is a fjord and forms an subarctic estuary environment as a result the lake's deep basins exceeding 250 m in depth and the sill at The Narrows. Further inland is Goose Bay, an estuary and southwestern extension of Lake Melville extending a further 25 km. Connecting the two water bodies is the Goose Bay Narrows a 2.5 km wide, 6 m deep dredged shipping channel. A large proportion of the Ungava Peninsula drains into Lake Melville and Goose Bay, receiving an annual average of 3000 m^3/s of freshwater discharge from 5 rivers: Churchill, Goose, Kenamu, North West and Naskaupi Rivers.

The lake contains very thick (> 400 m) sequences of glaciomarine and glacial sediments. These sediments were deposited between 10,000 and 9000 BP during the retreat of the late Wisconsinan ice sheet (Syvitski et al, 1993). The glaciomarine and glacial sediments of Lake Melville represent an uninterrupted record of distinctive phases during the glaciers retreat and include ice-contact, ice-proximal, ice-distal, paraglacial and postglacial processes (Syvitski and Lee,1997).

The Lake Melville project is a multi-disciplinary project, with two main goals. The first is establishing baseline conditions for Inuit health, community wellbeing and the marine environment. The second goal is develop the science for monitoring the downstream effects of industrial activity on a subarctic estuary and coastal Inuit communities. In the summer and fall of 2012 research commenced to address these goals.

In conjunction with the Ocean Mapping Group at the University of New Brunswick a high resolution marine geophysical survey was conducted at the western end of Lake Melville on board the Nunavut research vessel, MV Nuliajuk, equipped with a Kongsberg EM3002 multibeam echo sounder and a Knudsen chirp 3200 echosounder 3.5 kHz sub-bottom profiler. This survey provides detailed bathymetric maps of the seafloor identifying locations of net deposition and erosion, supporting seabed sampling, oceanographic monitoring and biological observations for benthic habitat mapping. The sub-bottom profiles will provide information on both glaciation and deglaciation, and its effect on the offshore geology of the lake.

Results are presented here for the surficial and subsurface geology of Goose Bay and the western end of Lake Melville using 3.5 kHz seismic sub-bottom, backscatter and multibeam bathymetry. The glaciomarine deposits likely to be identified include deltas, moraine(s), esker(s), slump deposits, and glaciomarine ice-proximal and ice-distal sands and muds.

ADAPT - ARCTIC IN DEVELOPMENT AND ADAPTATION TO PERMAFROST IN TRANSITION

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What are the implications of rapid environmental change in Canada and the circumpolar North caused by thawing permafrost conditions? How will we cope? These are the central questions driving this newly funded research program during a time of unprecedented economic development across the Arctic. ADAPT builds on the experience and knowledge derived from the International Polar Year, and brings together a team of 15 Canadian Arctic researchers with national and international collaborators (additional collaborations are welcome) to define how changing permafrost and snow affect tundra landscapes, water and wildlife, and the implications for Northern communities and industries who depend on these resources. The aim is to produce an «Integrated Permafrost Systems» framework that will help guide sustainable development and adaptation strategies, all in the increasingly urgent context of accelerated environmental change. ADAPT combines diverse expertise from within Canada and abroad, in engineering as well as the natural sciences, and will apply a broad suite of experimental, laboratory, field and modelling approaches. The numerous research sites extend across northern Canada, from the Yukon to Labrador via the Northwest Territories, Nunavut, the shores of Hudson Bay, Nunavik and Nunatsiavut. ADAPT will thereby generate a pan-Canadian view of permafrost dynamics which will be integrated via international collaborations into a broader circumpolar perspective. This theoretical and applied approach will also lead to a variety of coupled physical-biological models for Arctic landscapes that can be used as a framework for understanding what makes these systems so critical to the Earth System, and the implications of their rapid transition to higher energy states.

COUNTRY FOODS AND CARDIOVASCULAR HEALTH IN NUNAVIK (PART A): NEW BIOMARKERS OF SELENIUM TO STUDY THE COMPLEX BALANCE BETWEEN SELENIUM AND ENVIRONMENTAL CONTAMINANTS

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Selenium (Se) is an essential element highly present in the traditional marine diet of Inuit and their exposure to this element is among the highest in the world. Se is involved in several body functions through selenoproteins expression, including regulation of oxidative stress, and immune and thyroid functions. In fish and marine mammal eating populations, there is increasing evidence suggesting that high Se intake may play a role in offsetting some deleterious effects of methylmercury (MeHg) exposure. Conversely, selenoproteins have also been postulated as the key targets of MeHg and polychlorinated biphenyls (PCB) toxicity; high Se intake may restore their enzymatic functions. However, in Europe and United States, high plasma Se has been related to type-2 diabetes, hypercholesterolemia and/or hypertension. Contrary to these populations, Inuit present an exceptional intake of omega-3 fatty acids (n^{-3}), a preventive factor for cardiovascular diseases (CVD). They can also be highly exposed to MeHg, PCB, PFOS and trans-fat, all risk factors for CVD. Several selenoproteins share common metabolic pathways with glucose and insulin, and it remains unclear whether increased plasma Se and selenoproteins' activity is the cause or the consequence of the disease. In addition to plasma Se levels, the most common biomarker of Se status, several other biomarkers (e.g. selenoproteins and small Se molecules) have been identified and these may help to better characterise Se status.

This interdisciplinary research project is divided into two parts. Part A of the study aims to investigate relations between these new biomarkers of Se status and emerging health issues such as diabetes and CVD in Inuit adults, taking into account possible interactions with n^{-3}, MeHg and other environmental contaminants. Part B of the study aims to identify the concentrations and chemical forms of Se and Hg present in various Nunavik traditional foods and their bioavailability (see complementary poster). These much needed data will improve our capacity to assess the benefits and risks of Se intake and the traditional marine diet in this population.

The objectives of the Part A study are to: 1. To measure various new biomarkers of Se status [selenoprotein P, glutathione peroxidases and thioredoxin reductase, plasma total Se, inorganic Se (Se+4&Se+6), selenoneine, selenocysteine, selenomethionine and selenoalbumin] and speciate Hg fractions [MeHg and inorganic mercury (IHg)] in archived blood samples of the Inuit Health in Transition Study (IHTS), a cross-sectional study based on large and representative sample of the Inuit adult population in Nunavik realized in 2004 (n = 900); and 2. To examine the associations between these various biomarkers of Se status, between biomarkers of Se status and environmental contaminants, n^{-3}, diabetes and CVD

risk factors (e.g. fasting glucose and insulin, lipids profile, blood pressure, paraoxanase1 activity), and the possible interactions between all these variables. A method to analyse new biomarkers of Se combining ion-pair reverse-phase chromatography and affinity chromatography hyphenated to inductively coupled plasma-quadrupole mass spectrometry (ICP-qMS) is currently being developed at the Centre de Toxicologie du Québec and this poster will present the preliminary results of the Part A of the study.

COUNTRY FOODS AND CARDIOVASCULAR HEALTH IN NUNAVIK (PART B): COUNTRY FOODS CONCENTRATION, SPECIATION AND BIOAVAILABILITY TO STUDY THE COMPLEX BALANCE BETWEEN SELENIUM AND ENVIRONMENTAL CONTAMINANTS

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Selenium (Se) is an essential element highly present in the traditional marine diet of Inuit and their exposure to this element is among the highest in the world. In fish and marine mammal eating populations, there is increasing evidence suggesting that high Se intake may play a role in offsetting some deleterious effects of methylmercury (MeHg) exposure. However, a complete profile of Se and Hg concentrations in Nunavik country foods is lacking. Moreover, Se and Hg concentrations and may be influenced by several factors: traditional Inuit preparation of country foods, Se and Hg chemical forms found in country foods, and mutual interaction between Se and Hg in country foods. In terms of exposure assessments, oral bioavailability refers to the percentage of contaminants and nutrients that are absorbed into systemic circulation. In contrast, oral bioaccessibility describes the percentage of a contaminant or nutrient that is dissolved into gastrointestinal fluids. In vitro gastrointestinal (GI) models measure bioaccessibility as a surrogate for bioavailability.

This interdisciplinary research project is divided into two parts. Part A of the study (see complementary poster) aims to investigate relations between these new biomarkers of Se status and emerging health issues such as diabetes and CVD in Inuit adults, taking into account possible interactions with n^{-3}, MeHg and other environmental contaminants. Part B of the study aims to identify the concentrations, chemical forms, and bioaccessibility of Se and Hg present in various Nunavik traditional foods. This much needed data will improve our capacity to assess the benefits and risks of Se intake and the traditional marine diet in this population.

The objectives of the Part B study are to: 1. To collect selected country food samples from different villages in Nunavik; 2. To measure total Se and Hg concentrations(using graphite furnace and cold vapour atomic absorption spectrometry) and complete age determination of the samples at the Nunavik Research Center; 3. Identify and measure Se and Hg species in samples (using reversed-phase and anion-exchange HPLC-ICP-MS) at the U of Ottawa; 4. To study the bioaccessibility and transport of Se and Hg in Inuit country food using an in vitro GI model, known as the Simulator of the Human Intestinal Microbial Ecosystem (SHIME), which mimics the physical, chemical, enzymatic, and microbial conditions of the human GI tract. Intestinal absorption of Hg and Se species will be evaluated using a confluent intestinal epithelial cell line (Caco-2) (U of Ottawa); 5. To evaluate the associations between Se and Hg concentrations and chemical species found in country foods and Se and Hg biomarkers in human blood samples (measured in Part A). This poster will present the preliminary results of the Part B of the study.

WILD BERRIES, PLANTS AND SEAWEEDS HEALTH BENEFITS IN A CHANGING CANADIAN ARCTIC

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To survive in the Arctic, Inuit had for centuries to rely on animals and plants such as wild berries and seaweeds. However, since the 1990's, the consumption of

country food has decreased markedly, and the rapid food transition towards a western diet has led to excessive intake of carbohydrate, salt and trans-fatty acids. The obesity prevalence is increasing, and cardiovascular diseases and risk factors have become major health issues. Global environmental changes also affect Inuit dietary patterns in many ways including the availability of local animal and plant species and/or environmental contaminant concentrations. With limited access to fruits and vegetables, wild berries, plants and seaweeds found in Nunavik may provide plant-derived nutrients and secondary metabolites that offer unique potential for the prevention or management of metabolic disorders and associated cardiovascular complications. They may be an important source of antioxidants, especially polyphenols (flavonoids and tannins) and carotenoids, as well as fibers and vitamins C and E. Several of these phytochemicals have been reported to prevent or decrease lipid peroxidation, LDL oxidation, decrease glycaemia, improve insulin secretion and sensitivity, and/or act as vasoprotective and anti-inflammatory agents, possibly due to their diverse actions on metabolic processes. Moreover, in addition to their antioxidant activity, certain phytochemicals chelate heavy metal ions, possibly reducing the bioavailability and subsequent toxicity of environmental contaminants.

The objectives of this pilot project are to: 1. Conduct a literature review on nutritional and cardiovascular health benefits, Inuit traditional ecological and medicinal knowledge, and environmental aspects related to wild berries in Nunavik and elsewhere; 2. Collect selected wild berries (cloudberries, blueberries, blackberries, redberries and alpine bearberries), plants (mountain sorrel, seabeach sandwort, Labrador tea and northern Labrador tea) and seaweeds (*Laminaria* spp. and *Fucus* spp.) from three Nunavik villages (Ivujivik, Kangiqsualujjuaq, Inukjuak); 3. Characterize and quantify different phytochemicals (flavonoids, carotenoids, etc.), macronutrients and selected vitamins, minerals and environmental contaminants in these samples; 4. Assess the bioactivity (evaluate the protective potential) of sample extracts in in vitro models pertinent to the prevention and treatment of chronic diseases (antioxidant, antiglycation and anti-inflammatory); 5. Conduct an animal study to evaluate the contribution of wild berries in preventing the development of insulin resistance and obesity in mice; 6. Contribute to develop community-based intervention projects in Nunavik villages to: a. improve wild berries, plants and seaweeds consumption, distribution and availability throughout the year; b. propose local healthy alternatives to soft drinks and snacks; and c. stimulate youth empowerment and employment. Preliminary results of the project will be presented in the poster.

Better understanding the overall benefits of country foods consumed in Nunavik will support and orient public policies aiming to improve food security, promote Inuit culture, minimize the risks from environmental contaminant exposure, and the emergence of obesity, diabetes and cardiovascular diseases in this population and the Arctic.

FLIES, POLLINATORS OF VACCINIUM ULIGINOSUM, BAKER LAKE (NUNAVUT)?

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In all Inuit communities, berry picking is an important activity. Berry-producing plants are sensitive to climate variability that can directly influence bud preformation, flower production and fruit set. In addition, the current warming trend observed in the Arctic can also alter pollination, a critical element of berry productivity. What would happen if there was a mismatch between flowering period and the emergence of pollinating insects? In 2011, we investigated the pollination of blueberry (*Vaccinium uliginosum*) near Baker Lake, Nunavut using pollen exclusion nets, hand pollination and controls (n=40 ramets per treatment). In addition, insect activity was monitored continuously over a period of 20 days in early July for thirteen *V. uliginosum* shrubs using repeat photography (3 pictures/30sec for a total of approx. 60 000 pictures/shrub).

The field experiment revealed that *V. uliginosum* has a very low ability to self-pollinate and that the production of berries is pollen limited at Baker Lake; an average of 17% of hand pollinated flowers produced fruits compared to nearly 3% in the control treatment and less than 0.5% in the exclusion treatment. The main insects observed on *V. uliginosum* flowers were flies (36% of insect visits) with only a few bumble bees (1% of insect visits) recorded by the cameras. A large proportion of observations (mostly very small insects) remained undetermined (63%). As expected, insects were more active during the day (93% of the observations) then at night (7% of the observations) and were strongly affected by climatic conditions. They were more active on sunny and windless days. The mean productivity of the thirteen plants monitored by the cameras was 5%, which is comparable to that of control plants. These results suggest that insects play an important role in the pollination, and therefore productivity of *V. uliginosum*. While bumblebees are known to be efficient pollinators

of bell-shaped flowers, the large proportion of dipteran visitors in our system suggests that they may also play an active role in the pollination *V. uliginosum* in northern ecosystems.

SPATIAL AND TEMPORAL TRENDS IN HYDRO-CLIMATIC VARIABLES ACROSS THE MACKENZIE RIVER BASIN

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The hydro-climatic conditions in the Mackenzie River basin determine the flow characteristics of the Mackenzie River, which is a major contributor of water to the Arctic Ocean. Changing climate is having considerable effects on the hydrological cycle, including changes in temperature and precipitation patterns that modify the amount of snow fall and snow melt available to contribute to streamflow in the Mackenzie River basin. Studying such changes in patterns of snow accumulation and snow melt provides a better understanding of how a changing climate is affecting water availability in the region. The precipitation, snow depth, and snow melt across the basin determine the amount of flow, and the temperature across the basin controls its timing. The research examines the spatial and temporal variations in climatic variables affecting streamflow across the Mackenzie River basin, including analysis of historical trends in temperature, precipitation, snow depth, and snow melt for the time period 1950-2010. Analysis includes the use of gridded, observed data for winter and summer months for a selection of sub-basins within the study region using various methods of spatial and temporal analysis, including the Mann-Kendall non-parametric test and tests for local spatial autocorrelation. Large scale spatial patterns are also assessed through the use of pixel trajectory analysis, which provides a visual representation of time-series data over the entire study area. The results from this research provide a better understanding of the historical changes and variability in the hydro-climate affecting the Mackenzie River basin and will be useful in predicting future implications of hydro-climatic variability and change on water resources within the study area. This research is conducted as part of a larger hydro-climatic study that includes analysis of the freshet timing of the Mackenzie River as well as a study of the synoptic patterns and teleconnections associated with climatic variability of the study area.

CARBON AND NITROGEN DYNAMICS IN THERMOKARST PONDS AT SABINE PENINSULA, NUNAVUT, CANADA.

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The manner in which permafrost disturbances will influence nutrient cycling in continuous permafrost watersheds in the High Arctic remains uncertain due to the lack of research in this remote region. Understanding how climatically driven landscape changes affect nutrient dynamics in these thermally sensitive regions is of concern due to the potential consequences for terrestrial and aquatic ecosystem functions as well as nutrient cycling. Thermokarst ponds in forested, discontinuous permafrost regions of the subarctic are thought to act as reservoirs for microbial activity, but no studies have demonstrated this in Canadian High Arctic settings where the vegetation is characterized by a mixture of mesic tundra and polar desert species. This study examines the abundance and characteristics of carbon (C) and nitrogen (N) in thermokarst ponds at the Sabine Peninsula (76°34'N, 108°33'W), on Melville Island, Nunavut, where average annual atmospheric temperatures are -16°C. Preliminary results show that dissolved organic C (DOC) and N (DON) concentrations in thermokarst ponds are as high as 100 mg/l and 8.00 mg/l, respectively. The DOC and DON concentrations in these thermokarst ponds are uncharacteristic of atmospheric deposition sources, as they exceed those of a late season snow sample by up to two orders of magnitude. Concentrations of DOC and DON in the thermokarst ponds are also considerably higher than those of stream waters and subsurface seeps in the same geologic formation. This indicates that autochthonous (e.g. microbiota) sources of organic C and N play an important role in these environments. This unique dataset shows that these nutrients are actively and effectively being cycled in continuous permafrost environments, particularly in disturbance features of the Sabine Peninsula.

COMPILATION OF COASTAL GEOSCIENCE INFORMATION FOR ENVIRONMENTAL ASSESSMENT IN THE BEAUFORT SEA

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The ice-rich shoreline of the Beaufort Sea is subject to rapid erosion and morphological changes. Erosion of the coast removes protective landforms and mobilizes sediment which may contribute to harbour shoaling, while ice-rich sediments with massive ground ice create the potential for thaw consolidation and settling, as well as promoting coastal erosion. Existing critical port sites (notably Tuktoyaktuk) may see substantial changes, and other potential sites require foresight for prudent development. A better understanding of this dynamic coastline is critical for community and industrial stakeholders with interests in ports and harbours, safe navigation, oil-spill preparedness, and other aspects related to existing and proposed coastal infrastructure. In response to potential new coastal development in the region, the Geological Survey of Canada has been funded as part of the Beaufort Regional Environmental Assessment (BREA) to compile, synthesize, and analyse information on coastal and nearshore seabed conditions critical to the planning, site selection, regulation and management of harbour facilities. The results will enable informed assessment of the environmental impacts of development of shorelines of the Beaufort Sea. A number of data products are in various stages of completion including: (1) an inventory of existing data and research results; (2) a regional synthesis and assessment of coastal knowledge in a georeferenced format; and (3) in consultation with various levels of regional and local government and other partners, acquisition of new data to fill critical gaps and strengthen the regional synthesis. The resulting report and GIS data products will provide a regional framework to enable regulatory agencies and interveners to contribute to the prudent, safe and sustainable development of the Beaufort Sea coastal zone.

ENVIRONMENTAL EFFECTS ON THE BIOLOGY OF AN ARCTIC MEDICINAL PLANT: RHODIOLA ROSEA

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Rhodiola (*Rhodiola rosea* L., Crassulaceae) is a circumpolar Arctic medicinal plant with considerable value in traditional pharmacopeias as well as the commercial natural products industry. The rhizome and root of this species are used medicinally for their adaptogenic properties; to improve immunity, alleviate fatigue, depression, and stress, to fight infections, and to protect healthy cardiac function. Aerial parts of the plant serve as an important traditional foodsource for many aboriginal peoples, providing fresh vegetable matter and healthful antioxidants to human diets at a place and time of year where there are few other fresh vegetables available. Despite Rhodiola's established commercial and traditional value, little is known about the influence of environmental factors on growth, morphology, and potency. The current study investigates the linkages between environmental factors pertaining to the biology and phytochemistry of Rhodiola, and will also begin to explore the economic potential of this important Arctic medicinal plant in Northern Labrador communities.

Rhodiola is distributed in alpine and coastal habitats of Arctic regions of North America, Asia, and Europe. Due to its wide ecological amplitude, Rhodiola can be found growing in beach, tundra and rocky habitats. Current research shows that Arctic ecosystems are being disproportionately affected by climate change, which can affect the biology of Arctic medicinal plants in unpredictable ways. Consequently, Rhodiola's variability in growth, survival, and morphology across these various habitats, geographic regions, and changing environmental conditions merits further investigation.

Variations in habitat and environmental conditions may also affect Rhodiola's expression of medicinal properties. Medicinal plants are known to increase production of secondary metabolic compounds in response to stress, so the stressful effects of climate change can affect phytochemistry in a manner which may vary distinctly from species to species. Arctic plants in particular produce a range of compounds to protect against photoinhibition, such as phenolic compounds, anthocyanins, and flavonoids, families of compounds which

are intrinsic to the medicinal and anti-oxidant effects of these medicinal plants on human physiology.

To determine how this species responds to varying habitats and to the changing environmental conditions, Rhodiola populations were sampled across a North - South gradient along the coast of Labrador (between Nain and Rigolet), and comparisons of growth and allocation patterns were made within and between sites. Variations in secondary metabolites of Rhodiola across latitudinal gradients, in different habitat zones, and in response to biotic factors such as mites and weevils will also be examined.

Climate change and environmental factors may have unexpected effects upon the biology and phytochemistry of Arctic plants such as Rhodiola, and the importance of understanding these effects cannot be overstated, due to Rhodiola's significance in traditional Inuit medicine as well as in the global trade of medicinal plants. Further research is critical in order to clarify the effects that environmental factors such as latitude, zonation, biotic stressors, and climate change might have on wild populations of Rhodiola growing in its native habitat of coastal Northern Labrador.

MAPPING SURFICIAL GEOLOGY AND ASSESSMENT OF PERMAFROST CONDITIONS UNDER THE IQALUIT AIRPORT, NUNAVUT, CANADA.

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Formerly, characterization of permafrost conditions was minimal before the construction of infrastructures. It was assumed that the permafrost would forever remain a solid substrate. Before global warming, transportation infrastructures were not designed, especially in terms of materials and dimensions, to withstand without damage an increased input of heat in the soil. Iqaluit airport, the hub of the eastern Canadian Arctic, is currently affected by thawing permafrost. In fact, the runway, taxiways and apron are affected by differential settlements resulting from the presence of localized ice-rich soils.

This study uses a GIS approach that makes up for the absence of appropriate characterization before the construction of the airport during WWII and in the 1950s. Mapping of surficial geology, hydrography and landforms indicative of the presence of ground ice (e.g. tundra polygons) was produced by interpreting aerial photographs dating back from the initial phases of construction (1948) and photographs taken at intervals since then, to the most recent high-resolution satellite images. Subsequent map analysis shows that the original terrain conditions prevailing before the construction of the airport have a significant impact on the current stability of the infrastructure. Data integration allowed us to summarize the main problems affecting the Iqaluit airport which are: 1) Differential settlements associated with pre-construction drainage network 2) Cracking due to thermal contraction, 3) Linear depressions associated with ice wedge degradation and 4) Sink holes.

Most of the sectors affected by differential settlements and instabilities are perfectly coincident with the original streams and lakes network that has been filled to increase the size of the runway, taxiways and the apron. In addition, the runway is affected by intense frost cracking. Similarities with nearby natural terrain suggest that the network pattern of the cracks follows pre-existing ice wedges in the natural terrain. Analysis of ground penetrating radar profiles indeed shows parabolic reflectors typical of ice wedges under the larger runway cracks. Temperature data acquired with five thermistor cables in the runway, in a taxiway, in the apron and in nearby natural terrain shows that the thickness of the active layer varies between 90 centimeters for sectors covered with vegetation and more than 2 meters below paved surfaces which means that the thaw depth has now reached down into the original natural terrain under the infrastructure, thus causing settlements due to melting ice wedges. Sink holes are mostly localised on the edges of the northern part of the runway. Processes responsible for these holes possibly are seepage of water into the base course and the subgrade, melting of bodies of ice or soil compaction problems.

This established context of permafrost is now used for planning a detailed investigation program in preparation for the restoration of the airport and its adaptation to climate change. The program will include drilling, more geophysical surveys, thermal monitoring and numerical simulations.

WEANING AGE AND OTHER ONTOGENETIC DIET TRENDS IN EASTERN CANADIAN ARCTIC BELUGA (DELPHINAPTERUS LEUCAS) INDICATED BY STABLE ISOTOPE RATIOS (Δ15N AND Δ13C) IN TEETH

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Beluga whales (*Delphinapterus leucas*) are estimated to nurse from 6-32 months, while gradually supplementing diet with solid prey over that time. Field studies used to provide such varied estimates can be biased, but recently patterns of stable isotope (SI) ratios in annual growth layer groups (GLGs) of teeth have been used to infer weaning ages in several marine mammal species. We measured stable isotope ratios of nitrogen (δ15N) and carbon (δ13C) in the first 3-15 dentinal GLGs of teeth from 31 belugas from the Western Hudson Bay (n=8), Cumberland Sound (n=12), and Eastern High Arctic (n=11) populations in the eastern Canadian Arctic to provide weaning age estimates. Only teeth with a very clear neonatal line demarcating the first GLG were chosen for analysis, and the thick band thought to represent summer growth was sampled from each GLG. Most (n=28) individuals showed a gradual decrease in δ15N of ~1‰ over the first 2-4 GLGs, which was interpreted as evidence of a gradual decrease in reliance on milk (which has relatively higher δ15N). δ15N trends suggested 38% of these individuals were weaned by their second summer (i.e., ~12-15 months old), 31% by their third summer (~24-27 months old), and 19% by their fourth summer (~36-39 months old). Despite the considerable variation in individual weaning age, there were no clear differences in δ15N patterns among population, sex, or decade of birth (1970, 1980, 1990). δ13C patterns over the first several GLGs were not as clear as those for δ15N. Approximately half of the individuals showed an increase in δ13C of ~0.5‰ over GLGs 2-4, which could reflect weaning since milk comprises high amounts of lipids which have lower δ13C than solid prey. After the initial decrease in δ15N associated with weaning, δ15N trends were unrelated to population or decade of birth, but did show differences related to sex. Values in females remained relatively stable post-weaning, while males showed a gradual increase in δ15N that was ~0.5‰ higher than females from GLG8 onward. This is suggestive of a gradual ontogenetic diet change, with males feeding at a higher trophic level than females, although other factors such as sexual dimorphism and potential physiological differences between sexually mature females and males cannot be discounted as explanations for the observed difference in trends.

INVESTIGATING MERCURY CONCENTRATIONS AND MERCURY FRACTIONATION IN FOOD WEBS OF SELECTED ARCTIC LAKES (INUVIALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES, CANADA)

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This research focuses on determining the concentrations of mercury (Hg) in edible fish and the isotopic fractionation of Hg in selected predatory fishes, water, and sediments in selected Arctic lakes. Community members of Tuktoyaktuk and Inuvik, Northwest Territories (Canada) frequently utilize the Husky Lakes Watershed (HLW) for subsistence fish harvests. Both communities seasonally harvest fish as an integral part of their country food diet. Mercury is a globally distributed toxic pollutant, which can have severe health impacts on biota in both its inorganic and methylated forms (MeHg). While some information on the ecology and fish composition is becoming available, information on the transfer of Hg in the HLW is relatively unknown. Climate variability and change, is predicted to affect the cycling of contaminants, such as Hg by modifying the physical environment (water and sediment), which could alter the biological compartments (food web), and subsequent transfer of contaminants. This research intends to fill an important gap in knowledge pertaining to the cycling of contaminants in lakes, in part controlled by water column conditions (i.e. salinity), and subsequently through the food webs of freshwater systems. The study sites Big, Yaya, Noell, and Husky Lake systems, each differing in water column, ecological and Hg delivery mechanisms (marine-, riverine-, or freshwater derived), will be used to investigate how differences in these characteristics affect Hg transfer and fractionation. The data collected will be used for spatial comparisons of the concentrations of total Hg and Hg stable isotope ratios across basins within varying salinity gradients in the HLW. Sampling efforts focused on surface water and sediment samples, benthic and pelagic invertebrates, tissues from harvested fishes, and non-target fish. Each, with the exception of water, has been analyzed for total Hg concentrations by a Direct Mercury Analyzer

(DMA). Hg isotope ratios (δxHg) are analyzed by multi-collector inductively coupled plasma mass spectrometry (MC-ICP/MS). Hg mass independent fractionation (MIF; Δ199Hg) and mass dependent fractionation (MDF; δ202Hg) will be calculated for fish, sediment and water, and are evaluated against conditions measured in the water column (i.e. salinity), food web transfer and the potentially difference in Hg delivery (above). [THg] detected in harvested fishes will be compared to Health Canada consumption guidelines.

LEARNING GUIDES AS KNOWLEDGE TRANSLATION TOOLS FOR FOOD SECURITY IN INUIT COMMUNITIES

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This project aims to develop an appropriate model for building community competency in addressing obesity and food security in remote Inuit Communities. It is part of a larger project focused on developing a transferable and culturally appropriate model for engaging vulnerable and disadvantaged populations in designing community-driven interventions to address obesity and access to healthy foods. The first phase of the project focused on the Northern Inuit communities of Nunatsiavut, Labrador – a population that face some of the most extreme health inequalities in Canada. In 2010, the community of Hopedale, Nunatsiavut successfully completed a community-led food assessment (CLFA) project entitled NiKigijavut Hopedalimi ("Our Food in Hopedale"), using the BC Provincial Health Services Authority's "Community Food Assessment Guide" (2008).

Using the NiKigijavut Hopedalimi as a case study, the project began by evaluating the process of implementing a Community Led Food Assessment (CLFA) with the British Columbia developed tool in an Inuit community, in order to identify its use and applicability in Inuit communities. From the recommendations resulting from this evaluation, the tool was adapted in order to develop a culturally appropriate CLFA as the central aspect of a more broadly transferable CLFA to be used by other remote, northern, Inuit communities. Adaptations of the tool included expanding its content into a toolkit of five learning guides, changes to the format, language, and examples, as well as creating a more detailed process and inclusion of practice activities and additional resources. During the adaptation process, a steering committee of representatives from the Food Security Network of Newfoundland and Labrador, from the NiKigijavut Hopedalimi, as well as from national Inuit organizations were consulted and their feedback was incorporated into the adapted tool.

The project is developing a model for engaging communities in addressing risk factors influencing their food supply (including threats to country food harvesting, access to healthy foods, and food sharing networks) and the activity environment (programs enabling access to fresh, nutritious foods, basic food competency building), as well as individual and family factors of individual activity level and food consumption. A preliminary training session with representatives from Nunatsiavut communities was conducted using the tool, and feedback was very positive in regards to the tool being used for additional assessments, as well as a general training guide for other community based projects. As a result, an Inuit specific CLFA guide and resource materials will be available for Arctic communities in the near future.

BUILDING CAPACITY FOR ARCTIC HEALTH RESEARCH: LESSONS FROM THE NASIVVIK CENTRE FOR INUIT HEALTH AND CHANGING ENVIRONMENTS

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Introduction: To enhance Inuit community capacity in addressing environmental health issues, a Centre focusing on education, training, research and the enhancement of communication abilities was established at Laval University in 2003. As Inuit share a variety of unique issues, this Centre engages all Canadian Inuit regions and is directed by an Advisory Board comprised of representatives from the major Inuit land holding corporations and national organizations. Funded by the Canadian Institutes for Health Research – Institute for Aboriginal Peoples Health, the Nasivvik Centre aims to enhance Inuit research and communication/information capacity, through providing experiences and training for students and communities in such issues at all levels.

Objectives: The goal of the centre is to engage and train Inuit in order to move along the spectrum from

research on Inuit, to research with Inuit, and ultimately to research by Inuit on health issues.

Methods /Activities: Throughout its 8 years in operation, the Centre has focused on various themes as selected by its Inuit board of Directors, such as: community response to environmental change, Inuit knowledge and science for health research and education, environmental health surveillance and monitoring and Inuit health and well-being in the areas of food, water and natural/traditional medicines and remedies. Under these themes, the Nasivvik Centre has conducted a variety of education and training activities for students, and community researchers. Small scientific projects directed by outside researchers as well as community lead projects have been supported and the Centre has established a small summer student and graduate student scholarship program to encourage community-based research on priority Inuit environmental health issues. Other activities include the provision seed-funding for the development of new and innovative research projects involving both communities and University researchers to investigate priority environmental health issues and the establishment of a fund and process for north-south research mentoring and knowledge exchange between Inuit youth/community members and University-based researchers working on Inuit environment and health issues. The Centre also employs, and provides resources, support and training to 4 Inuit Research Advisors, who are local coordinators residing in each of the 4 Inuit regions.

Results: The Centre is an experiment in building capacity among Inuit communities for identifying, conducting and using research to address priority environmental health issues. A review of potential indicators of capacity and critical aspects of the Centre's objectives, structure and activities as a model for supporting the development of Inuit capacity in the areas of environmental and public health research and communications will be presented.

Discussion/Conclusion: Many lessons can be learned from the Centre's efforts to develop capacity in Inuit environmental health research within the current research structures that exist. Most importantly, in order to enhance research capacity many changes are required in the policies that govern access to funding and dictate research relationships, including changes in definitions of terms such as "Highly Qualified Personnel" and in criteria used to recognize and/or measure capacity, expertise, and knowledge.

READY TO HOST YOUR ARCTICNET DATA

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The Polar Data Catalogue (www.polardata.ca) is Canada's primary online source for data and information on research in the Polar Regions. Research projects presented in the Catalogue are conducted under the auspices of a wide variety of programs, including ArcticNet. The scope of the research covers a range of disciplines, from natural sciences to policy to health and social sciences.

The Polar Data Catalogue is now archiving datasets and publishing them online. Submitting datasets is very straightforward, with a few easy steps from metadata entry (in a wide range of formats) to online publishing. The ArcticNet data manager (Josée Michaud; pdc@arcticnet.ulaval.ca) is available to assist you and to answer any questions you may have regarding this process. Archiving your datasets will ensure that your data management plan (as increasingly required by many funding agencies) culminates in improved data organization and access, and it may open up new collaborations. A recent improvement to the Polar Data Catalogue is that digital object identifiers (DOIs) are being included in the metadata associated with archived datasets. DOIs are persistent identifiers that provide long-term links to data, improving the discoverability, citability and accessibility of the data to which they are assigned. In May 2012, DOIs became an ISO Standard. We are working in close collaboration with the Canada Institute for Scientific and Technical Information (CISTI), the entity responsible for DOI assignment for research data in Canada, to ensure the best use of this tool, and to continue to make the Polar Data Catalogue an attractive database for ArcticNet and other polar researchers.

GEOCHEMISTRY AND MINERALOGY OF MUD EJECTION FEATURES IN CONTINUOUS PERMAFROST ZONES

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Active layer mud ejection features in continuous permafrost zones in the High Arctic deliver dissolved metals, organic carbon, and trace gases from the subsurface to the atmosphere, and surface terrestrial and aquatic ecosystems. Active mud ejection features have been observed in continuous permafrost soils at the Cape Bounty Arctic Watershed Observatory (CBAWO), the Sabine Peninsula on Melville Island, Nunavut and Char Lake, Cornwallis Island, Nunavut. These features are present across the landscape in different physiographic and geologic settings and generally occur in areas subject to active layer slope failure or disturbance. Increases in soil water content from thawing permafrost and increased rainfall during the summer months likely results in the formation of pressurized waters within and at the base of the active layer causing sediment from depth to be ejected to surface as a slurry, forming flows and local surface accumulation features. Fluids and solid mineral phases were collected from these features for geochemical, isotope chemical, and mineralogical analyses. The goal of this work is to develop a working model that addresses the formation and solute acquisition of the subsurface fluid that is ultimately delivered to the surface.

The aqueous portion of one of the slurries sampled on the Sabine Peninsula, where local bedrock geology consists of acidic shale, has a circumneutral pH and based on the chemical composition is classified as Na-SO_4 type water. The fluid contains a suite of dissolved metals Fe, Mn, U, Li, B, Br, Ba, and Ti, in order of decreasing concentration, and contains high concentration of dissolved organic carbon (>20 mg/L) and total nitrogen concentrations that are 10x greater than local precipitation. High pCO_2 in these outflows are likely driving weathering reactions in the subsurface, and increasing the mobilization of metals in the active layer.

These features provide a unique opportunity to assess the subsurface hydrological, geochemical, and biogeochemical processes occurring in continuous permafrost environments. Unusually warm conditions in the Canadian High Arctic have led to changes in the continuous permafrost environment, including enhanced development of thermokarst features and slope disturbances, and it is likely that features similar to these will become more prevalent across the landscape as permafrost responds to projected regional climate change.

THE IMPACTS OF SHORELINE RETROGRESSIVE THERMOKARST SLUMPING TO THE WATER CHEMISTRY AND BACTERIAL PRODUCTION OF TUNDRA LAKES OF THE MACKENZIE DELTA UPLAND LAKES.

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Permafrost temperatures in the high Arctic have been rising causing a deepening of the active layer and an increase in thermokarst activity. The degradation of permafrost occurring directly adjacent to lakes has been associated with shoreline retrogressive thaw slumping (SRTS) in which massive amounts of terrestrial materials may be input to the lacustrine environment. Lakes unaffected by slumping have high concentrations of dissolved organic matter (DOM) and are tea coloured, conversely lakes impacted by SRTS tend to be less coloured and have lower concentrations of dissolved organic matter. Bacterial production is known to be an important food wed component of humic lakes and is therefore likely impacted by thermokarst disturbance given the potential levels of DOM subsidization. To ascertain the potential impacts of retrogressive thaw slumping to water chemistry and the bacterial production of tundra lakes, we conducted an in situ mesocosm experiment in which treatments consisted of various volumes of sediment additions taken from an active thermokarst slump. The experiment took place in an undisturbed Mackenzie Delta upland lake and consisted of twelve 1.2 meters square mesocosms: three replicates for each of three levels of sediment addition plus three replicates of a control in which no additions were made. Mesocosms were dosed in the spring and monitored over the course of the open-water growing season (early June to mid-September). Mesocosms were sampled weekly in both the benthic and pelagic environments. Bacterial production was quantified using the radio-labelled leucine uptake method.

Analyses showed that bacterial production increased with sediment treatment in the benthos (up to 500% in the high treatment) but decreased (down by up to 50% in the high treatment) in the pelagic zone. Water colour and phosphorous concentrations increased as a result of sediment additions.

Results from this study suggest that thermokarst slumping may impact the bacterial production in affected lakes and thus have cascading effects on upper trophic levels. In particular, stimulated benthic heterotrophic

productivity raises the possibility that such increased activity is the first step in a succession leading to the proliferation of benthic production as observed in slumped lakes.

Further study is needed to explore the possibility whether trophic effects are responsible for the decline in bacterial productivity in the water column.

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

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The Cape Bounty Arctic Watershed Observatory (CBAWO) utilizes two adjacent, geologically similar watersheds, West and East, which are currently undergoing climate-driven changes. The West catchment, for example, has experienced numerous active layer detachments during the past 5 years while the East catchment has experienced only minor disturbances. These alterations to runoff patterns and permafrost degradation may also drive changes in the biogeochemical cycling of mercury (Hg). We are investigating whether these changes are also seen in mercury bioaccumulation in arctic char and the food webs of West and East Lakes. We hypothesize that increased Hg inputs into West Lake will result in higher concentrations of Hg in char. To investigate this Arctic char (Salvelinus alpinus), and invertebrates were collected for analysis of total Hg (THg) and methyl Hg (MeHg) annually from 2008 to 2012 along with water and sediment samples. Food web samples included periphyton, zooplankton (>500 um and <100 - <500 um), amphipods, juvenile char, and adult char (except for in 2010 when no adult char could be captured). THg and MeHg were determined in all food web, water and sediment samples at Environment Canada labs in Burlington (ON) using standard U.S. Environmental Protection Agency analytical protocols. Carbon (C) and nitrogen (N) stable isotope analysis from the char confirmed that the fish are all landlocked and insectivorous with no evidence for multiple morphotypes observed in some larger lakes. Char have more depleted δ13C in East Lake vs West (mean ± 95%CI; -27.34±0.22 ‰ (N=57) vs -25.31±0.47‰ (N=35)) indicative of great pelagic C sources in East Lake. Also δ15N is significantly higher in East Lake char (11.06±0.16‰ vs 9.9±0.25‰) suggesting differences in food sources. The combined results from 2008 to 2012 collections show that the West Lake adult char have significantly higher Hg concentrations (0.155 ± 0.023 ug/g) compared to East Lake (0.102 ± 0.16 ug/g) and this difference is even greater if results are adjusted for δ15N using analysis of covariance. However, no significant trends in Hg concentrations in the char were found over the period 2008 to 2012 in either lake. The higher mean concentrations in West Lake char were consistent with higher unfiltered THg concentrations in the West River and in West Lake (see Poster by Kirk et al), extensive permafrost disturbance in the West watershed and seasonal anoxia in that lake. However, lake MeHg concentrations were slightly higher in East Lake suggesting that direct MeHg exposure of the fish does not explain the differences. Our preliminary conclusion is that increased total Hg inputs into West Lake are resulting in higher concentrations of Hg in char in that lake.

TEMPERATURE-GROWTH PATTERNS OF INDIVIDUALLY TAGGED ANADROMOUS ARCTIC CHARR SALVELINUS ALPINUS IN NORTHEASTERN CANADA

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Individual measurements of annual, or within-season growth were determined from tag-recaptured *S. alpinus* and examined in relation to summer sea surface temperatures and within-season capture timing in the Ungava and Labrador regions of eastern Canada. Differences in among-year growth were significant for Ungava Bay *S. alpinus*, with growth being positively correlated with temperature. Growth of Labrador *S. alpinus* did not vary significantly among years. Regional comparisons demonstrated that Ungava *S. alpinus* had significantly higher annual growth rates, with differences among years in all regions being positively correlated with temperature. Within-season growth rates of Labrador *S. alpinus* peaked in June, declined toward August, and were negatively correlated with the length of time spent at sea and mean experienced

sea surface temperatures. A quadratic model relating growth rate to temperature best explained the pattern of within-season growth. The higher annual growth of Ungava Bay *S. alpinus* was attributed to the high sea surface temperatures experienced in 2010-11 and the localized differences in nearshore productivity as compared to Labrador. Results suggest that increases in water temperature may have profound consequences for *S. alpinus* growth in the Canadian sub-Arctic, depending on the responses of local marine productivity to those same temperature increases.

TEMPORAL VARIABILITY OF THE CARBONATE SYSTEM IN THE CANADIAN ARCTIC ARCHIPELAGO

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The Canadian Arctic Archipelago constitutes one of the major pathways for water mass exchange between the Pacific, Arctic and and Atlantic Oceans. The outflow out of the Canadian Arctic Archipelago exerts strong control on the biogeochemistry o the downstream waters in Baffin Bay, the Labrador and Scotian Shelves, the Gulf of Maine and the NW Atlantic Ocean. We investigate the temporal variability of the characteristics of the water masses passing and leaving the Canadian Arctic Archipelago, based on two ArcticNet cruises in 2007/8 and 2011. We present the carbon cycle and related data and identify the main drivers for the observed variability.

ISOTOPES OF LAKESHORE BLACK SPRUCE TREES AS PROXY FOR NORTHERN QUEBEC PALEOCLIMATE?

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Knowledge of past variations in regional climate registered in natural archives contributes to a better understanding of current global climate change. Trees represent one of the best archives because stable isotopes in their rings can record climatic conditions prevailing during their yearly growth. Currently there is no isotopic millennial dendrochronological series existing for the North American boreal forest, but there is a need for such a long-term perspective. In northern Quebec, millennial tree-ring series can be constructed from sub-fossil stems preserved in the littoral zone of lakes. Such tree remains have fallen from the riparian forest after breaking at variable stem heights and collapsing on lake floors. Because tree remains generally contains less than 200 tree rings, the development of a millennial series requires crossdating several tree remains. However, the capacity of such tree from lakeshore trees to contain a meaningful and significant isotopic response to past climate variations has never been investigated. This is the main objective of the present study. Series of 130 tree ring (time period of 1880 to 2010) have been collected systematically at stem heights of 100 and 380cm in each of four black spruce trees (*Picea mariana* [Mill] B.S.P) on the shore of a lake in the central part of the Quebec-Labrador Peninsula. These eight series are used to verify if the carbon and oxygen isotopic values in cellulose show significant correlations with measured climatic parameters.

We have compared isotope series between heights for each trees, then using the mean series from the four trees of each height. In both cases, the carbon isotopes series show much stronger correlations than the oxygen isotope series. We have then assessed the correlations of regional climatic parameters with isotopic means, combining the two heights and the four trees. The compiled and harmonized climate data come from three weather stations (Schefferville, Wabush Lake, Nitchequon) located in the broad region of the selected lake. We have analyzed the correlations (Pearson coefficient and response functions) between the isotope ratios and several climatic parameters such as temperature, precipitation, climatic index (combination of precipitation and mean temperature), watershed inflow, etc., for individual months or their combinations. Again, the carbon isotopic mean series is more strongly correlated with climatic variables than the oxygen ratio, and the climatic index for spring months is the parameter standing out with the strongest correlations.

These preliminary results suggest two important points: (1) the isotopic series from different heights correlate significantly, allowing the combination of stem

segments from various heights for isotopic studies; (2) the carbon isotopes seem to represent the best isotopic indicator for climatic reconstruction if lakeshore trees are to be used for millennial studies.

ATMOSPHERIC CIRCULATION PATTERNS AFFECTING WATER AVAILABILITY OF ROCKY MOUNTAIN TRIBUTARIES TO THE MACKENZIE RIVER

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The headwaters of the three largest tributaries to the Mackenzie River, the Athabasca, Peace, and Liard Rivers, contribute approximately half of the total annual discharge of the Mackenzie River. The majority of this discharge originates as winter snowpack in the Rocky Mountain headwaters, and is released during spring freshet. Summer water availability is influenced by basin-wide precipitation, evapotranspiration, glacial meltwater, and/or release of water from dammed reservoirs. Interannual variability in winter snow accumulation, spring melt intensity and timing, and summer precipitation and evapotranspiration are strongly influenced by regional to synoptic-scale atmospheric circulation patterns that control air mass characteristics and moisture transport. Furthermore, large-scale teleconnection patterns, including El Nino-Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO) and the Pacific North American (PNA) pattern have also been shown to influence regional surface climate, particularly during the cold season. This study identifies and evaluates the atmospheric drivers of water availability on the north-eastern slopes of the Rocky Mountains, corresponding to tributaries of the Mackenzie River. Daily synoptic-scale atmospheric circulation patterns from 1949 to 2011 for winter (Nov-Apr) and summer (May-Oct) seasons are classified using Self-Organizing Maps (SOM), an unsupervised, iterative training process that clusters and projects data onto an organized output array. The top and bottom quartiles of precipitation and temperature are identified and compared with frequency and persistence of mid-tropospheric circulation patterns. Synoptic circulation patterns that occur with an increased/decreased frequency and/or persistence during positive, negative, and neutral ENSO, PDO, and PNA phases are then identified. This research is being conducted in conjunction with similar analysis on the southern Rocky Mountains, corresponding to the east-flowing North Saskatchewan, Red Deer, Bow, and Oldman Rivers. Results of this study will increase our understanding of the processes related to snow accumulation and release, and summer extreme high/low precipitation, which are fundamental to water resource management on these rivers, and is an indicator of spatio-temporal redistribution of water resources.

INUIT RESEARCH ADVISORS: THE FRONTLINE WORKERS OF ARCTICNET AND NORTHERN INUIT COMMUNITIES

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My poster will explain the Inuit Research Advisor Program and it's originations with ArcticNet. The focus will be on a timeline of events that took place from 2006 to 2010 and then share the changes to the Program from 2011 to present and how it has been restructured. My poster will outline the purpose of the IRA Program; explain the IRA's roles and responsibilities to funders and host (regional Inuit) organizations. Next, audience will learn about how the IRA's do their work and how they are able to accomplish these tasks with the help of our support organizations (national Inuit) organizations.

Next, IRA's role and responsibilities to ArcticNet will be explained, from IRA participation on the Inuit Advisory Committee, to working with the ArcticNet Students Association at the ASM, and how IRA's interact with the researchers and communities they assist. With all the lessons learned over the past five years, IRA Program is finally established with clear future goals and direction with the completion of the IRA Handbook and several other training initiatives underway for new IRA's. It is now that IRA's are ready to engage fully with the research community. We, in this presentation, hope to show all the ways we can be at each other's service.

SHOULD I GO OFF? KNOWING THE RIGHT PATH IN THE NUNATSIAVUT RESEARCH APPROVAL PROCESS

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Nunatsiavut Government

This poster highlights the unique role of the Nunatsiavut Government in research being conducted within the Labrador Inuit Settlement Area. I am employed as an Inuit Research Adviser as part of the Nunatsiavut Government and am the first point of contact for all researchers who are interested in conducting research in our region. Part of my role as the Inuit Research Advisor is to Chair the Nunatsiavut Research Advisory Committee. All proposed research to be conducted within Nunatsiavut must be reviewed and approved by this committee. The Labrador Inuit Land Claim Agreement received Royal Assent in 2005 and is the first of the Canadian Inuit Land Claims to achieve self-governance. This means that the research review and approval process within Nunatsiavut is uniquely embedded within, and not separate from, the Inuit Governance system. The process whereby proposed health research is reviewed and approved is also unique within the provincial context because any proposed health research to be conducted in Nunatsiavut by researchers from institutions outside of Newfoundland and Labrador also needs to be approved by the provincial health research ethics board. This means that researchers interested in conducting health research in Nunatsiavut have to navigate up to four levels of approval with community research advisory boards (i.e., TCPS2 Chapter 9), the Nunatsiavut Government, the Newfoundland and Labrador Health Research Ethics Board; and, for researchers from outside the province, ethics approval from your home institution is still required. It is part of my role as the Inuit Research Advisor for Nunatsiavut to help take you through this process step-by-step and ensure that your research proposal review and approval experience is as streamlined as possible.

TEMPORAL MONITORING AND COMPLETE DISAPPEARANCE OF PERENNIAL ICE-COVER ON CANADA'S NORTHERNMOST LAKE: WARD HUNT LAKE, NUNAVUT

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Recent environmental changes in the High Arctic have had a striking impact on surface cryospheric features such as lake ice, glaciers and pack ice. Recent reports of changes on Ellesmere Island's north coast have included the breakup of Ward Hunt Ice Shelf, the loss of epishelf lakes and the thinning of land fast ice. On arctic lakes, perennial ice cover has become less common and lake phenology is shifting as a consequence of warmer waters and decreased albedo. A GEOEYE satellite image acquired in late August 2011 revealed a complete absence of ice-cover on Ward Hunt Lake (WHL), Canada's northernmost lake, while lake ice thickness was reported to be around four meters in July 1958 and August 2003. Using synthetic aperture radar (SAR) imagery and oblique photographs of the lake, we conducted a yearly ice-cover monitoring of WHL since 1995 and confirmed the presence of perennial ice-cover throughout this period, with cover ranging from 63% to 85% (mean= 76%) of the lake's surface between 1995 and 2008. Climatic data was obtained from previous studies and from the SILA weather station network on Ward Hunt Island and nearby Lake A on Ellesmere Island. In 2008, a very warm summer melted 52% of the lake ice-cover, and a complete loss of ice-cover was observed in 2011. Early and/or late summer ice thickness measurements over the last ten years and reported measurements from the literature have indicated a rapid decline from around 4 m in the 1950's, early and late 1990's and early 2000's down to 3m in 2008 and 1.6m in 2010. During a field survey in late June and early July 2011, less than half the lake (48%) was covered by perennial ice, which was split in two rafts no thicker than two meters. A field visit in 2012 revealed a seasonal candle ice cover thickness of 1.76 m on July 1st, which is similar to the 2011 status (1.9 m). Overall, climate data showed a general warming trend in the last 50 years, with declining freezing degree days and increasing melting degree days. This warming resulted in a lack of recovery of perennial ice cover after warmer summers and a positive feedback effect clearly shown by an increase in the water column temperature profiles collected since 2010. Overall, possible effects of the warming temperature are the lowering of the lake and the ice-cover albedo by ponding and moating and by changing ice-type from multi-year to candle ice. This in turn delays ice formation during freeze-back and reduces perennial lake ice thickness in a positive feedback effect. Candle ice is also more fragile and more sensitive to mechanical fractures than perennial ice and these disturbances can accelerate lake ice cover destruction in summer. The implications of a reduced ice cover include an accelerating effect on lake phenology with water column mixing occurring earlier in the melt season in 2011 and 2012 than in 2010.

GEOCHEMICAL, BIOLOGICAL AND LIMNOLOGICAL RESPONSES OF NOELL LAKE, NORTHWEST TERRITORIES IN RELATION TO A CHANGING CRYOSPHERE

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Since 1980, increases in annual average temperatures over the Arctic have been approximately twice as large as the rest of the world. Components of the Arctic's terrestrial cryosphere (i.e. lake-ice, permafrost, snow cover) have exhibited significant reductions in both duration and extent. As a result, Arctic freshwater ecosystems have been identified as being particularly sensitive to climate variability and change. However, uninterrupted and long-term monitoring programs of Arctic freshwater ecosystems have not been undertaken in large areas of the Canadian Arctic. As a result, sparse baseline environmental data is available for analysis and comparison, rendering the prediction of how changes in climatic regimes will affect the aquatic productivity, geochemistry, and phenology of these freshwater systems difficult.

The Water & Climate Impacts Research Centre (W-CIRC) has been studying a range of hydrological, limnological, ecological characteristics of a gradient of lakes across the western Arctic in the context of a changing cryosphere (ie., alternations in permafrost and lake-ice conditions). My M.Sc. project, focusing on Noell Lake in the NWT, is a component of this broader research initiative. Noell Lake (68°31'37''N, 133°30'48''W) is located approximately fifteen kilometres northeast of the town of Inuvik, and has a total lake area of 30 km^2, maximum lake depth of 17.8 m, and a mean depth is 1.7 m. Noell Lake is representative of many of the medium-sized lakes located north of the treeline in Canada's western Arctic.

Through the use of representative sampling regimes and an Arctic Lake Monitoring System (ALMS) ice-buoy and sub-surface mooring system relaying constant real-time meteorological, limnological and water quality data, our research initiative has carried out continuous monitoring designed to facilitate a more comprehensive understanding of the changing physical, biological, and geochemical parameters of an Arctic lake in relation to observed alterations in lake-ice conditions. More detailed and integrated investigations of Noell Lake will facilitate the assessment of its current state and serve as reference data for future investigations. I present the key objectives of my study, describe the study design, and report on preliminary results on relationships among water chemistry, lake ice, and aquatic productivity parameters.

WAVELET ANALYSIS OF PROXY CLIMATE INDICES FROM THE GISP2 AND NGRIP GREENLAND ICE CORES

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In this study we explore the temporal variability in a variety of ice-core evidence from the Greenland Ice Sheet for two intervals: (1) Glacial-Interglacial Boundary 10,000-15,000 years before present and (2) A period between 25,000 to 35,000 years before present. The objective is to rigorously examine the concurrence and divergence in the records of the ice core data originating at GISP2 and NGRIP for climate proxies including atmospheric chemistry parameters (Greenhouse Gases & Aerosols), Volcanic History (volcanic sulfates), and Orbital Variation considerations (Obliquity, Precession &Eccentricity). We apply Morlet Wavelet Transform analysis using The Discrete Time Series Wavelet Calculator (Lordello, 2012) to identify the power spectrum for each parameter. This operator provides new insight into the behavior of the discrete spectra and permits qualitative interpretation of stability of atmosphere phenomena, Greenhouse Gas intensifications and variation in general chemical composition.

CONSIDERATIONS FOR DOCUMENTING AND DISSEMINATING INUIT KNOWLEDGE USING MULTI-MEDIA PLATFORMS

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Social network websites, iPods and iPads, feature films, documentaries, digital storytelling libraries, oral history databases, websites and more! New media

technologies are becoming popular strategies for documenting and disseminating Indigenous knowledge in scientific projects. The use of multi-media platforms is consistent with the rapid adoption of new media technologies in Northern communities. However, concerns have been raised about obtaining informed consent, protecting intellectual property rights, long-term administration of iterative media platforms (e.g. websites), and ensuring community member access to these media sources. While the impetus of researchers and community members to employ these technologies is important, there is a need to identify considerations for employing these techniques to ensure that community needs and concerns are addressed.

This poster describes a pilot study that identifies and examines considerations for documenting and disseminating Inuit knowledge using multi-media platforms, as part of the CIHR-funded project, 'Inuit Traditional Knowledge for Adapting to the Health Effects of Climate Change' (IK-ADAPT). The project involves working with 6 communities across the Canadian Arctic to examine ways to document, conserve, and promote Inuit traditional knowledge (IK) to prevent, prepare for, and manage the impacts of climate change on health. In July 2012, interviews were conducted with 18 community members in Ulukhaktok, Northwest Territories to document local perspectives on the use of media platforms for preserving and promoting Inuit Knowledge in research projects. Additional community interviews are currently planned in Nunavut and Nunatsiavut, as well as with regional stakeholders across the four Inuit regions of Canada and national stakeholders in Ottawa. The aim is to obtain data from multiple levels of stakeholders across Canada to identify similarities and differences in viewpoints and priorities and, ultimately, to identify key ethical and logistical considerations for documenting and disseminating Inuit knowledge using media platforms. Study results are intended to inform the use of multi-media platforms to document and disseminate Indigenous knowledge in Northern research.

THE THERMAL AND GEOMORPHOLOGICAL IMPACTS OF "SHRUBIFICATION" OF A PERMAFROST LANDSCAPE, UMIUJAQ, NUNAVIK

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The study takes place in Vallée-des-Trois near Umiujaq, Nunavik, in the discontinuous permafrost zone. Six plots were surveyed and instrumented along an array representative of the successional stages that likely lead to permafrost disappearance as climate warming actually induces active layer thickening, vegetation growth and a thicker snow cover. The stages range from intact permafrost covered by lichen tundra at plot no. 1 to highly degraded permafrost under trees at plot no.6, with the intermediate plots showing progressively higher and denser shrubs, steeper slopes and correspondingly thicker snow covers. By instrumentally recording temperatures above ground in the canopy and the snow cover, at the ground surface, in the active layer and at the permafrost table, our goal is to determine the changes that occur in heat fluxes between the three layers of the ecosystems and the interface between them when permafrost degrades, i.e. the vegetation/ snow cover layer, the ground surface, the active layer, the permafrost table and the top layer of the permafrost. Soil water content in the active layer is also monitored. Our methodology is an application of the ADAPT protocol. The six plots were first located on a high resolution air photograph and finely selected in the field. They measure 10 m in diameter. The organic layers and the soil were sampled at selected depths. Vegetation specific composition and structure were surveyed. Topography was surveyed at a precision of ± 1cm and active layer depth was checked with a temperature probe. Snow cover will be measured at topographic saturation in March-April 2013. Stems of shrubs (birch) and of spruce trees were sampled for tree-ring analysis; along with time-lapse air photographs, dendrochronology shall provide the time frame for the successional dynamics of permafrost degradation along the array. The temperature and humidity recordings are made at each plot with a Decagon ECH20 model five-channel datalogger, complemented by Pendants one-channel Onset Computer dataloggers. Local and regional climate parameters such as air temperature, wind speed and direction, incoming solar radiation, precipitation and snowfall are provided by a nearby SILA station of Centre d'études nordiques located in the valley. Ultimately, the data acquired at the site shall serve as input and validating information for a numerical model reproducing the dynamics of the permafrost ecosystem in transition.

CARBON CYCLING IN HUDSON BAY

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Coastal seas, like the Hudson Bay, are biogeochemically active areas with high primary productivity, yielding approximately 80% of the world ocean's organic carbon burial. In general the high productivity can be expected to lead to fractionation of 13C/12C creating depletion of DI12C in the surface and enrichment of DI12C in deeper waters. The lightning of the DIC isotopic composition is further aggravated by ocean absorption of isopotically light anthropogenic CO_2. Increasing CO_2 concentrations acidify the ocean and have larger impacts on ocean biogeochemistry. Since the Arctic and coastal seas are primarily sensitive to these changes assessing the carbon cycle of this areas is very important for future studies.

We present the carbon cycle and related data including the isotopic composition of DIC from the Arctic Net 2010 Cruise. We investigate and assess the processes governing the carbon cycle over the entire water column of Hudson Bay. Furthermore, we compare the depth profiles of the 13/12C isotope ratio, pH, pCO_2, and $CaCO_3$ saturation states to assess differences across Hudson Bay and as we move into Foxe Basin and the Hudson Strait.

A NECESSARY VOICE: CLIMATE CHANGE OBSERVATIONS AND PERSPECTIVES FROM INUIT YOUTH IN RIGOLET, NUNATSIAVUT, CANADA

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The importance and value of youth voices are frequently overlooked in climate change published research and policy development. A number of successful and interesting projects that work with children and youth are outlined in grey literature, but to date, there has been no published Arctic climate change research that has specifically focused on youth or as to how youth can contribute to climate change research. In order to address this gap in research, a case study was conducted with Inuit youth (12-25 years old) in Rigolet, Nunatsiavut, Labrador to explore youth observations and perceptions of climate change in their community. The study was part of the Changing Climate, Changing Health, Changing Stories project in Rigolet, a multi-year, community-driven project dedicated to using qualitative methods and digital media to study the impacts of climate change on health and well-being. Data were collected through in-depth, semi-structured interviews to explore youth observations and perceptions about changes in the land, snow, ice, sea, weather, hunting, and trapping in and around the community, and the subsequent impacts on their lives and culture. The participants, ranging in age from 12 to 25, reported witnessing substantial climatic and environmental changes throughout their lives. Five main themes emerged: the ways in which climate and environmental changes are altering travel conditions and access to hunting; the impact of these changes on Inuit culture; the concern that youth have for Elder well-being in the face of these changes; the strong emotional responses youth expressed because of these changes; and youth-identified adaptation strategies. The results indicated that Rigolet youth have valuable knowledge, experience, and ideas with the potential to enhance climate change adaptation policies and research. Considering the results of this study, as well as the significant socio-cultural, socio-economic, and climatic changes facing Northern youth, their families, their culture, and their communities, researchers and political leaders at all levels have an obligation to effectively educate, engage, and include this group in future climate change work, research, dialogue, and policy. Not only does including youth in early stages of adaptation planning create a potential for these strategies to be longer lasting, but involvement from the beginning also ensures that adaptation strategies are inclusive of multiple voices and perspectives. Effective and meaningful strategies to engage youth could include participation in community planning discussions, involvement in all stages of the research process, and providing information and opportunities for involvement in climate change work. Future research is necessary to expand on youth observations of climate change as well as to identify potential roles that youth could play in climate change research and policy.

POSTGLACIAL PALEOCLIMATES OF THE FOXE BASIN AND SURROUNDING REGIONS (NUNAVUT, CANADA): A MULTIPROXY LAKE SEDIMENT ARCHIVE STUDY

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Climate change reports show that global warming effects, which are amplified at high latitudes, drive unprecedented environmental changes (ACIA 2005; AMAP-SWIPA 2011). However, not all arctic regions yield the same rate of change (Smol et al. 2005). Several paleoclimate studies completed in areas surrounding the southern Foxe Basin, in Nunavik and Labrador suggest that these regions experienced relatively subtle climatic and environmental changes over the recent past (Pienitz et al. 2004) as compared to the drastic changes reported from the Canadian High Arctic. These contrasting scenarios underscore the need to increase our knowledge of past and present environmental conditions across the Arctic in order to refine our capacity to model past, present and future environmental impacts. Unfortunately, instrumental data available for developing regional and global climate models do not adequately capture the natural environmental variability that has affected these regions over the past.

In an effort to explore the potential responses of northern freshwater ecosystems and their watersheds to climatic change and to place instrumental records into a longer-term perspective, we use a multi-proxy paleolimnological approach to study the sedimentary records preserved in several lakes distributed across regions bordering the Foxe Basin (65°-70°N; 71°-85°W) in Nunavut. This presentation will showcase the preliminary results obtained through studies of lake sediment records from the Foxe Peninsula, Southampton Island, Melville Peninsula, Steensby Inlet and the Nettilling Lake area (Nunavut, Canada). Combined with sedimentological analyses (X-ray profiles, XRF, CHN, grain size, magnetic susceptibility), changes in the composition of both fossil chironomid and diatom assemblages provide an improved understanding of the temporal and spatial variability and of the timing of past climatic events since the last deglaciation. Our central objective is to generate a network of decadal-millennial scale records of quantitative variations in water quality parameters (e.g., temperature, dissolved organic carbon, alkalinity) to explore fundamental questions concerning postglacial ecosystem succession and water quality trends in northern landscapes. Regional comparisons with ice core data from the Penny Ice Cap and the Greenland Ice Sheet, as well as with paleoceanographic data from surrounding marine environments should also allow us refine regional paleoclimate models.

VARIABILITY OF PCO2 IN THE SURFACE WATER ACROSS THE CANADIAN ARCTIC ARCHIPELAGO

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The Arctic is warming faster relative to other regions of the Earth. Some ramifications of warming include increased summertime sea ice loss, transition toward younger sea ice, lengthening of the open-water season, and changes to the distribution of fresh water from both ice melt and river flow into the Arctic. These consequences have seasonally specific implications on the Arctic marine carbon cycle, and in particular the air-sea gas exchange of CO_2.

The air-sea exchange of CO_2 responds to the concentration of dissolved CO_2 in the surface seawater (expressed as the partial pressure of CO_2, or pCO_2). Recent literature has shown that several unique factors affect pCO_2 in waters dominated by sea ice, and that these factors are complex and poorly understood. Physio-chemical processes associated with the freezing and melting of sea ice can both raise and lower seawater pCO_2, affecting both the direction and magnitude of CO_2 exchange with the atmosphere. These processes are largely overlooked in carbon budget studies.

During the 2011 ArcticNet cruise of the CCGS *Amundsen* we measured the surface seawater CO_2 system over a geographic domain that extended from the southeast Beaufort Sea, through the Canadian Arctic Archipelago, and into Baffin Bay, NU during the summer and fall. On-track pCO_2 was continually measured using a flow-through shower-type equilibrator, while both dissolved inorganic carbon (DIC) and total alkalinity (TA) were measured from discreet water samples that were taken using the ship's rosette. The objectives of the cruise were to document the variability in surface seawater pCO_2 within the channels and bays of the Canadian Arctic Archipelago, and to explore relationships between surface pCO_2 and environmental factors, including sea ice formation and melt. Here we report on the spatial distribution of pCO_2 over the 2011 cruise, and present preliminary findings on

relationships between pCO_2, sea ice cover and seawater properties.

THAWING GROUND ICE: LANDSCAPE DYNAMICS IN THE EUREKA SOUND LOWLANDS, CANADIAN HIGH ARCTIC

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Ground ice plays a major role in the evolution of landscapes underlain by continuous permafrost. Thawing permafrost, widespread terrain instability and resulting infrastructure problems are often cited as serious problems facing Polar Regions (ACIA 2005). Information about ice content and distribution is extremely variable across the Arctic. Information on ground ice occurrence in the High Arctic is limited to the Eureka Sound lowlands (Pollard 2000). Several studies have alluded to increased thermokarst as an outcome of climate change, however little is known about the potential pattern and magnitude of thermokarst because of the patch nature of information on near surface ground ice. Detailed information about the active layer is also needed before a realistic prediction about thaw subsidence can be made. Areas where the active layer is relatively thin, like high Arctic polar deserts, are more vulnerable to even small increases in summer temperature and the duration of the thaw season because the buffering capacity of the active layer is limited.

This presentation documents results of a study on landscape dynamics and ground ice in the Eureka Sound lowlands in central Ellesmere and Axel Heiberg Islands in the Canadian High Arctic. Initial work characterized the stratigraphic, content and distribution patterns of ground ice and estimated potential thaw subsidence. Over the past 2 years a dramatic increase in the frequency and magnitude of thermokarst has been documented as well as the detection of increased thaw related to ice wedges. The Eureka area (~ 80N) is characterized by cold polar desert conditions (mean air temperature of -19.7ºC) and permafrost up to 600 m thick. In 2012 a total of 205 active retrogressive that slumps ice were mapped, representing a 27% increase from 2010. Repeat surveys of headwall positions have provided both short and long-term retreat rates. Retreat varies across the headwall of every slump; maximum retreat at a point along the headwall can be misleading so we took the average of the most active 20 m section. Over 20 years of observation the average retreat for all sites is 6.9 m/yr, the highest annual retreat was 23 m. A comparison between average annual retreat based on all surveyed slumps and mean July temperature does not show any correlation although the highest single retreat rates occurred in years with warmer than average July temperatures.

Beginning in 2005 ice wedge polygons in the vicinity of the monitoring sites began to exhibit thaw degradation and deepening of ice wedge troughs. Numerous new thaw ponds formed within ice wedge troughs and at trough intersections. A new focus of our work is the characterization of changes related to ice wedge subsidence and modeling their stability relative to surrounding permafrost.

ANALYSIS OF THE COMPOSITION PAST AND ACTUAL OF SILICEOUS ALGAE COMMUNITIES IN THERMOKARSTICS LAKES, NUNAVIK, QUÉBEC

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The rapid warming of the Arctic increases the degradation and melting of permafrost in northern Canada and accelerates the formation of thermokarst (thaw) lakes. Within the ADAPT Project (Arctic Development and Adaptation to Permafrost in Transition), our main research objectives will be to analyze in the thermokarst lakes of Nunavik the siliceous algal communities (diatoms and chrysophytes). Both planktonic and periphytic species will be the focus of our analyses. We will analyze the present-day composition of these communities for each type of substratum and habitat from four different sites distributed along a south to north gradient, in order to establish and quantify the relationships between species and environmental parameters. Finally, we will apply the transfer functions on the fossil diatoms preserved in the sedimentary sequences of some select sites. This we will allow as to infer the evolution of limnological conditions through time, and to predict the response of these ecosystems to global warming.

EFFECTS OF MARINE OMEGA-3 FATTY ACIDS ON TOTAL AND CARDIOVASCULAR MORTALITY IN THE INUIT ADULTS OF NUNAVIK

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Background: Marine omega-3 long-chain polyunsaturated fatty acids (n^{-3} LC-PUFAs) EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) found in fatty fish and marine mammals have been associated with lower risk of ischemic heart disease, but their effects on total and cardiovascular mortality remain inconsistent.

Objective: To assess the relationships between EPA+DHA concentrations and total and cardiovascular mortality in the Inuit adults of Nunavik.

Methods: The study sample was composed with 861 Inuit men and women aged 18–74 y who participated in the Qanuippitaa Health Survey carried out in the 14 communities of Nunavik in 2004. n^{-3} LC-PUFAs concentrations were measured in membrane phospholipids of red blood cells (RBC) of blood samples drawn from each participant according to standard protocols. Mortality data (n=54) were obtained using medical records during a follow-up carried out at the end of 2011. The relation of the combined RBC EPA+DHA with mortality outcomes was examined using logistic regression while controlling for potential confounders. Analyses were weighted to achieve population representativeness.

Results: The highest EPA+DHA quartile corresponded to an average marine food consumption of 118 g/d, compared to 60 g/d in the lowest quartile. After adjustment for age, gender, waist and smoking status, the estimate showed a significant reduced risk of all cause mortality (OR = 0.79, 95% CI 0.67–0.93, P=0.005) in participants with higher EPA+DHA levels. The adjusted odds ratio for all cause mortality comparing the highest to lowest quartile of EPA+DHA concentration was 0.43 (95% CI: 0.27–0.70), P=0.006.

Conclusions: These results suggest that higher RBC concentrations of EPA+DHA derived from marine products have a beneficial effect on all-cause mortality in this Inuit adult population. Whether increased intake of these n^{-3} LC-PUFAs can provide effects on cardiovascular mortality may be worthy of further follow-up.

SHORT TERM CHANGE DETECTION OF THE TUNDRA VEGETATION NEAR UMIUJAK, NUNAVIK

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Since the mid-1990's, station and experimental measurements of climate variables indicate the strong climatic change already occurring in the arctic regions. In Nunavik, these changes are and will be felt in terms of a rise in summer degree days, warmer winter temperatures and an increase of snow precipitation. A combination of these factors is expected to contribute to a strong increase of thickness in the active layer and eventually to a decline in permafrost stability and distribution. Expected impacts include changes to the northern ecosystems, by ways of alterations of the hydrological regime and the change of vegetation cover. Those effects can be readily seen at the transition zone between the subarctic and the arctic region like the area near the Inuit village of Umiujaq (56.55°N, 76.55°W) on the eastern shore of Hudson Bay.

The objective of the study is to establish the local changes in the vegetation occurring in the Umiujaq area since the last 20 years and to understand the link between those changes with the presence or melting of permafrost, the soil type, the local topography, climatic conditions, etc. The selected study area is a discontinuous permafrost area located at the treeline. The 60 km^2 area can be divided into two distinct environments: the coastal region to the east and the Lac Guillaume-Delisle graben to the west. The vegetation in the coastal region is very sporadic and dominated by tundra vegetation, while the graben vegetation is mainly scrublands with patches of conifers (mostly black spruce).

For this purpose, two vegetation maps will be produced from digital high resolution photographs acquired by the Quebec Government in 1994 and 2010. The two color photographs series are first geometrically corrected and then a texture analysis is applied to create texture images to be integrated as supplementary data layers to the three color bands in the process of classification. A multi-scale segmentation approach and a semi-automated object-based method well adapted to high resolution images is used (Dissanska et al, 2009). A ``from-to change`` detection map will also be produced to show the evolution of the land cover type. As ground truth data are indispensable to define the class types, train the classification algorithm and evaluate the precision of the classification, a vegetation inventory was completed over 80 plots of 2 m by 2 m in summer 2012. Surface soil samples for texture identification were also taken for 30 plots. The field data analysis as well as the images processing are progressing.

SEDIMENT AND CARBON DYNAMICS IN THE NEARSHORE ZONE: HERSCHEL ISLAND, YUKON TERRITORY

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This study seeks to determine the fate of sediment and carbon supplied into the nearshore zone by coastal erosion and thermokarst in permafrost landscapes. To accomplish this, the sediment and carbon sources and sinks were identified and quantified using remotely sensed imagery, bathymetric and sidescan surveys, shallow seismic profiles, and the interpretation of sediment cores.

Coastal dynamics on arctic coasts are characterized by a seasonal dichotomy. Sea ice and landfast ice limit the length of the open-water season, armoring the coast against wave-induced erosion; while in the absence of ice the coast is susceptible to the combined effects of mechanical and thermal erosion processes. This results in high erosion rates along coasts characterized by ice-rich permafrost, like the western Canadian Arctic. Current estimates show that there is about twice as much carbon stored in permafrost as compared to the atmosphere. Of special interest is the potential climate feedback triggered by carbon release into the nearshore zone by coastal erosion, in a region that according to many climate change models will experience disproportionate warming.

Herschel Island, the focus of the current study, is a push-moraine that formed at the northwestern limit of the Laurentide Ice Sheet. This part of the Canadian Yukon coast is characterized by high cliffs and numerous retrogressive thaw slumps, indicating the presence of large massive ice bodies susceptible to permafrost degradation.

This study aims to elucidate the erosion, transport, and deposition dynamics of sediments and carbon that enter the nearshore zone. We focus on the marine realm, directly accompanying studies that aim at quantifying and characterizing the terrestrial aspects of coastal erosion in the area. A combination of methods is used to identify sediment sources, their characteristics, pathways, and sinks. An interferometric sidescan sonar system is used in conjunction with Van-Veen grab-samples to create bathymetric and sidescan mosaics that allow for an areal view of sediment pathways, sources, and possible sinks. Surface sediments are analyzed for grain-size, nutrients, and carbon content. Using time series data acquired over multiple field seasons and satellite imagery will enable ascertaining the importance of cliff- vs. thaw slump erosion in supplying sediments. Sedimentation rates are obtained from sediment cores using 137Cs, 210Pb, and 14C dating methods. Simultaneous analyses of the carbon content in the cores provide the necessary data for a regional sediment and carbon budget. A seismic sub-bottom profiler is used to gain insights into the depositional history and submarine permafrost evolution of the region.

A SYSTEMATIC REVIEW OF RISK COMMUNICATION LITERATURE ON CONTAMINANTS AND HEALTH IN THE CIRCUMPOLAR NORTH

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There are significant challenges to communicating the risks and benefits of environmental contaminants in country foods to northern audiences. However, Arctic residents and decision makers require access to the best information to inform their decisions on a regular basis. Currently, little is known and presented in the existing literature to determine what messages have been released previously and what has and has not worked well in educating and informing northern publics and decisions makers on this topic. The objective of this study was to perform a systematic review and analysis of contaminant health risk communication literature in the circumpolar north to examine patterns in the work conducted to date and identify strengths and gaps in this field.

Peer-reviewed and grey literature was searched and gathered using online bibliographic databases. The geographic, temporal, population, contaminant and thematic focus of each article, as well as the percentage of each source that dealt with specifically discussed risk communication issues were documented and analyzed.

Fifty-five percent of the literature published since 1995 on this topic appeared in peer reviewed sources while 45% appeared in grey literature. Eighty-one percent of the publications represented work focused in Canada, while 15% of the literature reported on work from Alaska. Publications reporting research and activities related to contaminants communication in Russia, Greenland, Norway and Finland each represented less than 10% of all English language publications retained in this study. Fifty-seven percent of the publications focused on contaminant research yet contained some content on risk communication (14% grey literature; 43% peer-reviewed) while 43% focused on risk communication as the central theme and objective of the publication (31% grey literature; 12% peer-reviewed). Among the risk communication sources, only

23% of the grey literature and 6% of the peer-reviewed literature provided new recommendations for health risk communications, and 3% of each of the grey and peer-reviewed literature repeated recommendations already appearing in previously published material. However, among those sources focusing on contaminants research and not exclusively risk communication (on contaminants), only 6% of each of the grey and peer-reviewed literature respectively, provided new recommendations, while 13% of the grey literature and 24% of the peer-reviewed provided recommendations appearing previously in published documents.

Despite the challenges faced by northern health managers and individual consumers in providing clear advice on the risks and benefits associated with the consumption of country foods containing contaminants, to date, there has been little increase in publications about risk communication on this topic in Arctic communities. There appears to be a lack of research on this topic and a need to increase our understanding of the importance of risk communication and risk communication research on contaminants in the circumpolar region. Greater attention to critically examining this topic and generating empirical evidence upon which to develop recommendations for practice is required.

NAVIGATING ARCTIC SEA ICE REGIME SHIFTS: HOW CAN ARTISTIC PROCESS HELP BRIDGE KNOWLEDGE SYSTEMS?

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Bridging knowledge systems - and the means through which that knowledge is communicated (e.g., art, collective art making, stories) - may provide novel insights for understanding and navigating Arctic environmental change. This is a crucial challenge given rapid declines in the extent of summer sea ice and suggestions that such changes reflect a tipping point or 'regime shift' (Lenton 2012; Wassmann and Lenton 2012; Lenton et al. 2008). Regime shifts occur when one 'regime' or ecosystem (e.g. Arctic sea ice), even from only a small perturbation, literally shifts into a different 'regime' or identifiable ecosystem (Scheffer and Carpenter 2003). Given the implications of Arctic sea ice regime shifts for human wellbeing and ecosystem integrity, alternative ways to anticipate and navigate these changes are required.

In this poster we explore two largely unexamined ideas. First, we examine if and how local and traditional ecological knowledge of Arctic peoples (e.g., the Inuit of Canada's eastern Arctic) can complement western scientific assessments of potential Arctic sea ice regime shifts. For example, regime shift theory and models of complex systems indicate that particular statistical attributes, such as slowing down and skewness of critical ecological variables, can be useful in anticipating an impending regime shift (Dakos et al. 2008; Scheffer et al. 2009). Indigenous knowledge about climate change may account for similar attributes, such as slowing down and skewness, yet articulated differently, and in the context of an indigenous knowledge-practice-belief complex (Krupnik and Jolly 2002; Berkes 2008). Likewise, indigenous knowledge may have complementary knowledge about sea ice, not specific to particular attributes, such as skewness, but that offer conceptual depth and insight about regime shifts.

Second, we consider in a preliminary way, how creative strategies (e.g., art, artistic processes) can bridge complementary understandings of regime shifts to support the collaborative and cross-scale strategies needed to cope and adapt. In this regard, our poster outlines a novel typology for understanding the multidimensional role of artistic processes for both individual cognitive capacity, and collective capacities to anticipate and navigate regime shifts.

FACING ENVIRONMENTAL AND SOCIO-ECONOMIC CHANGE IN THE WESTERN AND CENTRAL ARCTIC: ADDRESSING CLIMATE CHANGE IMPLICATIONS AN ADAPTATIONS IN THE IRIS 1 RIA

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Canadian Inuit have expressed the need for adaptation capacity to contend with the impacts of climate change and associated cultural and socio-economic change. In response, ArcticNet adopted an Integrated Regional Impact Study (IRIS) framework that aims to study the many implications of climate change throughout the Canadian Arctic, with the purpose of developing a Regional Impact Assessment (RIA) for each of the four IRIS regions. Although written for a general audience, each RIA will be targeted at policy and decision makers in land-claim and territorial governments.

The western and central Arctic (IRIS 1) encompasses

the Inuvialuit Settlement Region of the Northwest Territories, the Kitikmeot Region of Nunavut, and the Yukon North Slope. Consultations with regional representatives and organizations are imperative to ensure that the RIA is relevant and meets regional needs, and that policy recommendations in the RIA are politically and culturally appropriate. Based on regional priorities, IRIS 1 is in the process of producing, compiling, and summarizing scientific and traditional knowledge and observations that will incorporate projected regional-scale climate change scenarios to the year 2050. This will enable the provision of regional-specific recommendations for sustainable development and adaptation strategies with regard to modeled future climate change impacts in the RIA. Priority topics include underlying issues and knowledge gaps relating to wildlife management, human health, food security, transportation, infrastructure and resource development.

In addition to outlining the IRIS process, this presentation highlights the outcomes from recent consultations with Kitikmeot representatives and provides a progress update on the IRIS 1 RIA.

IT'S NOT JUST WHAT YOU SAY, IT'S HOW YOU SAY IT – HOW RELATIONSHIPS AND TRUST INFLUENCE PERCEPTIONS AND COMMUNICATION ABOUT ARCTIC CONTAMINANTS IN SACHS HARBOUR, NT

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Traditional knowledge is inherently dynamic and 'living' in the sense that it encompasses cultural identity, practices and ethics, is place-based and contextual, and is experiential as it resides within each individual in addition to contributing to the larger collective knowledge of the community. With climate change, Inuvialuit have their own knowledges, history, and observations, and are thus are able to engage in dialogue with researchers because their own background enables them to better understand, trust, and communicate with science. However, this extensive historical background knowledge does not exist as such for contaminants issues. Compounded with the fact that contaminants are invisible, local engagement with this new information is more difficult and thus influences the trust of contaminants messages and communication methods. Despite less traditional knowledge about contaminant information or facts, knowledge about ways of communicating is abundant, and this knowledge has the ability to greatly impact how communication about contaminants research is approached: the focus thus moves beyond what (knowledge as topic) and focuses more on how (knowledge as process).

Years of ongoing effort to inform Northerners about contaminants have largely resulted in merely general awareness, and often confusion, about contaminants issues. Message content (what) and target audience perceptions of the hazard have been the sole focus of past communication efforts, while audience perceptions of the communication process, such as communication methods (how) and communicators/sources (who) have been disregarded. How and who are the primary resources of information about a hazard, and, from the standpoint of risk communication, may have significant bearing on an individual's perceptions of a hazard, such as contaminants.

To address this knowledge gap, this project explores the value of understanding the role of communication processes among target audience members in the construction of messages and communication strategies about environmental health risks, such as long-range atmospheric and oceanic contaminants in Arctic communities. Specifically, it considers risk perceptions of contaminants and contaminants communication in the Inuvialuit community of Sachs Harbour, NT. Collaboratively, we explore participants' knowledge and perceptions of contaminants research and how research is communicated within the community, and examine current communication methods used. From a community perspective, we discuss how contaminants research, using mercury as an example, can be communicated to communities in accessible, understandable, and relevant ways, and uncover the crucial roles that trust and relationships play in message construction, reliability, and retention.

THE VARIABILITY OF ARCTIC ICE EDGE BLOOMS AND THE IMPLICATIONS FOR THE BIOLOGICAL PUMP IN A PERIOD OF DECLINING ICE COVER

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The Arctic Ocean is facing ongoing environmental changes and the increased retreat of its sea ice cover will undoubtedly affect the arctic marine ecosystem (Smetacek & Nicol, 2005). The Marginal Ice Zone (MIZ), the interface between the heavy ice pack and the open ocean, is a highly dynamic region supporting major ice edge blooms (Sullivan et al., 1988). These blooms are recurrent and near-ubiquitous structures that account for a substantial proportion of the annual primary production (>50%) in the Arctic Ocean (Sakshaug and Skjoldal, 1989; Pabi et al., 2008). Moreover, environmental changes might have implications for the bloom dynamics and the vertical export of carbon to depth. There is a crucial need to accurately define the ice edge region using remote sensing and to quantify the variability of primary production in this area. This PhD project will investigate the variability of Arctic ice edge blooms and the associated biological pump using remote sensing and in-situ data. It will allow us to better understand phytoplankton dynamics at the ice edge and the variability of vertical carbon fluxes in the Arctic Ocean, related to the declining ice cover.

FACTORS CONTRIBUTING TO THE OCCURRENCE OF OPEN WATER LEADS ALONG THE NORTHERN COAST OF ELLESMERE ISLAND, NUNAVUT, CANADA

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There is anecdotal evidence that open water leads have increased in area and duration along the northern coast of Ellesmere Island over the past decade. These leads have been associated with the recent calving of ice shelves and multiyear landfast sea ice, meaning that factors that influence lead formation may be indirectly contributing to cryospheric loss. This study examined the occurrence of summertime leads along with purported contributing factors (i.e., wind, surface air temperature and the Arctic Oscillation (AO)). Weekly Canadian Ice Service Digital Archive (CISDA) geospatial data since 1997 was analyzed to quantify the temporal and spatial occurrence of open water. For the purpose of this study, three classes of sea ice concentration were considered as leads: (1) Open Water, consisting of open water and bergy water with ice concentrations <1/10, (2) Very Open Drift, consisting of ice concentrations from 1/10 to 3/10, and (3) Open Drift, consisting of sea ice concentrations of 4/10 to 6/10. Climate variables were obtained from the National Center for Environmental Prediction and the National Center for Atmospheric Research (NCEP/NCAR Reanalysis).

Open water leads were first observed during the summer of 1999 and were detected every summer until 2011, with the exception of 2006. The 13 year record showed appreciable interannual variability in the extent and duration of leads with an overall maximum in 2008. The majority of the leads were observed during the month of August and September, although, the onset of leads began earlier in the melt season (June and July) in recent years. Leads were most frequently observed west of the northern point of Ellesmere Island, which is consistent with westerly circulation of Beaufort Gyre.

Greater lead extent was generally found during periods of strong positive winter AO and strong negative summer AO. Their formation was more prevalent during, and following, episodes of offshore or shore-parallel winds. Leads did not form when air temperature was below -8oC, which points to a thermal threshold which must be exceeded to pre-weaken the sea ice. The results suggest that a combination of factors is important for the development of leads along the northern coast of Ellesmere Island and that this may have implications for future ice shelf attrition.

WHAT DRIVES CANADIAN ARCTIC MEGABENTHIC DIVERSITY?

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Most historic and modern researches on marine benthic invertebrates have been carried out to study macrofaunal diversity and their role on ecosystem functioning in the Canadian Arctic. However, megabenthic diversity patterns and hotspots are still poorly known even if Arctic research programs have been increasing in the last two decades. The main objective of this project is to describe and compare megabenthic diversity in different locations of the Canadian Arctic (from Amundsen Gulf in the west to Baffin Bay in the east) in relation to major controlling factors of polar environments (e.g., temperature, salinity, depth, ice cover, food supply).

Megabenthic data collected aboard the Amundsen from 2007 to 2011 and through several networks (ArcticNet, CHONe, IPY-CFL) are used to compile species richness, abundance and biomass at 65 stations. Although

species richness is quite high across all the Canadian Arctic with more than 200 different taxa, total abundance and total biomass vary by more than 20 fold across stations. Preliminary results show that food supply and upwelling zones seem to favor rich and abundant megabenthic communities.

This study will be the first, to our knowledge, to describe diversity patterns and controlling factors of megabenthic communities on the Canadian Arctic shelves. Outcomes of this project will be used to create a map of megabenthic diversity hotspots that will support proposal and implementation of marine protected areas. This database will also serve as a first baseline for monitoring megabenthic diversity changes according to anticipated human- and climate-driven impacts in the Arctic.

EXPERIMENTAL SIMULATION OF CLIMATE WARMING, NUTRIENT AVAILABILITY AND CARIBOU BROWSING: RESPONSES OF AN ERECT SHRUBS' BIOMASS

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Climate change has increased temperature in the poles leading to an increase in productivity and colonization of erect and dwarf shrubs in many arctic regions. Additionally, the higher soil temperature could increase nutrient availability for plant growth by the direct effect of temperature increasing but also with the effect of positive feedback loop of increase soil temperature, which increases bacterial activity causing acceleration in nutrient cycle. However, expansion in shrub cover isn't observed in all arctic regions. Browsing by large herbivores could be limiting the growth of shrubs. Yet, species such as birch can tolerate browsing through compensatory growth. Our objective is to assess the combined effects of climate warming (increase in temperature and in nutrient availability) and browsing by migratory caribou on the abundance of a species contributing to the densification of the erected shrub layer in arctic and subarctic ecosystems, Betula glandulosa. Previous analyses indicated full compensatory growth of dwarf birch at low to moderate caribou browsing pressure. Based on the compensatory continuum hypothesis, we thus expect climate warming to further increase the tolerance response of birch to heavy browsing pressure. Since 2009, we simulate three levels of summer browsing (0, 25 and 75% of twigs over 5 cm of which leaves are manually removed), two levels of simulated temperature increment (with and without open-top chambers) and two levels of nitrogen fertilisation (0 and 1 g m^{-2}) within 5 enclosed blocks. In opposition to our predictions, the compensatory potential along the browsing pressure gradient was independent of temperature and fertilisation. As observed before, the compensation only occurred under moderate browsing pressure. Unexpectedly, biomass of birch was lower in warmed plots. We also observed increasing shrub biomass from 2009 to 2012 that could either be related to the actual climate warming or to a decreasing trend of the Rivière-aux-Feuilles caribou herd. Our results suggest the increase of temperature won't influence birch's tolerance capacity to browsing. Therefore, caribou could have a top-down control effect on birch.

INFLUENCES OF CLIMATE AND INDUSTRY ON METHYLMERCURY CYCLING IN LAKE MELVILLE, LABRADOR

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Methylmercury (MeHg) in fish and seal is a serious concern for the Inuit people as these items are a large component of their country foods. Exposure to MeHg is known to cause long-term developmental delays in children and has also been associated with cardiovascular health risks in adults. Elevated MeHg concentrations have been observed in the Churchill River system for many decades since the original flooding of the Smallwood Reservoir. New flooding proposed for 2016 at Muskrat Falls raises new concerns about impacts on MeHg dynamics in the downstream environment of Lake Melville, Labrador, which is a traditional fishing and hunting territory for the Inuit. A number of climate-related changes in the Lake Melville ecosystem are also occurring including the extent and length of ice cover and hydrological changes associated with the spring freshet. We are investigating the combined impacts of industry and climate on MeHg dynamics in Lake Melville using a combination of new data collection and modeling activities. The first measurements of total Hg and MeHg concentrations and distributions in water, sediments and at the base of the Lake Melville food-web began in August 2012 and some results will be presented here. We use these data and measured inputs from freshwater tributaries and tides to construct a simple mass

budget for total Hg and MeHg in Lake Melville. Future work will link our preliminary modeling efforts to a more detailed hydrodynamic simulation and develop mechanistic relationships with environmental factors driving accumulation in marine food-webs from this system. This project is one component of the Arctic Net project: "Nunatsiavut Nuluak: Understanding and Responding to the Effects of Climate Change and Modernization in Nunatsiavut."

PHYTOPLANKTON PRODUCTION AND BIOMASS IN LABRADOR FJORDS

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The biological productivity of marine polar ecosystems is extremely variable in time and space. Labrador fjords are influenced by both Atlantic and Arctic water masses and receive freshwater, nutrients and sediments from glaciers and rivers. The main goal of this study is to determine the spatial and seasonal variability of phytoplankton production and biomass in four subarctic fjords of the East coast of Canada (Nachvak, Saglek, Okak and Anaktalak) during summer and fall. Primary production was measured by the 14C-assimilation method using in situ simulated incubations in August 2007 and October 2010 and by photosynthesis-irradiance curves in November 2009. Phytoplankton chlorophyll *a* (chl *a*) biomass was determined by fluorometric analyses. In August, Nachvak, Saglek and Anaktalak outer stations were extremely productive (1150-1730 mg C m^{-2} d^{-1}), with Nachvak and Saglek showing the highest primary production rates. In October, primary production ranged from 48 mg C m^{-2} d^{-1} at Anaktalak to 340 mg C m^{-2} d^{-1} at Saglek. For all the four fjords, inner station was consistently more productive than the outer one. In November, primary production was low, with rates four times higher at Saglek, Okak and Anaktalak (37 ± 18 mg C m^{-2} d^{-1}) compared to Nachvak (8 ± 2 mg C m^{-2} d^{-1}). Furthermore, at Okak, primary production was higher at the inner than the outer station whereas the contrary was observed at Saglek and Anaktalak. The low primary production rates measured in November can be partly explained by the low average irradiance in the euphotic zone (< 1 mole quanta m^{-2} d^{-1}). The large phytoplankton cells (> 5 µm) made up, on average, 34 %, 18 % and 16 % of the total primary production in August, October and November, respectively. The phytoplankton biomass was more variable in August (5-97 mg chl *a* m^{-2}) and November (8-98 mg chl *a* m^{-2}) compared to October (21-61 mg chl *a* m^{-2}). Moreover, except at Nachvak, phytoplankton biomass was generally higher at the outer than the inner station. Biomass values were, on average, two times higher in August compared to the two other sampling months. The biomass was generally dominated by large phytoplankton (> 5 µm) in August and by small cells (0.7-5 µm) later in the year. Overall, primary production decreases rapidly from summer to fall while phytoplankton chlorophyll a biomass remains relatively high. This suggests the accumulation of less productive phytoplankton cells in the euphotic zone. The high chl *a* biomass measured in November 2009 (100 mg m^{-2}) indicate that fall phytoplankton bloom may occur in Labrador fjords.

EROSION RATES OF RETROGRESSIVE THAW SLUMPS, HARSCHEL ISLAND, YUKON TERRITORIES

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Over the past few decades the coasts of the Western Canadian Arctic have been the focus of several studies concerned with the effects of global warming on coastal systems (Couture et al 2008, Hoque & Pollard 2009, Lantuit & Pollard 2003, 2005). Since these coasts are in the continuous permafrost zone, even a small change in temperature can have a dramatic effect on the depth of the active layer, thermokarst and coastal erosion. Retrogressive thaw slumps, a common thermokarst landform, have been increasing in both frequency and extent (Lantuit, & Pollard, 2005). Warming temperatures, changing sea ice and open water conditions, and changing wave climate are considered the main cause of increased coastal erosion and related thermokarst activity. Together with coastal erosion and thermokarst is the potential increase in soil organic carbon (SOC) flux into the Beaufort Sea. The impact of SOC flux is potentially far reaching.

This study focuses on the nature and rate of thermokarst for an area of ice-rich permafrost in the western Canadian Arctic. The aims of this research include: (1) creating a 3-dimensional model of three retrogressive thaw slumps showing the erosion between 2004 and 2012; (2) creating several 3-dimensional models of past surfaces in order to estimate erosion volumes and (3) using the resulting volumetric soil loss values to estimate SOC flux into the Arctic Ocean. The main study site is located on Thetis Bay along the southeast coast of Herschel Island,

Yukon Territory. The continuous permafrost of Herschel Island is known to be extremely ice-rich (Fritz et al 2011), making it vulnerable to thaw-related processes like thermokarst. One of the most common thermokarst landforms on Herschel Island are retrogressive thaw slumps caused by the melting of excess ice. The liquefied soil created by the rapidly retreating thaw slump headwall flows into the ocean carrying with it a range of materials including SOC. In order to better understand the dynamic nature of these thermokarst landforms dGPS spot heights taken between 2004 and 2012 were used to create a 3-Dimensional representation of volumetric soil loss within ESRI's ArcScene program. Past landscape surfaces were also modeled in order to better understand the geomorphology of the land, and to estimate volumetric soil loss over a longer period. Three surfaces were studied, an estimated original surface in which no significant erosion has occurred, a second surface estimated at 350 years old in which a large thermokarst landform can be extrapolated, and the modern surface, in which three distinct thaw slumps can be identified. This research not only provides insight into the geomorphic magnitude of thermokarst for this area but also the potential value of high resolution DEMs for questions of landscape change and land management.

THERMAL HABITAT USE AND GROWTH IN YOUNG-OF-THE-YEAR ARCTIC CHARR: A COMPARISON OF FLUVIAL AND LACUSTRINE POPULATIONS IN LABRADOR

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Body size plays a key role in fish biology and population dynamics, affecting survival, reproduction, swimming ability, foraging ability and predation risk. Being ectothermic, fish growth is highly dependent on environmental temperatures. Because of the importance of temperature, climate variability and change has resulted in increasing concerns over potential impacts of rising temperatures on fish, particularly cold-adapted species, such as Arctic charr, *Salvelinus alpinus*. Arctic charr are habitat generalists and can be found in marine, fluvial and lacustrine environments. Despite mixed use of freshwater habitats among Arctic charr populations, and differences in predicted hydroecological responses to climate change in fluvial vs. lacustrine environments, there has been little focus placed on how Arctic charr responses to climate change may vary among habitat types. Owing to the complexity surrounding predictions of climate change responses, an improved understanding of the present-day relationship between temperature and growth exhibited by Arctic charr may help guide future management decisions related to productivity and subsequent utilization. Here, we use temperatures derived using otolith thermometry, and fork length measurements of Arctic charr young-of-the-year obtained from proximal fluvial and lacustrine populations in Labrador to assess temporal and spatial variability in the relationship between temperature and growth. Results demonstrated notable differences in growth models between Kogluktokoluk Brook (Voisey's Bay) and Tom's Pond (Webb Bay) over the first summer. Further, otolith-inferred temperature and growth comparisons were more strongly related in Tom's Pond YOY (lacustrine) relative to Kogluktokoluk Brook YOY (fluvial). In both habitat types, the relationship between growth and temperature was stronger during July sampling events relative to those in August. The findings of this study demonstrate that Arctic charr populations may respond differently to increasing environmental temperatures based on habitat type, and highlight the complex and variable nature of modelling future fish responses to climate change.

VEGETATION PATTERNS OF RETROGRESSIVE THAW SLUMPS, HERSCHEL ISLAND, SOUTHERN BEAUFORT SEA, YUKON TERRITORY, CANADA

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Since vegetation exerts strong controls on local ecosystem processes, understanding the effects of disturbance on short-term and long-term revegetation patterns is a critical component of understanding the effects of climate change on the Arctic. Arctic landscapes underlain by massive ground ice and ice-rich permafrost are inherently unstable and often display surficial evidence of past and present thaw subsidence, or thermokarst. Retrogressive thaw slumps are permafrost thaw features which are progressively backwasting and tend to go through cycles of activity, resulting in dramatic changes to the landscape. The cyclic pattern of disturbance and stabilization related to these thaw slumps results in a patchy tundra landscape where the vegetation community reflects the stage of stabilization and the time elapsed since the initial disturbance. With future warming expected, the

presence and areal extent of thaw slumps on the Yukon North Slope are predicted to increase. This research investigates natural revegetation and patterns of succession following permafrost disturbance by retrogressive thaw slumps on Herschel Island, Yukon. The objectives of this research include determining the diagnostic features of disturbed surfaces, describing the vegetation succession following thaw slump disturbance, and creating a baseline vegetation dataset for future comparison. Seven sites were chosen for the study, representing undisturbed areas in addition to 250 year old, 20 year old, and 10 year old stabilized thaw slumps. Species presence, diversity, and cover are used to describe the plant community. Percent cover vegetation data are analyzed using non-metric multidimensional scaling (NMDS), multi-response permutation procedures (MRPP), and hierarchical clustering analysis (HCA). Indicator species are identified for each age class, and the pH, organic matter content, active layer depth, and gravimetric water content of each age class' soil are presented. Results indicate that distinct vegetation communities and soil characteristics are associated with each age class, with the least differentiation occurring between the 10 and 20 year old sites. Certain species recorded in this study are shown to occur in only one age class, making them useful indicator species. Notably, several prevalent tundra species recorded in this study grow exclusively in undisturbed areas. The discovery that after >250 years the vegetation community of a disturbed area has not 'recovered' to its undisturbed state has important implications for the complex biotic relationships of the Western Arctic. Given the observed significant increase of retrogressive thaw slumps believed to be linked to climate change, these local vegetation changes could lead to major shifts in landscape ecology across the region. In addition to increasing the number of retrogressive thaw slumps, climate warming may magnify ecological changes by facilitating the northward shift of plant species. While significant changes in arctic vegetation communities may have already begun as a result of recent climate change, an increase in nutrient-rich, bare surfaces such as those associated with retrogressive thaw slumps could facilitate the rapid colonization of novel species, further complicating successional species changes and permanently altering the ecology of the landscape.

LINKING ARCTIC RESEARCH AND TRADITIONAL KNOWLEDGE

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Inuvialuit people are making observations of climate change that may be affecting the health of Beluga and Fish at the traditional whaling camp, Kendall Island, NWT. These observations are very important to document and act upon for the local people in the Inuvialuit Settlement Region depend on the land for food. These changes may have implication to food security and is resulting in adaptation strategies to cope with these changes. At the request of the local hunters hunters and trappers committee a new beluga and fish health monitoring program is being designed and put into place at the Kendall Island whaling camp. Thus, the purpose of the project to was to address the community concern of the health of Beluga and Fish (in terms of population) was decreasing, which affects the livelihood of the Inuvialuit People of Inuvik, NWT. This project was organized to collect Traditional Knowledge from seasoned hunters and trappers as to the health of Beluga whale and fish affected by climate change.
To develop the project, a project coordinator, porject support leader, 4 elders, 3 youth and 1 translator travelled to Kendall Island and stayed there for 4 nights to conduct video interviews of the local people who stay out at Kendall Island all summer. Afterwards, the interviews were transcribed and key themes that were present in all of the interviews were analyzed and is a great output as to what Inuvialuit observations and concerns were made.

Preliminary analyses of the interviews revealed reoccurring themes were present and those themes are valuable for future research and monitoring designs around Kendall Island. It is good for the all of the hunters to recognize the common themes as it binds one another closer in the traditional way of living.

OBSERVATIONS OF WINTERTIME AIR-SEA HEAT EXCHANGE WITHIN POLYNYA ENVIRONMENTS OF AMUNDSEN GULF AND THE SOUTHEASTERN BEAUFORT SEA

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Turbulent exchanges of heat dominate the local micrometeorology over the world's polar seas. These fluxes fundamentally influence atmospheric thermodynamics and therefore affect climate and weather systems at all spatial scales. The Arctic icescape is particularly unique during the winter months when the presence of leads and polynyas within the main icepack introduce dynamic micrometeorological environments, whereby enormous amount of heat is exchanged across the air-sea interface. Despite their limited spatial coverage (on the order of 1-2% of the total Arctic icepack), open water environments contribute significantly (as high as 80%) to the total ocean-atmosphere heat flux in the winter. With climate change being front and center in the Arctic, such micro-scale measurements will significantly enhance our understanding of the larger scale effects of a thinning and shrinking ice cover.

Eddy covariance measurements of the air-sea exchange of sensible heat were made from the foredeck of the CCGS *Amundsen* during the Circumpolar Flaw Lead (CFL) study, which ran from October 2007 through to August of 2008. The study was the first of its kind, involving the overwintering of the research icebreaker, allowing for the nearly continuous measurement of surface heat fluxes in a single region. Such a dataset is highly unparalleled in Arctic research. Throughout the study, the vessel experienced rapidly changing ice conditions, including regions dominated by thin, first-year sea ice, thick multiyear ice and open water (leads and polynyas). Here, we present case studies during the 2007-08 winter in Amundsen Gulf and the Southeastern Beaufort Sea in which heat fluxes varied over a range of -50 to 100 W m^{-2}. These cases illustrate periods of unique combinations of atmospheric and surface conditions. The work provides a framework to better understand implications of the new Arctic ice regime on climate over a wide range of spatial scales.

IQALUIT'S FOOD SYSTEM UNDER CLIMATIC STRESS: A CASE STUDY OF THE 2010/11 EXTREME WINTER

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Arctic climate change is an influential food security determinant because varying environmental conditions affect the ability of Inuit to harvest traditional food, thus impacting food security. This case study examines how climatic extremes during winter 2010/11 affected the traditional food system in Iqaluit, Nunavut. Environmental conditions during winter 2010/11 were anomalous throughout the Canadian Arctic, manifesting locally via warmer temperatures, reduced ice coverage, and decreased ice stability. Drawing upon in-depth interviews with hunters (n=25), a fixed question survey with public housing residents (n=100), as well as analysis of remotely sensed sea-ice charts and temperature data, this work identifies and characterizes 1) the extreme climatic conditions experienced during winter 2010/11, 2) their subsequent effects on Iqaluit's traditional food system, and 3) coping strategies used for dealing with food-related stresses. Results show increased environmental stress to the traditional food system compared to previous years. Mean annual temperatures were 4.9°C higher than the climatological mean, and ice freeze up occurred 59 days later than the long-term average. These conditions negatively impacted hunters' harvests and therefore affected residents' food supplies. Coping strategies alleviated some stresses, but adaptability was particularly limited for financially insecure households reliant on income support. This study shows that when challenging socioeconomic conditions, such as those associated with public housing, are coupled with significant environmental stresses, such as those experienced during winter 2010/11, the vulnerability of the traditional food system is exacerbated causing implications for food security. We suggest that winter 2010/11 can be used as an analogue for exploring future food system vulnerabilities in Iqaluit, as climate models project similar conditions in the coming decades.

MERCURY UPTAKE WITHIN AN ICE ALGAL COMMUNITY DURING THE SPRING BLOOM IN FIRST-YEAR ARCTIC SEA ICE

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The bottom few centimeters of Arctic sea ice provide a unique habitat with relatively high concentrations of contaminants for ice algae. Particulate matter was sampled for total particulate mercury concentrations, [PHg]T, as a function of bloom progression between March and May 2008 from the bottom ice in Amundsen Gulf, Canadian High Arctic. [PHg]T ranged from 0.004 to 0.022 μg/g dw, and was highly variable prior to mid-April when chlorophyll a concentrations and algal cell abundances were still relatively low. During the peak of the spring bloom, [PHg]T showed a decreasing trend with time. PHg concentration per cell, [THg]cell, decreased as a function of the bloom progression, even though taxonomical and cell size composition of algae remained relatively constant; a circumstance suggesting biomass dilution. Mercury in ice algae originates from a combination of brine and seawater as sources. Atmospheric mercury depletion events (AMDEs) do not appear to significantly contribute as a source in real time. As the Arctic Ocean is shifting from a multi-year to a first-year ice system, we estimate that an additional 45 kg of mercury could be released to the Beaufort Sea annually with the settling particulate flux released from the melting first year ice. Although this flux is much smaller than the riverine Hg flux to the Beaufort Sea it is a considerable amount when compared with the atmospheric deposition. Given that sea ice algae can directly accumulate Hg from sea ice brine, this additional flux of Hg could contribute significantly to the bioaccumulation of Hg in Arctic marine biota.

SPATIOTEMPORAL OCCURRENCE OF SUMMER ICHTHYOPLANKTON IN THE SOUTHEASTERN BEAUFORT SEA BETWEEN 2002 AND 2011

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Retreating summer sea ice, combined with increasing river discharge and changing ocean currents, will strongly impact the Arctic marine ecosystem within the next half a century. Although fish constitute the main energy channel to seabirds and marine mammals in the Arctic Ocean, fish communities have been extensively studied only in the Chukchi and Barents seas, the representative gateways of the Pacific and Atlantic waters to the Arctic Ocean. In this study, we focus on the southeastern Beaufort Sea to assess current trends in an area that is not directly impacted by the inflow of the Pacific or Atlantic waters. In particular, we examine (1) the spatiotemporal variability of occurrence of ichthyoplankton and (2) interannual changes in species composition between 2002 and 2011.

Ichthyoplankton were sampled in summer (June–September) using a double square-net sampler that consisted of a rectangular frame carrying two 6-m long, 1-m^2 mouth aperture, square-conical nets (200, 500, 750, or 1600 μm mesh). The sampler was towed obliquely in the surface water layer (maximum sampling depth, 10–100 m). At each station, a CTD was deployed from the bottom to the surface. Larval and juvenile fish were enumerated and identified morphologically to the lowest taxonomic level possible. East Siberian cod *Arctogadus glacialis* was not distinguished from polar cod *Boreogadus saida* because of their similar morphology in early life stages. To estimate the density of fish, the volume of water filtered through the net was calculated from ship speed and towing duration.

A total of 6 families, 12 genera, and 14 species were identified. Irrespective of year and month, Gadidae (cod) always accounted for >75% of the total number of individuals collected in each month. Cottidae (sculpin) and Liparidae (snailfish) were usually subdominant (<14%). The spatial occurrence of 9 abundant species was classified into three groups. Polar cod *B. saida* (*A. glacialis*), gelatinous snailfish *Liparis fabricii*, sand lance *Ammodytes* sp. Arctic shanny *Stichaeus punctatus*, and Arctic alligatorfish *Ulcina olriki* were ubiquitous through the sampling area. Arctic staghorn sculpin *Gymnocanthus tricuspis*, dusky snailfish *Liparis gibbus*, and daubed shanny *Leptoclinus maculatus* occurred primarily on or close to the Mackenzie Shelf, which is characterized by shallow depths and influenced by the Mackenzie River plume. In contrast, bigeye sculpin *Triglops nybelini* was more abundant off the shelf. As for temporal patterns, most of the abundant species occurred continuously in summer, whereas Arctic staghorn sculpin occurred ephemerally in July. Although no clear interannual change was observed in the species composition, sand lance occurred only in 2010 and 2011. Our results indicate that polar cod still overwhelmingly dominates fish communities in the southeastern Beaufort Sea. However, the sudden occurrence of sand lance may be a first sign of significant changes in Arctic fish communities.

RELEASE OF DISSOLVED ORGANIC CARBON (DOC) FROM COASTAL EROSION IN THE SOUTHERN CANADIAN BEAUFORT SEA

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Arctic permafrost coasts make up around 34% of the world's coastlines. These coasts are highly susceptible to erosion since they are mostly composed of ice-rich unconsolidated sediments. Current estimations of carbon released by coastal erosion largely focus on particulate organic carbon (POC). Dissolved organic carbon (DOC) contents in ground ice bodies are implicitly considered to be negligible. The few published numbers on DOC contents, recently measured on ice wedge samples, show nonetheless that concentrations are far from being negligible and that DOC in ground ice could play a substantial role in the Arctic carbon cycle.

POC and DOC export from arctic rivers has been estimated in the past, reaching around 6 Tg/yr for POC and 33 Tg/yr for DOC, released mostly during the spring peak discharge. POC release from coastal erosion has also been quantified at around 8 Tg/yr, but DOC release from coastal erosion was never included. This is problematic, as ground ice is present nearly everywhere along the arctic coast. It can make up to 90% of the coastal bluffs in volume and can erode at rates up to 10 m/yr.

In this study, we show the results of a case study focusing on the role of DOC in the nearshore nutrient budget along the Yukon Coastal Plain. Several sites, in most cases natural exposures in retrogressive thaw slumps (RTS), were selected to be representative for sampling. In total, 42 samples of massive ground ice and ice wedges were obtained with a chainsaw and stored in a cold storage at -20°C before further processing. The samples were cut in a cold lab at -15°C in order to remove the melted and contaminated margins. The melted subsamples were then used for determining DOC contents and further hydrochemical (stable water isotopes, major anion and cations) and sedimentological parameters (particulate carbon content of sediment inclusions). In this presentation, we show the DOC contents from these samples, focusing on the relation with the genesis of the enclosing ground ice bodies. We then show that these results can be linked with known rates of coastal erosion and DOC discharge from RTS into the coastal zone and substantiate a comprehensive sediment and nutrient budget for the western part of the Canadian Beaufort Sea.

MULTI-YEAR SNOWFALL ACCUMULATION ACROSS CENTRAL GREENLAND DERIVED FROM ASIRAS

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The European Space Agency's CryoSat mission is designed to monitor the growth and decay of Earth's ice cover by comparing high-resolution measurements of elevation over land and sea ice through time. The Synthetic Aperture Interferometric Radar Altimeter (SIRAL) on-board CryoSat improves on previous spaceborne radar altimeters by offering a better spatial resolution resulting from the burst-type signal transmission and Doppler processing of the data. To validate the accuracy and assess the response of SIRAL to snow, firn, and ice across ice sheets, glaciers, and sea ice the Airborne SAR/Interferometric Radar Altimeter System (ASIRAS) was developed. Since 2006, ASIRAS has been flown repeatedly over several polar targets while scientists make in situ measurements as part of the CryoSat Validation Experiment (CryoVEx) campaigns. As a result of the large bandwidth and signal strength at relatively low altitudes, ASIRAS was found to be capable of resolving layers within the dry snow zone of ice sheets where temperatures are below 0°C throughout the year. The correlation between peaks in in situ density data and the ASIRAS horizons indicate that the observed layers corresponded to annual layers of snow accumulation.

This study explores the scientific potential of ASIRAS in the task of estimating snow accumulation within the dry snow zone of central Greenland along the historically studied EGIG transect line. We began by using in situ density profiles collected during 2006, 2010 and 2011, to develop radar wave velocity and density models along a 200 km transect. These models are required for converting ASIRAS time horizons to depths and subsequently measures of accumulation. With ASIRAS data collected during the 2006, 2008, and 2011 CryoVEx campaigns we generated maps of annual snow accumulation along the EGIG line that show annual layer accumulations as meters of water equivalent (m.w.e.) between the subsurface horizons. Consistent with previous studies, we observed a decrease in annual accumulation toward the Greenland summit (from approximately 0.45 to 0.27 m.w.e. a^{-1}) that is attributable to both thinner snow layers and a decrease in snow density with elevation. The

multi-year accumulation maps showed self-consistency between individual accumulation years within the range of instrumental error, and the average annual accumulation at point elevations along the transect are in agreement with multi-decadal historical records. A closer look at recent accumulation rates indicated that snowfall across the transect has decreased since 2006 from an average of 0.47 to 0.43 m.w.e. a^{-1} at the lowest elevation along the transect (2700 m), and from 0.28 to 0.25 m.w.e. a^{-1} at the nearest approach to the summit (3200 m). In addition to returning a record of annual accumulation rates across the EGIG line during the last decade, the ASIRAS data provides important benchmark parameters (layer accumulation and thickness) required for understanding how the surface elevation of an ice sheet changes through snow compression in response to accumulated snowmass over time. Understanding the degree to which this densification process contributes to elevation change on ice sheets will ultimately aid in acquiring mass balance and ice loss from CryoSat results.

RECENT SPATIAL AND TEMPORAL TRENDS OF TOTAL MERCURY (THG) CONCENTRATIONS IN NORTHERN DOLLY VARDEN CHARR (SALVELINUS MALMA MALMA) FROM THE NORTHWESTERN CANADIAN ARCTIC

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Analysis of total mercury (THg) in fish has become significant in understanding the health impacts of fish consumption on humans. Knowledge of trends, both spatial and temporal, also speaks to how large scale environmental phenomenon (e.g. climate change) or local development (e.g. mining) may be affecting accumulation pathways. Monitoring is even more critical in the context of the Arctic, where fish are harvested for subsistence purposes and where the effects of climate change are more likely to be evident. Dolly Varden charr (DVCH) are a prized food resource in the western Canadian Arctic and are considered a taxon of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). To date, little is known about the concentrations of THg that exist in DVCH from Canada or whether the levels have changed in recent years. To address that knowledge gap, two studies were conducted: 1) define the present spatial trends and, 2) the temporal trends of THg concentrations in DVCH from the northwestern Canadian Arctic. For the spatial study, muscle tissues from anadromous DVCH ($n \approx 30$ per site and year from 2011 and 2012) were obtained from rivers which ranged in latitude from 67 to 69° N and longitude from 136 to 141° W. Data from the contemporary spatial analysis are compared to data available from a retrospective spatial analysis (1988); the latter showed no significant geographic trends, either by latitude or longitude. For the temporal study, THg levels in anadromous DVCH from the Firth and Rat rivers were determined over a 25 year period (1986, 1988, 1995, and 2011). Carbon (δ13C) and nitrogen (δ15N) stable isotopes were used to determine the effects of trophic position on the levels of contamination. Results show that for both studies and for all sites, fork length and δ15N values are positively related to THg concentrations, indicating that the larger DVCH exhibit higher contamination levels and the concentration of THg is predominantly a result of bioaccumulation through the food web. Concentrations have remained constant over the period of 1986 to 1995 for the Rat River and Firth River, averaging, respectively, 78.6 ± 38.0 µg/kg for fish on the 295 – 619 mm size range and 111.0 ± 53.8 µg/kg for fish in the 123 – 681 mm size range.

EFFECTS OF INCREASED PREDATION RISK AND DIETARY CHANGE ON BELUGA WHALE CORTISOL

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Ongoing climactic changes in the Arctic could strongly influence the organisms that inhabit this region permanently and seasonally. Two major changes in the Arctic that could be affecting beluga whale (*Delphinapterus leucas*) populations are: (1) an increase in the ice-free period providing access to killer whales (*Orcinus orca*), a known predator of beluga, and (2) warmer ocean surface temperatures causing a shift in prey abundance and availability. Although the direct effects on beluga whale in an open arctic system are complex, we focused on the relationship between cortisol (a known stress hormone) and two potential stressors (diet and predation). We used 30 years of archived blubber and skin samples from five different beluga whale populations throughout the Canadian Arctic. We extracted cortisol

from blubber and measured the concentration using radioimmunoassay. We measured stable isotope ratios of carbon and nitrogen in skin to examine dietary change. Our findings reveal a shift in the stable isotope values of the Eastern Beaufort Sea and Cumberland Sound beluga whale populations over the last decade. Additionally, killer whale sightings have increased in some areas of the Arctic over the past decade. We show how changes in diet and predator abundance relate to stress levels of beluga whales. Chronic stress can reduce survival and reproductive success. The influence of predation pressure and dietary change on stress hormone levels is important to further our understanding of population declines in the Canadian Arctic.

EXPOSURE TO PERSISTENT ORGANIC POLLUTANTS AND RISK OF HYPERTENSION AMONG INUIT FROM GREENLAND

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Background: Exposure to persistent organic pollutants (POPs) is of concern in Arctic populations since these contaminants accumulate in fish and marine mammals, which is an important part of the traditional diet of these populations. Epidemiological and experimental studies have reported significant associations between POPs and increased blood pressure (BP) in populations with different degrees of exposure. Objective: We aimed to assess the risk of hypertension related to increasing levels of polychlorinated biphenyls (PCBs) and organochlorine (OC) pesticides. Methods: Fifteen PCBs and 11 OC pesticides or their metabolites were determined in plasma of 1614 Inuit adults ≥ 18 years living in 9 towns and 13 villages in Greenland. BP was measured using a standardized protocol. The risk of hypertension was estimated through logistic regression using POPs as continuous variables (log-transformed). Hypertension was defined as systolic BP ≥ 140 mm Hg, diastolic BP ≥ 90 mm Hg and/or antihypertensive treatment. Results: Overall, the odd ratios (ORs) of hypertension were not statistically significant for dioxin-like PCBs, non-dioxin-like PCBs and OC pesticides after adjusting for confounders. Once the analyses were stratified by age category (18-39 and ≥ 40 years), increased risk of hypertension was observed for total dioxin-like PCBs among the youngest [OR: 1.34 (95% CI: 1.03-1.74)] while a borderline protective effect was observed for total non-dioxin-like PCBs [OR: 0.81 (95% CI: 0.66-0.99)] among the oldest. Higher risk of hypertension was also associated with increasing p,p′-dichlorodiphenyltrichloroethane (DDT) concentrations among the youngest [OR: 1.42 (95% CI: 1.08-1.85)]. Conclusion: Overall, no significant associations were observed between PCBs, OC pesticides and blood pressure in this highly exposed population although the associations differed by age category.

SOURCES AND VARIABILITY OF ICEBERG PRODUCTION INTO BAFFIN BAY FROM THE GLACIERS AND ICE CAPS OF THE QUEEN ELIZABETH ISLANDS

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Previous studies have suggested that calving of icebergs may account for up to 40% of mass loss from the glaciated regions of the Queen Elizabeth Islands (QEI) [1], but little is currently known about the regional variability in these patterns and their changes over time. Icebergs can pose a significant threat to shipping and marine infrastructure in Baffin Bay and off eastern Newfoundland & Labrador, so a good understanding of the major sources of iceberg production is essential. This study combines surface velocities at glacier termini with ice thickness measurements to quantify ice flux for all major tidewater glaciers of the QEI. Ice velocities are derived from speckle-tracking of Radarsat-2 fine and ultrafine beam image pairs, and ice thicknesses are primarily derived from airborne GPR measurements made during the NASA Icebridge campaign in May 2012.

Our calculations allow for the identification of the major sources of iceberg production for Baffin Bay and a quantification of ice flux from each glacier. Because ice velocities are derived from winter Radarsat-2 imagery (prior to the loss of summer sea ice that allows the icebergs to drift away from the glaciers), expected iceberg production rates for the following Arctic shipping season can be provided to decision makers. In addition, the results of this study can be used to initialize iceberg drift models

with seeding sources and the relative size of icebergs. This study will also present a ~10 year record of ice flux from major tidewater terminating glaciers on eastern Ellesmere Island (Mittie, Trinity, Wykeham Ekblaw glaciers) to highlight the intra-annual variability in iceberg production from the QEI and provide constraints on maximum and minimum iceberg production from each glacier.

THE ARCTICNET PUBLICATIONS DATABASE: MAKING ARCTICNET PUBLICATIONS SEARCHABLE AND ACCESSIBLE

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In 2011, ArcticNet partnered with the Arctic Science and Technology Information System (ASTIS) to create a searchable database of ArcticNet publications. The ArcticNet Publications Database includes publications from ArcticNet and from its two predecessor marine research projects, the Canadian Arctic Shelf Exchange Study (CASES) and the International North Water Polynya Study (NOW).

The database provides complete coverage of the more than 1600 refereed publications and theses that have so far been produced by the three research projects, as well as partial coverage of other non-refereed publications (currently about 670 are listed). Publications can be found by searching many different fields including title, author, abstract, subject and geographic categories, community, project, and publication type, and the results can be sorted by year or first author. Database records contain citations, abstracts, detailed subject and geographic terms from the ASTIS thesauri, and in most cases, links to PDF files of the publications.

The ArcticNet Publications Database is available for free from a bilingual website at www.aina.ucalgary.ca/arcticnet and can also be accessed from the ArcticNet website.

The Arctic Science and Technology Information System (ASTIS), Canada's national northern database, describes 76000 publications and research projects about northern Canada. All records in the ArcticNet Publications Database are also available in the main ASTIS database, and relevant records are included in three ASTIS regional databases: the Inuvialuit Settlement Region Database, the Nunavut Database, and the Nunavik Bibliography.

THE ARCTIC SCIENCE AND TECHNOLOGY INFORMATION SYSTEM (ASTIS): CANADA'S NATIONAL NORTHERN DATABASE

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The Arctic Science and Technology Information System (ASTIS) is Canada's national northern database. ASTIS contains 76,000 records describing publications and research projects about northern Canada. The database includes all subjects and covers the three territories, the northern parts of seven provinces and the adjacent marine areas. ASTIS records contain abstracts, detailed subject and geographic indexing terms, and links to 20,000 online publications. With a mandate to make information about northern Canada more accessible to all, ASTIS is available for free from a bilingual website at www.aina.ucalgary.ca/astis. It has been in operation since 1978 and is funded through contract work and donations. ASTIS is a project of the Arctic Institute of North America (AINA) at the University of Calgary.

ASTIS covers both peer-reviewed and grey literature. Most of the citations in the database are to publications produced since 1978, but some older material is also included. Due to funding limitations, the database's coverage of publications is not comprehensive. In addition to publications, ASTIS contains 16,000 records describing research projects conducted since 1974 in Canada's three territories, based on information collected by the organizations that license northern research. This makes northern research project information available in one convenient place with consistent subject and geographic indexing terms from the ASTIS thesauri, and ensures that when people search ASTIS for publications they also automatically learn about relevant research projects.

ASTIS specializes in the preparation of bibliographic databases about northern Canada that are made available from customized websites for contract clients. These include regional databases such as the Yukon Biodiversity Database, the Inuvialuit Settlement Region Database, the Nunavut Database and the Nunavik Bibliography; subject databases such as the Hydrocarbon Impacts database, the Circumpolar Health Bibliographic Database, the Northern Granular Resources Bibliographic Database and the Canadian Permafrost Conferences website; and research program databases such as the Canadian IPY Publications Database, the ArcticNet Publications Database, the Northern Contaminants Program Publications Database and the Kluane Lake Research Station Bibliography. All of the

records in all of these subset databases are also available in the main ASTIS database. ASTIS also describes all of the 2600 papers, notes, commentaries, editorials, profiles, obituaries and essays that have appeared in AINA's peer-reviewed journal Arctic, and all of the 4000 publications on AINA's publications server.

Canada needs a comprehensive national northern database to provide a single point of access to the thousands of publications about northern Canada being produced each year, and to the hundreds of northern research projects being licensed each year. ASTIS provides good coverage of these two types of information now, but with additional funding could become comprehensive.

NET GREENHOUSE GAS BALANCE OF THREE HIGH-ARCTIC VEGETATION TYPES ALONG A SOIL MOISTURE GRADIENT AT CAPE BOUNTY, MELVILLE ISLAND, NUNAVUT

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Climate in high-latitude environments is predicted to undergo the most pronounced warming and increase in precipitation. In warmer and wetter soils, the net balance of greenhouse gases (GHGs) such as CO_2, CH_4 and N_2O could be altered, Changes in GHG dynamics, however, may not be uniform across the arctic landscape, where different vegetation types are distributed along moisture gradients. To predict the future contribution of Arctic ecosystems to global climate, it is important to understand the interactions between vegetation type and net GHG balance. Little research, however, has explored spatial variability in net GHG emissions from high-Arctic landscapes, especially in polar barrens that dominate the region. Most studies concentrated either on CO_2 fluxes, or were performed in low-Arctic ecosystems and polar oases. In 2008 and 2009, we measured CO_2, CH_4 and N_2O fluxes using static chamber techniques at Cape Bounty, Melville Island, Nunavut, Canada. Measurements were performed using transparent static chambers (to measure NEP, or opaque static chambers (for CH_4, N_2O, and ecosystem respiration) in three major plant community types across a moisture gradient: polar semi-desert (PD), mid-moisture tundra (MM) and wet sedge meadow (WS). CO_2 fluxes were measured with a VAISALA infrared gas analyzer, while trace gas fluxes were measured in air samples collected over 40 minutes and stored in pre-evacuated glass vials. In 2008, only the WS community was a net CO_2 sink, whereas in 2009 all vegetation types were CO_2 sources, with MM emitting almost ten-fold more carbon than the other two plant communities. WS released the most N_2O and CH_4, followed by MM communities, while PD soils were net CH_4 sinks. There was little discernible influence of environmental factors on N_2O fluxes. Emissions of CH_4 and N_2O, tended to be higher in the warmer year 2008. On a given land area, depending on the climate of a given season and on the relative cover of the different vegetation types, CH_4 flux can result either in carbon efflux or uptake (4.12×10^{-3} g C m^{-2} $season^{-1}$ in 2008 vs. -12.69×10^{-3} g C m^{-2} $season^{-1}$ in 2009 for the entire Cape Bounty area). The CH_4 effluxes are small compared to more southern ecosystems, but uptake values are significant, comparable even to tropical ecosystems. Given the vast expanses of polar deserts, and the more potent nature of CH_4 as a GHG, changes in the spatial extent of the different vegetation types could have a significant impact on net climate forcing attributed to high-Arctic ecosystems.

SEA-ICE ENVIRONMENTAL RESEARCH FACILITY

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The Sea-ice Environmental Research Facility (SERF) is the first experimental sea-ice facility in Canada. Located in Winnipeg on the campus of the University of Manitoba, the main feature of SERF is an outdoor seawater pool (60 feet long, 30 feet wide and 8 feet deep) 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 2011-2012 inaugural year of operation, 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, pCO_2, 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 properties and biogeochemical processes in the sea ice environment.

DIVE BEHAVIOUR OF MALE AND FEMALE NARWHALS (MONODON MONOCEROS) FROM THE BAFFIN BAY AND NORTHERN HUDSON BAY POPULATIONS

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Narwhals (*Monodon monoceros*) are culturally and socially important to Inuit people. The Inuit rely on narwhal blubber and muktuk (skin) to subsidize their diet and narwhals are part of the annual subsistent hunt in Canada and Greenland. The Baffin Bay (BB) narwhal population overwinters in Davis Strait and summers in the fiords and inlets of northern Canada and western Greenland. The northern Hudson Bay (NHB) population overwinters in Hudson Strait and summers in northern Hudson Bay. These two populations live in regions that have different bathymetry and depth profiles, with the BB population encountering deeper areas. We hypothesized narwhals from BB would spend more time and dive to deeper depths than those from NHB because of these habitat differences. In a previous study we identified differences in dietary signatures between males and females from the BB population that did not exist for the NHB population. As a result, we suspected males and females in BB might be utilizing resources in different portions of the water column, which would not be the case in NHB where all narwhals are limited to shallow depths and use the entire habitat. Narwhals from both populations were fitted with satellite transmitters that provided information on their dive behaviour. Three male and two female narwhals were tagged in NHB in 2006 and three male and one female narwhal were tagged in this region in 2007. Three female and two male narwhals were tagged from the BB population in 2010 and six females and one male were tagged in 2011. Overall, narwhals from BB spent much of their time at depths > 400 m, whereas NHB narwhals spent much more time at intermediate depths. On average, males and females from NHB spent approximately equal time at all depths, whereas females from BB spent more time at greater depths compared to males. Understanding dive behaviour in narwhals is essential for understanding their habitat requirements and foraging behaviour. Variation in dive parameters between sexes in BB suggests males and females may forage differently in the water column depending on the habitat available. The observed difference in dive behaviour between the two narwhal populations highlights the importance of assessing habitat requirements for each population independently.

ROCESS STUDY OF A RETROGRESSIVE THAW SLUMP ON HERSCHEL ISLAND, YUKON COAST

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The Canadian Yukon Coast is an ice-rich permafrost region and is highly vulnerable to environmental change. Rising sea level, increasing summer temperatures, and changing sea ice conditions are projected to lead to accelerated permafrost degradation and coastal erosion. Retrogressive thaw slumps (RTS) are common thermokarst features along arctic coasts and are mostly initiated by wave erosion and thawing of exposed ice-rich permafrost headwalls. Among other components, thawing permafrost releases large quantities of organic carbon into the nearshore zone, where it is recycled and sequestered. Organic carbon is released as particulate organic carbon (POC) and dissolved organic carbon (DOC). While recent studies have greatly improved our knowledge on the stocks and fluxes of POC in permafrost, the dissolved fraction is mostly still disregarded. However, DOC is chemically labile and directly available to the marine ecosystem. Changes in this complex and sensitive system, e.g. due to climate change, that increase coastal erosion may cause changes in the carbon cycle from the local to regional scale.

It is therefore important to improve our knowledge regarding the amount of total organic carbon stored and potentially released from thawing permafrost. Here we present a process study of one of the largest RTS in the Arctic, on Herschel Island off the Yukon Coast, performed over the summers 2011 and 2012. The studied RTS is over 400 m wide, has an exposed headwall of up to 30 m, and undergoes erosion at a rate exceeding 10 m/yr. Our study utilised an outflow channel equipped with a radar sensor to measure the discharge resulting from thawing permafrost in a known catchment before the material enters the nearshore zone, and hence to determine the eroded volume and the amount of organic carbon released. Washload samples taken at the outflow with an automatic water sampler provide continuous sampling over the thaw season, with measurements taken up to several times a day. Analysis of meltwater and suspended matter provides quantitative information about the material flux of minerogenic

matter, POC and especially DOC. We also obtained a detailed understanding of the grain size composition and hydrochemical characteristics (pH, conductivity, major anion and cation composition) of the sediments and fluids that are released.

THE EFFECTS OF CLIMATE CHANGE ON THE HYDROLOGY, LIMNOLOGY, AND BIOGEOCHEMISTRY OF THERMOKARST LAKES IN WAPUSK NATIONAL PARK, MANITOBA

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Wapusk National Park (WNP), located within the Hudson Bay Lowlands (HBL), contains over 10,000 shallow, thermokarst lakes and ponds spanning the boundary between discontinuous and continuous permafrost. Over the past ~50 years, this area has experienced some of the greatest warming in the circumpolar North and is considered one of the most sensitive regions in northern Canada to permafrost thaw. Since permafrost regions are diverse, account for approximately 50% of Canada's land mass, and are becoming increasingly dynamic, the linkages among climate change, permafrost behaviour, and the overall stability and functioning of the many Northern ecosystems are critical, yet challenging to identify. Gaining knowledge about linkages among hydrological processes, limnological conditions, and greenhouse gas exchange in thermokarst lakes is a high priority since climate-driven alterations to lake-water balances may influence limnological properties and hence greenhouse gas evasion rates. This research will involve collecting surface water samples from 20 lakes spanning three different ecotypes (coastal tundra, peatland, boreal forest) within WNP at three different times (spring-summer-fall) over a three-year period (2012-2014) to assess seasonal and inter-annual variability. Samples will be analyzed for water isotope composition (i.e., oxygen and hydrogen isotopes) and water chemistry (i.e., ions, nutrients, CO_2 and CH_4 concentrations). Preliminary results on GHG concentrations in spring and summer indicate that WNP ponds are sources of CH_4 but often sinks of CO_2. Isotope-mass balance models will be utilized to quantify lake-water balances and multivariate statistical methods will be used to identify relationships among hydrological processes, limnological conditions, and greenhouse gases in thermokarst environments. In addition, lake sediment cores will be obtained and physical, geochemical, and biological techniques will be used to reconstruct hydrological and limnological variability on decadal to centennial timescales. Overall, these results will identify the implications of rapid environmental change on aquatic ecosystems of the HBL in northern Canada caused by thawing permafrost. More specifically, research findings will contribute new knowledge to improve predictions of hydrological, limnological and biogeochemical consequences of climate change on thermokarst lakes.

THE ROLE OF CHEMICAL PROCESSES IN SOIL WEATHERING PROCESSES ON HERSCHEL ISLAND, YUKON.

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An essential requirement in evaluating the potential impact of climate warming on permafrost systems is a better understanding of the nature and behaviour of the active layer. Much of the research pertaining to soil weathering in the Arctic has focussed on physical processes, related to freeze-thaw as the primary determinants of soil morphology. Little consideration has been given to the possible role of chemical processes. The observations presented in this study are based on the permafrost environment of Herschel Island, in the northern Yukon, located in the Southern Beaufort Sea. Current and past climate variations in this part of the Arctic have led to the development of two well-defined thaw unconformities, including; 1) the first associated with the modern active layer, marking the contact with the underlying Hypsithermal paleo-active layer, and 2) the second associated with the base of the Hypsithermal paleo-active layer, which forms a cryostratigraphic contact with the undisturbed permafrost.. The part of the soil profile between the base of the modern active layer and the base of the Hypsithermal (paleo-) active layer is currently permafrost but forms a transition zone (layer). The thaw unconformity at the base of the current active

layer is characterized by a doubling in the concentration of most exchangeable cations and a tripling in the soil organic matter content, relative to the overlying soil horizon. The soil material above this zone of accumulation contains higher proportions of weathered material and silt-sized particles than the underlying frozen layers. This is consistent with the greater evidence of chemical weathering (higher ratios of mobile over immobile elements) in the composition of the bulk soil. The chemical composition and higher ice content of the soil in the "transition zone" also suggests past periods of prolonged climate warming. Finally, strong marine chemical signature below the second thaw unconformity, in the form of high contents of sodium and sulphate ions in the pore water, which reflects the marine origin of these sediment, suggests that in contrast to the overlying layers, this part of the soil profile was not subjected to thaw induced chemical changes. The results of this study provide compelling evidence for the important role that chemical processes plays in the overall development of cryosols. They also demonstrate clearly that weathering in arctic environments characterized by permafrost involves a complex interplay between physical and chemical processes.

Keywords: weathering; active layer; Hypsithermal; cryostratigraphy; Herschel Island

CLIMATIC AND ENVIRONMENTAL CHANGE ON THE YUKON COASTAL PLAIN DURING THE LAST 2000 YEARS – PRELIMINARY RESULTS

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The North American Arctic is experiencing one of the greatest increases in air temperature on Earth, resulting in drastic environmental changes affecting the entire Earth climate system. It is still largely unclear, however, how the regional climate of the Western Canadian Arctic has changed in the past. The lack of palaeogeographic benchmark data for this region hinders attempts to understand and provide prognoses of climate fluctuations and associated processes such as thermokarst and permafrost degradation.

This project is designed to provide a high-resolution reconstruction of absolute temperature amplitudes, precipitation and changes in vegetation communities on the Yukon Coastal Plain for the last 2000 years. It deals with rapid and short-lived climate fluctuations in the area such as the still unconfirmed presence and timing of the Medieval Warm Period and the Little Ice Age and how these climate fluctuations are related to permafrost dynamics.

In August 2012 a lake near Roland Bay on the formerly glaciated part of the Yukon Coastal Plain was investigated using acoustic sounding, water sampling and lake sediment sampling. The lake is approximately 500 x 300 m large and has a maximum depth of 3.7 m. Steep banks and a relatively flat bottom characterize the morphology of this thermokarst lake. Hydrochemical analyses suggest that the lake is well-mixed and rather rich in bicarbonate. Ice wedge polygons surround the lake on all sides. The ones on the western and northern side are low-centered, on the southern and western side high-centered polygons prevail. The tundra vegetation surrounding the lake is characterized by different dwarf shrubs, Ericaceae, Cyperaceae, grasses and a diverse moss cover.

Short cores were recovered from the lake sediment using a gravity corer. A core of 49 cm length was subsampled in the field in order to minimize disturbance during storage and transport. The core was cut into slices of 0.5 cm, which are subject to a number of ongoing analyses. 210Pb/137Cs dating complement 14C dates and allow the development of a reliable age-depth model and sedimentation rates for a subsequent pollen study. Grain size analysis and biogeochemical parameters such as TOC, C/N, δ13C, δ15N provide additional information on depositional conditions and organic matter preservation. This work will be the first high-resolution multi-proxy analysis of Late Holocene environmental change from lake sediments in the western Canadian Arctic.

SOIL ORGANIC CARBON IN WESTERN ARCTIC NATIONAL PARKS OF CANADA

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Soil organic carbon (SOC) stored in Arctic soils represents very important potential sources for increased emissions of greenhouse gases (CH_4 and CO_2) in a warming climate. One of the most visible impacts of warming climate change is effect of melting permafrost in the Arctic soils. Understanding the sensitivity of permafrost-based Arctic tundra soil to climate change will allow any adverse biological, ecological and physical effects of this change

to be projected. Consequently, effective management actions may be in places to reduce and eliminate some of the adverse impacts on Canadian national parks' operations and ecological management. As well, soil is one of the most complex habitats on earth, and contains the most diverse assemblages of living organisms. Study of SOC is key for understanding soil food web structure, controls of plant growth and distribution of vegetation and organisms in the Arctic ecosystems, and how, in turn, these biological community structures affect soil organic matter quality and quantity. Thus, it is critical to establish a baseline for monitoring and study SOC change in Arctic soils so that we can recognize changes as they develop.

As part of Parks Canada's long-term ecological integrity (EI) monitoring programs, permafrost change in soils has been identified as an EI measure of tundra ecosystems in Canadian northern national parks. We collected tundra soil samples since 2010 in three western arctic national parks (Ivvavik, Aulavik, and Tuktut Nogait) in Yukon Territory and Northwest Territories, Canada. A total of 56 soil profiles were studied and 103 soil samples were analyzed for soil total carbon (STC), SOC, and other soil physical and chemical characteristics. Relationships between SOC and permafrost distributions were explored. In this poster, we present our monitoring and analysis results with focuses on quantities of SOC and STC distributions along the studied soil profiles, their spatial distributions in the study areas of three watersheds in the three national parks. Our goal is to establish baselines of SOC and other soil properties of the tundra ecosystems in the three national parks. By using the baselines to determine if the soil characteristics, such as SOC, are changing or stable in future EI monitoring and research, we will have a good indicator of the health of the tundra ecosystems in our national parks. Our SOC and other soil data were also applied to a one-dimensional model in modeling and mapping climate change impacts on permafrost at high spatial resolution for Ivvavik National Park, where it is very challenging to monitor and study permafrost change due to complex terrains.

MEASUREMENTS OF PARTICLE SIZE DISTRIBUTION AND THEIR RELATIONS TO PARTICULATE ATTENUATION AND BACKSCATTERING PROPERTIES IN HUDSON BAY

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Particle size in a water column is a property affected by many processes, such as biological growth, flocculation, aggregation, disaggregation, and sedimentation. The particle size distribution (PSD) provides important information about pelagic ocean ecosystem structure and function. The slope of the PSD (also known as Junge exponent j) is the most frequently assumed to be an inverse power-law as a function of particle size. Moreover, the spectral particulate beam attenuation coefficient, cp(λ), also exhibit an inverse power-law dependence on wavelength, and the power-law slope has been theoretically related to the slope of the PSD. A Mie theory-based model was developed by Twardowski et al. (2001) to estimate bulk refractive index from backscattering ratio and the Junge slope of the PSD. However, no such study on in situ PSD, particulate attenuation and backscattering properties has been previously performed in Hudson Bay, which is a large inland sea located in central Canada with complex water optical properties due to a massive influx of freshwater mostly in its southern portion.

In situ measurements of PSD and inherent optical data collected in Hudson Bay during the summer 2010 were used to investigate the PSD properties and their relations to attenuation and scattering/backscattering properties. More than 92% of PSD slope values calculated were within the [2.5 – 4.5] range, consistent with values reported in other oceanic waters. Most of the particulate attenuation spectral slope (γcp) values varied between -0.5 and 1.5 though values out of this range also existed. Neither the Morel (1973) nor the Boss et al. (2001a) models can adequately describe the relationship between PSD slope and γcp because of the dominance of smaller size particles. The performance of the model for bulk refractive index (Twardowski et al., 2001) has been validated with backscattering ratio varying between 0.005 and 0.032 and the bulk refractive index in the [1.02 – 1.20] range. At inorganic particulate dominated stations, both the backscattering ratio and bulk refractive index had a larger range and had higher mean values than at organic particulate dominated stations.

CARBON MONOXIDE (CO) BIOLOGICAL PRODUCTION FROM AXENIC ICE-ALGAL CULTURES

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Carbon monoxide (CO) biological production from phytoplankton cultures (*A. septentrionalis, N. frigida and P. taeniata*), dominant ice-algal species in first-year sea ice in Arctic, was determined in this study. CO concentration was monitored from the lag phase to the exponential (or stationary) phase, along with other biology and chemistry parameters. CO total production rate (Pt, i.e. biological plus photochemical production) for each phytoplankton culture was increased from the starting of the incubation to the end of the exponential phase and then preserved stably or decreased tardily during the stationary phase. The daily CO biological production rates (Pbio) normalized to chlorophyll *a* (chl *a*) were at the ranges of 0.023-0.038 nmol CO (μg chl *a*)$^{-1}$ for *A. septentrionalis*, 0.025-0.052 nmol CO (μg chl *a*)$^{-1}$ for *N. frigida* and 0.014-0.082 nmol CO (μg chl *a*)$^{-1}$ for *P. taeniata*, with the ratios of Pbio:Pt being 24%-43%, 10%-70% and 8% to 36%, respectively. The results also suggested that all the three ice-algal species held higher activity during the exponential phase in terms of CO biological production other than the lag and stationary phase. This study firstly supplies another track to explain the high concentration of CO at the bottom layer in first-year sea ice during ice-algal bloom, relative to that in the upper layer and the underlying seawater. Furthermore, according to the results in this study, as well as photodegradation of organic matter, biological production by phytoplankton should be another important source of CO in the aqueous environment, which is worth being studied in the future.

FEEDING ECOLOGY OF EASTERN HUDSON BAY RINGED SEALS: INVESTIGATION OF SHORT AND LONG TERM VARIABILITY USING STABLE ISOTOPES AND FATTY ACIDS

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The ringed seal (*Phoca hispida*) is a small phocid seal with a circumpolar Arctic distribution which occurs at the southern limit of its range in Hudson Bay. Hudson Bay experiences complete ice cover in winter and complete open water in summer and is currently seeing a trend toward earlier ice breakup dates and later freeze up dates. Due to the distinct seasonality of Hudson Bay and the variability in environmental conditions, it is expected that ringed seals in this area undergo dietary shifts on both short (seasonal) and long term time scales. We used nitrogen (δ15N) and carbon (δ13C) stable isotope ratios and fatty acid signatures to study seasonal variability in diet as well as interannual and long term changes and how they relate to changes in ice and environmental conditions. Tissue samples and morphological measurements from ringed seals were obtained during the Inuit subsistence hunt from 2003 to 2011 from the community of Sanikiluaq, NU. Seasonal patterns of δ13C in muscle indicate pelagic feeding during the open water season when fat and energy stores are replenished, increased benthic foraging during the period of ice cover, followed by a period of fasting during the spring molt. Fatty acid composition of blubber suggests seasonal changes in diet which could include increased importance of pelagic fish such as capelin (*Mallotus villosus*) and sandlance (*Ammodytes sp.*) in the fall. From samples collected in the fall of each year, δ15N underwent a small but significant decline over the eight year study period and had a positive relationship with ice breakup date. Years with early ice breakup generally had lower δ15N than years with later breakup dates. Seal body condition, determined using percent blubber of total body mass, was strongly correlated with muscle δ15N. These results suggest that either ringed seal diet and prey availability are changing or that baseline and/or food web changes at lower trophic levels are causing shifts in stable isotope ratios which are reflected in ringed seal tissues. Further analyses will be conducted to investigate potential dietary changes. It is possible that a shift in food web dynamics and/or ringed seal feeding could cause a decline in seal body condition. As a result, ringed seals may experience reduced reproductive success and increased vulnerability to disease, which would have negative implications for polar bear populations who rely on ringed seals as an important food source, and Inuit communities for whom ringed seals provide subsistence food and cultural significance.

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Queen's University

SPONSORS

GOLD

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

Aboriginal Affairs and Northern Development Canada - Northern Contaminants Program / Affaires autochtones et Développement du Nord Canada - Programme de lutte contre les contaminants dans le Nord

The Northern Contaminants Program (NCP) has been addressing the issue of contaminants in the Arctic for over twenty years. Results of NCP monitoring, research and human health studies are used to support national and global actions on contaminants. The NCP's long-term goal is to reduce and where possible eliminate contaminants in the environment and traditional/country foods while providing Northerners with the information they need to make informed dietary choices.

The Vancouver Aquarium

The Vancouver Aquarium is a non-profit society dedicated to the conservation of aquatic life. www.vanaqua.org.

vancouver aquarium ocean wise™

GRADUATE STUDENT POSTER AWARDS

Nasivvik Centre

www.nasivvik.ulaval.ca

The Nasivvik Centre for Inuit Health and Changing Environments is a multidisciplinary research and training centre funded by the Canadian Institutes of Health Research-Institute of Aboriginal Peoples' Health. The Nasivvik Centre is focused on building capacity in Inuit environmental health research through trainee support and the provision of targeted research support and facilitation.

NASIVVIK

ARCTIC INSPIRATION PRIZE CEREMONY

RBC Wealth Management
PH&N Investment Counsel

EXHIBITORS

Axys Technologies Inc.

AXYS Technologies Inc. (AXYS) presents Arctic Lake Monitoring Systems as well as unique solutions for the challenges faced with year-round continuous monitoring of the hydro-ecology of Arctic freshwater lake systems. AXYS is an ISO 9001-2008 registered Canadian company with over 30 years experience in the design, manufacture and installation of remote environmental monitoring systems worldwide.

Aurora Research Institute

The Aurora Research Institute strives to improve the quality of life for NWT residents by using scientific, technological and indigenous knowledge to solve northern problems and advance social and economic goals. We provide logistical support to visiting researchers at 3 regional research centres located in Inuvik, Fort Smith and Yellowknife.

Eqquera Inc.

Eqquera Inc is a company based in Vancouver BC Canada mainly focusing in innovating and developing unmanned aerial vehicles for civil and commercial applications. The innovation of SG 240 unmanned vehicle and adjustable sub vehicles provide the use for multiple applications to combat wildfires, Arctic drilling for scientific investigations etc.

Yukon Research Centre

The Yukon Research Centre (YRC) facilitates innovation and research with a collaborative, multi-disciplinary approach combining social, natural, and physical sciences with traditional knowledge. YRC will showcase its many programs, projects and services including: hazards mapping for climate change planning, hydro security forecasting, and funding opportunities for cold climate innovation.

L'Agence spatiale canadienne / Canadian Space Agency

L'Agence spatiale canadienne (ASC) appuie les priorités stratégiques du gouvernement du Canada dans l'Arctique, telles le développement durable, la sécurité et la souveraineté. Par le biais de ses programmes et activités, l'ASC travaille, en étroite collaboration avec ses partenaires, à relever les défis et enjeux auxquels font face tous ceux et celles qui vivent et travaillent dans le Nord canadien.

The Canadian Space Agency (CSA) supports government priorities related to sustainable development, security and sovereignty in the Arctic. Through its programs and activities, the CSA is working closely with its stakeholders to address the key challenges and issues facing those living and working in the Canadian North.

EXHIBITORS

Inuit Circumpolar Council (Canada)

www.inuitcircumpolar.com
ICC promotes and celebrates Inuit unity and works collectively to advocate internationally on behalf of the 155,000 Inuit living in Chukotka, Greenland, Alaska and Canada. ICC (Canada) is a non-profit organization led by a board of directors comprising the elected leaders of the four land claims settlement regions: Inuvialuit Settlement Region, Nunatsiavut (Labrador), Nunavik, and Nunavut.

Inuit Tapiriit Kanatami

Inuit Tapiriit Kanatami (ITK) was founded in 1971. ITK is the national Inuit organization in Canada representing the 55,000 Inuit from four Inuit land claim regions: Inuvialuit Settlement Region, Nunatsiavut (Labrador), Nunavik (Northern Quebec) and Nunavut. The President of ITK is Terry Audla.

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

Aboriginal Affairs and Northern Development Canada - Northern Contaminants Program / Affaires autochtones et Développement du Nord Canada - Programme de lutte contre les contaminants dans le Nord

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Natural Resources Canada | Ressources naturelles Canada

Polar Continental Shelf Program

polar.nrcan.gc.ca
The Polar Continental Shelf Program (PCSP), part of Natural Resources Canada, provides logistical support for up to 165 research projects each year that involve over 1100 scientists, students and field technicians conducting field studies across Canada's Arctic. Services include air transport to and from remote field camps, field equipment, and accommodations at the PCSP Resolute facility.

ATS Technology Systems Inc

As a leading provider of meteorological services across the Arctic, employs an extensive network of aviation weather observer/communicators, aero logical observers, and meteorological instructors. ATS also specializes in meteorological instrumentation by partnering with several world-class sensor manufacturers allowing ATS to offer meteorological solutions ranging from basic monitoring to fundamental research.

EXHIBITORS

Canadian Polar Commission / Commission canadienne des affaires polaires

Established in 1991, the Canadian Polar Commission is dedicated to developing, aggregating, and disseminating polar knowledge; contributing to Canadian public awareness of the importance of polar issues; identifying emerging opportunities and challenges; enhancing Canada's international profile as a circumpolar nation; and fostering international cooperation in the advancement of polar knowledge.

Canadian Polar Commission
Commission canadienne des affaires polaires

Campbell Scientific (Canada) Corp.

Campbell Scientific (Canada) Corp. is an experienced provider of rugged, reliable data acquisition systems and sensors. Our dataloggers feature wide operating ranges, durable construction and dependable stand-alone operation. They have low power consumption from a variety of sources, telecommunications options, and have the flexibility to support a variety of measurement and control applications.

CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

Blue System Integration LTD

Blue System Integration (BSI) is a systems engineering company specializing in the development of customized data acquisition and computer-based measurement systems. Since 2008 BSI has also developed ice-penetrating radar acquisition systems for the scientific community. These instruments are used throughout the world in the Yukon, Iceland, Bolivia, Arctic, US, and France.

IceRadar
Blue System Integration

Hoskin Scientific LTD

Hoskin Scientific is a Canadian environmental monitoring instrumentation distributor with offices in Vancouver, Burlington and Montreal. We carry an extensive range of products with major emphasis in the following areas: Water Quality, Limnology, Hydrology Meteorology, Agronomy, Soil Science and Snow Science. Please stop by our booth for a brochure or visit our website (www.hoskin.ca) for more information.

HOSKIN SCIENTIFIC

Students on Ice

www.studentsonice.com
Students on Ice is an award-winning organization offering unique educational expeditions to the Arctic and the Antarctic. Our mandate is to provide students, educators, and scientists from around the world with inspiring educational opportunities at the ends of the Earth and, in doing so, help them to foster a new understanding and respect for the planet.

STUDENTS ON ICE

EXHIBITORS

ROMOR Ocean Solutions

ROMOR Ocean Solutions and Liquid Robotics Inc. is a Canadian owned company with 25 years of experience in the Marine Industry. We are excited to introduce you to the Liquid Robotics' Wave Glider. It is the first unmanned autonomous marine robot to use only the ocean's endless supply of wave energy for propulsion (no manpower, no emissions, no refueling). We are an Oceans Solutions provider exclusively representing and distributing oceanographic and geophysical instrumentation.

ARCTIC INSPIRATION PRIZE

PRIX INSPIRATION ARCTIQUE

You're invited to the Award ceremony for

The 1st Annual

$1 Million Arctic Inspiration Prize

What	$1 Million will be awarded to a multi-disciplinary team or teams that have created a viable plan to put their Arctic knowledge into action for the benefit of the Canadian Arctic and its peoples.
Who	Vancouver-based S. and A. Inspiration Foundation generously donated the annual $1 M prize voluntarily managed by ArcticNet.
Where	Vancouver Westin Bayshore Hotel 1601 Bayshore Drive, Grand Ballroom ABC
When	December 13th, 2012 between 5 pm–7 pm

One to five teams will be awarded the first Arctic Inspiration Prize and a share of the associated $1 million award. Former Governor General Michaëlle Jean, Nobel Peace Prize nominee Sheila Watt-Cloutier, Juno-award winning singer-songwriter Susan Aglukark, CBC News anchor Peter Mansbridge, Former commissioner of Yukon Geraldine Van Bibber, and other distinguished individuals known for their commitment to the Canadian Arctic, have selected the winners, which will be announced at the ceremony.

Hors d'oeuvres and refreshments will be served.

All ASM2012 participants are invited to attend.

www.arcticinspirationprize.ca

ArcticNet

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Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

NORTHERN CONTAMINANTS PROGRAM

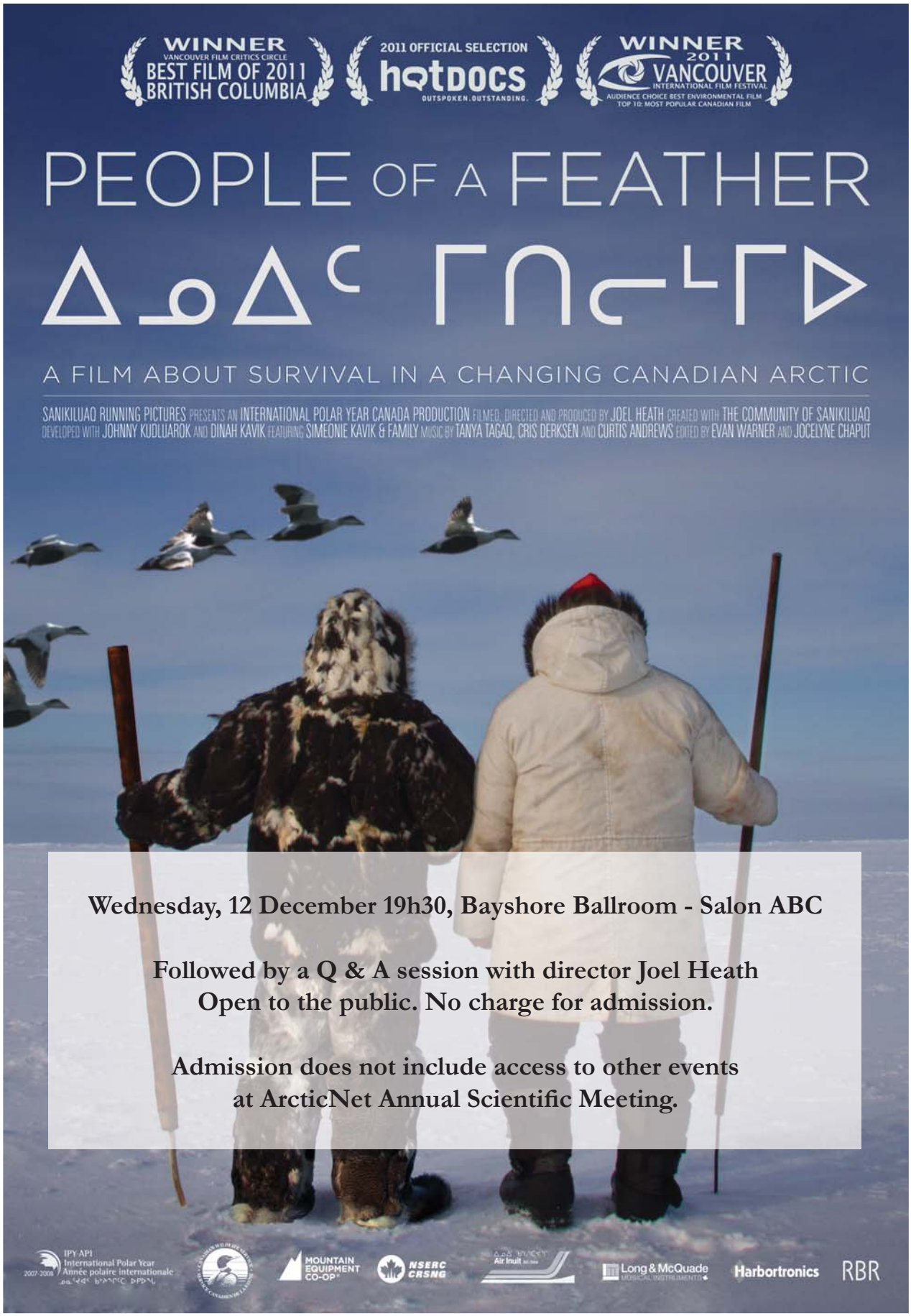
Photo: Eric Loring

Call for Proposals 2013-2014

The Northern Contaminants Program (NCP) is led by Aboriginal Affairs and Northern Development Canada in partnership with other federal, territorial, provincial, academic and Aboriginal organizations.

The NCP is now accepting proposals for work to be undertaken in the 2013-2014 fiscal year in the following areas: Human Health; Environmental Monitoring and Research; Community Based Monitoring and Knowledge Integration; and Communications, Capacity, and Outreach. The deadline for proposal submission is January 14, 2013. For more information, stop by the NCP booth at the ASM or email us: PLCN-NCP@aadnc-aandc.gc.ca.

Canada


WINNER
VANCOUVER FILM CRITICS CIRCLE
BEST FILM OF 2011
BRITISH COLUMBIA
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PEOPLE OF A FEATHER
A FILM ABOUT SURVIVAL IN A CHANGING CANADIAN ARCTIC
SANIKILUAQ RUNNING PICTURES PRESENTS AN INTERNATIONAL POLAR YEAR CANADA PRODUCTION FILMED, DIRECTED AND PRODUCED BY JOEL HEATH CREATED WITH THE COMMUNITY OF SANIKILUAQ
DEVELOPED WITH JOHNNY KUDLUAROK AND DINAH KAVIK FEATURING SIMEONIE KAVIK & FAMILY MUSIC BY TANYA TAGAQ, CRIS DERKSEN AND CURTIS ANDREWS EDITED BY EVAN WARNER AND JOCELYNE CHAPUT
Wednesday, 12 December 19h30, Bayshore Ballroom - Salon ABC
Followed by a Q & A session with director Joel Heath
Open to the public. No charge for admission.
Admission does not include access to other events
at ArcticNet Annual Scientific Meeting.
IPY-API
International Polar Year
Année polaire internationale
MOUNTAIN EQUIPMENT CO-OP
NSERC CRSNG
Air Inuit
Long & McQuade
Harbortronics
RBR

Inuit Partnership of Excellence Poster Award

Inuit Tapiriit Kanatami and Inuit Circumpolar Council – Canada proudly announce the Inuit Partnership of Excellence Award 2012.

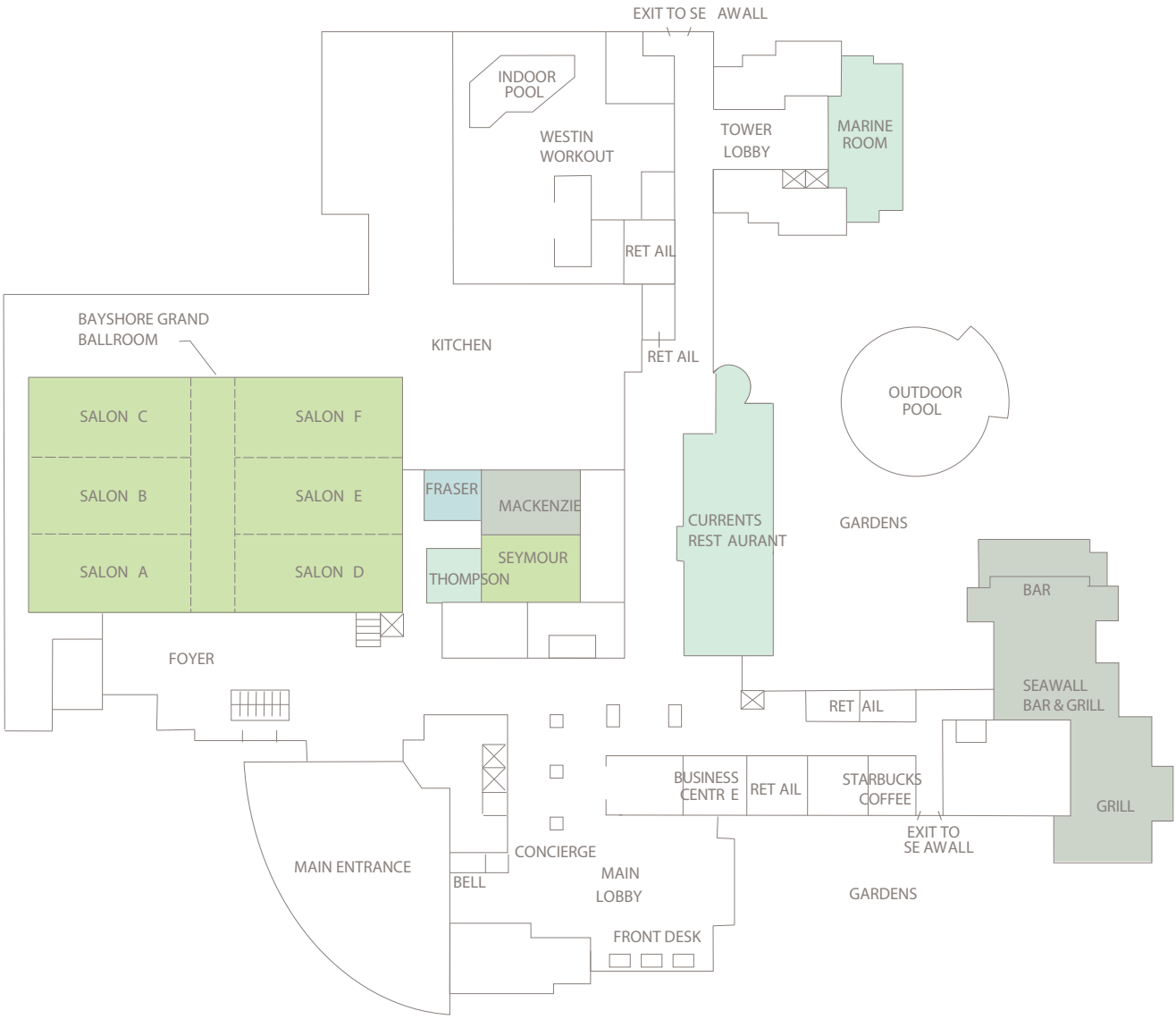
The Inuit Partnership of Excellence Award will be awarded to the student whose poster best addresses Inuit priorities, involves Inuit partners and builds capacity. Specifically, the adjudication committee will be looking for posters that highlight:

- Engagement of the Inuit Research Advisors (IRAs) and regional Inuit organizations
- Capacity building (e.g. active partnerships, training, involvement of local schools)
- The incorporation of local knowledge
- Partnerships and communication with Inuit in all phases of the research
- Results and conclusions that are significant to Inuit

The winner of the Inuit Partnership of Excellence Award will be announced at the ArcticNet Banquet on Thursday, 13 December 2012.

The Westin Bayshore

Lobby level

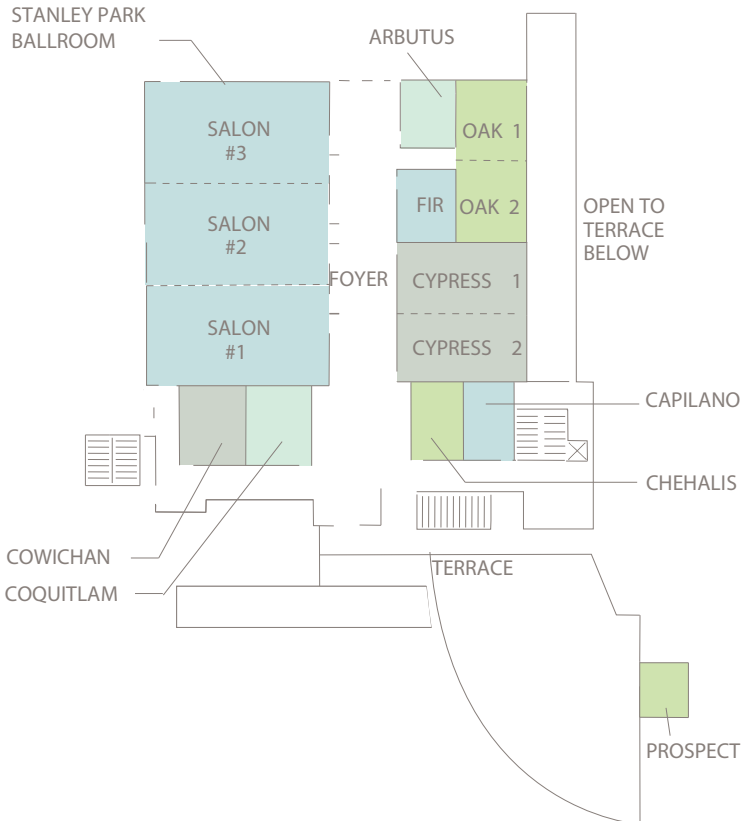


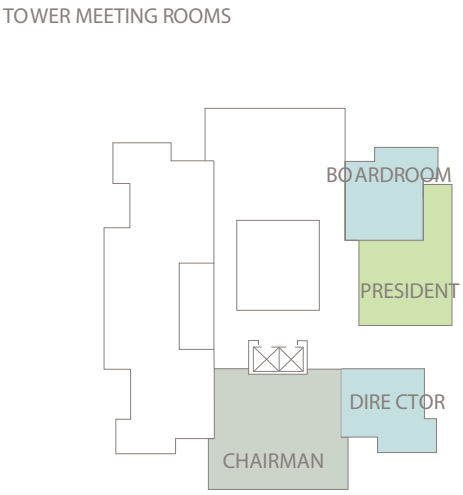
Legend

Bayshore Ballroom Salon ABC: Plenary sessions, Arctic Inspiration Prize Ceremony, Banquet and 'People of a Feather' documentary presentation
Bayshore Ballroom Salon EF: Posters
Bayshore Ballroom Salon D, Mackenzie, Seymour and Marine: Topical sessions
Thompson: Media Room

The Westin Bayshore

Second floor





Legend

Stanley Park Ballroom: Lunch and Topical Sessions
Cowichan: Speaker Ready Room

Breakfast Options

Starbucks: In hotel lobby
Blue Tree Café: 551 Cardero St. (corner of Bayshore Drive)
White Spot: 1616 West Georgia St. (between Bidwell and Cardero St.)
Café Villagio: 1506 Coal Harbour Quay (between Cardero and Nicola)
De Dutch Pannekoek House: 1725 Robson St. (between Denman and Bidwell St.)