Programme

Annual Scientific Meeting

2007

Réunion scientifique annuelle

11-14/12/2007, Collingwood, ON
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<th>Time</th>
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<tbody>
<tr>
<td>6:30</td>
<td>Breakfast in Georgian Bay Ballroom</td>
</tr>
<tr>
<td>7:30</td>
<td>Registration in Atrium</td>
</tr>
<tr>
<td>8:30</td>
<td>Amandine Lapoussière: Objectives and agenda of Student day</td>
</tr>
<tr>
<td>8:35</td>
<td>Louis Fortier: Opening Remarks from the ArcticNet Scientific Director</td>
</tr>
<tr>
<td>8:45</td>
<td>Dany Dumont: Overview of ASA 2007 Achievements</td>
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<tr>
<td>8:55</td>
<td>Duane Smith: Address from our Inuit Partners</td>
</tr>
<tr>
<td>9:10</td>
<td>David Anderson: The Challenges of Linking Science and Public Policy</td>
</tr>
<tr>
<td>10:10</td>
<td>Break</td>
</tr>
<tr>
<td>10:30</td>
<td>Stéphane Thanassekos: Modeling Cod Larvae</td>
</tr>
<tr>
<td>10:45</td>
<td>Angela Pacey: <em>H. pylori</em> Infection and Anemia in Inuit children in Nunavut</td>
</tr>
<tr>
<td>11:00</td>
<td>Anne-Marie Lévesque: Climatic Events, Public Safety and Town Planning in Salluit</td>
</tr>
<tr>
<td>11:15</td>
<td>Laura McKinnon: Trophic Interactions Effects on Arctic Insectivores</td>
</tr>
<tr>
<td>11:30</td>
<td>Martina Tyrrel: Finding Common Ground in the Co-management of Arctic Species</td>
</tr>
<tr>
<td>12:00</td>
<td>Lunch with Board members in Georgian Bay Ballroom</td>
</tr>
<tr>
<td>13:30</td>
<td>Sonja Ostertag: Introducing Break-out Sessions</td>
</tr>
<tr>
<td>13:40</td>
<td>C. Barnard, P. Yoon: Data Management (Huron Room)</td>
</tr>
<tr>
<td>13:40</td>
<td>R. Shearer, L. Braithwaite: Designing a Dynamic Research Proposal (Huron Room)</td>
</tr>
<tr>
<td>13:40</td>
<td>R. Gislason &amp; I. Turcotte: Education, Communication and Outreach (Reflections Room)</td>
</tr>
<tr>
<td>13:40</td>
<td>M. McKenna and Inuit Research Advisors: Northern Training and Involvement (Nipissing Room)</td>
</tr>
<tr>
<td>15:15</td>
<td>Break</td>
</tr>
<tr>
<td>15:30</td>
<td>Jane Kirk: NCE Trainee Association</td>
</tr>
<tr>
<td>15:40</td>
<td>Isabelle Turcotte: IPY-CYSC and ArcticNet: Building the Legacy</td>
</tr>
<tr>
<td>15:50</td>
<td>Jackie Grom, Julie Veillette, Gabrielle Gascon: ArcticNet Training Fund: International Summer School on High Northern Latitude Climate in St-Petersburg, Russia</td>
</tr>
<tr>
<td>16:00</td>
<td>ASA General Assembly</td>
</tr>
<tr>
<td>17:00</td>
<td>ASM2007 Registration Icebreaker in Atrium (Cash bar)</td>
</tr>
</tbody>
</table>
### Wed, Dec 12: ArcticNet Annual Scientific Meeting

**Venue:** Village at Blue Mountain Conference Centre

**6:30 - 8:30**
- **Breakfast in Georgian Bay Ballroom**

**7:30 - 9:30**
- **Registration in Atrium - Room: Huron Grand Ballroom I & II**
- **8:30 - 8:35** Martin Fortier
- **8:35 - 8:50** Louis Fortier
- **8:50 - 9:10** Yves Gratton
- **9:10 - 9:30** Warwick Vincent
- **9:30 - 9:50** Tim Papakyriakou
- **9:50 - 10:10** Gordon McBean

**10:10 - 10:40**
- **Break**

**10:40 - 10:45**
- Bernie Boucher

**10:45 - 10:50**
- Duane Smith

**10:50 - 11:05**
- Jean-Claude Gavrel

**11:05 - 11:20**
- Scott Lamoureux

**11:20 - 11:35**
- Catherine Lalande

**11:35 - 11:55**
- Grace Egeland

**11:55 - 12:00**
- Question Period

**12:00 - 13:30**
- **Lunch in Georgian Bay Ballroom**

**13:30 - 13:45**
- Doug Bancroft

**13:45 - 14:00**
- John Hughes Clarke

**14:00 - 14:15**
- Michael Byers

**14:15 - 14:30**
- Luc Forand

**14:30 - 14:45**
- Duane Smith

**14:45 - 15:15**
- Question Period

**15:15 - 15:45**
- **Break**

**15:45 - 16:00**
- Jason Prno

**16:00 - 16:15**
- Brent Wootton

**16:15 - 16:30**
- Sonia Hachem

**Room: Huron Grand Ballroom III & IV**

**17:00 - 19:00**
- **Poster Session 1 (With Snacks and Cash Bar)**

**19:00 - 21:00**
- **Diner on your own**
### Thursday, December 13
**ArcticNet Annual Scientific Meeting**  
**Village at Blue Mountain Conference Centre**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>6:30</td>
<td>Breakfast in Georgian Bay Ballroom</td>
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#### Room: Huron Grand Ballroom I & II

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
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<tbody>
<tr>
<td>9:00</td>
<td>Sarah Finkelstein</td>
<td>Contrasting Ecological Response to Climatic Warming in Arctic Lakes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with Low and High Diatom Biodiversity</td>
</tr>
<tr>
<td>9:15</td>
<td>Joëlle Taillon</td>
<td>The Migratory Caribou of Northern Quebec-Labrador: Factors Affecting</td>
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<td></td>
<td></td>
<td>the Body Condition of Female-Calf Pairs in Two Herds of Different</td>
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<td></td>
<td></td>
<td>Population Sizes</td>
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<tr>
<td>9:30</td>
<td>Dominique St-Hilaire</td>
<td>Arctic Coastal Dynamics under Changing Relative Sea-Level and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environmental Forcing</td>
</tr>
<tr>
<td>9:45</td>
<td>Emilie Counil</td>
<td>Trans-Polar-Fat: 1. Distribution and Health Implications of Trans-Fatty</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acids in Two Inuit Populations.</td>
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<tr>
<td>10:00</td>
<td>Question Period</td>
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<tr>
<td>10:15</td>
<td>Break</td>
<td></td>
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<tr>
<td>10:45</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>11:00</td>
<td>Simon Prinsenberg</td>
<td>Arctic Ocean and CAA Circulations in Global Ocean-Ice Modeling</td>
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<tr>
<td>11:15</td>
<td>Feiyue Wang</td>
<td>Toward a Mercury Mass Balance Model in Beaufort Sea: What Caused the</td>
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<td></td>
<td>Mercury Pollution in Beaufort Beluga Whales?</td>
</tr>
<tr>
<td>11:30</td>
<td>Frank Duerden</td>
<td>Community Vulnerability in the Canadian Arctic: From Assessment to</td>
</tr>
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<td>Action</td>
</tr>
<tr>
<td>11:45</td>
<td>Judith Alain</td>
<td>Climate Change and Country Food Security in Nunavik: A Video Documentary</td>
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<tr>
<td></td>
<td></td>
<td>of Inuit and Scientific Perspectives</td>
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<tr>
<td>12:00</td>
<td>Lunch in Georgian Bay Ballroom</td>
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<tr>
<td>12:45</td>
<td>Break</td>
<td></td>
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<tr>
<td>13:30</td>
<td>Ronald Stewart</td>
<td>Hazardous Weather Conditions in Nunavut</td>
</tr>
<tr>
<td>13:45</td>
<td>Gita Laidler</td>
<td>Inuit Knowledge in the Management and Research Activities of Auyuittuq</td>
</tr>
<tr>
<td>14:00</td>
<td>Charles Hannah</td>
<td>Polynyas and Tidal Currents in the Canadian Arctic Archipelago</td>
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<tr>
<td>14:00</td>
<td>Joel Heath</td>
<td>Trade-Offs Between Short Term and Long Term Processes Influence the</td>
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<td>Ability of Wintering Eiders to Adjust to Environmental Changes in Sea</td>
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<td>Ice Habitats</td>
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<tr>
<td>14:30</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>15:00</td>
<td>Kathleen Fisher</td>
<td>An update from the IPY Federal Program Office</td>
</tr>
<tr>
<td>15:15</td>
<td>David Hik</td>
<td>Sustaining Arctic Observing Networks (SAON) as a Legacy of the</td>
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<tr>
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<td></td>
<td>International Polar Year (IPY)</td>
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<tr>
<td>15:30</td>
<td>Russel Shearer</td>
<td>Canada’s plans for a High Arctic Research Station</td>
</tr>
<tr>
<td>15:45</td>
<td>Marty Bergmann</td>
<td>Polar Continental Shelf Project’s 50th Anniversary: Where Do We Go</td>
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<td></td>
<td></td>
<td>from Here?</td>
</tr>
<tr>
<td>16:00</td>
<td>Tom Hutchinson</td>
<td>Study of Infrastructure and Logistics in Support of Northern Research</td>
</tr>
<tr>
<td>16:15</td>
<td>Question Period</td>
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#### Room: Huron Grand Ballroom III & IV

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>16:30</td>
<td>Poster Session 2 (With Snacks and Cash Bar)</td>
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#### Room: Kandahar Foyer & Weider Room, Blue Mountain Inn

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>19:00</td>
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<td>19:30</td>
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<tr>
<td>22:30</td>
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</table>

<table>
<thead>
<tr>
<th>Event</th>
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<tbody>
<tr>
<td>Banquet Dinner Cocktail (Cash bar)</td>
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<tr>
<td>Banquet Dinner with Guest Speaker Canadian Astronaut Dave Williams</td>
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<tr>
<td>Student Poster Award Ceremony</td>
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</tbody>
</table>
**FRIDAY, DECEMBER 14**  
ArcticNet Annual Scientific Meeting  
Village at Blue Mountain Conference Centre

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>6:30</td>
<td>Breakfast in Georgian Bay Ballroom</td>
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**Room: Huron Grand Ballroom I & II**

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>9:00</td>
<td>Konstantia Koutouki</td>
<td>Inuit Perceptions of the Ability of Land Claims Agreements to Aid Adaptation to Climate Change</td>
</tr>
<tr>
<td>9:15</td>
<td>Jim Hamilton</td>
<td>Measuring Volume, Freshwater and Heat Transports Through Lancaster Sound</td>
</tr>
<tr>
<td>9:45</td>
<td>Scott Heyes</td>
<td>Diminishing Knowledge: Inuit Nomenclature of the Land-Water Interface</td>
</tr>
<tr>
<td>9:45</td>
<td>10:00</td>
<td>Question Period</td>
</tr>
<tr>
<td>10:00</td>
<td>10:30</td>
<td>Break</td>
</tr>
<tr>
<td>10:30</td>
<td>Tom Sheldon</td>
<td>Assessing Ecosystem Recovery from a Local Historical PCB Source in a Northern Marine Environment: A Living Case Study</td>
</tr>
<tr>
<td>10:45</td>
<td>Kathleen Parewick</td>
<td>Things Change, We Change: Community Adaptation Dynamics</td>
</tr>
<tr>
<td>11:00</td>
<td>Zhuo Liu</td>
<td>Evaluation of Gem-Lam over Southern Baffin Island</td>
</tr>
<tr>
<td>11:15</td>
<td>Greg McCullough</td>
<td>The Development and Dispersal of the Nelson-Hayes Estuary Sediment and CDOM Plumes in Hudson Bay</td>
</tr>
<tr>
<td>11:30</td>
<td>12:00</td>
<td>Question Period and hotel check-out</td>
</tr>
<tr>
<td>12:00</td>
<td>13:30</td>
<td>Lunch in Georgian Bay Ballroom</td>
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**PLENARY SESSION: ENTERING ARCTICNET PHASE II**

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
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<tbody>
<tr>
<td>13:30</td>
<td>Louis Fortier</td>
<td>Entering ArcticNet Phase II: Building on Research Excellence</td>
</tr>
<tr>
<td>14:00</td>
<td>Jay Anderson</td>
<td>The ArcticNet Iris Modelling Scenarios (Aims) Database - Where Do we Go from Here?</td>
</tr>
<tr>
<td>14:15</td>
<td>Michel Allard</td>
<td>Initiating the Eastern Sub-Arctic IRIS Approach</td>
</tr>
<tr>
<td>14:30</td>
<td></td>
<td>Question Period</td>
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<tr>
<td>15:00</td>
<td></td>
<td>Meeting adjourns</td>
</tr>
<tr>
<td>16:00</td>
<td></td>
<td>Departure of complimentary buses to Toronto Pearson Airport (Registered passengers only)</td>
</tr>
</tbody>
</table>
STUDENT DAY TALKS
Listed in alphabetical order of contributing author
A REVIEW OF THE ARCTICNET TRAINING FUND AND THE OPPORTUNITY TO ATTEND THE INTERNATIONAL SUMMER SCHOOL ON HIGH NORTHERN LATITUDE CLIMATE IN ST. PETERSBURG, RUSSIA

Grom, Jackie¹ (jackie.grom@mail.mcgill.ca), Gabrielle Gascon² and Julie Veillette³

¹Department of Geography, McGill University, Montreal, Quebec H3A 2K6
²Department of Atmospheric and Oceanic Sciences, McGill University, Montreal, Quebec H3A 2K6
³Département de biologie, Université Laval, Québec, Québec G1V 0A6

ArcticNet provides compensation for student members to attend national and international field schools, courses, and institutes through the ArcticNet Training Fund. Each year, up to $40,000 is available for students through two competitions; allocated awards cover 75% of the participation costs up to $5,000 per student. This September, four ArcticNet student members received support through this fund to attend the International Summer School on High Northern Latitude Climate, held at St. Petersburg State University in Russia. The conference covered several topics pertaining to the Arctic, such as the 2007 IPCC assessment, statistical data analysis, thermohaline circulation and sea ice modeling, and polar atmospheric boundary layers. Students attending the school were from Russia, Finland, Slovenia, Scotland, Norway, the United States, and Canada, and as such, the school offered a unique opportunity for students to share and be exposed to research on an international scale. This presentation will review the process of applying for the ArcticNet training fund in addition to the opportunity that was awarded to students attending the International Summer School on High Northern Latitude Climate.

SALLUIT: ANALYSIS OF SIGNIFICANT CLIMATIC EVENTS RELEVANT TO PUBLIC SAFETY AND TOWN PLANNING AND ASSESSMENT OF THEIR FUTURE FREQUENCY AND INTENSITY

Lévesque, Anne Marie (anne-marie.levesque.4@ulaval.ca) and M. Allard

Department of Geography, Université Laval, Québec, Québec G1K 7P4

Located at the northern extremity of Nunavik, Salluit is a community which is particularly exposed to the rigours of the arctic climate as well as the impacts of climate change because of the ground the village is built on, which is particularly sensitive to warming and melting, and also, because of its location. Situated in the Sugluk Fjord, on the southern shore of the Hudson Strait, it must deal with the complex dynamics of winds, ice, currents and fog. Located at the bottom of a valley, the village is only partially protected from the strong winds which sometimes descend from the high plateaus of the Ungava Peninsula. Consequently, serious incidents related to public safety occurred in the area and important questions regarding housing and infrastructure stability were put forward. The Canadian and international climatic models suggest that climate change will be amplified in the polar regions which thus entails important physical, ecological and economic repercussions. Several models predict important modifications in terms of the frequency, intensity and geographical distribution of climatic events. Reality in Nunavik is already alarming and as it is observed that the climate is changing quickly in this area, it becomes imperative to provide to the decision makers and the community the necessary information to work out adaptive strategies and measures. In this perspective, climatic events were targeted according to their bearing on town planning and public safety (episodes of violent winds, particularly warm spells, etc.) Interviews were carried out with members of the community in order to identify their main concerns regarding the climate. A thorough analysis of the hourly data obtained from the weather stations installed in 2002 in Salluit was carried out in order to study the frequency and the intensity of these significant events. In order to substantiate the data, any additional relevant and accessible source of

TROUBLE IN THE TUNDRA: HOW CLIMATE CHANGE IS AFFECTING NORTHERN LANDSCAPES

Hudson, James (jmghudson@gmail.com)

Department of Geography, University of British Columbia, 1984 West Mall, Vancouver BC, V6T 1Z2

Climate change is affecting tundra ecosystems across the circumpolar arctic. It is critical that we understand and predict these responses because changes to tundra ecosystems may affect biogeochemical cycling and future climates. The International Tundra Experiment (ITEX), a network of more than 20 polar and alpine sites around the world, is attempting to advance this understanding by conducting small-scale, simulated climate change experiments. ITEX examines plant-, community- and ecosystem-level responses. The primary ITEX site is located in the Canadian High Arctic at Alexandra Fiord, Ellesmere Island. Over the past thirty years, the site has experienced significant changes in climatic conditions. A series of long-term, community-level analyses of tundra responses to experimental climate change at Alexandra Fiord, as well as the subsequent implications for northern ecosystems, will be presented.
information was utilized (climatic data from the local weather station located at the airport of Salluit, articles of newspapers, filed incident reports, etc.) Furthermore, scenarios from the Canadian Regional Climate Models (CRCM) of Ouranos were used in order to estimate the future frequency and intensity of these events. Hence, this research project follows a new approach which acknowledges the importance of combining both social and physical sciences. At this point, it is of primary importance to study the impacts of climate change at a community scale rather than a regional one and, especially, to consult and inform those directly concerned. Indeed, an important component of this project is to share information and communicate the results to the community. Finally, it is hoped that this project will allow the community to be more aware of its sensitivity to the changes of the climate, to revise its emergency measures, to evaluate the potential risks, to support its claims concerning public safety and town planning to the governmental authorities and to implement adaptive measures.

**ARCTIC INSECTIVORES: POTENTIAL EFFECTS OF CLIMATE CHANGE VIA DIRECT AND INDIRECT TROPHIC INTERACTIONS**

McKinnon, Laura¹ (lauramckinnon3@gmail.com), Joël Béty² and G. Gauthier²

¹Département de biologie et Centre d’études nordiques, Université du Québec à Rimouski, 300 Allée des Ursulines, Rimouski, PQ G5L 3A1
²Département de biologie et Centre d’études nordiques, Pav. Vachon, Université Laval, Québec QC, G1K 7P4

Predicting the effects of climate change on wildlife populations is highly complex because population dynamics can be influenced by both direct and indirect effects of climate, usually through interactions with other species (trophic interactions). Direct correlations between climatic variables and breeding parameters, although informative, cannot provide the same level of mechanistic insight as an ecosystem approach which considers the effects of trophic interactions. Terrestrial arctic ecosystems are relatively simple, offering a good natural laboratory to examine both direct and indirect trophic interactions in the context of a changing climate. Arctic insectivores form one of the most diverse components of the arctic avifauna and are highly susceptible to changes in climate, due to their dependence on temperature-controlled arthropod resources and their vulnerability to various predators. Here we take an ecosystem approach to examine how weather conditions and trophic interactions affect breeding parameters in arctic insectivores and how these interactions may be affected by future climate changes. An intensive survey and monitoring of breeding shorebirds (2005-2007) and songbirds (1995-2007) was conducted on Bylot Island (Sirmilik National Park, Nunavut). Data on breeding parameters (breeding phenology and success) of White-rumped Sandpipers (Calidris fuscicollis), Baird’s Sandpipers (Calidris bairdii) and Lapland Longspurs (Calcarius lapponicus) were collected, in addition to data on resource availability (seasonal abundance of insects), predation pressure (estimated using artificial nests), alternative prey availability (lemming and goose abundance) and local weather variables. In 2005 and 2006, seasonal trends in daily temperature were similar, with mean daily temperature remaining above 0°C after the first week of June, slowly rising to a peak in early July (July 9, 11.2°C in 2005; July 15, 11.5°C in 2006). Peak insect abundance occurred within 5 days of the peak temperature each year and median hatch dates of sandpipers occurred slightly prior to peak insect abundance in both years. Nest success for real and artificial nests was higher when lemmings were more abundant, reflecting an indirect interaction between prey species through shared predators. The only recorded shorebird nest predator was the arctic fox (Alopex lagopus). It is clear that both direct and indirect trophic interactions are important factors affecting the reproductive output of insectivores. These trophic interactions are likely to be affected by climate change (e.g. abundance of insects is highly correlated with temperature and lemming population fluctuations may be influenced by winter snow cover conditions). To further understand how climate change may affect trophic interactions involving arctic insectivores, we will experimentally investigate the effects of snow cover on arthropod and lemming populations and subsequently estimate the potential indirect effects on arctic insectivores.

**HELCOBACTER PYLORI INFECTION AND IRON DEFICIENCY ANEMIA IN INUIT PRE-SCHOOL CHILDREN LIVING IN NUNAVUT**

Pacey, Angela¹ (angela.pacey@mail.mcgill.ca), Nancy Fara², Donna Leggee² and Grace Egeland²

¹School of Dietetics and Human and Nutrition, McGill University, MacDonald Campus, Ste-Anne-de-Bellevue, Québec H2V 3X9
²Centre for Indigenous Peoples’ Nutrition and Environment, McGill University, MacDonald Campus, Ste-Anne-de-Bellevue, Québec H2V 3X9

Traditional Inuit diets are changing due to social factors and environmental change. Certain factors, such as H. pylori infection, may diminish resiliency to dietary changes among Inuit of Nunavut. Decreased consumption of iron rich foods, such as Inuit country food is among these changes. Low dietary iron consumption can result in iron deficiency and iron deficiency anemia which is particularly
concerning for children because it is related to poor cognitive functioning, poor school performance and growth delay. The prevalence of iron deficiency anemia among Inuit children is likely high since it ranges from 11-35% for Aboriginal Canadian children compared to 3-7% for non-Aboriginal Canadian children. Iron deficiency anemia has yet to be estimated for Inuit children in Nunavut. To complete the picture of iron deficiency among Inuit children, potential causes must also be considered. While diet is one of the main factors, children’s resiliency to iron deficiency may be further diminished due to high exposure to the human pathogen Helicobacter pylori (H. pylori). H. pylori is most commonly associated with causing stomach ulcers and gastric cancer in adulthood, but evidence has emerged that H. pylori is associated with iron deficiency anemia in children. Possible explanations for the relationship between H. pylori and IDA include the bacteria causing reduced gastric acidity and iron malabsorption. As well, H. pylori may compete for iron in the stomach, since it requires iron for its own growth. Inuit children are at greater risk for H. pylori infection at a young age because they are likely more exposed to the main risk factors for infection including crowded living conditions and poor sanitation. The assessment of iron deficiency, consumption of iron-rich food and H. pylori infection is a component of the broader IPY funded child component of the Inuit Health Survey taking place in 2007 in Baffin and Kivalliq regions of Nunavut. Venous blood will be collected from 250 preschool children, ages 3-5. The prevalence of H. pylori infection will be estimated by measuring antibodies to the pathogen in the plasma. The prevalence of iron deficiency will also be estimated by measuring serum ferritin, serum transferrin receptor and hemoglobin in plasma from venous blood. The children’s consumption of iron-rich country and market foods will be looked at using data from 24-hour recalls, Food Frequency Questionnaires for country and market food and repeat 24-hour recalls on a sub-sample of children. The broader relationship between dietary iron consumption, H. pylori infection and iron deficiency will be examined. Potential risk factors for iron deficiency and H. pylori infection, such as household living conditions and food insecurity, will also be investigated.

LARVAL ARCTIC COD
MODELLING GROWTH AND SURVIVAL OF LARVAL ARCTIC COD

Thanassekos, Stéphane (stephane.thanassekos.1@ulaval.ca), F. Dupont et L. Fortier
Québec Océan, Pavillon Alexandre-Vachon, Laval University

The Arctic cod, Boreogadus saida, affect an estimated 93% of the energy transfer between zooplankton and upper trophic levels in the Arctic marine food web. Year-class strength and the overall abundance of Arctic cod populations depends largely on the survival of the larval and juvenile stages which, in turn, depend on biotic (prey and predator abundance) and abiotic factors (sea-ice, temperature). The on-going regression of the ice cover in Artic seas is expected to impact severely the population dynamics of Arctic cod and other ice-dependent hyper-specialists. We developed a numerical Individual-based model of the early life of Arctic cod larvae with the objective of exploring survival and growth under various climate scenarios for spatial scales ranging from the regional (e.g. the North Water polynya) to the hemispheric (pan-Arctic regime shifts).

The central equation of the model calculates growth based on the metabolic balance between energetic gains (by consumption) and losses (e.g. by respiration and excretion). A negative balance eventually leads to death by starvation and increases vulnerability to predators. Temperature limits metabolic processes, thereby affecting growth efficiency. A preliminary predation module mimics the impact of a piscivorous fish on Arctic cod larval survival. In order to generate a heterogeneous population, stochasticity is added to parameters such as the daily intake of prey, based on variance reported in the literature. The model correctly reproduces the increased survival of fast-growing individuals. Growth calculation is validated by comparison with age-length distributions sampled in three regions of the Arctic Ocean (Beaufort Sea, North Water, and Northeast Water). Model results indicate that larval growth is limited primarily by prey consumption and/or foraging costs in the field. The off-line coupling of the biological model with a physical model of ocean circulation in the Canadian Arctic (F. Dupont) allows tracking the trajectories of the larvae in a Lagrangian framework. The first bio-physical simulations suggest superior growth and survival in known nursery areas of the species such as the Amundsen Gulf and Baffin Bay.

THE CANADIAN YOUTH STEERING COMMITTEE FOR THE INTERNATIONAL POLAR YEAR AND ARCTICNET: BUILDING THE LEGACY

Turcotte, Isabelle1,2 (isabelle.turcotte@ualberta.ca) et Alexis Schafer1,3

1IPY Canadian Youth Steering Committee Z-908 Biological Sciences University of Alberta Edmonton, AB, T6G 2E9 and ArcticNet
2Department of Renewable Resources, University of Alberta, Edmonton, AB
3Department of Soil Science, University of Saskatchewan, Saskatoon, SK
The International Polar Year (IPY) Canadian Youth Steering Committee (CYSC) is a group of highly motivated Canadian University students passionate about sustainability in the polar regions. The CYSC will create channels for northern youth to voice their concerns about the changes occurring in their regions, and provide them with educational initiatives and opportunities to address them. Also, the CYSC will aid northern youth in engaging directly in this IPY and help build the next generation of northern Canadian scientists and leaders. In the spirit of this IPY, the CYSC will exist as a group until March 2009 when the IPY ends as well. However, the legacy of the CYSC will continue after the IPY is over and initiatives should also continue to be promoted to carry a message about the importance of northern youth involvement into Canadian science and politics. ArcticNet has been chosen to collaborate with the CYSC efforts and to host its initiatives when the Committee dissolves. People, ideas and materials created during the IPY will have a strong and stable home for the future. For the ArcticNet 2007 annual meeting, we intend to present progress and future initiatives such as grassroots involvement and funding, contests, collaboration with partners at the national level, and many other ideas to bear fruit within the IPY time frame. We will also highlight the collaborative work with ArcticNet and propose a plan for eventual transition of the CYSC mandate to be adopted under the ArcticNet organization by 2009.

AT THE INTERSTICES OF KNOWLEDGE: FINDING COMMON GROUND IN THE CO-MANAGEMENT OF ARCTIC SPECIES

Tyrrell, Martina (mt443@cam.ac.uk)

Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge, CB2 1ER, United Kingdom

Social science scholarship on the topic of wildlife co-management and traditional ecological knowledge has, for the most part, emphasised the differences between non-indigenous/Western and indigenous knowledge systems and world-views. Some scholarship has been critical of attempts to extract indigenous knowledge from its deeper cultural contexts in order to render it useful and accessible to wildlife scientists and management practitioners, while other scholarship has sought to find ways to make both knowledge systems more mutually accessible. Emerging from this literature is a sense that, with regard to the management and care of wildlife and environment, there exists two distinct and, for the most part, mutually exclusive and conflicting ways of knowing and understanding the world. And, in each case, these two knowledge systems are possessed by two distinct groups of people – indigenous northerners and non-indigenous scientists/managers. It is easy to imagine the mutual spatial and philosophical isolation of these two groups – indigenous peoples, living their lives in their northern environments, and scientists and policy-makers making their living in the conference rooms and laboratories of government departments and universities. And when the two groups occasionally meet, conflict and misunderstanding are par for the course. In reifying knowledge and practice it becomes easy to reify the lives of individual people. In order to render co-management more successful I suggest that we do not, in fact, need to find ways to make these two knowledge systems more mutually accessible. There are already many instance across the North where mutual understanding and common goals already exist in the semi-formal and informal contexts where indigenous resource-users and non-indigenous wildlife scientist/managers meet. I refer to these spaces and places as the interstices of knowledge – those fluid boundaries where beliefs and understandings ebb and flow and rush together, muddying the waters, and infusing old ideas with new. It is at these fluid boundaries, where indigenous and scientific knowledge systems can and do speak to each other, that the greatest potential exists for the successful co-management of species and ecosystems. However, the continuing power imbalances and cultural misunderstandings at the heart of many formal co-management contexts continue to prevent this knowledge, understanding and trust from influencing co-management decisions. In order for the co-management of wildlife and ecosystems to be successful and acceptable to all, we must begin to pay attention to and build upon those spaces and places at the interstices of knowledge where meaningful collaboration and knowledge-sharing are already taking place, and find ways to incorporate these informal arrangements into formal policy and management practice.
ANNUAL MEETING TALKS
Listed in alphabetical order of contributing author
This 13 minute DVD presents a short documentary on the topics of climate change, resource access and country food security in Nunavik. Its aim is to communicate and disseminate information on the issues of climate change and country food security to Nunavik community residents of all ages and specifically to students, active and future harvesters as well as municipal decision-makers. It draws upon perspectives from both scientific as well as Inuit experts. In it, Dr. Louis Fortier, Scientific Director of ArcticNet explains the current climate situation in the Arctic as well as the current and future impacts for Inuit coastal communities. Dr. Eric Dewailly, Director of the Nasivvik Centre and Scientific Co-Director of the Nunavik Inuit Health Survey for the Quebec Public Health Institute discusses some of the key factors impacting Inuit country food and Inuit health in the region. These views from science are then complemented with Inuit perspectives from the villages of Umiujaq and Kangiqsualujjuaq, Nunavik. These two communities have a high level of participation in traditional and subsistence harvesting activities and it is these activities, which are reported to currently be under stress from various forms of local environmental change. This documentary project was conducted in collaboration with the community researchers from the Renewable Resources Department of the Kativik Regional Government and residents of the two participating communities. The video includes samples of ArcticNet funded research that has been conducted in the communities, interviews with local representatives/experts, and footage from an elders workshop on this topic held in the fall of 2006. These personal perspectives are complemented with interviews and footage of the local communities and beautiful surrounding environments. The project has been conducted in cooperation with, and through the generous support and participation of the communities of Kangiqsualujjuaq and Umiujaq, Nunavik, the Nasivvik Center – Laval University, Trent University, ArcticNet – Network of Centres of Excellence, and the Renewable Resources Department, Kativik Regional Government. Special thanks to The National Film Board of Canada.

THE ARCTICNET IRIS MODELLING SCENARIOS (AIMS) DATABASE - WHERE DO WE GO FROM HERE

Anderson, Jay (jander@cc.umanitoba.ca) and David Barber

Centre for Earth Observation Science 460 Wallace Building, University of Manitoba 125 Dafoe Avenue Winnipeg, MB R3T 2N2

One method of achieving the scientific integration promised by the IRIS concept is to provide a framework on which dissimilar studies can meet and share to contribute to a holistic resolution of scientific questions. This objective is one of the goals of Project 4.1 - to link the measurements and research conducted across the various themes to each other by the use of numerical models. Such models integrate the present state of knowledge and provide a window into the future. But models can also play a broader non-research role - when displayed as maps and charts, they can pass the knowledge gained to the public forum, where it can be used in teaching, debate, and policy development. The development of models, and access to model results and datasets will become increasingly important as the ArcticNet experiment grows into the IRIS framework and begins to affect public policy. Models of the present state of the physical side of the environment - the cryosphere, ocean, land, and atmosphere - can be projected into the future and used as a framework for the study of biological and social structures in years to come. As such, they have value beyond the focus of the research projects for which they were constructed. The AIMS project is now collecting data from Environment Canada’s GEM model and has a 16-month archive of meteorological information. We are now at the stage where modelling experiments funded within the ArcticNet umbrella are producing valuable outputs that should be collected and opened to other IRISs and eventually to the Canadian public. The AIMS database project comes with several challenges that can only be addressed by the larger ArcticNet community: - What data are of most interest to non-modelling researchers within ArcticNet? - Are these data available from the numerical modellers? - Can the model data be archived and shared equitably? - Can some part of the datasets be shared with the public? Project 4.1 envisages a data-distribution Web site in which geocoded ASCII data are made available to the science community. We imagine a site where 3-D maps can be constructed on the fly and where large and small datasets can be accessed through an uncomplicated menu system. Such a resource should promote additional collaborations between IRISs and extend the utility of the numerical datasets beyond their mathematical borders. This presentation will address the questions outlined above and outline some of the challenges and successes of model integration.
POLAR CONTINENTAL SHELF PROJECT’S 50-YEAR ANNIVERSARY: WHERE DO WE GO FROM HERE?

Bergman, Marty (mbergman@NRCan.gc.ca)

Polar Continental Shelf Project, Natural Resources Canada, 615 Booth Street, Room 487 ON K1A 0E9

The Polar Continental Shelf Project (PCSP) will be celebrating its 50th anniversary in May, 2008. It is the view of many Canadian researchers and experts that current resources are not sufficient to respond to the increasing scientific demand for logistic support in the Arctic. Throughout the Arctic, with a focus on the High Arctic, the Polar Continental Shelf Project currently delivers about $10M per year in logistical support, primarily for Canadian researchers in all disciplines of science. Co-located with the community of Resolute Bay of about 220 residents, PCSP maintains a facility at Resolute on Cornwallis Island, at the geographic centre of the Canadian Northwest Passage. Resolute Bay has long been recognized as a strategic location for Arctic logistic support and military activities. PCSP currently provides logistics support about 400 scientists conducting over more than 130 research projects throughout the Arctic. The average distribution of support over the past decade is about 42% university researchers, 43% other federal department, 10% territorial government and 5% northern land claims organizations. Presently, greater than 90% of projects supported by PCSP are located outside of the northern communities reaching remote areas throughout the Canadian Arctic landscape. In addition to the support provided directly to these organizations, PCSP manages many more research projects on a cost recovery basis related to national priority activities such as UNCLOS and IPY. Building on the long standing and excellent reputation of PCSP as a cost efficient logistics provider, we are discussing with our partners ways to rejuvenate PCSP. The “Polar Shelf Canada” is an essential infrastructure element to support the priority research and information objectives of the government of Canada in the remote arctic areas of Canada’s north. Polar Shelf Canada will build stronger on-going links to granting councils and organizations (such as: NSERC, SSHRC, CIHR), universities, university associations (ACUNS), northern organizations, communities and governments, and various Federal departments.

CANADA’S ARCTIC WATERS IN DIPLOMACY AND INTERNATIONAL LAW

Byers, Michael (michael.byers@ubc.ca)

Liu Institute for Global Issues, University of British Columbia, 6476 N.W. Marine Drive, Vancouver, British Columbia, V6T 1Z2

The rapid loss of Arctic sea-ice is raising the prospect of international shipping through the Northwest Passage within decades, perhaps even years. This poses serious security and environmental risks to both Canada and the United States, and yet the two countries are locked in a diplomatic dispute with respect to the legal status of the waterway. In this paper, I argue that climate change, the end of the Cold War and the rise of global terrorism have altered the situation in such a way that the Canadian position—that the Northwest Passage constitutes Canadian internal waters subject to the full force of Canadian domestic law—actually coincides with the interests of the United States today. Interviews with officials from Canada, the United States and other countries support this analysis, as do historic precedents concerning the resolution of analogous disputes elsewhere.

TRANS-POLAR-FAT: 1. DISTRIBUTION AND HEALTH IMPLICATIONS OF TRANS-FATTY ACIDS IN TWO INUIT POPULATIONS.

Counil, Emilie1 (Emilie.Counil@crchul.ulaval.ca), Eric Dewailly1, Peter Bjerregaard2 and Pierre Julien3

1Public Health Research Unit, CHUL Research Centre, Quebec, Canada
2National Institute of Public Health, Copenhagen, Denmark
3Lipid Research Centre, CHUL Research Centre, Quebec, Canada

The Inuit diet is changing, a process bound to have great health implications and referred to as the «dietary transition». While omega-3 fatty acids (n3-FA) are indicative of the traditional consumption of marine mammals and fish, industrially produced trans-fatty acids (IP-TFA) are likely to be found in Arctic junk food. They actually confer practical qualities that are valuable to the food supply of remote communities. An innovative means of exploring the Inuit dietary transition thus lies in the assessment of the respective amounts of n3-FA and TFA in blood. These biomarkers may also be indicative of the ongoing Inuit health transition since those lipids exert opposite health effects. We present original trends regarding biological levels of omega-3- and trans-fatty acids (TFA) in two Inuit groups. Our data come from the baseline survey of the Inuit Health in Transition Study.
that was conducted in Nunavik and Greenland respectively in 2004 and 2005. People aged 18 and above were interviewed during the same 3-4 hour visit, went through paraclinical examinations and had a blood sample drawn. The fatty acid composition of phospholipids of red blood cell membranes was measured following the standard method currently used at the Québec Lipid Research Centre. Our results show that average omega-3 fatty acids levels are slightly lower in Nunavik (9.4±2.8%, n=888) as compared to Greenland (12.1±4.0%, n=528). In the meanwhile, mean TFA levels are on average thrice as high in Inuit people living in Nunavik (1.22±0.78%) as they are in Greenlanders (0.43±0.27%). Moreover, TFA decrease with age in Nunavik, the youngest being most exposed, while the Greenlanders show low levels of TFA that are homogeneous across age groups. The geographical differences observed regarding trans fats point to the importance of following across Nunavik and the entire circumpolar world the example of Denmark and Greenland which imposed a maximum content of 2g/100g fat on industrially produced trans-fats in 2003 (see abstract 2). Moreover, the trends towards being simultaneously more heavily exposed to TFA and eating less n3-FA as a young Inuit living in Nunavik call for broader actions to rehabilitate and recover access to country foods while improving accessibility and knowledge of healthy imported foods that are not part of the traditional diet. It is about time the prevention of the ‘junk food epidemic’ was considered as a public health priority in the Arctic. This will require strong food market policies, great nutritional education efforts, and a good sense of creativity to imagine a new Inuit diet, between tradition and modernity.

COMMUNITY VULNERABILITY IN THE CANADIAN ARCTIC: FROM ASSESSMENT TO ACTION

Duerden, Frank¹ (fduerden@ryerson.ca), T. Pearce² and J. Ford³

¹Department of Geography, Ryerson University, Toronto, Ontario M5B 2K3
²Global Environmental Change Group Department of Geography, University of Guelph, Guelph, Ontario N1G 2W1
³Postdoctoral Fellow, Dept. of Geography, McGill University, Montreal, Quebec, H3A 2K6

One of the main aims of community vulnerability research in the Arctic is to inform policy and assist adaptation to the inevitability of change. Over the past several years considerable research effort has focused on identifying community vulnerabilities to changing climate in the Arctic; this paper presents the next step in moving from identifying stresses and vulnerabilities, to establishing appropriate courses of action for strengthening the capacity of communities to deal with the affects of a changing environment. Drawing from our research in the Inuvialuit Settlement Region of the Western Arctic and review of published works for a range of Arctic communities – Arctic Bay, Igloolik, Cape Dorset, Pangnirtung, Sachs Harbour, Clyde River, etc. – two inter-related sets of vulnerabilities are examined: 1) those that arise as a direct consequence of a changing environment, and 2) those related to constraints within communities which inhibit ability to respond (e.g. low incomes, break-down of transmission of traditional knowledge (TK), limited human resource capacity), and courses of action to address these stresses are identified. We argue that responses lie at different scales with communities taking responsibility for addressing emerging problems of a local nature (e.g. trail management and TK education), and broader governments taking responsibility over larger scale initiatives (e.g. permafrost/infrastructure problems). Existing policies, procedures and decision making structures are examined and opportunities to mainstream climate change adaptation policy identified and critically reviewed.

INTERNATIONAL POLAR YEAR INUIT HEALTH SURVEY: HIGHLIGHTS OF 2007 AND UPDATES FOR 2008

Egeland, Grace M. (grace.egeland@mcgill.ca), H. Saudny-Unterberger, D. Leggee, I. Sobol, G. Osborne, G. Charbonneau, S. Bruneau, L. Williamson, E. Sheutapik and T.K. Young

CINE, McGill University, MacDonald Campus, 21,111 Lakeshore Rd, Ste.Anne-de-Bellevue, QC H9X 3V9

Health disparities provide insight into the magnitude of preventable disease between and within populations. Today, most health indicators suggest persistent health disparities between Inuit and other Canadian populations. Comprehensive and uniformly collected health indicators are not available for Inuit living in different jurisdictions. Also, a good deal of research usually involves a focus on a single etiologic factor or disease. International Polar Year funding with supplemental assistance from ArcticNet, CIHR, and NCP has made possible the first cohesive data collection of health indicators of randomly selected coastal communities throughout Nunavut, Inuvialuit, and Nunatsiavut. Many aspects of the adult survey have been designed to be compatible with the 2004 Nunavik Inuit Health Survey, and will thereby provide a comparable way of assessing health status for Canadian Inuit living in 4 jurisdictions. Furthermore, there will be opportunities for international comparisons and when indicated and when jurisdictions agree, selected data may be combined to evaluate conditions where small numbers may thwart
efforts to gain an understanding of contributory causes of illness in the Arctic. In August and September of 2007, the Nunavut Inuit Health Survey, “Qanuippitali” was successfully launched. The Nunavut Inuit Health Survey steering committee includes the Government of Nunavut, Nunavut Tunngavik Inc, and the Nunavut Association of Municipalities. Furthermore, six universities contribute their expertise to the IPY health survey research. Over 1,200 individuals from randomly selected households participated from a total of 18 communities in Kivalliq and Baffin Regions in August and September 2007. The study was made feasible by the CCGS Amundsen icebreaker and research vessel and by 100 Qanuippitali staff members including ship research crew, land teams, community research assistants, and drivers. While participants are now being informed on their own personal results, planning is underway for 2008 when Inuvialuit, Nunatsiavut and remaining Nunavut communities will be visited.

CONTRASTING ECOLOGICAL RESPONSE TO CLIMATIC WARMING IN ARCTIC LAKES WITH LOW AND HIGH DIATOM BIODIVERSITY

Finkelstein, Sarah¹ (Finkelstein@geog.utoronto.ca) and K. Gajewski²

¹Department of Geography, University of Toronto, 100 St George St., Room 5047, Toronto, Ontario, M5S 3G3
²Department of Geography, University of Ottawa, Simard Hall, Ottawa, Ontario, K1N 6N5

The protection of biodiversity is an important conservation goal but there remains a lack of information on the functional importance of biodiversity, particularly as this relates to responses to climatic change. As a consequence of the current warming climate, some lakes and ponds in the Arctic are experiencing increases in diatom biodiversity, as well as increases in diatom production and changes in community composition. Since algae form the basis of aquatic food webs, such changes in the structure of algal communities could affect the function of aquatic ecosystems as a whole in the Arctic. Arctic lakes vary in their responses to recent and paleoclimate changes, with some lakes displaying relatively large increases in algal biodiversity, and more significant changes in community composition, while other lakes show lesser response. It has been hypothesized that biodiversity provides “insurance” in the face of environmental change; thus lakes with more diverse diatom assemblages should display less significant changes in response to warming. Paleolimnological records from two lakes in the Prince of Wales group of islands in the central Canadian Arctic were used to test this hypothesis. The two lakes are separated by approximately 100 km, and experience similar climates, however ecological responses to climatic warming differ significantly between the two lakes. Lake PW03 (73.12°N; 96.68°W) is situated on the coast of Prescott Island, on crystalline rocks of the Canadian Shield, and is relatively acidic. Modern and fossil diatom assemblages in Lake PW03 display higher species richness and evenness than average for Arctic lakes. Lake PW02 (74.07°N; 97.77°W), by contrast, is situated on the carbonate-containing conglomerate of eastern Russell Island, and is more alkaline. Modern and fossil diatom assemblages in Lake PW02 have lower diversity relative to Lake PW03 and are >80% dominated by the Fragilarioid group. In Lake PW03, diatom valve production and biogenic silica concentrations increased since 1850 AD but diatom species richness showed little change. At this site, maximum species richness occurred 2300 years ago. The species composition of diatom communities also showed few changes in recent times. In Lake PW02, diatom valve production, biogenic silica concentrations, species richness and evenness also increased significantly, particularly since 1950 AD. However, at this site, the recent values of production and biodiversity exceed any recorded during the Holocene. The composition of diatom communities also changed notably in Lake PW02 following 1950 AD with a decrease in the proportion of small, benthic Fragilarioid species, and increases in epiphytic taxa. Thus, the magnitude of the community and ecosystem response to climate warming was greater in Lake PW02, which had lower biodiversity prior to 1850 AD, than in higher-diversity PW03. These results suggest that the functional response of aquatic ecosystems in the Arctic may depend on prior biodiversity.

SURVEILLANCE OF CANADA’S HIGH ARCTIC

Forand, Luc¹ (luc.forand@drdc-rddc.gc.ca), D. Brookes², J. Lee³, G. Heard², N. McCoy³, M. MacLeod⁴, R. Dao⁵ and K. Kollenberg⁵

¹DRDC Valcartier, 2459 Blvd Pie XI North, Quebec, QC G3J 1X5
²DRDC Ottawa, Ottawa, ON
³DRDC Atlantic, Dartmouth, NS
⁴DRDC CORA, Ottawa, ON
⁵DRDC Headquarters, Ottawa, ON

The Canadian Arctic is fast becoming an area of increasing strategic and economic importance to Canadians and its government. As a result, the need for the Canadian Forces (CF) to monitor and surveil activities in this area; particularly in the navigable passages, is increasing. However, due to the large distances, low population densities, and lack of infrastructure in the Canadian Arctic, this is not an easy task. Presently, this is limited to information gathered by overflights carried out by the CF’s
Maritime Patrol Aircraft (Auroras) or from the Canadian Rangers. To improve the ability of the CF to surveil the high Arctic, Defence Research and Development Canada (DRDC) has begun a four year Technology Demonstration (TD) project to investigate and demonstrate technologies that could be used to monitor and surveil its waters. During these years, the work will require significant effort from managerial, scientific and technical personnel at DRDC Headquarters, DRDC CORA, DRDC Ottawa, DRDC Valcartier and DRDC Atlantic. This paper discusses the various technologies that the team will investigate, develop and demonstrate and the program of work that has been proposed. In particular, it focuses on the sensor detection technologies that will be investigated. These include passive underwater sonar and electromagnetic detection, active and passive radio-frequency detection, and active and passive optical and infrared detection. The performance of such sensors will be evaluated for two types of operations. The first type involves the placement of a suite of ground-based sensors able to provide continuous coverage at certain strategic locations in the Canadian Arctic. This will be tested through the development and installing of a system at a test site near Gascouyne Inlet on Devon Island. It will include an Automatic Identification System (AIS), an underwater hydrophone and electromagnetic sensor suite that is part of the Rapidly Deployable System (RDS) TD developed at DRDC Atlantic, a navigational radar (RF) system, an electronic intelligence (ELINT) system developed at DRDC Ottawa, and a new DRDC Valcartier electro-optical (EO) system called the Canadian Arctic Night and Day Imaging Surveillance System (CANDISS). The second type involves the use of other detection technologies such as RF and EO satellite surveillance, high-frequency surface wave (HFSW), RF and EO aerial surveillance, and information provided by platforms of opportunity (ships, aircraft, personnel). The investigation of these possibilities will only be conducted using studies and computer modelling. No field-testing of this operational mode is currently foreseen. This paper discusses the schedule of work and the major work elements associated with each of the major sensing technologies to be developed during this program. The result of this effort is to provide expert advice to the CF as to how to best surveil and monitor the high Arctic in a cost effective manner, and to maintain and further develop the expertise of its research centres in Arctic operations.

**MEASURING VOLUME, FRESHWATER AND HEAT TRANSPORTS THROUGH LANCASTER SOUND**

Hamilton, Jim (Hamiltonj@mar.dfo-mpo.gc.ca) and Simon Prinsenberg

DFO, Bedford Institute of Oceanography PO Box 1006, Dartmouth, Nova Scotia B2Y 4A2

The Arctic Ocean is connected to the Northwest Atlantic Ocean by three main passages through the islands of the Canadian Archipelago. Flow through these passages accounts for about half of the...
freshwater leaving the Arctic Ocean, making it an important consideration in understanding and modelling the Arctic freshwater balance. Since 1998, an extensive array of instrumented moorings has been maintained across Barrow Strait/Lancaster Sound, the widest of these three passages. Comprehensive measurements of current speed and direction, salinity, temperature and ice thickness have provided data to estimate volume, freshwater and heat transports through this connecting pathway. To accomplish this, specialized instrumentation has been developed to address unique aspects of the study location. Conventional compasses are unreliable at the site, because of its proximity to the north magnetic pole. To obtain accurate current direction measurements, a strategy that uses specialized instrumentation to cope with the small horizontal component of the earth’s magnetic field has been developed and employed. Another challenge has been to obtain year-round, near-surface salinity measurements. The study area is ice-covered for 10 months of the year, with ice ridges presenting a hazard to conventional sub-surface instrumented moorings extending up into the top 30 m of the water column. Yet, it is in this upper layer that the fresh water from ice melt is concentrated. To make the required measurements in this critical zone, the moored profiler “icycyle” has been developed and used to successfully collect daily year-round profiles to the under ice edge. Iycycle consists of a winch in the main float of a mooring, which reels out an instrumented float once a day using a sonar to detect the depth of the ice, and a safe pay-out distance. When not profiling, the instrumented float is reeled in well below any danger of ice impact. The measurements made so far have been used to construct an 8 year time series of volume, freshwater and heat transport through Barrow Strait. Discussion of these results is the subject of another presentation at this meeting. Here, we discuss the unique instrumentation developed to acquire these useful time series. Recent work at extracting biomass estimates from previously acquired acoustic Doppler current profiler measurements at our field site will also be discussed.

A tidal model of Canadian Arctic Archipelago was used to map the strength of the tidal currents, tidal mixing (hU3), and the vertical excursion associated with the tidal currents driving water up and down slope. The hot spots in these quantities correspond to the location of many of the small polynyas in the Archipelago, supporting the idea that the tidal currents make an important contribution to the dynamics of many of these recurring polynyas. The potential link with tidal mixing means that these locations may have enhanced plankton production in the summer.

**POLYNYAS AND TIDAL CURRENTS IN THE CANADIAN ARCTIC ARCHIPELAGO**

Hannah, Charles¹ (HannahC@mar.dfo-mpo.gc.ca), Frederic Dupont² and Michael Dunphy³

¹Bedford Institute of Oceanography, Fisheries and Oceans Canada, Box 1006, Dartmouth, N.S., B2Y 4A2
²Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, B3H 4J1
³Department of Applied Mathematics, University of Waterloo Waterloo, Ontario, N2L 3G1

**TRADE-OFFS BETWEEN SHORT TERM AND LONG TERM PROCESSES INFLUENCE THE ABILITY OF WINTERING EIDERS TO ADJUST TO ENVIRONMENTAL CHANGES IN SEA ICE HABITATS**

Heath, Joel P.¹ (jpheath@sfu.ca), H. G. Gilchrist² and R.C. Ydenberg¹

¹Centre for Wildlife Ecology and Behavioural Ecology Research Group, Simon Fraser University, 8888 University Dr, Burnaby, BC, V5A 1S6
²Canadian Wildlife Service, National Wildlife Research Centre, 1125 Colonel By Drive, Raven Road, Carleton University, Ottawa, ON. K1A 0H3

By adjusting their behavioural routines, animals can negotiate a range of physiological and environmental considerations to obtain the energy required for survival and reproduction. Here we show, for Common Eiders wintering in the arctic, that a trade off between short-term profitability in dive cycles and longer term digestion can result in very different patterns of adaptive foraging behaviour, depending on environmental context. Incorporating data from underwater video and radio telemetry with a dynamic model indicates that eiders allocate foraging effort in a different and sometimes counter-intuitive manner in order to maximize net energy gain under different current profiles of the lunar cycle. Under an intermediate current profile, Eiders concentrate foraging efforts during slack tide, when diving is most profitable. Under a strong current profile of the new moon, Eiders concentrate foraging efforts in medium currents, when foraging is less profitable. Under a strong current profile of the new moon, Eiders concentrate foraging efforts in medium currents, when foraging is less profitable. In slacker currents near the half moon, foraging effort matches time availability. Time series and bout analysis demonstrate how eiders adjusted the organizational structure of their behaviour to accomplish these allocation strategies. Near the strong effects of the new moon, foraging patterns were complex and did not show well defined bout structure. However, under weaker currents near the half moon, foraging routines of eiders became structured into foraging cycles with a period of about 20-30 minutes. Therefore, a simple change in the strength of currents over the lunar cycle
led to a major shift in foraging patterns from simple bout structure to complex patterning. This energetically beneficial shift in dynamics is likely influenced by a strong non-linear relationship between current speed and the energetics of foraging. These results are important for understanding trade-offs between short and long term processes, the structuring of activity patterns, and their implications for energy budgets and winter survival in sea ice habitats. This approach will be particularly important in evaluating potential impacts of changing current regimes and winter sea ice conditions for eiders and hunters in eastern Hudson Bay. We discuss implications for co-management of eiders with the community of Sanikiluaq and concerns of hunters and elders about changing sea ice and tidal current regimes. Our future research involves extending the individual based approach to a population and ecosystem level. We present a novel technique for simultaneously monitoring eider ducks, sea ice dynamics and currents, which could be easily implemented as part of a Community Based Monitoring program. This approach would yield time lapse video, which allows hunters to comprehensively view the results of their monitoring efforts, facilitating flexible input about monitoring protocols and more direct community involvement.

DIMINISHING KNOWLEDGE: INUIT NOMENCLATURE OF THE LAND-WATER INTERFACE

Heyes, Scott (sheyes@unimelb.edu.au)
Faculty of Architecture, Building and Planning, The University of Melbourne, Victoria, Australia 3010

This paper will explore the various terminologies that Inuit from the coastal village of Kangiqsualujjuaq currently use to describe geographic phenomena and spatial regimes of the Ungava Coast in Nunavik. Based on participant-observation fieldwork that has been carried out in the village with the participation of thirty Inuit hunters between 2002 and 2007, the paper will demonstrate that the elderly, middle-aged and young generations often use different Inuktitut words to describe the same geographic phenomena. The findings of the study also reveal that Inuit youth have a very limited vocabulary to describe coastal features and phenomena. The reasons why coastal lexicons have not been successfully transmitted to younger generations will be discussed, as will the various ways in which this form of traditional knowledge may be passed on more effectively within the community and among hunters. The diminishment in knowledge of traditional coastal lexicons should be closely monitored by the community, not only to preserve the richness of the Inuktitut language, but to ensure that future generations will have the capacity to understand the link between traditional narratives and geographic features. More than physical objects, geographic phenomena are mnemonic devices for recalling and reliving many ancestral events, narratives and legends.

SUSTAINING ARCTIC OBSERVING NETWORK AS A LEGACY OF INTERNATIONAL POLAR YEAR (IPY)

Hik, David (david.hik@ualberta.ca)
Canadian IPY Secretariat, Z-908 Biological Sciences, University of Alberta, Edmonton, AB, T6G 2E9

The need for a well-coordinated and sustained Arctic Observing Network that meets scientific and societal needs has been identified in numerous high profile reports and at a variety of workshops and conferences. In November 2006, at the Arctic Council Ministerial Meeting in Salekhard, Russian Federation, Ministers welcomed the International Polar Year (IPY), 2007 –2008, as a unique opportunity to stimulate cooperation and coordination of Arctic research and increase awareness of the importance of the Arctic region. Further, the Arctic Council Ministers requested the Arctic Monitoring and Assessment Programme (AMAP), to cooperate with the other AC working groups, the International Arctic Science Committee (IASC), and other partners in efforts to create a coordinated Arctic Observing Network that meets identified societal needs (Salekhard Declaration). The goal of developing an Arctic Observing Network as a legacy of IPY (WMO/ICSU) was endorsed by the WMO XV Congress in May 2007. In January 2007, the Sustained Arctic Observing Networks Initiating Group (SAON IG), composed of representatives of international organizations, agencies, and northern residents involved in research and operational and local observing, has been formed to develop a set of recommendations on how to achieve long-term Arctic-wide observing activities that provide free, open, and timely access to high-quality data that will realize pan-Arctic and global value-added services and provide societal benefits. The Swedish and Canadian IPY Committees have agreed to take the lead in the launch of the SAON initiative by running a succession of workshops together with the SAON IG. The first workshop was held in Stockholm, Sweden on 12-14 November 2007 and addressed the question: Are current Arctic observing and data and information management activities sufficient to meet users’ needs? The second workshop, to be held in Alberta, Canada, in spring 2008, will be hosted by the Canadian IPY Secretariat. This workshop will address the question: How will Arctic observing and data and information management activities be coordinated and sustained over the long-term? A third workshop in
Finland is planned for Autumn 2008, to be hosted by the Finnish Meteorological Institute. The format and scope of this workshop remains to be determined, but an important element will be a synthesis of the advice and information gathered at the previous workshops into the final set of recommendations for the coordination and promotion of sustained, integrated Arctic observing activities.

**STUDY OF INFRASTRUCTURE AND LOGISTICS IN SUPPORT OF NORTHERN RESEARCH**

Hutchinson, Tom (thutchinson@trentu.ca)

Canadian Polar Commission, Suite 1710, Constitution Square, 360 Albert Street, Ottawa, Ontario, K1R 7X7

The need for an ongoing sustainable research infrastructure in the Canadian North has been repeatedly underlined as a priority in numerous workshops and reports over the past 25 years. The joint NSERC-SSHRC Task Force “From Crisis to Opportunity: Rebuilding Canada’s role in Northern Research” 2000 offered damning perspectives on the effect of obsolete, unsustainable and inadequately funded infrastructure on northern research and on the training of highly qualified personnel. Working in the North and especially at remote locations requires field stations with good accommodation, good and safe access, basic laboratory facilities and excellent communications. While there has been a commendable surge in polar research and in research programmes over the past 10 years, e.g. NSERC’s Northern Chairs, Canada Research Chairs, refitting of the research icebreaker CCGS *Amundsen*, establishment of the ArcticNet Centre of Excellence and the launch in 2007 of the International Polar Year, very little has been done to improve the field station situation, with certain notable exceptions. A recent CPC infrastructure workshop in Quebec City revealed that the present field stations are now running at full capacity or are exceeding it and turning people and courses away at certain times of year. There is a clear need for a national effort to improve the situation.

**INUIT PERCEPTIONS OF THE ABILITY OF LAND CLAIMS AGREEMENTS TO AID ADAPTATION TO CLIMATE CHANGE**

Koutouki, Konstantia¹ (konstantia.koutouki@umontreal.ca) and Natasha Lyons²

¹Faculty of Law, Université de Montréal
²Department of Archeology, University of Calgary

The present research works across cultural borders. We, as southern EuroCanadian researchers, are working with different Inuit groups to understand Inuit views on the ability and flexibility of their land claims agreements to anticipate and accommodate climate changes. This cross-cultural research environment creates a working dynamic that requires commitment to cultural translation, especially on the ‘outsider’s part. In anthropology, we distinguish between the concepts of insider’s (or emic) knowledge from outsider’s (or etic) knowledge. Insider’s knowledge is comprised of the perceptions, thoughts, and views of the world held by Indigenous or other communities under study; outsider’s knowledge is that of the external researchers or proponents that work with or for these communities. Inuit of Nunavik use the Inuktitut term maqainniq to refer to the land-based activities that one is required to learn to be inutuinnaq, a ‘genuine Inuk’. The traditional ecological knowledge involved in becoming maqainniq is what has allowed Inuit to track environmental changes over the centuries and to help them adapt to periodic climatic shifts. The contemporary concept of kiinaujaliurutit, by contrast, refers to the process of Inuit gaining appropriate skills to participate in the modern industrial world (such as the use of English, technological and administrative skills etc). The combination of kiinaujaliurutit and maqainniq help Inuit today to practice their centuries old cultural patterns of land use while being and becoming ‘modern’ people. It helps them to broker the differences between their culture and those of the southern Canadian majority. Inuit knowledge of environmental change, in this context, is critical to understanding and planning for the environmental, social, and political challenges of climate change in the north. William David and Scot Nickel from the Inuit Tapiriit Kanatami (ITK) have noted that in recent decades Inuit have concluded detailed Land Claims Agreements; the James Bay and Northern Quebec Final Agreement, the Inuvialuit Final Agreement, the Nunavut Final Agreement, et cetera. They argue that the problem with these comprehensive agreements is that although they may enhance compliance, with the current pace of climate change, they may not be flexible enough. Our goal is to understand the potential of the aforementioned three land claims agreements to facilitate adaptation to climate change as perceived by Inuit people. Eventually we would like to examine how well these perceptions conicide with established legal principles. A perception that land claims agreements are flexible, adaptive instruments is reflected in statements made by our collaborators in Inuvik. One collaborator insists that, “the way that it is written [the land claims agreement] its not very detailed and you can interpret, [it is] subject to amendment and interpretation and any interpretation has to be in our favour and there is a clause in there that if they give anything to the Gwich’in or to any other claimant groups … they have to give it to us.” Another collaborator supports this view by explaining that, “when we did out land clams there was no talks of self-government and when the
Gwich'in and the Sahtu got that clause in theirs they had to give it to us. A third collaborator describes the land claims agreement as "a working document." The data used in this study were accessed through a variety of means. Primary data derive from interviews and time spent with Inuit Elders, youth, and community members from three regions of Arctic Canada: Inuit of Nunavik, Arctic Quebec, Padlimiut of Western Hudson's Bay, Nunavut and; Inuvialuit of the Mackenzie Delta, Northwest Territories. As researchers, we have a history of working in and with these communities: Koutouk in Kangiqsujuaq and Lyons in Aklavik, Inuvik, and Arviat. Secondary data comes from the study of respective land claims and their legal context, and from our readings of the historical and anthropological literature of these regions and communities.

INUIT KNOWLEDGE IN THE MANAGEMENT AND RESEARCH ACTIVITIES OF AUYUITTUQ NATIONAL PARK

Laidler, Gita1 (glaidler@grcr.carleton.ca), M. Manseau2,3, E. Karetak4, K. Johannson3 and G. Mouland5

1Geomatics and Cartographic Research Centre, Department of Geography and Environmental Studies, Carleton University, 1125 Colonel By Dr., Ottawa, ON, K1S 5B6
2Western and Northern Service Centre, Parks Canada, 145 McDermot Ave, Winnipeg, MB, R3B 0R9
3Natural Resources Institute, 70 Dysart Road, University of Manitoba, Winnipeg, MB, R3T 2N2
4Parks Canada, Nunavut Field Unit, P.O. Box 278, Iqaluit, NU, X0A 0H0

Beginning in 2005, the Parks Canada Inuit Knowledge Project (IKP) was initiated out of the Nunavut Field Unit in Iqaluit. This 5-year project is intended to develop a comprehensive vision for the future of Nunavut National Parks management that will incorporate both Inuit and scientific knowledge in an applied manner, including: i) parks management policy; ii) ecological integrity monitoring; iii) tourist and community use safety; and, iv) decision-making structure. In order to develop this vision, strong partnerships must be fostered between the Nunavut Field Unit and communities nearest to the National Parks. This presentation will focus on Auyuittuq National Park (and its neighbouring communities of Pangnirtung and Qikiqtarjuaq), to highlight the opportunities and challenges present in attempting this integrated approach to parks management. Specifically, recommendations coming from the establishment of the Auyuittuq Inuit Knowledge Working Group, and two workshops held over the past year (October, 2006 and June, 2007) will serve to inform future directions taken by the Nunavut Field Unit. With ongoing involvement of Working Group members, conventional approaches to parks/resource management are being challenged and expanded. Priorities identified by the Working Group go beyond jurisdictional boundaries, including: i) an emphasis on sea ice conditions, use, and safety (and related environmental factors) around the communities, and beyond the national park extant; ii) the importance of Inuit youth learning about sea ice use and safety in a holistic and experiential manner; iii) the provision of Inuit knowledge and survival tips for tourists using the park; iv) a flexible and interactive approach to community involvement in parks management or research activities; and, v) the complexity of attempting to interpret and apply both Inuit Qaujimajatuqangit and scientific paradigms in complement, for research, decision-making, and education purposes. This paper will show how the above priorities are being addressed, and where improvements need to be made or new approaches need to be explored. Working in partnership implies equality of influence, and while we cannot claim a full partnership yet, there is much to be learned through the progress made towards achieving this more cooperative approach.

PAN-ARCTIC COMPARISON OF THE ANNUAL VARIABILITY OF PARTICULATE CARBON FLUXES IN THE BEAUFORT SEA, NORTHERN BAFFIN BAY, AND LAPTEV SEA

Lalande, Catherine (catherine.lalande.1@ulaval.ca), Alexandre Forest and Louis Fortier
Québec-Océan, Pavillon Alexandre-Vachon, Université Laval, Québec, Québec G1K 7P4

Potential impacts of a decline in sea ice cover in the Arctic Ocean are the enhancement of annual primary production through the extension of the growth season and the subsequent increase of the export flux of carbon over the Arctic continental shelves. A higher export of particulate organic carbon (POC) out of the upper ocean over the immense Arctic shelves may significantly affect the Arctic marine ecosystem and could also lead to a significant sequestration of atmospheric CO2 into the deep Arctic basin. However, the effect of a decline in sea ice cover may vary over the different Arctic continental shelves depending on their respective hydrographical conditions. It is therefore necessary to measure POC fluxes over different regions of the Arctic shelves to evaluate how a reduction in seasonal sea ice cover will affect carbon export in the Arctic Ocean. Long-term moored sediment traps were deployed in the Beaufort Sea and Northern Baffin Bay in the Canadian Arctic and in the Laptev Sea in the Siberian Arctic to achieve a pan-arctic comparison of the magnitude and nature of POC export fluxes over these continental...
shelves. Annual POC fluxes obtained at 200 m during the 2005-2006 deployment period ranged between 1.5 and 6.3 g C m-2 y-1, with the highest annual flux observed in Northern Baffin Bay and the lowest annual flux observed in the Beaufort Sea. Sinking particles were on average relatively labile in Northern Baffin Bay and in the Laptev Sea in contrast with more refractory particles collected in the Beaufort Sea. All annual cycles of POC fluxes exhibited an increase in POC export following sea ice melt in May or June, however, the annual cycles showed different patterns for the rest of the deployment period. In the Beaufort Sea, POC fluxes were elevated following sea ice melt and in the absence of ice cover in the Amundsen Gulf region, while they were elevated during winter and before ice melt on the Mackenzie shelf, most likely reflecting the input of terrestrial matter from the Mackenzie River. In contrast, POC fluxes in Northern Baffin Bay were elevated both following sea ice melt and during fall, reflecting the spring and fall bloom observed in the North Water polynya. In the Laptev Sea, most of the POC export occurred following the melting of sea ice, although an increase in POC flux was also observed under ice cover during winter. This variability observed among the annual cycles of POC fluxes in 2005-2006 reinforces the importance of measuring the present POC fluxes over different Arctic shelves to assess the eventual variability of carbon export in response to climate change.

HYDROLOGICAL IMPACT OF EXTENSIVE PERMAFROST DISTURBANCE IN A HIGH ARCTIC WATERSHED, CAPE BOUNTY, MELVILLE ISLAND

Lamoureux, Scott (scott.lamoureux@queensu.ca) and Melissa Lafrenière

Department of Geography Queen’s University
Kingston, ON, K7L 3N6

Comprehensive watershed process monitoring initiated in 2003 and expanded in 2005 to include hydrochemical flux measurements has provided a long-term data set to explore the linkages between climate change, hydrological processes, and fluxes of water, sediment, nutrients and solutes to coastal lakes. During July 2007, we observed exceptional and persistent warm temperatures that are unprecedented since records have been kept in the 1950s. In an area where mean daily July temperatures are typically c. 5ºC, we recorded frequent temperatures above 15ºC and several days with temperatures exceeding 20ºC. These conditions resulted in rapid deepening of the active layer to well below 50 cm depth, the depth reached in the previous year. The thickened active layer, together with a 12 mm rainfall event in late July resulted in widespread active layer detachments across the West watershed at Cape Bounty between July 25 and August 1. Measurements indicate that thaw depths were at least 100 cm and in many instances, detachments revealed underlying ground ice. Mapping indicates that approximately 2-3% of the watershed was directly impacted by disturbances. The immediate fluvial impacts of the detachments was primarily in the form of sharp rises in river discharge, turbidity and electrical conductivity. Turbidity records reveal short-lived pulses associated with initial hydrological connection of major detachment slides, including a number substantially isolated from the main channel. Additionally, a large detachment dammed the river over a length of 200 m, resulting in significant upstream ponding. While the impact of detachments had an immediate and substantial impact on river conditions, it is clear that erosion of unstable material and solute-rich soil waters are likely to have a sustained impact on watershed fluxes in future years. Continued monitoring of this system will yield a comprehensive dataset to understand the impact of permafrost disturbance on coastal watersheds, water quality and hydroecological conditions. Additionally, we anticipate that the frequency of similar disturbances will be apparent through ongoing analysis of the sedimentary record in the lake.

EVALUATION OF GEM-LAM OVER SOUTHERN BAFFIN ISLAND

Liu, Zhuo1 (zhuo_liu@umanitoba.ca), John Hanesiak1, Ron Goodson2 and Ronald Stewart3

1Centre for earth observation science, University of Manitoba
2Hydrometeorology and Arctic Lab Environment Canada, Edmonton, Alberta
3Department of Atmospheric and Oceanic Sciences, McGill University

Storms in the Arctic region have strong impacts on climatic, human life, the landscape (terrestrial, sea ice and ocean), economy, the environment, as well as on social society. In order to better understand the severe weather systems in the Arctic area, we will focus on these hazardous Arctic storms that occur in the southern Baffin Island region, where various observational infrastructures have been established. Since there is a lot of open water that feeds heat and moisture into atmosphere, the storm that develops can be very powerful. Over the past few decades, this area experiences some of the most frequent and severe winter storms. To make progress on this critical issue, we carried out a modeling study as well as observations. The model we’re using is GEM-LAM, which is a general environmental multi-level model. With different configurations, the model is able to run over various regions and variable resolutions. The model domain covers southern Baffin Island and surrounding areas; the horizontal resolution
is 2.5km and vertical level contains 58 sigma-pressure hybrid coordinate levels up to 10 hPa. The model was applied to study the November 6-9, 2006 storm event. As observed, around Nov. 6, 2100Z, a cyclone propagated from southwest to northeast, with warm air advection ahead of the system and a sudden wind shift as the system moved through Iqaluit. Temperatures rose 4-5 C and surface pressure declined from 1007hPa to 993 hPa, the wind direction at Iqaluit changed from easterly to northwesterly. The model run began Nov.7, 1300Z, and was integrated 18 hours ahead. The vertical profile of the simulated fields was compared to radiosonde observations every 3 hours at Iqaluit and time series surface fields were also compared with METAR files. The differences between temperature forecasts and observation are less than 4C. Both surface temperature and dew point temperature are always over estimated after 7 hours forecast. This is also true for vertical levels between 600 hPa and 900 hPa. The difference of dew point temperature between prediction and observation is much larger than that of temperature. For relative humidity, the simulated one is always overestimated, especially above 850mb and is of course in agreement with the simulated dew point temperature. For wind speed, the simulated surface wind is always weaker than the observation; while at 925hPa, the simulated wind has a strong jet and is much stronger than the observations. Modeled wind direction near the surface was reasonably close to observations except for the timing of the wind shift, which was delayed 4 hours compared to observations.

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THE DEVELOPMENT AND DISPERAL OF THE NELSON-HAYES ESTUARY SEDIMENT AND CDOM PLUMES IN HUDSON BAY

McCullough, Greg¹ (gmccullo@cc.umanitoba.ca), P. Colline¹, D. Barber¹, M. Granskog², K. Sydor³ and T. Aziz³

¹Centre for Earth Observations Science, Wallace Building, University of Manitoba, Winnipeg, Manitoba R3T 2N2
²Arctic Centre, University of Lapland, P.O. Box 122, 96101 Rovaniemi, Finland
³Manitoba Hydro, 540-444 St Mary Ave., Winnipeg, MB R3C 3T7

Hudson Bay receives more river runoff per unit area or volume than the Arctic and other world’s oceans, with potentially larger effects on circulation and vertical mixing, and light distribution in the euphotic zone. Recent studies have highlighted the significance of terrigenous dissolved organic matter to the light field in Hudson Bay. Shore plumes visible in satellite imagery indicate a plume of suspended solids along the entire Hudson Bay lowlands portion of the Hudson Bay coast that further restricts light fields in at least those coastal regions. The persistence of a turbid plume up to 50-100 km from the mouth of the Nelson River, the second largest river draining into the Hudson-James Bay system, indicates that river-borne suspended solids are important regionally. Nonetheless, instantaneous suspended solids concentration (SSC) in the Nelson-Hayes Estuary is largely independent of salinity indicating that it is not determined solely by loading from the watershed, but also by local sedimentation and erosion/resuspension processes. By a series of profiles of salinity, temperature, SSC and chromophoric dissolved organic matter (CDOM) along longitudinal transects through the Nelson Estuary, we show that high turbulence in a scour zone at the developed at the intersection of fluvial and tidal currents develops SSC as much as an order of magnitude higher than upstream, although this enhanced SSC is quickly reduced by sedimentation in the outer estuary. Remote sensing data also shows persistently turbid coastal waters along the entire Hudson Bay lowlands portion of the Hudson Bay shore, only very weakly dependent in either concentration or spatial extent on proximity to large river mouths, indicating that litoral erosion also contributes SSC to Hudson Bay. In contrast to SSC, CDOM is conservative with salinity, at least in the estuary region. Because CDOM concentrations differ between the Nelson and Hayes, salinity-CDOM plots allow determination of instantaneous relative contribution of each river to the estuarine plume. Satellite data and salinity, temperature, SSC and CDOM profiles along shore perpendicular transects, recorded on Amundsen cruises in 2005 and 2007, are used to place this regional study in a larger spatial context.

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THINGS CHANGE, WE CHANGE: COMMUNITY ADAPTATION DYNAMICS

Parewick, Kathleen (paerewyck@hotmail.com)

Department of Geography, Memorial University, St. John's, Newfoundland Canada, A1B 3X9

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This talk/poster examines the ups and downs of recent research experience in three Arctic case study communities where participatory local planning processes have been undertaken with the benefit of a variety of local geohazard-related studies, climate change observations, and organizational engagement. A basic analytical framework derived from resilience theory is presented and used to illustrate specific factors conditioning each community’s response to environmental changes. Implications for future community adaptations are discussed, with reference to cross-scale interactions, change management practices and institutional dynamics.

LIVING WITH CHANGE: COMMUNITY EXPOSURES AND ADAPTATIONS IN KUGLUKTUK, NU

Prno, Jason (jprno@uoguelph.ca) and B. Bradshaw

Department of Geography, University of Guelph, Guelph, Ontario, N1G 2W1

Canadian Arctic communities face a number of risks or 'exposures' that most southern communities do not. Climate change, for one, is already impacting upon the physical and social landscapes of the Arctic. Resource development, be it related to the extraction of minerals or fossil fuels, is further stressing community institutions, infrastructure, the natural environment, and individuals and their families. Combined with ongoing social, cultural, economic, and political transformations in Arctic communities, these externally imposed drivers of change have implications for ecosystems and for peoples' livelihoods. This paper reports on research conducted in collaboration with the community of Kugluktuk, Nunavut, which aims to characterize and understand the nature of that community's vulnerability to multiple risks. Based on a 4-month field season in 2007, it is evident that key community vulnerabilities include a lack of education and knowledge about climate change and its impacts among residents of Kugluktuk, poor transmission of Inuit traditional knowledge to younger generations from elders, and community infrastructure that is mal-adapted to a changing climate. Residents of Kugluktuk are also vulnerable to a number of social ills, which they regularly regard as more significant than the risks associated with climate change. These findings suggest that climate change is, and will likely continue to be, just one of a number of risks that Canadian Arctic communities must manage.

ASSESSING ECOSYSTEM RECOVERY FROM A LOCAL HISTORICAL PCB SOURCE IN A NORTHERN MARINE ENVIRONMENT: A LIVING CASE STUDY

Sheldon, Tom A.1 (tom.sheldon@rmc.ca), N.M. Burgess2 and T.M. Brown1

1Environmental Sciences Group, Royal Military College of Can., PO Box 17000 Stn Forces, Kingston ON, K7K 7B4
2Canadian Wildlife Service – Atlantic Region, Environment Canada, St. John's, NL, A1N 4T3

Marine sediments in Sagleq Bay contain elevated concentrations of polychlorinated biphenyls (PCBs) as a result of historic terrestrial soil contamination associated with a former military radar facility on the southern shore of the Bay. Historically, pelagic and wider ranging species were not affected, whereas the shorthorn sculpin (Myoxocephalus scorpius) and black guillemot (Cepphus grylle), two indicator species associated with the local benthic-based food chain contained elevated concentrations of PCBs. Within Nunatsiaq Nuluak, current efforts are underway to assess the extent of ecosystem recovery from the PCBs in the marine environment now that the shore-based source has been removed. This study is part of an on-going stakeholder process that is committed to incorporating Inuit Kajuimajatuk Kangit (knowledge) into all aspects of the planning, implementation, analysis and communication. Both physical measurements as well as biological indicator species and valued ecosystem components are being used to document the current effects of the PCBs in the local marine food chain, assess temporal trends in PCB burdens, and project the pace of natural ecosystem recovery over time. Surface sediment measurements indicate decreases in both the extent (spatial coverage) and average concentrations of PCBs throughout Sagleq Bay. Although concentrations of PCBs in shorthorn sculpin remain elevated, they have decreased significantly from 1998 levels. The pelagic and wider ranging arctic char (Salvelinus alpinus) captured from Sagleq contains PCB concentrations equivalent to arctic background areas. Approximately 25% of the ringed seals (Pusa hispida) captured from Sagleq Fiord contain levels of PCBs that are higher than other eastern Arctic sites. Further work is warranted on both the feeding behaviour and movement patterns of ringed seal in northern Labrador to better understand these results. Finally, in 2007, we returned to Sagleq to determine the current concentrations of PCBs in black guillemot nestlings and the current impacts of the PCBs on the health and development of the guillemot chicks.
Two environmental variables that will have a significant impact on the Arctic coastline in the context of climate change are relative sea-level (RSL) rise and reduced sea-ice cover. Both can alter the wave energy regime at the coast, causing flooding, accelerated or increased shoreline change, and influencing the morphology and sedimentology of depositional landforms. Such changes represent increased hazard risk for community infrastructure, nearshore benthic habitats, and coastal resources. Projecting the future response of the coastal system to these changes in environmental forcing is a prerequisite to an effective adaptation strategy. The primary goal of this research is to define gravel shoreline sensitivity and response to rising sea level and changing environmental forcing in the context of anticipated climate change in the Arctic. It will contribute to an improved understanding of coastal hazards and climate-change impacts in the coastal zone and will inform decision-making for community and government adaptation strategies to climate change. Two complementary approaches are being used to achieve this goal: (1) the study of past responses under time-varying conditions as recorded in the geological record and (2) the study of present responses under spatially varying forcing as interpreted from modern processes. Selected study sites are located along a longitudinal transect in the central and eastern Canadian Arctic encompassing gradients of both RSL trends and coastal exposure to different levels of energy. The coupled study of submerging and emerging coastal sites gives insights into the dynamics and processes associated with coastlines under various scenarios of sediment supply, basement topography, exposure, and rate and direction of RSL change. It offers therefore a unique opportunity to decipher the role of individual controls on beach morphodynamics. The westernmost study sites, located in Barrow Strait, are characterized by falling RSL. Thus far, these emerging coastal sites have provided valuable information on the role of sea-ice and storms on beach morphodynamics. The easternmost sites, located in Lancaster Sound, Navy Board Inlet and Baffin Bay, are characterized by stable or rising RSL. These sites provide important analogues for ongoing and predicted global sea-level rise. Onshore research is being conducted using multi-temporal analysis and mapping of modern and relict (raised) coastal systems using airphotos, satellite imagery, LiDAR and RTK surveys. Land-based work supports temporal studies on the modern coastline using both historical records and ongoing monitoring programs. Shallow-water mapping of transgressive coastal systems is carried out using multibeam sonar, single-beam and side-scan echo-sounders, sub-bottom profiler and sediment cores. Sea-floor imagery and sub-bottom profiles enable a better understanding of past coastal responses to rising RSL and indicate how coastal bathymetry and sediment composition are influencing the development of coastal systems under both rising and falling RSL. This research contributes to the objectives of ArcticNet Projects 1.2 and 2.4 and the IPY CAVIAR (Community Adaptation and Vulnerability in Arctic Regions) project. It also forms part of a larger integrated regional impact study (IRIS) of climate change in the eastern Arctic.

HAZARDOUS WEATHER CONDITIONS IN NUNAVUT: AN OVERVIEW OF ARCTICNET PROJECT 4.3

Stewart, Ronald E. 1 (ronald.stewart@mcgill.ca), G. McBean*, H. Carmichael1, S. Gearheard3, D. Nadeau1, N. Nawri1 and E. Roberts1

1Department of Atmospheric and Oceanic Sciences, McGill University, Montréal, Québec H3A 2K6
2Department of Geography, University of Western Ontario
3Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado

This presentation gives an overview of the research currently conducted under the ArcticNet Project 4.3, concerned with Arctic weather hazards. The most serious weather-related impacts are often from storms and related phenomena such as strong and variable surface winds, heavy snowfall, and freezing precipitation. Such hazards are a constant concern to northern residents. To address these concerns, we continue to conduct climatological and case studies of various hazardous weather phenomena. Using long-term routine weather data from various locations in the Arctic, we are investigating the effects of elevated terrain and land – sea – sea ice transitions on boundary-layer winds, as well as the climatological features and large-scale forcing of freezing precipitation. We are also conducting studies on short-term surface weather variability across the Canadian Arctic, as well as extreme winter warm events across Canada. In addition, we are working on an analysis of low-level wind jets in the Canadian and European Arctic. Based on data from special measurement campaigns, we are conducting case studies of cold season storms which
are typically characterized by strong winds and heavy snowfall. Through this field work we are collaborating with, among others, Environment Canada, the University of Manitoba, the Nunavut Research Institute, and the Nunavut Arctic College. Last autumn, during a 5 week field project, we launched weather balloons into passing storm systems from Iqaluit and Pangnirtung. This allows us to better understand the effects of the terrain and the complex coastline of southern Baffin Island on passing storm systems and their local impacts. A major field study is underway in the autumn of 2007 that builds on the earlier work. This project, STAR (Storm Studies in the Arctic), will provide an unprecedented amount of information from a wide variety of sensors on the nature of cold season storms in the vicinity of southern Baffin Island. On a smaller scale, to investigate changes in surface weather conditions in the vicinity of Iqaluit due to the surrounding terrain and water or sea ice, we set up two weather stations within 8 km of the community. For the planning of a new subdivision, we are interacting with the City of Iqaluit regarding the location of one of these instruments and the results from it. The measurements by these stations have already provided some insight into small-scale differences of surface wind and temperature, which are of importance for improvements of local weather forecasts as well as climate predictions. In Clyde River and other communities, through interviews we are documenting Inuit knowledge about hazardous weather conditions. These studies have mainly focused on strong winds and long-term changes in the prevailing surface wind conditions. A journal article has been submitted that summarizes some of these results and compares them with local station data. Studies have also been initiated on the anticipated future changes in the occurrence of weather-related hazards. Such occurrence changes are linked with, for example, expected changes in storm tracks, extended open-water periods, and additional water vapour.

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THE MIGRATORY CARIBOU OF NORTHERN QUÉBEC-LABRADOR: FACTORS AFFECTING THE BODY CONDITION OF FEMALE-CALF PAIRS IN TWO HERDS OF DIFFERENT POPULATION SIZES

Taillon, Joëlle1 (joelle.taillon@bio.ulaval.ca), S. D. Côté1, V. Brodeur2 and M. Festa-Bianchet3

1Department of Biology, Université Laval, Québec, Québec G1K 7P4
2MRNF, Direction de l'aménagement de la faune, Nord-du-Québec, Chibougamau, Québec, G8P 2Z3
3Department of Biology, Université de Sherbrooke, Sherbrooke, Québec, J1K 2R1

More than one million migratory tundra caribou are distributed in Northern Québec and Labrador. They range over nearly one million square kilometres and are one of the world’s largest wild ungulate populations. Caribou are a key element of the northern ecosystem and are intimately linked to the culture and the economy of Northern Québec/Labrador. Two populations are recognized, the Rivièr-aux-Feuilles herd is very large and appears to be declining; the Rivière-George herd is about half the size of the Rivière-aux-Feuilles herd but appears to be increasing. The factors influencing changes in body condition of tundra caribou are still poorly understood, but are essential to our understanding of natural and human-induced variations in the survival and reproductive success of individuals and the demography of herds. This research will quantify variations in the body condition of females and their calves and compare the condition and parasite load of females and calves between herds. In June 2007, we culled 20 female-calf pairs on the calving grounds of each herds to evaluate the body condition of individuals. Adult females from the Rivière-George herd were heavier (80.4 ± 1.8 kg) than those from the Rivière-aux-Feuilles herd (73.0 ± 1.8 kg), but they did not differ in skeletal size (hind foot length was 54.0 cm in both herds). Calves from the Rivière-George herd had a greater body mass and hind foot length (6.2 ± 0.2 kg and 33.2 ± 0.3 cm) than those from the Rivière-aux-Feuilles herd (5.2 ± 0.2 kg and 31.9 ± 0.3 cm). A lower body mass at birth is likely to decrease calf survival and growth. We also observed a positive relationship between the body mass of a female and that of her calf for the Rivière-aux-Feuilles herd, but not for the Rivière-George herd. These results suggest that under constraining conditions, i.e. at high population size, differences in females’ body condition are more likely to affect the condition of their offspring than under more favourable conditions. All adult females were parasitized either by warble flies, taenias (in lungs or muscles) or liver flukes, or a combination of these parasites. Warble flies were much more common in the Rivière-aux-Feuilles herd than in the Rivière-George herd. Liver flukes were almost absent in the Rivière-aux-Feuilles herd, but common in the Rivière-George herd. Taenias in lungs and muscles were rare in both herds. These data from early summer will be compared with data to be collected on female-calf pairs in November 2007. Combining these two dataset, we will quantify the influence of herd size on adult female body condition following lactation and on calf body condition and early growth.

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TOWARD A MERCURY MASS BALANCE MODEL IN BEAUFORT SEA: WHAT CAUSED THE MERCURY POLLUTION IN BEAUFORT BELUGA WHALES?

Wang, Feiyue1 (wangf@ms.umanitoba.ca), Gary Stern1, Robie Macdonald2, Steve Ferguson3, Peter
One of the major findings in recent studies on the global mercury (Hg) pollution is the highly elevated Hg levels in beluga whales from Beaufort Sea of the Arctic Ocean. The Hg levels in Beaufort beluga were on average 10-fold higher than during the 15th to 17th centuries. Most notably, liver Hg concentrations of this population tripled from the early 1980s to the mid-1990s, and were the highest relative to other Canadian Arctic beluga populations. The atmospheric Hg deposition, including the tropospheric mercury depletion events (MDEs), alone seems insufficient to explain such high Hg burdens and large variations. As part of the Canadian-led ArcticNet program, extensive studies have been carried out to probe the causes of Hg pollution in the Beaufort beluga whales. Mercury and methylmercury concentration, speciation and flux from a variety of possible Hg sources and processes were studied. These included the Mackenzie River, permafrost melting and coastal erosion, oceanic circulation, and sea ice loss. Further studies were conducted on the habitats and feeding patterns of beluga whales and the food web structures. The results allowed us to construct the first mass balance model of Hg in Beaufort Sea including both the abiotic and biotic components. While the Mackenzie River ranked the largest known source of Hg to Beaufort Sea, biotic processes were found to play a major role in the Hg bioaccumulation in Beaufort beluga whales.

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**ARCTIC OCEAN AND CAA CIRCULATIONS IN GLOBAL OCEAN-ICE MODELING**

Wang, Zeliang1 \(^{(1)}\) (WangZ@mar.dfo-mpo.gc.ca), J. Su1, D. Wright1, G.Holloway2, Y.Lu1 and Simon Prinsenberg1 (prinsenberg@mar.dfo-mpo.gc.ca)

1Ocean sciences Division, Bedford Institute of Oceanography, Dartmouth, NS, B2Y 4A2
2Institute of Ocean Sciences, Sidney, BC, V8L 4B2

A new ocean/ice modeling effort has begun within DFO, based upon the European "NEMO" model. Testing is underway using a global domain with relatively coarse resolution near 100km that is refined to less than 20km in the Canadian Arctic Archipelago (CAA). The next phase will have global resolution near 25km with less than 5km in the CAA. This is intended to provide the ocean basis for a DFO-EC joint effort toward operational marine and atmospheric extended range forecasting. Present research includes attention to connections between the Arctic and global oceans with special focus on the CAA. In particular, we examine the role of wind-forced setup over the Beaufort Sea driving seasonal variation in Barrow Strait transport as compared with transport observations. Representation of unresolved eddies using the "Neptune" parameterization is found to improve the representation of recirculations within CAA channels and basins and in larger scale (pan Arctic) cyclonic "rim currents". The effects of a biharmonic Smagorinski momentum mixing scheme will also be discussed. Model skill is evaluated globally against hydrographic data and special attention is given to the Arctic region where a comparison with observations is made based on a compilation of more than 2500 long-term current meter records spanning more than 9000 observation months.

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**ASSESSING THE EFFICACY OF CONSTRUCTED WETLANDS IN THE TREATMENT OF MUNICIPAL WASTEWATER IN NORTHERN COMMUNITIES**

Wootton, Brent C.,1 (bwootton@flemingc.on.ca), A. Durkalec1, D. Shrestha2, C.D. Metcalfe3

1Centre for Alternative Wastewater Treatment, Fleming College, 200 Albert St., PO Box 8000, Lindsay, Ontario, K9V 5E5
2Watershed Ecosystems Graduate Program, Trent University, Peterborough, Ontario, K9J 7B8
3Environmental and Resource Studies Program, Trent University, Peterborough, Ontario, K9J 7B8

We are examining the use of wetlands to treat wastewater in the Canadian Arctic. Treatment wetlands improve water quality by taking advantage of complex natural wetland processes that involve microorganisms, plants, substrate (such as soil or aggregates), water, air and the sun. They can remove pathogens (such as E. coli and fecal coliform bacteria), excess nutrients (nitrogen and phosphorus) and other types of contaminants. Wetlands are currently being used for sewage treatment in many Northern communities, primarily because the use of conventional sewage treatments plants is not feasible for a variety of reasons, including: high infrastructure, operational and maintenance costs; limitations imposed by climate, geography, or remoteness; and limited community capacity caused by personnel shortages or other unavailable servicing requirements. While treatment wetlands are in use in many
locations, there is a significant paucity of knowledge about their efficacy. Research is needed that will assess treatment performance and that will examine design options most suitable to Arctic conditions, particularly in the context of changing community needs as populations grow and settlement patterns shift. The purpose of this research project is to contribute to safe, practical and low-cost wastewater solutions, and to help protect the long-term health of Northern water resources and peoples. Research activities will encompass: 1) Assessment of the efficacy of the existing range of wetland treatment systems; 2) Optimization of a prototype design specific to Arctic needs through intensive monitoring of controlled experimental systems; 3) Bench scale mesocosm experimentation focusing on microbial processes unique to Arctic environments; 4) Enhancement of local capacity in the area of community sanitation through training and education of community members and technicians. Data that are collected will be used to develop guidelines for treating wastewater with wetlands in the North and can inform regulatory agencies that currently lack sound scientific evidence upon which to base regulations. It is expected that wetlands in some communities will be found to be highly effective in the treatment of regulated parameters, while others may be found to be significantly ineffective at treating one or more parameters, at particular times of the year, or under high loading conditions. This is anticipated because of the array of local conditions, differences in treatment systems, and the ranges in strength of sewage effluent. Insights into the limitations and upper performance thresholds of various systems will provide greater understanding of treatment wetland bio-chemical processes unique to Arctic environmental conditions and allow for a validation of a pilot scale prototype design that can be scaled up. Infrastructure and logistical limitations to implementation will also be examined and noted. In summary, this research initiative has the potential to make significant contributions to the health and well-being of Northern peoples and their environment by improving our understanding of safe and appropriate wastewater treatment solutions.
ANNUAL MEETING
POSTERS
Listed in alphabetical order of contributing author
CLIMATE CHANGE IMPACTS ON TRADITIONAL FOOD SECURITY IN KANGIQSUALUJJUAQ, NUNAVIK

Alain, Judith1,2 (judith.alain.1@ulaval.ca) and Christopher Furgal1,3

1Community Health, Department of Social and Preventive Medicine, Université Laval, QC, G1K 7P4  
2Unité de recherche en santé publique, CHUQ-CHUL, Édifice Delta 2, Bureau 600, 2875, boulevard Laurier, 6e étage Ste-Foy, QC, G1V 2M2  
3Indigenous Environmental Studies Program, Trent University, 1600 West Bank Dr, Peterborough, ON, K9J 7B8

Throughout the Arctic, research documenting Aboriginal observations of climate change has been carried out and reported many similar observations. These changes have the potential to influence the availability, accessibility and quality of natural resources essential to the traditional diet of Inuit communities. These foods are a central determinant of health for Inuit, because of their nutritional benefits, social and cultural importance. Therefore, the potential threat to aspects of country food security by environmental change in northern regions represents a significant public health concern that requires further study. In order to document Inuit experience-based observations and perspectives on the implications of environmental change for regular subsistence activities, 20 individual semi-directed interviews were held during the 2006 fall hunting season in the coastal community of Kangiqsualujjuaq, Nunavik. Preliminary results from interviews with hunters, fishers and other collectors in the community identified a variety of environmental changes impacting availability and quality of traditional/country foods as well as individuals' access to these resources. Key changes in environmental conditions mentioned as having an influence on the availability and accessibility of traditional/country food resources, included the later freeze-up and earlier break-up of sea ice and the lack of snow restricting travel on the land to access hunting and fishing areas in both the winter and spring. The closer proximity and more frequent presence of polar bears along the shoreline has also been reported to restrict camping associated with long term hunting and fishing in the area. Changes in timing of species migration are also reported to be influencing optimum periods for fishing and hunting. Arctic Char (Salvelinus alpinus) are now seen to be going up river earlier and snow geese (Chen caerulescens) tending to stay longer into the fall. As well, hunters identify that the availability of rock ptarmigan (Lagopus mutus) appears to have decreased in the areas as well as the numbers of bird eggs (various spp.) to be collected. As well, participants interviewed identified a number of changes in the quality of traditional/country foods, including a different taste of the meat of caribou (Rangifer tarandus), abnormalities in the flesh of Arctic Char and a thinner layer of fat on seals (Phoca hispida) and caribou. Although all participants reported impacts associated with the documented environmental changes, when asked about the ability to access "enough" traditional/country food for their household needs, slightly more than half of the respondents reported being satisfied with the amount of food they could currently collect. These preliminary results suggest that some harvesters are using or developing adaptation strategies, which are effective thus far in coping with the adverse effects of environmental change on country/traditional food harvesting activities. The results of the study are currently being shared with and validated by the community and participants. It is expected that this project will help support the identification and development of approaches to help individuals adapt to changing conditions at the community level to deal with adverse effects of climate change on Inuit food security.

SENSITIVITY AND ADAPTATION TO CLIMATE CHANGE IN TUKTOYAKTUK

Andrachuk, Mark (mandrach@uoguelph.ca)

Department of Geography, University of Guelph, Guelph, Ontario N1G 2W1

Things have changed and nothing is the same – for me it’s really hard to adjust" - resident of Tuktoyaktuk Community-based research in the Inuvialuit community of Tuktoyaktuk identified two main areas of sensitivity to changing climate-related conditions: livelihoods, which are based on a mix of subsistence harvesting and a wage economy; and community infrastructure. The research methodology was based on a vulnerability framework, which highlights sensitivities and exposures to the impacts of climate change, as well as the capacity of individuals or communities to adapt to changing conditions. Pre-research consultations, the research licensing process, and communication with key contacts in Tuktoyaktuk have ensured that the outcomes of this research are relevant for scientists, policy-makers, and residents of Tuktoyaktuk. Collaboration with local researchers facilitated information sharing and afforded the opportunity to further build local capacities. Many Tuktoyaktuk residents rely on subsistence harvesting as a source of food, cultural identity, and income. Recent declines in the nearby caribou population, shifting migration routes of geese during the spring and fall, and unpredictable variations in ice and wind conditions have stressed the ability of Tuktoyaktuk residents to take advantage of subsistence harvesting. Some individuals and families have extensive experience with subsistence harvesting and can readily adapt to these changing conditions, while others are able to seize opportunities in the wage economy. Nonetheless, the adaptability of
some residents is constrained by limited experience and knowledge required for subsistence harvesting, inconsistent employment, lack of sufficient education or training, or substance abuse. Tuktoyaktuk residents are also sensitive to coastal erosion and melting permafrost that are threatening public buildings, homes, and roads within the community. The ability of the community to adjust to these changes is constrained by limited space for new buildings and a growing population that continually requires more housing units. Though local government recognizes that a relocation of the community may be necessary, interim strategies have focused on protecting shorelines and filling depressions with gravel. Both the interim strategies and the prospect of relocating the entire community to higher ground require substantial financial resources and, consequently, the community is highly dependent on the territorial and federal governments. On the basis of existing sensitivities, it is clear that Tuktoyaktuk residents are vulnerable to future climate change, which is expected to drive further changes to weather, sea ice, permafrost, and animal populations. There is considerable variation in the ways that Tuktoyaktuk residents are affected by changing environmental conditions but options for adaptation are limited. Stresses to subsistence harvesting and infrastructure caused by future climate change may be beyond the capacity of current adaptive mechanisms and could require significant changes to the livelihoods of residents or involvement of higher levels of government.

MONITORING FOR ECOLOGICAL INTEGRITY IN A NORTHERN LABRADOR FIORD-BASED ECO-SYSTEM: NACHVAK AND SAGLEK FIOARDS

Bastick, Jacquie¹ (Jacqueline.Bastick@rmc.ca), Ken Reimer² and T.W. Knight³

¹Royal Military College of Canada, PO Box 17000 Stn Forces, Kingston, ON, K7K 7B4
²Parks Canada, Western Newfoundland and Labrador Field Unit, Box 130, Rocky Harbour, NL A0K 4N0
³Ocean Mapping Group Dept of Geodesy and Geomatics Engineering University of New Brunswick P.O. Box 4400 Fredericton, NB E3B 5A3

Labrador Inuit are concerned about the impact of stressors, such as climate change, industrialization, and contaminants, to the marine environment in northern Labrador. Nunatsiavut Nuluak, an ArcticNet project providing a baseline inventory and comparative assessment of three fjords in northern Labrador, examines the impacts of these stressors. This particular Nunatsiavut Nuluak research in Nachvak and Sagle Fiords, adjacent to the newly established Torngat Mountains National Park Reserve, examines the utility of several key indicators to assess and monitor ecosystem change through time. Fieldwork from both shore and ship-based platforms was conducted during the summers of 2006 and 2007. Preliminary results include productivity profiles for the mouth and head of the fiords, bathymetric mapping, and data collected to generate habitat maps. Clam and sculpin samples also were collected throughout the fjords, in collocation with water column profiles. These data will be used to analyze clam-community compositions, establish fish health indices, and provide contaminant loading information. Aging and isotopic analysis will also be conducted. Results of this study will provide Parks Canada with significant baseline data required to establish the park's long-term marine monitoring program. It will also provide Labrador Inuit with a comparative snapshot of ecosystem health in relatively pristine reference sites.

GEOHAZARDS AND NAVIGATIONAL HAZARDS IN THE NORTHWEST PASSAGE

Bennett, Robbie¹ (rbennett@nrcan.gc.ca), S. Blasco¹, J. Beaudoin², J. Hughes-Clarke², B. MacLean¹

¹Geological Survey of Canada (Atlantic) P.O. Box 1006 Dartmouth, NS B2Y 4A2
²Ocean Mapping Group Dept of Geodesy and Geomatics Engineering University of New Brunswick P.O. Box 4400 Fredericton, NB E3B 5A3

From 2004 to 2007, ArcticNet project 1.6 has been investigating geohazards and hazards to navigation in the Northwest Passage using multibeam sonar and sub-bottom profiler data. This work addresses engineering issues related to hydrocarbon development, improves navigation safety in the Northwest Passage, and provides seabed information for benthic ecosystem assessment as well as northern fisheries. A large fault on the Beaufort shelf-edge off Baillie Island, NWT was imaged using seismic reflection onboard the CCGS Nahidik in 2007. The seismic data also revealed what appears to be diapirism related to the shelf-edge faulting. During the ArcticNet program several geohazards related to shelf-edge and slope instability have been observed (slumping, sliding, faulting, diapirs, etc.) which provide valuable information for the development of future seabed infrastructure. A group of ten mud volcanoes on the Beaufort Shelf in approximately 55 meters water depth was mapped in 2007. These features are distributed in a patch about 2 km in diameter as opposed to other mud volcanoes mapped near the MacKenzie Trough which occur along a corridor about 20 km long. The distribution of the 2 km wide patch could be controlled by a hole (or talik) in the sub-seabed permafrost of the area which is allowing the upward migration of hydrocarbons. At times the scientific program of ArcticNet has required that the Amundsen transit through areas that have yet to be charted for navigation (i.e. areas of Hudson Bay in 2007). During these transits the multibeam operators from project 1.6 have aided the Coast Guard crew to
safely navigate these waters and accomplish the scientific goals of many other ArcticNet projects. This work will also contribute to the development of safe transit routes for the Northwest Passage to avoid maritime accidents as marine traffic increases in the Canadian Arctic. Multibeam and sub-bottom data collected in Cumberland Sound in 2007 will assist the fishermen of Pangnirtung to understand the bottom types present in their fishing area.

A REMARKABLE SEDIMENT DEPOCENTER AND ENVIRONMENTAL ARCHIVE OFF THE GREAT WHALE RIVER, HUDSON BAY, QUEBEC

Bentley, Sam\textsuperscript{1} (sjb@esd.mun.ca), Peter Hülse\textsuperscript{1}, Ian Church\textsuperscript{2}, and Steve Brucker\textsuperscript{3}

\textsuperscript{1}Earth Sciences Department, Memorial University of Newfoundland, St. John's NL A1B 3X5
\textsuperscript{2}Ocean Mapping Group, University of New Brunswick, Fredericton NB E3B 5A3

As part of a study of fluvial sediment and freshwater flux into Hudson Bay, a sonar and box-core survey offshore of the Great Whale River (Quebec) was conducted during Leg 1 of the CCGS Amundsen 2007-2008 expedition. Fresh water discharge from the Great Whale River is presently approximately 20 cubic km/y from a drainage basin of 43,200 square km in northwestern Quebec, making it one of the larger rivers flowing into Hudson Bay. Present sediment discharge is not known, but is likely to be proportional to water discharge, and has been estimated at approximately 1,000,000 t/y from statistical hydrologic models (Bentley, 2006), and may be declining due to declining discharge and changing climate in the basin (Dery et al., 2005; Bentley, 2006). As a first step in constraining patterns of discharge that extend back beyond the ~40y instrument record, cores, multibeam, and subbottom sonar data were collected offshore of the river mouth, from a coastal basin of approximately 140 square km in extent. Boxcores were subsampled for X-radiography, granulometry, and sediment radiochemistry. Core samples are presently being analyzed for the particle-bound radioisotopes Be-7 (half-life=53.3d), Th-234 (half-life=24.1d) and Pb-210 (half-life=22.3yr), to elucidate spatial and temporal patterns in sediment flux and thus freshwater input on seasonal to centennial timescales. Preliminary results show that this offshore basin contains extensive deposits of terrigenous sediments that locally exceed 50m thickness, suggesting that this basin is a remarkable archive of environmental history in the form of stratified sediment deposits from the Great Whale River catchment. More detailed understanding will be derived from ongoing analysis of core and sonar data in hand, and proposed sampling in future years. References: Bentley, S.J., 2006, Fluvial Sediment Delivery to Hudson Bay in a Changing Climate; Proceedings, ArcticNet Annual Science Meeting, Victoria BC. Déry, S., et al., 2005, J. Climate, 18: 2540-2557.

TERRESTRIAL ARTHROPOD ABUNDANCE AND PHENOLOGY IN THE CANADIAN ARCTIC; A BASELINE STUDY ON THE VARIATION IN RESOURCES AVAILABLE TO ARCTIC-NESTING INSECTIVORES

Bolduc, Elise\textsuperscript{1} (Elise.Bolduc@uqar.qc.ca), L. McKinnon\textsuperscript{1}, J. Bêty\textsuperscript{1} and P. Smith\textsuperscript{2}

\textsuperscript{1}Département de biologie et Centre d’études nordiques, Université du Québec à Rimouski, Rimouski, QC G5L 3A1
\textsuperscript{2}Carleton University / Canadian Wildlife Service, Ottawa, ON K1A 0H3

Some arctic terrestrial arthropods such as insects and spiders have been identified as irreplaceable plant pollinators, important soil fertilizers and significant elements of the arctic food web. However, in the Canadian arctic tundra, very little is known on most arthropod communities, their ecological roles, and their potential response to global warming. Many species of insectivorous birds depend on arthropods to survive and breed successfully in the Canadian Arctic. These birds are then consumed by different species of predatory birds and mammals. The main focus of our study is the interaction between nesting insectivorous birds and arthropod communities of the arctic tundra. It is one of the very few extensive studies of terrestrial arthropods in the Canadian Arctic. The data presented here were collected on Bylot Island, Nunavut (2005 and 2006) and Southampton Island, Nunavut (2006). They include baseline data on insect diversity, insect phenology, seasonal variation in insect abundance, insectivore (shorebirds) reproductive phenology and relationships between those parameters and local weather conditions. Such information is essential to identify the vulnerability of arthropods and insectivores to actual climate changes. Insects are known to be highly responsive to temperature. As a result, insect growth and reproduction are limited to a very narrow window of favorable climatic conditions in the Arctic. This generates a short-lived peak in abundance and activity over the summer. It is critical and challenging for migrating insectivore birds to synchronize their hatch date with this narrow peak in food availability. Climate changes will very likely affect the timing and level of this peak. Potential effects of these changes on insectivore populations are unknown and we are currently trying to document the adaptability of insectivores to the rapidly changing breeding environment. In association with the International Polar Year (IPY) 2007-2008, our sampling is being expanded to cover 4 different sites throughout the
arctic (2007-2009), one of the most extensive studies of terrestrial arthropods in the Canadian Arctic. Combining data on the seasonal diversity and abundance of insects with data on insectivore reproductive phenology from various sites throughout the arctic will provide greater insight into arctic arthropod and insectivore communities and their potential response to global warming.

**IMPACTS OF CLIMATE CHANGE ON THE AVAILABILITY OF GRANULAR RESOURCES IN THE INUVIALUIT SETTLEMENT REGION, NWT**

**Borsy, Emily**¹ (eborsy@ryerson.ca) and Frank Duerden²

¹Environmental Applied Science and Management, Ryerson University, 350 Victoria Street, Toronto, M5B 2K3
²Department of Geographic Analysis, Ryerson University, 350 Victoria Street, Toronto, M5B 2K3

It is generally well documented that physical community infrastructure is vulnerable to changes in permafrost regimes resulting from warming in Arctic environments. Although vulnerability of community infrastructure is primarily the result of environmental change, it is greatly exacerbated by a host of other factors related to accessibility to aggregates that commonly insulate built form from the active layer of the permafrost. The ability of communities to address stresses brought about by melting permafrost is a function of access to aggregates, the ability to transport them, and competition for gravel between users. In the Inuvialuit Settlement Region readily accessible aggregate is in short supply, and concerns about resource allocation pre-date current prognoses about the impact of global warming. The prospect is that while demand for gravel will increase as permafrost is degraded, competition from new activities, e.g., the Mackenzie Valley pipeline, and possibly the construction of a road from Inuvik to Tuktoyaktuk, along with degradation of winter roads may stress further supplies. A key to reducing vulnerability to communities will be the proper management of aggregate resources, including conducting demand forecasts, gravel inventories, and ensuring proper monitoring of gravel use. This poster describes a research project examining the manner in which institutional arrangements, the geography of aggregate distribution, transportation, and competition from emerging new activities exacerbate vulnerabilities associated with permafrost melt. Research involved assessment of the possible physical impacts of permafrost degradation, assessment of the distribution of, and access to aggregates in the ISR, and interviews with community representatives, government departments and engineers involved in infrastructure construction and maintenance, and granular resource allocation and management. The ability to alleviate infrastructure vulnerabilities depends to a great extent on an integrated approach to the management of aggregate resources, and the capacity to manage competing demands.

**PROGLACIAL SUCCESSION OF BIOLOGICAL SOIL CRUSTS AND VASCULAR PLANTS ON A HIGH ARCTIC GLACIER FORELAND**

Breen, Katie and Esther Lévesque (esther.levesque@uqtr.ca)

Département de chimie-biologie, UQTR, Trois-Rivières, Québec G9A 5H7

The retreat of glaciers over much of the High Arctic since the end of the Little Ice Age (LIA) ca. 1850 has resulted in the exposure of new land surfaces to biotic colonization. Pioneering microorganisms such as cyanobacteria, green algae, lichens, mosses, fungi and heterotrophic bacteria are typically the first organisms to colonize this new terrain. These organisms can coalesce over time to form a visible organic matrix on the soil surface known as a biological soil crust. In polar deserts or recently deglaciated areas devoid of higher plants, these early colonizers are crucial in initiating the formation of an organic and nutrient-enriched substrate in which more complex organisms may become established. This poster outlines the influence of biological soil crusts on the establishment and maintenance of vascular plants along the Teardrop Glacier foreland in Sverdrup Pass (79°N), Ellesmere Island, Nunavut. Vegetation community analysis and investigations of soil characteristics undertaken during the summer of 2004 demonstrate that this unique foreland supports a well-developed community of biological soil crusts and vascular plants with enhanced soil moisture and nutrient characteristics. Greater plant species richness, cover and density were observed compared with other glacier foreland communities previously investigated in the Canadian High Arctic. Biological crusts were associated with rapid colonisation by vascular plants within 36 m of the glacier (<20 years following glacier retreat). Plant densities in the crusts were more than 3 times those of the surrounding polar desert region, underscoring the successful recruitment and establishment ability on the Teardrop foreland. Crusts did not increase seed retention or germination compared to bare soil; however, they significantly improved the nutrient status of the substrate. Species dominant in later successional stages (e.g. the shrubs Salix arctica and Dryas integrifolia) had a higher density in crust, suggesting that their successful recruitment and/or maintenance is associated with the presence of crust. Predicted increases in vegetation
cover across the Arctic therefore may depend on the distribution of biological soil crusts.

ZOPLANKTON COMPOSITION AND ABUNDANCE: A COMPARISON OF THREE FIOARDS ALONG THE LABRADOR COAST

Brown, Tanya M. (tanya.brown@rmc.ca) and T.A. Sheldon

Environmental Sciences Group, Royal Military College of Canada, P.B. 17000 Stn Forces, Kingston ON, K7K 7B4

Zooplankton are an important component of the Arctic marine food web, channeling energy from primary production to fish and marine mammal resources at the higher trophic levels. Their pivotal role in the food web make zooplankton an excellent indicator of the state of a marine ecosystem. This study is one component of Nunatsiavut Nuluak (ArcticNet 3.7), a project conducting a baseline inventory and comparative assessment of three Labrador fiord marine ecosystems. The objectives of this study are: (1) to provide a baseline description of the distribution, composition, and abundance of zooplankton in three Labrador fiords; (2) to look at seasonal zooplankton differences in the three fiords; and (3) to assess the impacts of climate change and human activities on the fiord zooplankton populations. Zooplankton composition and abundance were investigated in Anaktalak, Saglek, and Nachvak in the fall 2006 and summer 2007. Vertical Hydrobios nets and oblique Tucker Trawls were used to collect the zooplankton. Salinity and temperature profiles were taken at every station using a Seabird SBE911 CTD, deployed from a rosette. Water samples for nutrients were collected at various depths. During the summer 2007 survey, water samples were collected at different depths in the photic zone to obtain measurements of Chl a and for the determination of cell counts and species composition. Zooplankton communities for all three fiords were dominated by Copopoda (Calanus hyperboreus, Calanus glacialis, Pseudocalanus sp., Oithona similis) and Chaetognatha (Sagitta elegans). The copepod Metridia longa, was found in the two most northern fjords (Saglek and Nachvak) and not in Anaktalak. Nachvak had the greatest number of zooplankton species (37) and the highest nutrient concentrations compared to Saglek and Anaktalak. Nutrient concentrations were greater in the inland areas of Saglek and Anaktalak. Preliminary results indicate that Nachvak may be more diverse than Saglek and Anaktalak. Work in the winter of 2007 will be completed to reveal the relationship between these differences and their association to climate change and/or human activity.

AVIAN CHOLERA RECURRING IN A COMMON EIDER (SOMATERIA MOLLISSIMA) BREEDING COLONY IN CANADA’S LOW ARCTIC

Butlter, E. Isabel1 (ibuttler@connect.carleton.ca), H.G. Gilchrist2, C. Soos3, S. Dechamps1, A. Dallaire4, D. Biehler5 and S. Lair6

1Carleton University, Ottawa, Ontario K1A OH3
2Environment Canada, Science and Technology Branch, National Wildlife Research Centre, Ottawa, Ontario K1A OH3
3Environment Canada, Science and Technology Branch, Saskatoon, Saskatchewan S7N 0X4
4Canadian Cooperative Wildlife Health Centre, Faculté de Médecine Vétérinaire, Université de Montréal, St. Hyacinthe, Québec, J2S 7C6
5USGS

National Wildlife Health Center, Madison, Wisconsin, USA -- Avian cholera, caused by the bacterium Pasteurella multocida, is one of the most common diseases resulting in mass mortality among North American wild waterfowl. However, outbreaks have only recently been detected in the Eastern Canadian Arctic, and appear to be moving progressively north and east. Despite the common occurrence of avian cholera, it has been difficult to assess its impact on distinct wild populations. Beginning in 2004, we have observed annual outbreaks of avian cholera in a breeding population of Common Eiders (Somateria mollissima) at East Bay Island, Southampton Island, Nunavut. The appearance and severity of the disease coincided with the dramatic increase in the total number of nesting pairs on the island from about 5000 pairs between 2001 and 2004 to about 9800 pairs in 2006. In 2004, mortality among breeding females was low (<1%), but rose to 5.1% in 2005, and peaked in 2006 at 31.7%. In 2007, colony size was lower at an estimated 4700 pairs (potentially a result of the previous year’s high mortality rate), and mortality among breeding females decreased to 15.4%. Mortality among males was only observed when the onset of outbreaks occurred before males had left the colony to moult. Outbreaks began progressively earlier each year, and in 2007, the first dead eider was seen only two days after male numbers on the island peaked. Accordingly, the number of recovered male carcasses constituted only 0.5% of the total carcasses in 2005 (1 of 203), but 1.9% of recovered carcasses in 2007 (15 of 781). Diagnostic evaluation of carcasses by necropsy, histopathology, and bacteriology revealed P. multocida as the cause of mortality in 2005 to 2007. All bacterial isolates obtained in 2005 were serotype 1, the most common serotype among west and central North American waterfowl populations. In 2006, both serotype 1 and 3/4 isolates were obtained. Serotype 3/4 outbreaks have historically occurred on the east coast (Maine, Chesapeake Bay). In 2007, we investigated the role of environment as a reservoir for P. multocida by collecting water and sediment
samples prior to and during the outbreak, also addressing whether the bacteria can survive over winter in the arctic environment. We also collected choanal and cloacal swabs from apparently healthy eiders arriving on the colony to evaluate their carrier status prior to outbreaks.

**MERCURY AND ORGANIC MATTER IN THE MACKENZIE RIVER BASIN, NWT**

Carrie, Jesse¹ (umcarrie@cc.umanitoba.ca), Fariborz Goodarzi², Dan Leitch¹, Hamed Sanei², Gary Stern³ and Feiyue Wang¹

¹Dept. of Environment & Geography, University of Manitoba, Winnipeg, Manitoba, R3T 2N2  
²Geological Survey of Canada-Calgary, Calgary, Alberta, T2L 2A7  
³Freshwater Institute, Dept. of Fisheries and Oceans, Winnipeg, Manitoba, R3T 2N6

A preliminary look at the speciation of mercury (Hg) in river sediments in the Mackenzie River Basin (MRB) has been undertaken. Sediment samples were taken along the entire length of the Mackenzie River and its main tributaries and analysed for Hg and underwent Rock-Eval pyrolysis and petrological analysis. Results show that the middle reaches of the river have the highest Hg levels. This region is bounded by the Mackenzie Mountains on the western side, and suggests that these high energy systems are contributing Hg to the Mackenzie mainly via erosion. There is no correlation between any of the Rock-Eval parameters (S1, S2, RC, TOC) and Hg in the system as a whole. However, significant correlation between S1 and Hg (r² = 0.51) has been found in the tributaries that are lake fed (n = 5), suggesting that the lakes are acting as an organic source of Hg. A coal bed situated near Tulita, NWT has very elevated levels of Hg in spots (up to 2.4 mg/kg) and petrological studies show that the largest size and highest density of huminitic particles reside in this area, confirming that the coal bed is acting as a source of Hg to the river.

**POTENTIAL EFFECTS OF CLIMATE CHANGE ON METHYL MERCURY CYCLING IN HIGH ARCTIC FRESH WATERS: INSIGHTS FROM EUTROPHIED MERETTA LAKE, CORNWALLIS ISLAND**

Chételat, John (john.chetelat@umontreal.ca) and M. Amyot

Département de sciences biologiques, Université de Montréal, Montréal, Québec, H3C 3J7

Methyl mercury (MeHg) is a potent neurotoxin that biomagnifies through food webs and concentrations of concern have been observed in land-locked arctic char of the Canadian High Arctic. The movement of MeHg through aquatic ecosystems is likely to change over the upcoming decades as fresh waters become more productive due to increases in temperature and nutrient loads from watersheds. Meretta Lake on Cornwallis Island was artificially enriched with nutrients for several decades but since sewage discharges diminished and eventually stopped in the 1990s, the trophic state of Meretta has returned to slightly above background conditions observed in adjacent lakes. In the summers of 2005 and 2006, we sampled several ecosystem components from Meretta Lake and made comparisons with other regional lakes to investigate potential effects of increased productivity on the movement of mercury. Concentrations of MeHg were elevated in the stream water (0.1-0.3 ng/L) of one of the inflows to Meretta Lake. This inflow was covered with thick filamentous algae and had warmer water temperatures and higher total phosphorus than other inflows suggesting that conditions stimulating higher primary productivity may have also enhanced in situ methylation. Greater trophic transfer of MeHg to resident chironomid larvae was also measured in this stream. Profundal sediment from Meretta Lake had relatively low mercury content although it was higher than in most lakes in the area. Among-lake variation in sediment mercury content was positively related to the amount of organic matter present, suggesting that increased lake or watershed productivity may lead to greater deposition of organically-bound mercury to sediment. In addition, eutrophication of Meretta Lake caused a shift in zooplankton taxonomic composition to dominance by Daphnia species, a taxon that tends to bioaccumulate more MeHg than copepods. Our preliminary findings require further validation to determine the underlying processes but they suggest that increased productivity in High Arctic aquatic ecosystems could potentially have multiple effects on MeHg cycling by altering methylation, sedimentation and the community structure of biota. We stress the need to focus future research efforts on the role of ecosystem productivity in mercury cycling and its implications for climate change in the High Arctic.

**YOUTH ENVIRONMENTAL AWARENESS: PERSPECTIVE ON INTERGENERATIONAL KNOWLEDGE TRANSFER ON ENVIRONMENTAL CHANGE IN CHURCHILL, MANITOBA**

Chow, Linda (umchowlh@cc.umanitoba.ca)

Department of Environment & Geography, University of Manitoba, Winnipeg, Manitoba, R3T 2N2
The purpose of this research is to document the importance of elders, cultural teachers and scientists as role models, sharing traditional, local and scientific knowledge with youth aged ten to twelve. This research relies on an individual’s own knowledge, beliefs and attitudes towards environmental change issues, therefore one of the specific objectives of this research is to identify the impact of elders and cultural teachers on youth environmental awareness. Elders (Métis, First Nations, Inuit and non-Native) possess distinct knowledge and intergenerational knowledge transfer that is essential for a healthy cultural dynamic. By linking traditional, local and scientific knowledge, children will be able to better understand the environmental changes in their community. There are three main objectives of this research. The first objective is to gain the trust of locals in the community and to build a close relationship with the children and elders. The second is to work with the children and elders to research their traditional and local knowledge regarding environmental changes in their surroundings to be linked with scientific knowledge gathered from literary works of other researchers. Lastly, utilizing the information gathered to assist children in environmental awareness and in bridging the gap between elders and scientists. There are three proposed methods for this research. The first method is to facilitate discussions concentrating on children and elder participation by conducting interviews with elders concerning environmental change. The next step is to allow children to demonstrate their knowledge of environmental change through a series of activities. Finally, collaboration between children and elders in facilitated discussions will be recorded. This will allow researchers to comprehend the current elder-child relationship in order to identify if the passing of knowledge from generation to generation is still strong. The significance of this research is primarily focused on learning from children and elders in the town of Churchill and to provide the researcher with an in-depth insight as to what are the problems regarding environmental change that the community is most concerned about. As well, to identify whether children are aware of their changing environment as a result of learning traditional and local knowledge. The researcher will then compile recommendations made by elders and children for future environmental change research.

APPLYING PREDICTED TIDES FROM A LOCAL HYDRODYNAMIC MODEL TO MULTIBEAM BATHYMETRY: A SOLUTION FOR SEABED MONITORING IN REMOTE LOCATIONS

Church, Ian (ian.church@unb.ca), S. Haigh and J.-E. Hughes Clarke

There has been an increased interest in monitoring seabed transformation from geological processes, such as ice-scouring, mass-wasting, tidal scouring and bedform migration, in remote locations of the Canadian Arctic. The CCGS Amundsen and the CSL Heron have the capability of collecting survey data in these areas for geological interpretation with their EM300 and EM3002 multibeam sonar systems, respectively. To monitor seabed change over time multiple survey datasets are compared, but direct comparison requires a stable common vertical reference datum. The often decimeter level relative vertical precision that is required to detect alterations in the morphology is difficult to obtain in remote locations. One specific project is monitoring the evolution of pro-glacial deltaic sediments in Oliver Sound, within Sirmilik National Park. Traditionally, a tide gauge would be installed in the vicinity of the study area to record water levels during a survey period. In this case, logistics, time constraints and conditions prohibit the installation of such a device. If a gauge could be established, the individual deltas are spread out over several 10’s of kilometres along constricted waterways and there is no prior knowledge of the likely propagation of the tidal wave. Other, non-conventional methods of establishing a vertical reference datum must be considered. Ship based globally corrected RTG GPS observations (CNav) are available, but for the requirements of these surveys are not accurate enough and suffer from severe reliability issues due to the steep fjord walls. The Arctic-wide WebTide tidal prediction model would be an option for the more open waters, but does not resolve the fjords. Predicted tides from nearby benchmarks could also be used, but they are far from the survey area and separated by complex and restricted bay geometries. In order to overcome these hurdles, a local nested hydrodynamic circulation model has been developed. The model delivers predicted tidal amplitude, phase and current information at any location within its domain for the two principal semidiurnal constituents (M2 and S2) and diurnal constituents (K1 and O1). Applying these predicted tides to multibeam survey data removes the effects of the tide, thus allowing them to be related to a common vertical datum. The model can be tested against CNav GPS observations, which can confirm correct model phasing of high and low water.

INFLUENCE OF SUMMER INVERSION FREQUENCY ON MELT SEASON PARAMETERS AND ENHANCED ARCTIC GLACIAL MELT

Chutko, Krystopher J. (2kjc2@queensu.ca) and Scott F. Lamoureux
We investigated the vertical variation of temperature in the High Arctic to identify differences between weather records from stations near sea level and higher elevations where ice caps are located. Mean daily lapse rates were determined from twice-daily rawinsonde ascents at Resolute, Nunavut from May 1 to September 30 from 1961 to 2003. Results indicated that thermal inversions are critical for determining the length and intensity of the melt season at the level of low-elevation ice caps (e.g., 300 m asl). Increased observed July inversion frequency (the ratio of days with positive lapse rate to the total number of days in the set) resulted in a 72% increase in the total melting degree-days as opposed to estimates using a fixed linear lapse rate. For the 1961-2003 period (May through September), a mean increase in total melting degree-days of 41% was observed. Also, intraseasonal lapse rates demonstrate a control on the initiation and conclusion of the melt season. Reduced inversion frequency in June and September reduced the incidence of positive temperatures and effectively limited the melt season to July and August. In years with increased June and September inversion frequency, a commensurate lengthening of the melt season was observed. The increasing trend of vertical lapse rates observed since the late 1980’s implies a general lengthening of the Arctic melt season since that time. Increased inversion frequency leading to shallower vertical lapse rates since the late 1980’s are explained by observed synoptic scale climate patterns. The tropospheric circumpolar vortex is a dominant control on Arctic atmospheric circulation. When centered over the Canadian Arctic, the circumpolar vortex blocks northward moving warm air masses and maintains cooler surface temperatures. However, a 40% decrease in the incidence of a Canadian Arctic centered vortex since 1987 has been observed and was identified as an important factor in increasingly negative glacier mass balance since that time (Gardner and Sharp, Journal of Climate, in press). The net mass balance of four Canadian Arctic ice masses decreased from −0.07 m·a⁻¹ to −0.20 m·a⁻¹ from 1963-1986 to 1987-2001, respectively. The net mass balance is highly correlated with the summer mass balance on Devon Ice Cap ($r^2 = 0.97$) and strongly suggests that the increased mass loss is due to enhanced summer ablation. Summer thermal inversions are likely the result of the incursion of warm air masses to higher latitudes as a consequence of the position of the circumpolar vortex in the Eurasian Arctic, and are a potential cause of enhanced summer glacial ablation.

Current research indicates that certain contaminants are becoming a major concern in many Northern communities. In the community of Sanikiluaq, which is one of the arctic homelands of Canada’s Inuit, the potential social, cultural and health implications of contaminants are becoming a concern within the community. For many Inuit, cultural identity is linked to the procurement and consumption of traditional foods; so the presence of these substances can undermine trust in the safety of these foods and the important role they play in communities. Today, not only are their traditional hunting grounds at risk from externally-generated contamination but their whole future and identity can be at stake. To date, there is little evidence that the Inuit’s specific concerns regarding contaminants have been adequately considered in environmental management planning issues. Elucidation of their perceptions and concerns, which are based on culturally framed qualitative factors, is critical to risk management efforts in Northern Communities. The management and communication of the risks posed by environmental contaminants in the food chain of northerners comprises a very challenging issue for health and environmental professionals; and unfortunately, risk management and communication strategies in the past have often resulted in confusion and distrust. Therefore, in order to minimize these impacts more emphasis needs to be placed on understanding the perceptions and examining the levels of comprehension and awareness within the local community. With that in mind, the objective of this project is to determine community perceptions and comprehension, as well as to examine current linkages between traditional and scientific knowledge on the topic of contaminants in the Arctic environment. This will be done by incorporating both quantitative and qualitative methodologies but will focus on the latter; which will include oral and observational techniques. To date, interviews have been conducted with community elders, hunters, women of child-bearing age; in addition to this a workshop was held with high school youth to discuss, explore and document their perceptions on issues related to contaminants. Through the interviews the researcher was able to gain an understanding of the everyday activities of the community; their relationship with the environment; as well as the impact of environmental contaminants and how they perceive them. Preliminary results indicate that the concept of
"contaminants" includes a wide spectrum of related items, many of which are outside the definition of "chemical contaminants"; there is a moderate level of awareness of contaminants issues; and incorporating traditional knowledge in communication and education strategies is important to the community and essential in improving community comprehension of contaminants issues. The results of this project will help determine why certain misconceptions exist and enable corrections to be made in future communication strategies.

MAPPING OF NACHVAK AND SAGLEK FIORDS, NORTHERN LABRADOR

Copeland, Alison (g37aic@mun.ca) and T. Bell

Department of Geography, Memorial University of Newfoundland, St. John's, NFL and Labrador A1B 3X9

The seabed mapping component of Nunatsiavut Nuluak (ArcticNet Project 3.7) is intended to address questions of navigation, seabed bathymetry, marine geology and geohazards, and benthic habitat classification in three fiord systems of northern Labrador. This presentation describes recent progress in Nachvak and Sagleq fiords, including preliminary analysis of data from the 2007 field season. A substantial area of the seabed of Nachvak and Sagleq Fiards has been surveyed using multibeam sonar on the research vessels CCGS Amundsen, CCGS Matthew, CSL Heron and CSL Plover. In the first instance, these data are used for navigation and the generation of nautical charts because there are limited bathymetric data available for these fiords. Multibeam data, however, comprise both bathymetric and backscatter intensity values which in combination with adequate seabed sampling can be used to generate first-order substrate and habitat maps. Nachvak Fiord, the most northern fiord system, is a 45 km-long glacial trough cut through the Torngat Mountains. The fiord is 2-4 km wide, increasing gradually eastward to Nachvak Bay, which opens to the Labrador Sea. Previous bathymetric and seismic surveys revealed a succession of basins, separated by shallow barriers. The fiord threshold at the entrance to the fiord is very shallow with an average depth of <50 m and numerous bedrock-cored shoals. Nachvak fiord, located adjacent to the recently established Torngat Mountains National Park Reserve, provides an important reference site for the collection of baseline data on pristine Labrador fiords. Sagleq Fiord is a 50 km-long fiord at the southern edge of the Torngat Mountains. It narrows inland from a 13.5 km-wide embayment of the Labrador Sea to a 2 km-wide, steep-walled glacial trough at its head, called Uigjuktok Fiord. A tributary arm complex of the fiord enters from the north and includes West Arm, Southwest Arm (~0.75 km wide) and North Arm (~0.6 km wide). With the exception of Sagleq Bay at the mouth of the fiord, very little is known about the bathymetry, marine geology and benthic habitats of Sagleq Fiord. PCB contamination of 10 sq km of sediments in Sagleq Anchorage from an adjacent military site has focused field surveys on large-scale sediment mapping and movement with a view to establishing appropriate indicators for future monitoring. The overall goal of the benthic habitat project in Sagleq and Nachvak fiords is to create a classification of substrate and habitat types and map the results using multibeam acoustic data. In 2007, benthic grab samples and video were collected at 130 target stations throughout both fiords, as well as 11 towed video transects along the shoreline in Sagleq anchorage, where PCB contaminated sediments are located. The description of bottom type and dominant biota at these stations will help develop classification rules for substrate and habitat mapping from multibeam sonar data. In addition, repeat multibeam surveys of the contaminated seabed provide an opportunity to detect change in the location of PCB-hosted sands, which are subject to current and wave action, and to validate the results of sediment modeling in the basin.

IMPACTS OF PRESENT-DAY AND PAST ANIMAL POPULATIONS ON THE NUTRIENT AND CONTAMINATION STATUS OF FRESHWATER LAKES ON BYLOT ISLAND

Côté, Ghislain1 (ghislain.cote.2@ulaval.ca), R. Pienitz2 and G. Gauthier7

1Département de Géographie & Centre d’études nordiques, Université Laval, Québec, Quécqub G1K 7P4
2Département de Biologie & Centre d’études nordiques, Université Laval, Québec, Québec G1K 7P4

Arctic freshwater ecosystems are most sensitive to external environmental stresses, but the knowledge of their developmental history and natural variability is still very limited. Our study focused on 5 lakes and ponds on Bylot Island (72.4–73.5 N; 76.2–81.0 W), located in the largest breeding and nesting colony of the Greater Snow Goose (Chen caerulescens atlantica) in the Arctic. Due to protection measures and changes in the overwintering habitat, the population of breeding snow geese has increased dramatically over recent years (Giroux and al., 1998). As a result, the nutrient load originating from faecal goose droppings has increased, which may profoundly change the relative concentrations of C, N and P in the usually dilute and unproductive (oligotrophic) arctic lakes (Van Geest and al., 2003). Both nutrient loading (due to increased numbers of birds) and temperature...
Paleolimnology is a multidisciplinary science that studies the biological, chemical and physical research. Paleolimnological techniques have been used for this functioning of these tundra ecosystems. Elevation (due to rapid warming of high latitude regions) may cause large shifts in the composition and functioning of these tundra ecosystems. Perturbations (e.g., Engstrom, 1991; Finney et al., 2000; Sun et al., 2000; Laing et al., 2002). By extracting sediment cores from impacted lakes near breeding bird colonies and from non impacted lakes in the area, we used paleolimnological techniques to track short- and long-term changes in lake nutrient (trophic) status and contamination. Reconstruction of past levels of trophic state (nutrients like P and N) using algal fossils (diatoms) and stable isotopes (δ15N, δ13C) allowed us to determine if there is a correlation between our data and the known changes in bird population size over the past 30 years. By identifying this correlation, we will be able to track long-term changes in the size of past goose populations.


The present project was developed in the framework of the project 1.5. ArcticNet that deals with ‘Changes in dietary pattern and impacts on chronic diseases emergence (new diseases)’, in particular as far as section 3 (Integration of network partners (Inuit organizations and communities, industry...) and section 5 (Training of Highly Qualified Personal) are concerned. Following discussions about the emerging junk food problem in Nunavik, we were asked by Makivik Corporation to write a letter concerning ‘A call for a ban on industrially produced trans-fats in foods imported in Nunavik’. This letter was intended to provide Inuit representatives with scientific evidence regarding the necessity and feasibility of banning industrially-produced trans-fatty acids (IP-TFA) in foods sold in Northern Québec. The scientific argument was built around seven allegations that were meant to bring clues about: (1) the known and suspected harmful health effects of trans-fats; (2) the vulnerability of Inuit communities to imported foods that are rich in IP-TFA; (3) the heterogeneity of exposures to TFA found across the Arctic depending on the quality of imported foods (see abstract 1); (4) the example of Denmark and Greenland that successfully reached minimum levels of exposure through a strict regulation on food content; (5) the possible implementation of a ban on IP-TFA in Nunavik; (6) the urge for such preventive actions in Inuit communities whose health is already in transition; (7) and the more global public health priority of preventing the arising ‘junk food epidemic’ across the circumpolar world. This argument was mailed to the Nunavik Board of Health and Social Services, the Kativik School Board and the Kativik Regional Government to create awareness in those institutions and organisations. The present project deals with the follow-up of the Makivik initiative, and in particular as far as allegation (5) of the argument is concerned. Our aim was to bring scientific and technical support to Inuit representatives as well as people responsible for the food supply in Nunavik in the practical implementation of the ban on IP-TFA in the framework of a public/private partnership. After a prospective phase conducted in Québec that allowed us to set a list of products sold in Nunavik that may contain trans-fats and a list of potential alternative (trans-fat free products) as well as an information leaflet on TFA
directed to Nunavik residents, we performed a pilot study in Kuujjuaq. Of particular interest is that a Québécois bachelor student in Nutrition and an Inuk secondary five student worked together to gather relevant information from the food retailers, professionals from the regional board of health, Inuit representatives, and people living in Kuujjuaq. The results are encouraging as potential pitfalls pertaining to inaccurate or incomplete labelling and lack of availability of substitutes in some food categories should not be a major obstacle to the adoption and implementation of a ban within a year. Moreover, this Nunavik case-study could serve as an example for other regions interested in the ban of IP-TFA (Nunavut and James-Bay in particular) and other junk-food related policies.

MODELLING THE EROSION OF ICE-RICH DEPOSITS ALONG THE YUKON COASTAL PLAIN

Couture, Nicole (nicole.couture@mail.mcgill.ca), Md. Azharul Hoque and Wayne Pollard

Geography Department and Global Environmental and Climate Change Centre, McGill University, Montreal, QC H3A 2K6

The Yukon Coastal Plain is an area of ice-rich deposits along the Canadian Beaufort Sea and has been identified as highly vulnerable to the effects of sea-level rise and climate warming. The region is extremely susceptible to changes in environmental forcings because it is affected on three fronts: by terrestrial, oceanic, and atmospheric processes. Erosion is therefore a function not only of the composition and morphology of coastal features, but of wave energy as well. This paper outlines a simple model that considers these factors. Variations in ground ice contents and onshore and nearshore morphology for the Yukon Coastal Plain are examined, as is their effect on the coastal dynamics of the region. Ice volumes are shown to be highly variable, ranging from 5 - 98%. They depend to a large extent on surficial geology, being lowest in marine deposits (average of 12%) and highest in lacustrine (72%) and morainic (76%) material. Historical climate records from several stations are used to elaborate a wave climate for the region. These data are used as input for an erosion model and spatial variations in shoreline change are appraised. Future erosion is predicted based on expected changes in environmental forcings such as the extent and duration of sea ice, storm surges, air and water temperatures, and sea levels.

INUIT OBSERVATIONS OF ENVIRONMENTAL CHANGE AND EFFECTS OF CHANGE ON INUIT IN NORTHERN LABRADOR

Davies, Hilary1 (davies.hilary@gmail.com), C.Furgal2, S.Sturman3, M.Biasutti4, K. Reimer5

1School of Environmental Studies, Queen’s University, Kingston, Ontario K7L 3N6
2Indigenous Environmental Studies Program, Gzowski College, Trent University, Peterborough, Ontario K9J 7B8 3Environmental Sciences Group, Kingston, Ontario K7K 7B4
4Nunatsiavut Government, Happy Valley Goose Bay, Labrador A0P 1E0
5Department of Chemistry and Chemical Engineering, Royal Military College of Canada, Kingston, ON K7K 7B4

As in many Arctic regions, impacts of increasing environmental stressors, such as climate change, industrialization (particularly mineral exploration and mine development) and contaminants, have led local Inuit in northern Labrador to notice changes in their environment. In addition, they have expressed concerns that research and monitoring programs aimed at understanding and tracking these changes are lacking in many areas and do not accurately reflect their knowledge and concerns. Many communities feel powerless in the face of these changes as they lack the resources needed to respond. In consideration of this, an integrated regional approach has been initiated in Nunatsiavut, called Nunatsiavut Nuluak, to ensure concerns from all stakeholders, including Inuit as well as major industrial and governmental organizations, are adequately addressed. The larger project aims to provide a baseline inventory and comparative assessment of three fiords (Anaktalak, Sagleq and Nachvak) in northern Labrador to examine the impacts of environmental stressors. The purpose of this study was to further the understanding of environmental changes in Anaktalak Bay (the shipping route to the Voisey’s Bay Nickel mine) and the effects of these changes on local Inuit in order to inform the development of a Community Based Environmental Monitoring (CBEM) program for the area. The research was conducted using a participatory approach that included documenting Inuit Knowledge obtained during a workshop involving 14 long-term residents of Nain (25+years; both genders) in December 2006. Trends identified during the transcript analysis highlight the fact that often the most severe perceived effects on Inuit occur when environmental stressors work synergistically. Potential environmental indicators for inclusion in a monitoring program were also identified, along with key linkages between environmental changes and effects. For example, an increased prevalence of thin ice has lead to the perception that the ice is not as safe for travel and can be linked with winter shipping activities, increased dust/particulate on ice, changes in wind
direction, and warmer air and water temperatures. As a result, Inuit health and well being associated with harvesting and recreation activities, which are all linked with adequate access to safe travel routes, have been negatively affected. The workshop findings document the local desire for a monitoring program to track ecosystem-based changes, as well as the social, economic and environmental effects of these changes, to ensure that Inuit are able to mitigate these changes, and adapt when mitigation is not possible or sufficient. Workshop participants voiced an interest in participating in future monitoring activities and it is anticipated that program development will give both researchers and community members an opportunity to continue to work together and learn from each other, in order to develop and implement relevant and appropriate local solutions. Ultimately, this program should begin to address the Inuit desire in this region to strengthen and protect their relationship with the environment and regain their right to manage resources in their traditional lands.

VULNERABILITY AND ADAPTATION TO CHANGING CLIMATE IN HOPEDALE NUNATSIAVUT

DeSantis, Ruth (rdesanti@uoguelph.ca)
Department of Geography, University of Guelph, Guelph, Ontario N1G 2W1

Hopedale is a community in Nunatsiavut that is already experiencing climate change and the need for adaptation. This poster highlights research that assesses the vulnerability of Hopedale to climate change in the context of other forces of change. Primary data collection was undertaken over a two month period in collaboration with research partners from the community to document and characterize exposure and adaptive capacity. This research recognizes the forces operating within and outside the community that influence the ability of residents to respond to the effects of climate change. Findings indicate that Hopedale residents are particularly sensitive to the effects of changing sea-ice conditions. Indicators of sea-ice formation such as steam or “smoke” do not occur as before. Also changing wind direction and strength, impact sea-ice formation. Residents explain that a southeasterly wind does not generate the necessary drop in temperature. This associated with an increase in windiness inhibits sea-ice development. The result is later sea-ice formation that causes a delay in wood gathering which is a more economical and desirable energy source. Furthermore, the winter traveling season is shorter affecting time spent with family and friends, access to services and traditional hunting areas. Sea-ice is an essential infrastructure for travel in the winter connecting Hopedale residents to family and friends who were separated with relocation. Residents explain that due to relocation and increasing travel and employment in the wage economy connections among communities have expanded. Further, increasing employment in the wage economy decreases their ability to monitor and watch sea-ice formation. This change impacts individual and community knowledge of sea-ice conditions as information is dependent on individual monitoring. Hopedale residents are dealing with climate and other change via adaptive strategies. Routes and the timing of travel and hunting activities are adjusted to cope with environmental conditions. In addition, those employed in the wage economy have adapted land based activities to fit their employment schedule. However, choosing employment in the wage economy can decrease an individual’s availability to fish, hunt, and trap. Yet, wage employment provides monetary resources which are necessary to adapt and pursue livelihood activities. For example, monetary resources are needed to explore alternative routes to common fishing, hunting and trapping grounds. Alternative routes are vital as the effects of climate change transform established routes causing them to be unreliable or inaccessible. Adaptations have been made to share the costs of hunting and fishing activities as many residents employ a “buddy system”. The effects of climate change in Hopedale have implications for well-being in relation to livelihoods and maintaining kinship and friendship connections. Hopedale is particularly sensitive to changing sea-ice. Further climate and other change will increase Hopedale’s susceptibility to sea-ice change and influence their ability to adapt.

IMPORTANCE OF HUNTING PRESSURE ON COMMON EIDER SURVIVAL AT EAST BAY, SOUTHAMPTON ISLAND, NUNAVUT

Descamps, Sébastien1,2 (sebastien.descamps@uqar.qc.ca), G. Gilchrist1, E. Reed4, J. Bety1 and I. Buttler3

1Université du Québec à Rimouski, Département de Biologie et Géographie, Rimouski, Québec, G5L 3A1
2National Wildlife Research Centre-Carleton University, Ottawa, Ontario, K1A 0H3
3Service canadien de la Faune, Environnement Candada, Gatineau, Québec, K1A 0H3

The numbers of common eiders in the eastern Canadian arctic are declining. Information on the survival rates and causes of mortality of eiders are crucial for their effective management. A population of common eiders has been monitored since 1996 on Southampton Island (Nunavut). Hundreds of individuals have been banded annually, which enabled to get accurate estimates of their annual survival. Significant numbers of common eiders breeding in the Canadian arctic migrate to Greenland during the winter, where they are heavily harvested.
By 2001, harvest regulations were imposed in Greenland, which shortened the hunting season by 4-5 month. Our results suggest that such harvest limitations led to a significant increase in eiders' survival and population size. Harvest may thus be a primary determinant in eiders' population dynamics in the Canadian arctic, even though other environmental factors also strongly influence eiders' survival.

IMPACTS OF CLIMATE CHANGE ON PLANT-Herbivore INTERACTIONS IN THE HIGH ARCTIC

Doiron, Madeleine1 (madeleine.doiron.1@ulaval.ca), Gilles Gauthier1 and Esther Lévesque2
1Département de Biologie and Centre d'études Nordiques, Université Laval, Québec, QC, G1K 7P4.
2Département de Chimie-Biologie and Centre d'études Nordiques, Université du Québec à Trois-Rivières, QC, G5L 3A1

Climatic models predict a global warming of 3 to 5°C over the next 60 years, and these changes will be most pronounced in Polar regions. Migratory bird species breeding in the Arctic are expected to be among the species most affected by climate change. This study examines the impact of climate change on the interactions between a herbivorous bird species, the Greater Snow Goose (Chen caerulescens atlantica), and its food plants on Bylot Island, Nunavut. In many herbivores such as geese, the growth and subsequent survival of young is dependent upon a good synchrony between hatching of young and seasonal change in plant nutritive quality. If plants respond more quickly than geese to global warming, this may lead to a mismatch between the availability of high quality food (expected to occur earlier with warming) and hatching date of goslings. The objective of this project is thus to test experimentally the hypothesis that global warming will have a negative impact on the synchrony between goose reproductive phenology and plant growth in the High Arctic. We are manipulating environmental parameters most likely to be affected by global changes (surface temperature and date of snow melt) using small plexiglass open-top chambers (OTC) that can increase the surface temperature by approximately 2°C, and by adding or removing snow in spring. The experiment was set up in 2006 in two dominant plant communities used by snow geese (wetlands and mesic prairies) in a randomized block design with 6 blocks, each containing 6 different treatments. Each treatment is a combination of two manipulations, either adding (+) or removing (-) snow in spring with a shovel (leading to an advance or a delay of about 7 or 5 days, respectively, in snow-melt), or presence or absence of a pair of OTC over a 2m x 2m plot. Our 6 treatments (control, +snow, -snow, OTC, +snow/OTC, -snow/OTC) allowed us to create conditions ranging from warmer early seasons (plots with OTC and snow removal) to later snow melt seasons (plots with snow addition and without OTC). In 2007, we examined seasonal change in nutritive quality of two plant species in each habitat: Arctagrostis latifolia and Luzula arctica in mesic prairies and Eriophorum scheuchzeri and Dupontia fisheri in wetlands. From shortly after snow melt in mid-July until the end of July, we collected plant biomass every 10 days in all treatments; samples were dried and weighed, and will be analysed for nitrogen content. The effect of treatments on the microclimate of growing plants is monitored with small automated data loggers throughout the summer and soil moisture is assessed periodically with a hand held sensor. These manipulations will be repeated in 2008. Preliminary results of the first year of the experiment will be presented.

IS CLIMATE CHANGE CHANGING THE TIMING OF BREEDING IN BIRDS ON HERSCHEL ISLAND?

Doyle, Frank1, Dave H. Mossop2, Don Reid3 (dreid@wcs.org)
1Wildlife Dynamics Consulting, Box 129, Telkwa, British Columbia V0J 2X0
2Arts and Science Division, Yukon College, Box 2799, Whitehorse, Yukon Y1A 5K4
3Don Reid: Wildlife Conservation Society Canada 39 Harbottle Road Whitehorse, Yukon Y1A 5T2

The Arctic Ecosystems are we know undergoing dramatic changes as a result of a changing climate. How the ecosystems are changing, and the implication for individual species and the people who rely on these species as a resource is part of a long-term ArcticWOLVES Inter Poplar Year Project taking place across the Arctic. On Herschel Island we have the opportunity to compare the timing of breeding in a cross section of bird species, with similar information that has been collected here in previous decades. In addition, we are establishing ecosystem baseline monitoring and research that will help us to understand not only what is changing, but why it is influencing factors such as the timing of breeding in birds. Here we compare the timing of breeding in passerines, waders and raptors in 2007, looking not only at the differences between species, but also at the changes within species over time.
THE FE CYCLE IN ARCTIC OCEAN SEDIMENTS

Dubien, Danielle¹ (danielle.dubien@ete.inrs.ca), C. Gobeil² and R. W. Macdonald²

¹INRS-ETE, Université du Québec, Québec, QC G1K 9A9
²Department of Fisheries and Oceans, Institute of Ocean Sciences, Sidney, BC, V8L 4B2

The Fe cycle in the Arctic Ocean deserves to be investigated considering that this ocean receives about 10% of the freshwater carried by the world’s rivers and that river water is an important source of both dissolved and particulate Fe. Furthermore, the total area of the Arctic continental shelf represents about 20% of the world’s continental shelf and shelf sediments are believed to be active sites of Fe recycling and a potential primary source of Fe for phytoplankton production in the interior ocean. In order to document the role of the Arctic Ocean in the global ocean cycle of Fe, we collected sediment box-cores while aboard the CCGS Sir Wilfrid Laurier in July 2007, along the continental shelf and slope at depths varying from 60 to 2000 m in the Chukchi Sea, Barrow Canyon and the Mackenzie Shelf. The cores were horizontally sectioned in 0.5 cm thick slices from the sediment surface to 2 cm depth, and then in progressively thicker slices of 1, 2 and 3 cm down to 10, 20 and 35 cm depth, respectively. Sediment samples are currently being analyzed to determine the vertical distribution of total Fe, acid volatile sulfide (mainly amorphous FeS), pyrite (FeS2), Fe oxyhydroxides (operationally defined) as well as total S and organic C. Our initial results reveal strong regional contrasts in the concentration and speciation of Fe in the sediments. For instance, in the Chukchi Sea and in Barrow Canyon, where primary production reaches several hundred g of C per m² per year, FeS is detected in surface sediments indicating early reducing conditions and the Fe concentration in the form of FeS represents nearly 10% of the total Fe concentration a few cm below the sediment-water interface. However, in the sediments of the Mackenzie Shelf, an area strongly influenced by the Mackenzie River and where the biological productivity is approximately 30 g m² yr⁻¹, FeS is not detected in surface sediments and the concentration of Fe as FeS represents less than 1% of the total Fe concentration down to 30 cm depth. A preliminary conclusion of our research is therefore that an overall picture of the Fe cycle in Arctic Ocean sediments can only emerge from coherent observations and measurements in regions that integrate the wide regional variability of environmental conditions that characterize the Arctic continental shelf.

CHARACTERIZATION OF THE WINTER ENVIRONMENT OF LEMMINGS IN RELATION TO THE SNOW COVER IN THE ARCTIC

Duchesne, David¹ (david.duchesne.2@ulaval.ca), G. Gauthier² and D. Berteaux²

¹Département de biologie and Centre d’étude Nordique, Université Laval, Quebec, QC, G1K 7P4
²Département de biologie and Centre d’étude Nordique, Université du Québec à Rimouski, Rimouski, QC, G5L 3A1

The cyclic dynamics of northern rodent populations has a considerable impact on the terrestrial food web and is very important for the ecosystem of the arctic tundra. The demography of predators (weasel, arctic fox, snowy owl etc.), herbivores (snow goose) and insectivores (shorebirds) are all directly or indirectly affected by the fluctuations in abundance of rodents. It is thus imperative to better understand factors affecting the cyclic dynamics of northern rodents in the context of global warming because the latter will profoundly modify conditions currently prevailing in the Arctic. In Scandinavia, the density of small rodents has undergone a marked decline since 1970, a situation that was linked to the greater occurrence of warm and wet winters associated with recent changes in the North Atlantic Oscillation. The increased frequency of frost / thaw cycles in winter decreases the quality of the snow cover, and thus of the protection that it can offer to small rodents. It has been suggested that a good snow cover is a prerequisite for the occurrence of large amplitude, multi-annual cycles of small northern rodent populations. In this context, the objective of the present study is to determine factors influencing the spatial distribution of winter nests of brown (Lemmus sibiricus) and collared lemmings (Discofonyx groenlandicus). These nests made of vegetation are built in autumn, are used all winter long by lemmings under the snow, and contribute to their survival and the onset of reproduction in early spring. We sampled and characterized the site of 215 nests used by lemmings during the winter 2006-2007, as well as an equal number of random sites on Bylot Island, Nunavut. The topography and vegetation of these sites were sampled in summer 2007, and the subnivean temperatures and snow depth will be followed during winter 2007-2008 by means of automated temperature loggers and early spring measurement. We formulate the hypotheses that (1) the depth of the snow cover, affected by the topography, influences the thermal protection offered by a site, and consequently the spatial distribution of lemming winter nests; (2) the abundance of key plant species for the winter subsistence of lemmings will be higher at the winter nests than at the random sites. We also wish to compare the winter ecology of both lemming species based on their winter nests.
MODELING OF THE NORTH WATER POLynyA ICE BRIDGE

Dumont, Dany¹ (dany_dumont@ete.inrs.ca),
Y. Gratton¹ and T.E. Arbetter²

¹Institut National de Recherche Scientifique, Centre Eau, Terre et Environnement, Québec, QC, G1K 9A9
²National Ice Center, Suitland, Maryland, USA

Sea ice has typically been modeled as a viscous-plastic (VP) nonlinear material significantly improving sea ice property distribution diagnostic and prediction in large-scale studies compared to purely thermodynamic models. The VP models are now considered the best ones for simulating the state of the cryosphere (ACIA, 2004). The present paper aims to adapt this class of large-scale models to narrow constrained areas typical of the coastal Canadian Arctic geography to render phenomena like the formation of ice bridges and landfast ice. In particular, we focus on the formation of the ice bridge in Smith Sound that triggers the opening of the North Water (NOW) Polynya, in northern Baffin Bay. Through the use of an idealized high resolution domain, we show that current sea ice dynamical parameterization cannot simulate the ice bridge and modifications must be done. We compare two widely used rheologies, elliptical (Hibler, 1979) and Mohr-Coulomb (Tremblay and Mysak, 1997) and find that only a rheology that includes a minimal amount of uniaxial tensile strength, ordinarily absent from most models, can lead to the formation of a stable ice bridge preventing ice from drifting into the open water area. The optimized rheology is then used in realistic simulations of NOW. The results may be used to improve the estimates of sea ice and freshwater export from the Arctic as well as to study the fate of the ice bridge – and the polynya itself – in a changing climate. ACIA (2004) Scientific Report. Cambridge University Press. 1042 pp. Hibler, W. D., III (1979). A dynamic thermodynamic sea ice model. J. Phys. Oceanogr., 9: 815-846. Tremblay, L.-B. and L. Mysak (1997). Modelling sea ice as a granular material, including the dilatancy effect. J. Phys. Oceanogr., 27: 2342-2360.

GREENHOUSE GASES FLUXES AND MICROBIOAL DIVERSITY OF THERMOKARST PONDS

Dupont, Christiane¹ (christiane.dupont@ete.inrs.ca),
Isabelle Laurion¹ and Connie Lovejoy²

¹Institut National de Recherche Scientifique Eau, Terre & Environnement, 490 de la Couronne, Québec, QC, G1K 9A9
²Department of Biology, Université Laval, Québec, QC, G1V 0A6

The thawing of permafrost in arctic and subarctic regions can lead to the formation of small depressions filled with water named thermokarst ponds. Microbial activity in those ponds can lead to methane (CH4) and carbon dioxide (CO2) production and therefore, atmospheric greenhouse gas (GHG) emission. The main objectives of this study are: (i) to characterize the microbial diversity of thermokarst ponds, (ii) to investigate the relationship between microbial communities and GHG production and (iii) to determine the physical and chemical factors controlling this production. During July 2007, 33 ponds were sampled in the Kuujjuarapik area (Nunavik) and on Bylot Island (Nunavut). A floating gas chamber was used to quantify CO2 flux and profiles of dissolved gas were performed. Beside basic physicochemical data, we also measured total suspended solids, optical characteristics of dissolved organic matter (to give further insights on the quality of DOM), bacterial and picoplankton concentration using flow cytometry and microscopy, bacterial production and pigments. Genetic analyses using denaturing gradient gel electrophoresis (DGGE) are currently ongoing in order to assess the diversity patterns among thermokarst ponds. Samples will then be chosen to further characterize microbes via a cloning library. Results indicate large variations in optical and limnological characteristics of the ponds despite their proximity, providing diverse habitats to microbes. For example, total suspended solids varied between 1 and 42 mg L-1, dissolved organic carbon between 1.5 and 18.4 mg L-1 and surface bacterial concentration between 1.2 and 17.8 millions ml-1. Oxygen and temperature profiles clearly showed steep stratification in many subarctic ponds even though they are quite shallow (<3m). Interestingly, bacterial concentration and methane production at the bottom of the ponds were significantly higher than at the surface.

ASSESSING COMMUNITY CAPACITY FOR MUNICIPAL WATER RESOURCES MANAGEMENT IN NUNAVUT

Durkalec, Agata (adurkale@flemingc.on.ca) and Brent Wootton

Centre for Alternative Wastewater Treatment, Fleming College, 200 Albert St., Lindsay ON K9V 5E6

Water protection and effective drinking water and wastewater treatment are complex challenges in northern Canada for a variety of reasons. As populations grow and communities become more sedentary and urbanized, identifying the conditions needed to ensure that water resources are protected from contamination has become increasingly critical. Our research will explore the relationship between community capacity and sustainable, effective water and wastewater treatment in several Nunavut communities. We will (1) investigate the status of
community capacity, awareness and concerns with regard to current water and wastewater treatment practices in selected Nunavut hamlets, (2) develop community capacity indicators as they relate to effective water and wastewater treatment and (3) explore the potential for enabling community health capacity through collaborative or parallel engagement of Inuit and mainstream scientific knowledge paradigms in the context of protecting and treating water resources. We expect that water and wastewater-related capacities will differ between communities, as will concerns about water quality. Common capacity indicators across a range of communities in a region of Nunavut will be identified, which will provide useful information to regulators, local leaders and other key decision-makers. Further, this knowledge can be used to enhance capacity in communities through the encouragement of mechanisms that support capacity-building and the removal of barriers. This approach to water protection has the potential to broaden the framework within which water management decisions are made, and with the involvement of both scientific and Inuit knowledge traditions may contribute to both improved stewardship of water resources and to increases in community health capacity.

SOIL NUTRIENT, MICROBIAL, AND EXOENZYME DYNAMICS DURING THE WINTER-SPRING TRANSITION IN SUB-ARCTIC SEDGE MEADOWS

Edwards, Kate A. (edwards@eeb.utoronto.ca)

Department of Ecology and Evolutionary Biology, University of Toronto, 25 Willcocks St. Toronto, ON, MSS 3B2

Sub-Arctic and Arctic regions are currently experiencing climatic changes that are expected to impact ecosystem properties such as plant productivity and decomposition. Climatic warming may be expected to have considerable impact on biological processes during the transition from winter to spring, when multiple freeze-thaw cycles occur and nutrient availability and microbial biomass are high. Shifts in the timing and length of spring thaw could therefore affect processes that determine the availability and the amounts of nutrients sequestered by plants early in the growing season, with important implications for regional and global carbon budgets. I measured microbial biomass (MB) and various soil nitrogen (N), phosphorus (P) and carbon (C) pools over three years in sub-Arctic sedge meadows in northern Manitoba, Canada. Sampling was concentrated during the winter-spring transition, and activities of several exoenzymes also were measured. Similar to findings from alpine tundra sites, MB peaks in this sub-Arctic site in late winter, despite sub-zero temperatures, followed by a period of decline before spring as soil temperatures increased towards the freezing point. As soils thaw and liquid water becomes abundant in these water-saturated sites, physical disturbance by freeze-thaw cycles and fluctuations in soil oxygen levels likely disrupt key anaerobic groups of microbes, leading to the observed decline in MB and possibly a shift in microbial species composition. Whereas in alpine soils the MB peak is generally followed by a peak in available nutrients, in the sub-Arctic system studied here nutrients reach an annual peak concurrently with MB, and both MB and various measured nutrient variables decline in tandem. Preliminary data suggests that Carex aquatilis, the dominant plant in this system, is able to take up nutrients when they are abundant in late winter and early spring, despite soils being in a frozen or near-frozen state. Soil exoenzyme activities were measured over an annual cycle, with some exoenzymes such as acid phosphatase showing high activity in soils collected in winter, followed by a decline prior to melt, and sustained low levels of activity in summer. Rates of activity for these winter-active enzymes are high even when assays are performed at low temperatures (4°C), revealing an increased capacity to operate in cold soil conditions relative to exoenzymes that are less active in winter. Under warmer and more variable climate conditions, winter microbial and exoenzyme activities could increase, and the timing of various below-ground events during the winter-spring transition could be altered, compromising the availability of nutrients to plants in early spring.

ESTIMATING AIR-SEA CO2 FLUX IN HUDSON BAY USING SATELLITE REMOTE SENSING TECHNIQUES

Else, Brent1, T. Papakyriakou2 (papakyri@cc.umanitoba.ca) and J. Yackel1

1Foothills Climate Analysis Facility: Centre for Alpine and Arctic Climate Research Department of Geography, University of Calgary Calgary, AB, Canada, T2N 1N4
2Centre for Earth Observation Science Department of Environment and Geography, University of Manitoba Winnipeg, MB, Canada, R3T 2N2

The role of coastal seas as either a sink or a source of CO2 is subject to a great deal of uncertainty. This uncertainty largely arises from a lack of observations in the coastal zones. Remote sensing offers an avenue for expanding these observations by allowing for the extrapolation of relatively limited datasets of dissolved CO2 (pCO2sw). In this paper, predictive algorithms for pCO2sw that could be applied to remote sensing products were created from a field data set collected in Hudson Bay from September-October as part of the 2005 ArcticNet cruise. The field data showed that an effective pCO2sw interpolation algorithm could be created using sea surface temperature (SST) as a predictor,
and that a slight improvement of the algorithm could be achieved if measurements of absorption due to coloured dissolved organic material (aCDOM) were included. Unfortunately, satellite retrievals of aCDOM were found to be unreliable, and so only SST (obtained from the MODIS Aqua sensor) was used to create monthly maps of pCO2sw for the period of August-October. To estimate fluxes of CO2, these maps of pCO2sw were combined with estimates of gas transfer velocity derived from QuikSCAT wind retrievals, and pCO2air based on field observations. The results of these calculations revealed that Hudson Bay acts as a source of CO2 during August and September, but reverts to a sink of CO2 in October as the water temperature cools. Overall, a positive flux of 0.93 GtC was estimated for the region during the ice-free season. This result is in stark contrast to most Arctic or sub-Arctic continental shelf seas, where usually strong absorptions of CO2 are observed.

METHODOLOGY OF INUIT HEALTH SURVEY FOR CHILDREN IN NUNAVUT

Faraj, Nancy¹, (ipy.cine@mcgill.ca), Angela Pacey¹, Grace Egeland², Laakkuluk Williamson³, Lynda Gunn and Geraldine Osborne⁴

¹School of Dietetics and Human Nutrition and Centre for Indigenous Peoples’ Nutrition and Environment (CINE) McGill University, Montreal Quebec, Canada
²Nunavut Tunngavik Incorporated (NTI), Iqaluit Nunavut, Canada
³Nunavut Association of Municipalities (NAM), Iqaluit, Nunavut, Canada
⁴Government of Nunavut, Iqaluit, Nunavut, Canada

Health disparities between Inuit and other Canadian children remain unacceptable. Dietary surveys have found that food security is a primary concern throughout Northern Canada and that 5 out of 6 households were food insecure in one community survey. In the context of food insecurity, nutrient dense country food is replaced by abundantly available and cheap refined carbohydrates. Not surprising then, micronutrient deficiencies, such as iron deficiency anemia, and suboptimal vitamin A and vitamin D status can accompany overweight and obesity among children. Breastfeeding, housing conditions, and health care access are likely contributing to the health disparities noted between Inuit and other children in Canada. An Inuit Health Survey for children conducted in the fall of 2007 was carried out to better understand the factors contributing to Inuit health, health transition, and the Inuit spirit of thriving and resiliency in the face of changes. This cross-sectional survey could provide baseline information for future comparisons and further opportunities for improving our understanding of the changes that are occurring and their health impacts on Inuit children. Objectives of the survey were to evaluate the extent of food insecurity, underweight and overweight, micronutrient deficiencies, dietary inadequacy, and country food consumption among children; to evaluate breastfeeding and complementary feeding patterns for a representative sample of children; to evaluate the prevalence of H. pylori infection and its association with micronutrient deficiencies; to collect the baseline data with permission for record linkages to medical charts to allow for case-control analyses of selected conditions (otitis media and lower respiratory tract infections). The protocol utilized portable tests for assessment of the children. Questions regarding dietary habits and health histories were asked, and the children underwent a number of nutritional assessments including: anthropometrics, blood hemoglobin levels, saliva test for vitamin D, saliva test for H. pylori, a heel ultrasound measurement and a visual acuity test for near and distance. A review of the methodology will be presented.

CHURCHILL NORTHERN STUDIES CENTRE RESEARCH IN ACTION

Fishback, LeeAnn (fishback@churchillscience.ca) and Carley Basler

Churchill Northern Studies Centre P.O. Box 610 Churchill, Manitoba R0B 0E0

The Churchill Northern Studies Centre is an independent, non-profit research centre with a mandate to facilitate research and education in the western Hudson Bay region established by members of the local community, university researchers and government officials. The CNSC operates year-round as an active field research station located in the Canadian subarctic on the shores of Hudson Bay. The Centre facilitates research and education in this region such as non-credit learning vacations and contract research services to university and government clients. Research activity and the demand for logistic services in the North continue to grow as public attention has focused on polar regions as barometers of planetary health. The realization that northern regions are being affected more rapidly and more dramatically by a climate in transition has propelled the issue of global warming to the forefront of public opinion. A number of research projects that have utilized the Centre during the past year will be featured with research highlights from polar bears to plovers and snowpack structure.
ADAPTATION POLICY AND ENVIRONMENTAL CHANGE IN THE CANADIAN ARCTIC

Fleming, Laura (lifleming@uoguelph.ca)

Department of Geography, University of Guelph, Guelph, ON N1G 2W1

Global environmental change is affecting communities throughout the world. Communities that rely on ecosystems for livelihoods with limited resources for adaptation are particularly vulnerable to the impacts of environmental change. Vulnerability is reflective of the exposure and sensitivity of a system and the ability or capacity of the system to cope or adapt. Inuit communities in the Canadian Arctic are experiencing changes in climate and socio-economic and cultural systems, yet adaptation policy development for Inuit communities in the Canadian Arctic has been limited. Further understanding of the characteristics of Inuit communities’ current and anticipated vulnerability and adaptive capacity is needed to develop and implement appropriate policies. Such policies will need to be sensitive to the nature of Inuit ecological-socio-economic systems and the governance structures with which decisions relating to adaptation are taken. It is now recognized that effective adaptation initiatives are mainstreamed into established risk management and resource management systems. Empirical research will identify and model the ways in which the governance structures in the Canadian Arctic can enhance the capacity of communities to deal with climate change effects. The research plan includes identifying a suitable case study location with necessary community interest and institutional support. Characterization of vulnerability will be developed through assessments of previous or original research. Building on the established vulnerability and adaptation research, my work will focus on developing a model of the decision making structures and processes into which adaptation initiatives could fall, noting the role of stakeholders, organizations, and governments at levels from local to international. The model will provide a necessary foundation for assessments of the prospects for adaptation strategies or policies.

PARTICULATE ORGANIC CARBON FLUX DYNAMICS IN TWO CANADIAN HIGH ARCTIC WATERSHEDS

Fletcher, James (6jahf@queensu.ca), Scott Lamoureux and Melissa Lafrenière

Department of Geography, Queen’s University, Kingston, Ontario K7L 3N6

By unit volume, the Arctic Ocean is the largest ocean recipient of terrestrial organic matter and freshwater. As the climate warms, the resultant changes to runoff will alter fluvial fluxes of organic matter. To date, much of the available data on these fluxes have emphasized dissolved organic carbon (DOC) over particulate organic carbon (POC) and data that cover the Canadian High Arctic are particularly lacking. Here, we provide a first assessment of fluvial POC fluxes in coastal regions of the Canadian High Arctic. This represents a key new initiative as part of a comprehensive hydrological observatory that was established at Cape Bounty in 2003. The study objectives were twofold: (1) to determine the quantity and character of POC being carried in fluvial sediment fluxes in two Canadian High Arctic watersheds; and (2) to develop and employ sampling techniques that facilitate sample collection for the purposes of this analysis. During the 2007 melt season, we employed a systematic sampling approach to capture POC suspended in discharge from each of two small catchments located at Cape Bounty, Melville Island, Nunavut. The samples were combined and concentrated with chemical flocculation to produce c. 5–10 grams of particulate material per day. POC flux quantity was assessed by capturing sediment from uncombined samples on polycarbonate filters. Total carbon and total nitrogen analyses were conducted on the combined POC samples to investigate the character of the particulate.


Folliott, Jadah (jfolliot@uwo.ca)

Department of Geography, The University of Western Ontario, London, Ontario N6A 5C2

Identification of the vulnerability of Indigenous populations in the Arctic to environmental change is a highly important and current theme in Arctic research, and necessitates the documentation of changes in weather, snow and ice conditions, vegetation, and the location and condition of fauna. Climate change is expected to increase the unpredictability of weather-related hazards, alter mean conditions, and could exacerbate existing vulnerabilities. In the decades to come, the Arctic will experience accelerated social, economic and political change but significant changes in weather conditions are already threatening the culture, livelihood, health and overall wellbeing of the people who live in Arctic communities. In the communities of Aklavik, Northwest Territories and Old Crow, Yukon Territory, Canada, residents are witnessing changes in weather and related events. Some of the impacts of these events have been captured through annual interviews.
(1996-2006) with the most active hunters and harvesters in these two communities. The interviews have been facilitated through the Arctic Borderlands Ecological Knowledge Co-operative. This study is part of ArcticNet 4.3 and investigates weather observations, perceptions of changing weather, and the impacts of these changes on the Gwich’in and Inuvialuit residents of Aklavik and Old Crow.

DRDC VALCARTIER’S NORTHERN WATCH EFFORT

Forand, Luc (luc.forand@drdc-rddc.gc.ca) and V. Larochelle

DRDC Valcartier, 2459 Blvd Pie XI North, Quebec, QC G3J 1X5

The Canadian Arctic is fast becoming an area of increasing strategic and economic importance to Canadians and its government. As a result, the need for the Canadian Forces (CF) to monitor and surveil activities in this area; particularly in the navigable passages, is increasing. However, due to the large distances, low population densities, and lack of infrastructure in the Canadian Arctic, this is not an easy task. Presently, this is limited to information gathered by overflights carried out by the CF’s Maritime Patrol Aircraft (Auroras) or from the Canadian Rangers. To improve the ability of the CF to surveil the high Arctic, Defence Research and Development Canada (DRDC) has begun a four year Technology Demonstration (TD) project to investigate and demonstrate technologies that could be used to monitor and surveil its waters. During these years, the work will require significant effort from managerial, scientific and technical personnel at DRDC Headquarters, DRDC CORA, DRDC Ottawa, DRDC Valcartier and DRDC Atlantic. This paper discusses the various technologies that the team will investigate, develop and demonstrate and the program of work that has been proposed. In particular, it focuses on the sensor detection technologies that will be investigated. These include passive underwater sonar and electromagnetic detection, active and passive radio-frequency detection, and active and passive optical and infrared detection. The performance of such sensors will be evaluated for two types of operations. The first type involves the placement of a suite of ground-based sensors able to provide continuous coverage at certain strategic locations in the Canadian Arctic. This will be tested through the development and installing of a system at a test site near Gascoyne Inlet on Devon Island. It will include an Automatic Identification System (AIS), an underwater hydrophone and electromagnetic sensor suite that is part of the Rapidly Deployable System (RDS) TD developed at DRDC Atlantic, a navigational radar (RF) system, an electronic intelligence (ELINT) system developed at DRDC Ottawa, and a new DRDC Valcartier electro-optical (EO) system called the Canadian Arctic Night and Day Imaging Surveillance System (CANDISS). The second type involves the use of other detection technologies such as RF and EO satellite surveillance, high-frequency surface wave (HFSW), RF and EO aerial surveillance, and information provided by platforms of opportunity (ships, aircraft, personnel). The investigation of these possibilities will only be conducted using studies and computer modelling. No field-testing of this operational mode is currently foreseen. This paper discusses the schedule of work and the major work elements associated with each of the major sensing technologies to be developed during this program. The result of this effort is to provide expert advice to the CF as to how to best surveil and monitor the high Arctic in a cost effective manner, and to maintain and further develop the expertise of its research centres in Arctic operations.

FOOD INSECURITY IN IGLOOLIK: A BASELINE STUDY

Ford, James1 (james.ford@mcgill.ca), Celina Irngaut2, Kevin Quunnut2, Lea Berrang Ford1

1Dept. of Geography, McGill University, Montreal H3A 2K6
2Hamlet of Igloolik, Nunavut, X0A 0HO

Food insecurity, or the inability of individuals and households to meet their nutritional requirements in a culturally acceptable manner, is believed to be widespread among Inuit communities in Northern Canada. The extent of the problem, however, remains largely unknown, constraining the ability for targeted intervention. Moreover, climate change poses threats to the Inuit food system: a limited baseline understanding of food security in the North constrains an understanding of climate change vulnerability. This paper reports on a study conducted in Igloolik during summer 2007 to develop a baseline understanding of the magnitude and prevalence of food insecurity in the community, identify high risk groups and characterize conditions facilitating and constraining food security. To this end, fifty close-ended oral surveys were administered to a stratified cross section of the community by a research team composing a university researcher and Iglulingmiut. Data were descriptively evaluated in SPSS using cross-tabulations, and analyzed using chi-squared and Fisher exact tests to test for significant associations. The data highlight a high prevalence of food insecurity in Igloolik which significantly exceeds the Canadian average: 64% of participants experienced some degree of food insecurity between July 2006 and July 2007, with 24% classified as having very low food security. This is cause for particular concern given the negative
physical and mental health impacts that have been documented for low nutritional status. The prevalence and severity of food insecurity differed among participants; females, those obtaining half or more of their food from the store, and unemployed were at highest risk. Consumption of traditional foods was significantly associated with increased food security among all ages, both sexes, and all occupation groups. Key determinants of food insecurity identified by survey participants included increasing prices of store food and hunting equipment, inadequate income, lack of jobs, and inability to hunt. Further research is required to investigate key trends documented by the surveys and identify entry points for policy in order to strengthen the food system.

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FOOD INSECURITY IN IGLOOLIK, NUNAVUT: THE ROLE OF CLIMATE

Ford, James1 (james.ford@mcgill.ca), Celina Imgaat2, Kevin Qrunnut2, William Gough1, Gita Laidler2 and Barry Smit3

1Dept. of Geography, McGill, Montreal H3A 2K6
2Hamlet of Igloolik, Nunavut, X0A 0L0
3Department of Physical and Environmental Sciences, University of Toronto at Scarborough, M1C 1A4
4Dept. of Geography, University of Toronto, MSS 3G3
5Dept. of Geography, University of Guelph, N1G 2W1

To be food secure, individuals and households must be able to reliably access food, the availability of nutritious food must be sufficient, and it must be of an acceptable quality. Food insecurity occurs when the dietary and socio-economic functions of food systems are stressed. Compromised food security is undesirable in and of itself, and has also been linked to negative physical and mental health outcomes. Food access, availability, and quality are sensitive to climatic conditions and it is believed that Inuit food systems are susceptible to climate change. This paper examines the role of climate in affecting food security in the Inuit community of Igloolik, Nunavut, building upon community concerns regarding food access and availability identified during ArcticNet research between 2003 and 2006. It focuses upon the extreme sea-ice year of 2006 to illustrate links between climate-related conditions and food security, drawing upon focus groups and interviews conducted in 2006 and 2007. The link between climate, climate change and food security maybe direct. Sea ice conditions in 2006 – described by Inuit and documented in instrumental data-sets as significantly departing from the long-term mean – stressed the food system by reducing access and availability of country foods. A lack of floating sea ice in the summer, for example, significantly reduced the success of the walrus hunt in northern Foxe Basin. In many instances, however, the effects of climatic conditions and change on food security are mediated through interactions with multiple social and physical stresses. Migration of caribou away from the Igloolik region in recent years, for example, exacerbated the difficulty of obtaining country food due to a late ice freeze-up and the unsuccessful summer walrus hunt. Probably of greater importance in 2006, however, was the role of economic factors. Higher oil and commodity prices, particularly in 2005 and 2006, have stressed adaptive strategies used by Igloolik Inuit to manage climatic risks. In 2006 high gas prices limited the ability of hunters to travel further to find walrus and hunt caribou, while higher store prices reduced the ability to offset traditional foods with store food. Moreover, underlying weaknesses in the food system and the chronic nature of food insecurity documented in the surveys highlights a food system vulnerable to climatic and non-climatic stresses.

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THREE-YEAR ASSESSMENT OF PARTICULATE ORGANIC CARBON FLUXES IN AMUNDSEN GULF (BEAUFORT SEA): SATELLITE OBSERVATIONS AND SEDIMENT TRAP MEASUREMENTS

Forest, Alexandre1 (Alexandre.Forest@giroq.ulaval.ca), S. Bélanger2, M. Sampei1, H. Sasaki3, L. Fortier1

1Québec-Océan, Département de biologie, Université Laval, Québec, G1K 7P4
2Département de géographie, Université du Québec à Rimouski, Rimouski, Québec, G5L 3A1
3Senshu University of Ishinomaki, Ishinomaki, Miyagi 986-8580, Japan

Surface concentrations and vertical fluxes of particulate organic carbon (POC) were assessed in Amundsen Gulf (AG) (southeastern Beaufort Sea, Arctic Ocean) over the years 2004 to 2006 by combining remote sensing and moored sediment trap measurements. Sea ice and wind conditions were related to POC data to explain their interannual variability. Extended periods (> 2 weeks) of increased surface POC (200 - 500 mg C m-3) occurred recurrently in the southwestern areas of AG near Cape Bathurst. Concentrations distant from these areas remained relatively low (< 100 mg C m-3), indicating that enhanced primary production was restrained to a small vicinity. In 2004, the detected phytoplankton bloom was weak (< 200 mg C m-3) despite a normal ice break-up (early June). Unusual concentrations of old ice were however noticed in summer 2004. Two blooms (spring and late summer, ~300 mg C m-3 each) were observed in 2005 when an earlier ice break-up (mid-May) related to a large positive temperature anomaly occurred. In 2006, a single but strong bloom (up to 500 mg C m-3) was recorded when sea ice retreated late in summer (mid-July). The magnitude, timing and extent of vertical
POC fluxes followed the spatial and temporal variability of surface POC. The summer maxima of daily POC fluxes at 100 m depth were consistently higher in western AG (up to 19, 31 and 72 mg C m⁻² d⁻¹, respectively in 2004, 2005 and 2006) than at the east (persistently < 15 mg C m⁻² d⁻¹). Daily POC fluxes at 200 m depth were similar in both sectors (1 to 30 mg C m⁻² d⁻¹). The annual POC fluxes in western AG were recurrently lower at 200- than at 100 m depth (1.2 - 2.3 vs. 2.9 - 6.0 g C m⁻² y⁻¹); while in the eastern sector they were greater at 200- than at 100 m depth (1.9 - 3.1 vs. 1.2 - 2.6 g C m⁻² y⁻¹). In addition to increased POC production near Cape Bathurst, we suggested enhanced grazing pressure at intermediate depths to explain the spatial variability of POC fluxes in AG. Our study represents an initial step in the monitoring of vertical POC fluxes during the current phase of environmental changes in the Beaufort Sea.

MERCURY CONCENTRATIONS OF LANDLOCKED ARCTIC CHAR (SALVELINUS ALPINUS) AND BIOACCUMULATION FACTORS FROM 18 LAKES IN 3 REGIONS OF THE CANADIAN ARCTIC

Gantner, Nikolaus¹ ² (ngantner@uoguelph.ca), X. Wang¹, G. Köck³, R. Pienitz², J. Reist⁵, J. Babaluk⁶, M. Power⁴, K. Solomon¹ and D. Muir² ¹.

¹Dept. of Environmental Biology, University of Guelph, Guelph, ON, Canada
²Water Science and Technology Directorate, Environment Canada, Burlington, ON, Canada
³Austrian Academy of Science, Vienna, Austria
⁴Dept. of Geography, Université Laval Québec, QC, Canada
⁵Freshwater Institute. Department of Fisheries and Oceans, Winnipeg, MB, Canada
⁶Dept. of Biology, University of Waterloo, Waterloo, ON, Canada

We set out to examine possible links between climate warming and increases in mercury concentrations ([Hg]) in landlocked Arctic char (S. alpinus) in the High Arctic. [Hg] vary regionally and have remained constant or increased slightly in coastal waters in Nunavut over a 12-16 year period. This, despite declining industrial mercury emissions in North America. Therefore, we hypothesized that climate warming might increase the input of Hg from catchments through altering conditions in wetlands, leading to greater associated body burden of adult char. To investigate the influence of the catchments on Hg, we selected coastal lakes of similar size in Arctic regions that vary in climatic conditions, to also include the influence of latitude on Hg concentrations in Arctic char. One lake, Pingualuit Crater Lake in Nunavik, was selected as reference point for atmospheric deposition of Hg to a lake with minimal catchment area. Sampling of water and Arctic char was aided by local people. Water and char muscle samples were analysed for total Hg (THg) using a combustion method, methylHg using CVAFS. Stable isotope analysis was conducted using isotope ratio MS to determine trophic position (Δ¹⁵N) of char. Bioaccumulation factors (BAF) were calculated to characterize lake specific mercury accumulation. THg in char muscle tissue varied regionally, ranging from 0.05 – 1.8µg/g (Ellesmere), and 0.06 – 3.4µg/g (Cornwallis), to 0.03 – 0.5µg/g (Kent Peninsula) area. Intra-lake variability of char THg was related to trophic position (diet), greater [Hg] (>0.2µg/g) in piscivorous char and smaller [Hg] (<0.2µg/g) in benthivorous char. While variability of methylHg bioaccumulation was observed from lake to lake, with logBAF varying from 6.98 – 8.07, THg in water did not directly predict char muscle THg. Lake to catchment area ratios did not reveal lake to lake differences. [Hg] in char from Pingualuit Lake were similar to all other lakes, indicating that processes within the lake may dominate the fate of deposited Hg in a lake. Our results indicate that trophic conditions within each lake should be considered for comparisons of [Hg] in landlocked Arctic char. However, greater delivery of Hg from the lake catchments under projected warming conditions may still alter these processes within the lake. Only after adjustment for trophic position can the significance of spatial (or temporal) trends and their potential linkages to climatic change be examined.

MAJOR COLD SEASON PRECIPITATION EVENTS IN IQLAULIT

Gascon, Gabrielle (gabrielle.gascon@mail.mcgill.ca), R. Stewart and W. Henson

Department of Atmospheric and Oceanic Sciences, McGill University, Montreal, Quebec H3A 2K6

Snowstorms, blizzards and heavy rain commonly occur in the Arctic. They are normally very difficult to predict and so they often severely impact Northern Communities. Despite their importance, storms producing snow and mixed phase precipitation with significant accumulation have received little attention in particular. The objective of this study is to advance our understanding of the mechanisms through which severe precipitation events are produced. To analyze the problem in greater detail than ever done before, the study focuses on the cold season (October-April) events at one site, Iqaluit. The synoptic, mesoscale and surface features of such events are being investigated. Several datasets are being exploited. The 1955-1997 corrected daily precipitation data from Environment Canada was used to select extreme precipitation events. The 199
selected events were those in the uppermost 95th percentile of daily precipitation amount. This sets the daily accumulation threshold at 9.4 mm for Iqaluit. The North American Regional Reanalysis and the National Centers for Environmental Prediction reanalysis data were used to manually retrieve the storm track and synoptic stage of each event. The analysis of this information showed three dominant storm tracks: arriving from the Atlantic, the south and the west; a fourth group was created for the outliers. About half of the cyclones were decaying (cut-off or closed lows) whereas the others were still mature. However, the mature cyclones decayed shortly after the event, making the Eastern Canadian Arctic a preferential region for cyclogenesis. The analysis of the Environment Canada hourly surface observations showed that snow was the dominant precipitation type, followed by rain and snow grains. Strong winds channeled by the surrounding topography were also dominant. The detailed study of one event, October 24-25 1985, a storm coming from the west, has been carried out so far. Fifty-three millimeters of precipitation was produced in two days, mostly as rain. Freezing rain and the combination of rain and snow were also observed. Through the analysis of atmospheric soundings, the inversion layer responsible for freezing rain and the isothermal layer of 0°C leading to a mixture of rain and snow were identified. The temperature evolution during the event suggested a warm-frontal stratiform precipitation band. Finally, the cyclone was maintained by strong negative potential vorticity at upper-levels and warm air advection at low-levels. Future work includes the analysis of case studies from all the storm tracks. This research is expected to assist in improving the simulation and prediction of such storms, as well as to better assess how they will change in the future.

ITTAQ HERITAGE AND RESEARCH CENTRE: AN INUIT LED, COMMUNITY-BASED EFFORT TO SUPPORT RESEARCH ACTIVITIES IN NUNAVUT

Gearheard, Shari1,2 (shari.gearheard@nsidc.org), Nick Illauq3, Billy Palluq1,2, Attakalik Palluq1, Peter Paneek1,2, Mike Jaypoody1,2, Tina Kunilusie1, Kevin Killiktee1 and Jaypeeetee Killiktee1,4

1Ittaq Heritage and Research Centre, Clyde River, Nunavut, X0A 0E0
2Hamlet of Clyde River, Clyde River, NU, X0A 0E0
3University of Colorado at Boulder, Campus Box 449, Boulder, CO, 80309
4Nammautaq Hunters and Trappers Association, Clyde River, Nunavut, X0A 0E0

Ittaq Heritage and Research Centre was established by local residents of Clyde River, Nunavut, in 2007. A major goal of Ittaq is to increase local participation in, and direction of, research in the community, simultaneously creating local job opportunities and better research projects. Ittaq supports diverse research projects, whether local, government, industry, or university-led, by providing quality services such as logistics support, guiding, traditional knowledge input, environmental monitoring, sample/data collection and processing, interpreting/translating, outreach design and facilitation, and liaison work with local individuals and community organizations. With a focus on facilitating collaboration between researchers and local people, Ittaq allows both groups to benefit. For example, researchers can include local, expert knowledge as part of their project, access expert help for land travel, and contract trained individuals to carry out data collection, observations, or oversee equipment maintenance or experiments year-round. Local Inuit benefit from jobs in research, training in various disciplines and skills, exposure to and experience in science and technology, and input into research design and research products so that results benefit local people. Ittaq is actively seeking partnerships with science projects in Nunavut that are interested in collaboration.

THE EXCHANGE FOR LOCAL OBSERVATIONS AND KNOWLEDGE OF THE ARCTIC (ELOKA)

Gearheard, Shari1 (shari.gearheard@nsidc.org) and C. McNeave2

1National Snow and Ice Data Center, University of Colorado at Boulder / Ittaq Heritage and Research Centre, P.O. Box 241, Clyde River, Nunavut, X0A 0E0
2National Snow and Ice Data Center, University of Colorado at Boulder, Boulder, CO, 80309

Over the last decade, Arctic residents and indigenous peoples have been increasingly involved in, and taking control of, research. Arctic communities have made significant contributions to research, including understanding recent climate and environmental change, and community-based research, including traditional knowledge research and community-based monitoring, will be an important part of IPY activities and any Arctic Observing Network (AON). One of the greatest challenges of local and traditional knowledge (LTK) research and community-based monitoring, will be an important part of IPY activities and any Arctic Observing Network (AON). One of the greatest challenges of local and traditional knowledge (LTK) research and community-based monitoring to date has been effective and appropriate means of recording, storing, and managing data and information. It has been a challenge to find effective means of making community-based data and information discoverable and available to Arctic residents and researchers, as well as other interested groups such as teachers, students, and decision makers. Without a network and data management to support LTK and community-based research, a number of problems have arisen in the North such as: misplacement or loss of extremely precious data (e.g. knowledge and information from
CLIMATE CHANGE IMPACTS ON BERRY ECOLOGY IN CANADIAN ARCTIC TUNDRA: LINKING TRADITIONAL ECOLOGICAL KNOWLEDGE WITH SCIENCE

Gérin-Lajoie, José1 (jglajoie@globetrotter.net), E. Lévesque1 and A. Cuérrier2

1Département de chimie-biologie, Université du Québec à Trois-Rivières (UQTR), Trois-Rivières, QC, G9A 5H7
2Institut de Recherche en Biologie Végétale (IRBV), Montréal, Québec, H1X 2B2

Berry picking is an important activity in Northern communities and berries are a good source of vitamins and antioxidants. The main objective of this project is to link traditional ecological knowledge (TEK), by interviewing Inuit elders, with scientific data on inter-annual variations in annual productivity (biomass/m²) of commonly used berries (Vaccinium vitis-idaea, Empetrum nigrum, Vaccinium uliginosum, Rubus chamaemorus) in relation with environmental factors (shrub cover, snow cover, ground temperature, etc.). Two communities of Nunavik, Kangirsujuaq and Kangirsualujjuaq, and two others in Nunavut, Pangnirtung and Pond Inlet are participating in the project. In 2007 in the Nunavik communities, long term vegetation plots have been established (approx. 10m x 10m) with a minimum of 10 smaller monitoring quadrats marked for each species. Aerial photographs (ancient and recent) are being analysed to assist in the reconstruction of the evolution of the vegetation, as well as the historical records stemming from scientific literature, maps and photographs. TEK is being used to find where berry picking took place in the past decades (the best sites) and where this activity is still practiced. Semi-structured interviews are used to collect Inuit knowledge. General themes are established, but questions remain open-ended and, thus, leave room for new information to emerge. These interviews are recorded and transcribed. Old photographs of berry picking scenes and sites are searched and eventually used to help the interviewees remembering and locating these ancient sites and to facilitate story-telling. In 2008-2009, we plan to return to a few sites with elders or berry pickers to evaluate any changes and identify the most sensitive zones. These sites will be evaluated to see if they are still productive. If not, we will investigate potential causes. Permanent plots will be established to characterize the various cover, vegetation height, plant phenology, berry productivity and biophysical parameters. In the early phase of this project, the proposed objectives are discussed with communities in order to insure that community needs are addressed concurrently with basic scientific issues. Since the project is participative, part of the data collection is already being made with the help of interested members of the community (students, teachers, etc.). Protocols are developed in collaboration to insure that the monitoring can be maintained in the future. In addition, data collection and preliminary analyses can easily be integrated in a science or mathematics school project. In the following years, we will survey berry sites during the picking season to gather berries with our collaborators and to collect other information. This program may later be expanded to other parts of the Canadian North and integrated in monitoring networks such as CANTTEX and PlantWatch.

HOLOCENE GEOMORPHOLOGICAL EVOLUTION OF SOUTHERN NASTAPOKA SOUND, EASTERN HUDSON BAY (NORTHERN QUÉBEC)

Girard Thomas, Marilou1 (marilou.girard-thomas.1@ulaval.ca), Patrick Lajeunesse1, Guillaume St-Onge2 and Bill Doidge3

1Centre d’études nordiques & Département de géographie, Université Laval, Québec, QC, Canada G1K 7P4
2Institut des sciences de la mer de Rimouski (ISMER), Université du Québec à Rimouski, 310 allée des Ursulines, Rimouski, QC, Canada G5L 3A1
3Makivik Corporation, Nunavik Research Centre, Kuujjuaq, QC, Canada, J0M 1C0

Geophysical surveys conducted in southern Nastapoka Sound (eastern Hudson Bay) provide new information on the local bathymetry and seafloor deposits in order to reconstruct the Holocene evolution of this coastal zone. This study allows us to locate the major sedimentary basin and sediment transport pathways, to describe the complete Holocene stratigraphic sequence and to provide a new dataset for mapping marine habitats. More than 350 km of survey lines were collected on two small boats using the Hypack® software at an interval of 200 m for north-south transects and 500 m for east-west transects. The surveys were carried out using a single beam echosounder for bathymetry (200 kHz) and a chirp-sonar for subbottom acoustic profiles (12 kHz). Side-scan sonar data (100 & 500 kHz) provided
information of sea floor morphology and surficial deposits. Surface sediments were also sampled using a grab sampler. Bathymetric data (data est pluriel en Anglais) show that the terrestrial basaltic and metasedimentary cuesta ridges also occur offshore in a parallel-to-coast direction, forming deep sediment filled basins (15-20 m) enclosed between bedrock ridges (20-30 m). Many bedrock escarpments are also visible on the cuesta fronts and sides. The occurrence of this high submarine relief separates two sedimentary basins where glaciomarine (Unit 1), paraglacial (Unit 2) and postglacial sediments (Unit 3) have been trapped, filling the bedrock depressions. Submarine slope failures have been observed in different sectors of the study area and include numerous submarine gravity flows in Unit 1 and submarine slides in Unit 3. As reported in previous studies in eastern Hudson Bay, submarine mass-movements appear to have acted as a major reworking process during the Holocene. Earthquakes might have played an important role for triggering mass-movements during the rapid postglacial uplift, although no record of past seismic activity exists for the area. However, forced regression and reducing accommodation space might also be responsible for generating these mass-movements by enhancing bottom wave erosion of unconsolidated sediments deposited very rapidly during deglaciation. Local submarine morphology (erosion/sedimentation features) reveals strong south-north currents occurring in both basins located between the coast and the island. Along with currents, the relatively low modern sedimentation rate seems to allow important bioturbation on the seafloor as observed in surface and sediment cores.

MARINE FISHERY IN THE CHURCHILL REGION OF THE HUDSON BAY

Green, Tyler (greentyler@hotmail.com)
Clayton H. Riddell, Faculty of Environment, Earth, and Resources, University of Manitoba, Winnipeg, Manitoba, R3T 2N2

The purpose of this project is to collect fish for Dr. Jacques Gagne of Universite Laval. The three objectives are: (1) Collect fish from local fisherman. The species targeted are marine forage species such as Arctic Cod (Boreogadus saida) and its possible competitors, Capelin (Mallotus villosus), Sand Lance (Ammodytes spp.), Herring (Clupea harengus), and Smelt (Osmerus Mordax). These fish are used for biological, contaminant and stable isotope analyses. (2) Collect information from local fishermen pertaining to the type and whereabouts of the targeted fish species. (3) Initiate a monitoring program following the Tariuq sampling protocol established in the Mackenzie Region. This objective implies that fish collection strictly follows a specific sampling protocol year after year at each monitoring site. The third objective is important to keep in mind when fishing so that our records will correlate with those of future studies. Much information and new knowledge was gained during this field season. Many Churchill residents (Métis, First Nations, and non-Aboriginal) actively fish the marine environment. It was originally unknown exactly how, where, when and why the local fishers harvest the many different species found within the Churchill region of the Hudson Bay. This information was collected and recorded in hopes of returning for a very successful field season. Additional research is needed to learn about topics such as: factors influencing the fishing efforts, contributions that fishing makes to the local economy and quality of life, usage of fish species, impact of fishing on other species, local or traditional knowledge on fishing or fish, if there are any Inuit fishing in the Churchill area, and linkages between traditional knowledge and scientific knowledge on fishing.

A STUDY OF HIGH ARCTIC RETROGRESSIVE THAW SLUMP DYNAMICS, EUREKA SOUND LOWLANDS, ELLESMERE ISLAND

Grom, Jackie Dee (jackie.grom@mail.mcgill.ca) and Wayne Pollard
Department of Geography, McGill University Montreal, QC H3A 2K6

High-latitude regions are expected to exhibit a strong response to projected warming trends due to positive feedback systems inherent to the environment. A significant concern is the expansion of thermokarst and the resulting terrain instability and landscape alteration throughout the Arctic. Retrogressive thaw slumps - landforms resulting from the thawing ice-rich permafrost - are a prominent thermokarst feature in polar landscapes and consist of three main structural components: i) a vertical “headwall” of the permafrost active layer; ii) a steeply-inclined ice “headscarp,” and; iii) a low-angle mud pool forming a lobate pattern at its base. Thaw slumps have reportedly been increasing in frequency and extent due to increased coastal erosion and ablation of massive ground ice. Consequently, rates of slump development are expected to increase under projected climate change scenarios. However, the interplay of climatic, geomorphic, and surficial controls makes it difficult to establish projected rates of retreat. Furthermore, spatial variations in diurnal ablation rates and energy balance anomalies complicate the understanding of retrogressive thaw slump process and development. This study investigates thaw slump process in the Eureka area of the Canadian High Arctic. It attempts to identify microclimatic variation in and around a thaw slump and a possible positive
feedback for ice ablation and headwall retreat. Two automatic weather stations were strategically placed in the area of the landform: one was located within the slump floor to gather the microclimate, and the other located upslope of the slump to capture the control climate. Additional instrumentation was placed above the ice face in order to define the energy activity at the ablat ing ice surface. Initial examination of micrometeorological data indicates a unique energy exchange influenced by slump morphology. Morphologic data were also gathered for the site, including headwall retreat, ice face and terrain angles, and ice characterization, in order to describe associated controls on the landform.

**DISSOLVED ORGANIC MATTER IN FIRST YEAR ICE IN ARCTIC SHELVES**

Gueguen, Celine (celinegueguen@trentu.ca)

Department of Chemistry, Trent University, 1600 West Bank Drive, Peterborough, Ontario K9J 7B8

Sea ice formation is an important physicochemical process in Polar Regions that could potentially influence the biogeochemical cycling of many chemical species. However, detailed fractionation pathways of dissolved organic matter (DOM) and other chemical species during ice formation are not well understood. In this study, we present partitioning of colored dissolved organic matter (CDOM) and dissolved organic carbon (DOC) between newly formed sea ice and underlying waters. During ice formation the bulk of the CDOM and DOC fractions are expelled along with the salts. The solute concentrations in ice ranged between 5 and 10% of that in the underlaying waters. However, at the bottom of the ice cores, sea ice was enriched in CDOM and DOC through ice algal production and the release of algal exudates. The increased in CDOM and DOC typically ranged from 2 to 76 and 2 to 60 respectively depending on the sampling time. The highest values were found in April/May when sea ice primary production was at the highest. The positive correlations between CDOM and Chl-a and, DOC and Chl-a were consistent with sea ice alga production of DOM. Like concentrations, the nature of CDOM retained in the ice was affected by ice formation. Indeed, smaller molecules were preferentially found in the ice relative to the underlying waters. The change in salinity due to salt exclusion is likely to affect chemical characteristics of DOM retained in the ice.

**VARIATIONS IN SOLUBLE METHANE IN POOLS OF A EUTROPHIC SUB-ARCTIC FEN IN CHURCHILL, MANITOBA, CANADA**

Hanis, Krista¹ (krista_hanis@hotmail.com), P. Mojdehi², M. Tenuta¹, and R. Bello²

¹Department of Soil Science, University of Manitoba, Winnipeg, Manitoba R3T 2N2
²Department of Geography, York University, Toronto, Ontario, M3J 1P3

Previous studies have indicated that tundra fens are significant methane sources (Rouse et al. 1995; Churchill, 2007). Methane emissions varied spatially and temporally because methane production and consumption depended upon soil conditions, ground water levels and pond depths. It is uncertain if the spatial variation of methane emissions from ponds is because of ebullition of methane gas or diffusion to the atmosphere of soluble methane. The objective of this study was to determine if soluble methane variations do exist within the pools of a eutrophic sub-arctic fen in the Churchill region and thus contribute to the spatial variation of pond methane emissions. We also were interested in determining pond conditions related to the variation in soluble methane. An initial study examined lateral and horizontal gradients in soluble methane in the pools. Dissolved methane was higher near the sediment-water interface and towards the centre of the pools. Thereafter, water samples were taken in the centre of pools at the water-sediment interface (point of maximum soluble methane) and near the water-atmosphere interface (point of minimum soluble methane). Monthly surveys of fifty pools were performed during the summer of 2007 in order to relate soluble methane in pools to pool characteristics of depth, area, temperature, dissolved oxygen, pH, conductivity, oxidation-reduction potential, and dissolved organic carbon, cations and anions. The syringe-headspace stripping technique was used to gather water samples and remove methane from the water with helium gas for analysis. Gas samples were stored in small tedlar bags temporarily and analyzed for methane and carbon dioxide with a micro-gas chromatograph. The data is currently being analyzed and will provide valuable information about what the driving factors are behind methane gas emissions and their variability within a eutrophic sub-arctic fen.

**MERCURY ASSESSMENT OF THE HUDSON BAY MARINE ECOSYSTEM**

Hare, Alex¹ (Harea@dfo-mpo.gc.ca), D. Armstrong², G. Stern³, F. Wang³, D. Lean³, M. Pazernik¹, Z. Kuzyk¹ and R. Macdonald⁵

¹Hare, Alex¹ (Harea@dfo-mpo.gc.ca), D. Armstrong², G. Stern³, F. Wang³, D. Lean³, M. Pazernik¹, Z. Kuzyk¹ and R. Macdonald⁵

¹Department of Soil Science, University of Manitoba, Winnipeg, Manitoba R3T 2N2
²Department of Geography, York University, Toronto, Ontario, M3J 1P3
³Department of Chemistry, Trent University, 1600 West Bank Drive, Peterborough, Ontario K9J 7B8
⁴Department of Chemistry, University of Toronto, 80 St George Street, Toronto, Ontario M5S 3H6
⁵Department of Chemistry, Trent University, 1600 West Bank Drive, Peterborough, Ontario K9J 7B8

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A preliminary Hg budget for the Hudson Bay ecosystem is presented.

AN INVESTIGATION OF POTENTIAL IMPACTS OF CLIMATE CHANGE ON SURFACE DRINKING WATER QUALITY AND INFECTIOUS GASTRO-INTESTINAL ILLNESSES IN NUNATSIAVUT, CANADA

Harper, Sherilee (harpers@uoguelph.ca), V. Edge and S. McEwen
Department of Population Medicine, Ontario Veterinary College, University of Guelph Guelph, Ontario, Canada, N1G 2W1

A pilot study investigating the relationship between drinking water quality (surface sources) and weather events in two Inuit communities in Nunatsiavut (northern Labrador), indicated that some residents had concerns with the quality and quantity of their treated drinking water and reported that the use of untreated (raw) drinking water sources was not uncommon (Martin et al., 2007). This study also found that these communities were potentially experiencing an impact of climate change in decreased precipitation, resulting in fewer raw sources of potable water. Recommendations from the study included further investigation into health impacts of global climate change in Inuit communities such as changes in the risk of infectious illness due to pathogen contamination of available water (Martin et al., 2007). We propose a study that compares weather (rainfall and air temperature) data with different measures of drinking water quality and gastrointestinal (GI) illness outcomes in two Nunatsiavut communities. The main objectives are: 1) To compare weekly water quality variables (Total Coliforms, E. coli, and Enterococci) with recorded weather (rainfall and temperature) events and hourly turbidity data collected from raw water sites. 2) To compare weekly water quality and weather events (objective 1) with local health clinic records (in aggregate de-identified form) of infectious GI illness. 3) To provide the generalized results of this study in the form of educational material on climate change, water quality, and health for Nunatsiavut residents. Previous studies predict that global warming in Canada will generally result in longer summers, milder winters, increased summer drought, and an increased frequency of extreme weather events (Christensen et al., 2007). This could increase the risk of waterborne illness in this country due to the resulting impact and stresses on the natural and man-made environment. This project would engage
Nunatsiavut Inuit communities in a study to investigate relationships between GI illness incidence, weather events, and water quality. This study would also use this generated knowledge to create tangible and sustainable interventions, while developing the community’s capacity to understand and identify potential risks, and the ability to adapt and manage changes in water quality due to a changing climate. Results from this study would potentially be of use to inform policy making decisions, may help improve public health infrastructure in Inuit regions, and may illustrate potential impacts of climate change on drinking water quality and waterborne illness in other areas of Canada.

THE PEOPLE OF A FEATHER FILM PROJECT: COMBINING INUIT AND SCIENTIFIC KNOWLEDGE FOR EDUCATION AND OUTREACH

Heath, Joel P. (j沛heath@sfu.ca)

Dept. Mathematical Biology, University of British Columbia
Center for Earth Observation Science, University of Manitoba

The People of a Feather film project combines Inuit and scientific knowledge in order to communicate to a general audience, the ways in which environmental change is influencing sea ice habitats, wildlife and subsistence hunting on the Belcher Islands, Nunavut. Eider ducks winter in polynyas around the Belcher Islands. Given a lack of caribou on the islands, eiders have been an important source of clothing and food for the Belcher Islands Inuit. The warmest feather in the world (eider down) allows both Inuit and eider ducks to survive the winter. They share a common struggle to adapt to environmental change in Hudson Bay. Inuit storytelling is used to describe ecological themes in a manner accessible to a broad audience. In both modern and traditional recreation sequences, an Inuit family is followed as they prepare for hunting. A hunter and his young son are followed as they travel and interact with wildlife on the land. As the Inuit hunter teaches his son, the themes of the film are taught to the audience. The story switches between characters and wildlife sequences as ecological interactions occur, providing an impressionistic view of the modern and traditional ecology of arctic sea ice ecosystems. Interviews with Inuit elders drive home the message of increasing environmental variability, decreasing predictability and dangerous travel conditions which must be overcome for Inuit and eiders to adjust to environmental change in Hudson Bay. This project is being produced in collaboration with the community of Sanikiluaq and the Nuiyak high school. A multi-media modular educational package is also being produced and distributed with this project to promote national and international education and outreach in schools and interpretation centers.

THE INTEGRATION OF INUIT TRADITIONAL ECOLOGICAL KNOWLEDGE AND WESTERN SCIENCE IN WILDLIFE MANAGEMENT IN NUNAVUT, CANADA: THE CASE OF AVIAN CHOLERA OUTBREAKS AMONG COMMON EIDER DUCKS IN THE WEST HUDSON STRAIT AND NORTH JAMES BAY AREA

Henri, Dominique¹ (dominique.henri@mail.mcgill.ca) and Grant H. Gilchrist²

¹Oxford University Centre for the Environment, University of Oxford, South Parks Road, Oxford, Oxfordshire 0X1 3QY, United Kingdom
²Canadian Wildlife Service, 1125 Colonel By Drive, Raven Road, Carleton University, Ottawa, Ontario K1A 0H3

In the last decades, Inuit traditional ecological knowledge (TEK) has gained considerable importance in wildlife and resource management in the Canadian north. This study aims to critically examine the contribution that Inuit TEK may offer to contemporary wildlife management in the context of recent avian cholera outbreaks among Common Eider ducks (Somateria mollissima) in the west Hudson Strait and north James Bay area. A survey of Inuit TEK of the Common Eider was conducted in the communities of Kimmirut, Cape Dorset and Coral Harbour, Nunavut, Canada. It is suggested that Inuit TEK of that species provides a reliable foundation for its integration with Western scientific perspectives into various aspects of Eider management, such as the provision of historical baseline data, the assessment of population trends and sustainable harvest levels, the implementation of effective monitoring strategies, the creation of culturally adapted harvesting recommendations and regulations, as well as the identification of areas for further investigation and research. Moreover, from the analysis of gathered TEK data and existing scientific literature, the authors infer that avian cholera has only recently migrated into the west Hudson Strait and north James Bay area, rather than being a cyclical phenomenon in that region. Finally, the examination of the validity and reliability of TEK information through a definition of TEK holders’ expertise is proposed to ensure its meaningful integration into environmental decision-making.
ROLE OF BENTHIC ALGAE IN THE CO2 EXCHANGE FROM PONDS IN THE HUDSON BAY LOWLAND

Hille, Erika¹ (erikah@yorku.ca), Richard Bello¹, Patrick Mojdehi¹, Tim Papakyriakou², Mario Tenuta²

¹Department of Geography, York University, Toronto
²Faculty of Environment and Geography, University of Manitoba, Winnipeg

Lowland exchange from ponds in the Hudson Bay is discussed. Differences in pond depth on seasonal CO2 exchange radiation are presented and the influence of fluxes to temperature and photosynthetically active under cloudless sky conditions. The sensitivity of the amplitude in the CO2 flux has diminished and water is balances daytime uptake. By late fall, the daily changes in atmospheric CO2 exchange are negative on a daily basis coupled to benthic exchange. Early spring changes in atmospheric CO2 exchange which are understood. We present data from spring through fall 2007 from Frisbee Pond (d=40 cm) using new instrumentation to continuously monitor the flux of CO2 between ponds and the atmosphere and the corresponding flux of carbon between benthic algae and the overlying water. The silicone dissolved gas diffuser (SDGD) was employed in a closed loop with a Qubit S151 infrared gas analyzer (IRGA) to continuously monitor half-hourly average dissolved CO2 concentrations in the surface waters and complementary measurements of ambient CO2 with a Licor Li7500 open path IRGA and measured windspeed were used to calculate the CO2 flux. Clear acrylic chambers on the pond bottom were automatically flushed with fresh water on a 15 minute cycle and then closed to monitor changes in the concentration of dissolved oxygen (DO) over time using a YSI600QS hydroprobe. DO fluxes were used to infer the net benthic CO2 exchange assuming photosynthetic and respiratory quotients of 1.0. Shading experiments isolated photosynthesis from respiration. There are large diurnal and seasonal changes in atmospheric CO2 exchange which are coupled to benthic exchange. Early spring atmospheric CO2 fluxes are negative on a daily basis owing to strong algal uptake corresponding to long days and intense sunlight arriving at the pond bottom which is well correlated with photosynthesis. Strong benthic uptake produces highly undersaturated CO2 concentrations in the water (~275 ppm) and corresponding increases in pH (~9.1). Ponds evade CO2 to the atmosphere for periods of several hours following rain events which generate spikes in concentration (~500 ppm) from dissolved CO2 in rainfall and in shallow subsurface flow from the contributing watershed. As day length decreases, nocturnal evasion of CO2 increases and eventually balances daytime uptake. By late fall, the daily amplitude in the CO2 flux has diminished and water is generally supersaturated with CO2 except at mid-day under cloudless sky conditions. The sensitivity of the fluxes to temperature and photosynthetically active radiation are presented and the influence of differences in pond depth on seasonal CO2 exchange is discussed.

IMPACTS OF HERBIVORY ON RHIZOSPHERE INTERACTIONS IN AN ARCTIC SALT MARSH

Horrigan, Emma J. (emma.horrigan@utoronto.ca)

Department of Ecology and Evolutionary Biology
University of Toronto 25 Willcocks St. Toronto, ON M5S 3B2

Some recent studies suggest that plants can have a positive influence on soil microbes and the availability of nutrients under the influence of herbivory. Plants subjected to aboveground herbivory exude liable organic carbon (C) into the rhizosphere, benefiting C-limited microbes. Increased microbial activity results in higher rates of net nitrogen (N) and phosphorus (P) mineralization, which increases the availability of inorganic N and P for plant growth and the production of new photosynthetic tissue. In this study, changes in microbial biomass and soil nutrient availability were determined where swaths of Puccinellia phryganodes, the dominant forage grass in Arctic salt marshes, are grazed by lesser snow geese (Chen caerulescens caerulescens). This research was carried out near Churchill, MB, in a salt marsh that has been intensively grazed by lesser snow geese during the last 40 years. In order to test the impact of grazing on plant-microbial interactions, and to determine the possible role of C in controlling nutrient availability for plants and microbes, three pairs of experimental 1 m x 1 m plots were set up in 2007, on patches of P. phryganodes, with four nutrient addition treatments (C, N+P, N+P+C, and control) with or without the exclusion of geese. Preliminary results indicate that microbial C was higher in ungrazed plots compared with grazed plots, irrespective of the nutrient treatments. This indicates that grazing in this system does not lead to an increase in microbial biomass as the result of a likely increase in root carbon exudates. The severe loss of aboveground plant photosynthetic tissue in the grazed plots appears to limit the release of C into the rhizosphere for microbial uptake. Any photosynthetic C is mostly likely used in the regrowth of aboveground plant biomass, and fecal N from the birds provides a readily available source of N. This research is relevant for evaluating differences in the various degrees of impacts herbivores have on the interactions that occur belowground between soil microorganisms and plant roots, and how that in turn will affect plant re-growth and resource consumption at higher trophic levels.

RIVER-OCEAN INTERACTIONS IN HUDSON BAY

Hülse, Peter (p.huelse@mun.ca) and Samuel J. Bentley

Memorial University, Department of Earth Sciences, St. Johns, NL
River-ocean interactions in Hudson Bay
Peter Hüse*, Samuel J. Bentley* "Memorial University of Newfoundland, Department of Earth Sciences p.huelse@mun.ca This project focuses on sedimentary records of recent changes in freshwater input from major rivers flowing into Hudson Bay. Earlier work (Déry et al. 2005) revealed that freshwater discharge decreased by 13% in the period from 1964-2000. From before 1964, only sparse data of river runoff from the Canadian Shield to Hudson Bay are available. Because ~40% of total freshwater runoff from Canada enters Hudson Bay, there is a critical need to gain a better understanding of historical freshwater input patterns. To investigate this, box-cores and seafloor sonar data were collected off river mouths in Hudson Bay during ArcticNet Leg 1 in summer 2007. First work focuses on the macrotidal Nelson River estuary in western Hudson Bay, which shows the greatest annual discharge rate and is regulated by dams (Déry et al. 2005). Core locations were selected following study of sonar records. Box-cores were collected from topset, forset, and bottomset beds of the subaqueous delta, and were subsampled for granulometry, X-radiography, and sediment radiochemical measurements. Core samples are presently being analyzed for the particle-bound radioisotopes 7Be (half-life=53.3d), 234Th (half-life=24.1d) and 210Pb (half-life=22.3yr), to elucidate spatial and temporal patterns in sediment flux and thus freshwater input on seasonal to centennial timescales. Additionally the sediments are described in terms of grain size, density and water content. Preliminary studies of sedimentary strata in sonar records and X-radiographs suggest that sediment transport on the subaqueous delta occurs both due to fluvio-tidal resuspension, primarily on the topset beds, and also possibly gravity-driven flow in forset and bottomset regions. References: Déry, S., et al., 2005, J. Climate, 18: 2540-2557

TRADITIONAL KNOWLEDGE ON SEA ICE CHANGE IN SANIKILUQAQ: IMPACTS ON INUIT HUNTERS

Imrie, Devin (Devin_Imrie@umanitoba.ca)
University of Manitoba, Natural Resources Institute/ CEOS, 303-70 Dysart Road, Winnipeg MB, Can. R3T 2N2

Reduction in thickness, extent, and duration of sea ice has become reality throughout the Canadian Arctic, a reality with both global and local impacts. Inuit in the community of Sanikiluaq, NU, on the Belcher Islands, rely heavily on seasonal sea ice cover to conduct the majority of their traditional harvesting activities. Sanikiluaq residents are concerned that the combine effects of climate change and hydro-electric development in the Hudson Bay watershed are altering their sea ice environment, and in turn negatively affecting wildlife and the Inuit way of life. This project documents the observations and insights of hunters and elders from Sanikiluaq on sea ice change in the vicinity of the Belcher Islands. Specific areas where major changes have occurred are mapped out, and the impacts of these changes on hunting, travel, and way of life are discussed. This project will help to facilitate the flow of knowledge on environmental change from hunters and elders, to younger generations in the community. In addition, this research will complement and provide direction for ongoing community based monitoring of sea ice by Arcticnet scientists, to better understand the environmental changes underway.

COMMUNITY-SCALE HAZARD CLASSIFICATION IN THE CANADIAN ARCTIC: A CASE STUDY OF CLYDE RIVER, NUNAVUT

Irvine, Melanie1 (mela_irvine@yahoo.ca), I.R. Smith1,2 and T. Bell1

1Geography Department, Memorial University of Newfoundland, St. John’s, NL, A1B 3X9
2Geological Survey of Canada, 3303 - 33 Street NW, Calgary, AB, T2L 2A7

Northern communities, generally located on permafrost landscapes in coastal environments, are subjected to harsh climates, with strong seasonal contrasts in temperature, wind and precipitation. These climate cycles also drive seasonal changes in the landscape, creating instability and hazards. For example, rapid snowmelt on frozen ground may cause flooding; saturated, non-frozen ground may fail on moderate to steep slopes causing landslides; thawing of ice-rich permafrost results in ground subsidence; and sea-ice free coasts permit increased wave energy, producing coastal flooding and shoreline migration. Future climate scenarios predict changes in climate variables that may increase landscape instability and hazard risk. Effective planning and adaptation strategies require improved understanding of landscape sensitivity to predict future impacts under various climate-change scenarios. Integrated Assessment of Climate Change Impacts and Adaptation Options in Nunavut Communities is a project co-managed by the Government of Nunavut (GN) and Natural Resources Canada, in collaboration with Memorial University of Newfoundland, the Canadian Institute of Planners, and the Canada Nunavut Geoscience Office. It strives to integrate traditional knowledge, community decision makers, and scientific research on climate change impacts to improve community planning capacity and develop a Nunavut Adaptation Plan. It builds on the Adaptation Action in Arctic Communities workshop (Iqaluit, December 2006), and initially field activities are
IDENTIFICATION OF A NEAR-SURFACE TEMPERATURE MAXIMUM IN THE SOUTHERN CANADA BASIN, ARCTIC OCEAN

Jackson, Jennifer\(^1\) (jjackson@eos.ubc.ca), Grant Ingram\(^2\), and Susan Allen\(^1\), Eddy Carmack\(^2\) and Fiona McLaughlin\(^2\)

\(^1\)Department of Earth and Ocean Sciences, University of British Columbia, Vancouver BC, Canada

\(^2\)Institute of Ocean Sciences, Department of Fisheries and Oceans Canada, Sidney BC, Canada

Recent observations from the Canada/Japan/USA joint study of the Canada Basin, Arctic Ocean, reveal a near-surface temperature maximum layer (NSTM) with distinct properties. The NSTM is found at a depth of ~20m and is characterized by a temperature that is at least 0.4ºC warmer than the freezing temperature. It is associated with high concentrations of suspended particles, salinities < 30, and strong stratification. The NSTM was observed in the summers of 2002-07 and was the warmest and covered the greatest area in 2007. The freshwater content of this layer, relative to a base salinity, was also greatest in 2007. In addition, it was estimated that the heat in the NSTM could melt about 2 times more ice in 2007 than other years and it would take 2-3 times longer for the water to reach the freezing temperature than in other years. We propose that the NSTM is formed by the absorption of solar radiation due to the stratification produced by sea ice melt.

**AIR-WATER GAS EXCHANGE OF HEXACHLOROCYCLOHEXANES IN THE EASTERN CANADIAN ARCHIPELAGO**

Jantunen, Liisa M.\(^2\) (liisa.jantunen@ec.gc.ca), Terry F. Bidieman\(^3\), Gary A. Stern\(^2\) and Fiona Wong\(^1,2\)

\(^1\)Department of Chemistry, University of Toronto at Scarborough, 1265 Military Trail, Toronto, ON, M1C 1A4

\(^2\)Centre for Atmospheric Research Experiments, Science and Technology Branch, Environment Canada, 6248 Eighth Line, Egbert, ON, L0L 1N0

\(^3\)Freshwater Institute, Department of Fisheries and Oceans, 501 University Crescent, Winnipeg, MB, R3T 2N6

Hexachlorocyclohexanes (HCHs) are the most abundant organochlorine pesticides in Arctic air due to their facile atmospheric deposition in the cold environment and slow degradation rates. In the past two decades, there has been a reduction in primary emissions of technical HCH with an accompanying decline in atmospheric HCHs concentrations (1). As a result, a reversed direction of air-water flux from net deposition to net volatilization has been observed in some arctic regions (2,3). This study was carried out to determine the gas exchange of HCHs using gradients of HCH concentrations and enantiomer fractions (EF) of a-HCH, where EF = concentrations of (+)/[(+)] + (−)] enantiomers. Air and surface water samples were collected during the Arcticnet 2007 expedition from July 27 – August 16, which traveled from Quebec City to the Labrador Sea, through Hudson Strait and along a southern route in Hudson Bay to Churchill, Manitoba. Open water was encountered along the entire route. Air samples were simultaneously collected at ~1 m, ~6 m and ~15 m above water to characterize the vertical gradients of HCH concentration and EFs in the atmosphere. Air volumes of 50 – 600 m3 were sampled with a glass fiber filter – polyurethane foam cartridge. Water samples of 4 L were collected and the HCHs were isolated on XAD-2 or ENV+ solid adsorbent cartridges. HCH isomer ratios and EFs of a-HCH will
be determined to trace the sources of HCHs in the atmosphere; i.e. volatilization vs. long-range transport. Net gas exchange direction of HCHs will be examined using a fugacity approach. It is hypothesized that HCH concentrations in air will decrease from the lowest sampling height (1 m) to the highest (15 m) if volatilization from surface water is a significant source of HCHs to the atmosphere. Similarly, EFs of a-HCH in air sampled closest to the water are expected to approach the nonracemic EFs in the surface water and tend toward more nearly racemic values with height. Sampling will be continued in the late spring of 2008 to investigate the influence of ice cover on the air-water exchange of HCHs in western Archipelago. 1. Li, Y-F., Bidleman, T.F. (2003). Correlation between global emissions of a-HCH and its concentrations in arctic air. J. Environ. Informatics 1: 52-57. 2. Sahsuvar, L., Helm, P.A., Jantunen, L.M., Bidleman, T.F. (2003) Henry's law constants for a-, b-, and g-hexachlorocyclohexanes (HCHs) as a function of temperature, and revised estimates of gas exchange in arctic regions. Atmos. Environ. 37: 983-992. 3. Jantunen, L.M., Helm, P.A., Kylin, H., Bidleman, T.F. (2007), Hexachlorocyclohexanes (HCHs) in the Canadian Archipelago. 2. Air-water gas exchange of a- and g-HCHs. Environ. Sci. Technol., in press.

**AIR-WATER GAS EXCHANGE OF CURRENTLY USED PESTICIDES**

Jantunen, Liisa, M.,1 Fiona Wong2, Terry Bidleman1, Gary Stern3

1Centre for Atmospheric Research Experiments, Science & Technology Branch, Environment Canada, 6248 8th Line, Egbert ON, L0L 1N0
2Science & Technology Branch, Environment Canada, 4905 Dufferin Street, Toronto, ON, M3H 5T4
3Freshwater Institute, Department of Fisheries and Oceans, 501 University Crescent, Winnipeg, MB R3T 2N6

Transport of pesticides from agricultural fields to non-target areas is of great interest because they are manufactured to be toxic to biota. Currently used pesticides (CUPs) are generally less persistent than the older style organochlorines, but they can still undergo atmospheric transport through volatilization and deposition followed by re-emissions. Some ultimately make their way to sensitive ecosystems such as the Canadian Arctic. The CUPs daclath, chlorothenol and endosulfan are found in areas where no usage occurs. Endosulfan has been reported in temperate Canadian lakes1 and Arctic Ocean water2,3; daclath and chlorothenol have been detected in temperate and arctic lakes1, and in surface water of the eastern Canadian Archipelago4. The purpose of this study was to quantify the above CUPs and search for additional ones in air and water during Leg 1 of the 2007 ArcticNet expedition. Parallel large-volume air and water samples were collected from Quebec City to Churchill, Manitoba in July-August 2007. Occurrence and levels of CUPs in air and surface water will be presented along with the water/air fugacity ratios to determine net gas exchange direction. 1. Muir, D.C.G., Teixeira, C., Wania, F. 2004. Empirical and modeling evidence of regional atmospheric transport of current-use pesticides. Environ. Tox. Chem. 23, 2421-2432. 2. Jantunen, L.M.M., Bidleman, T.F. 1998. Organochlorine pesticides and enantiomers of chiral pesticides in Arctic Ocean water. Arch. Environ. Contam. Toxicol. 35: 218-228. 3. Weber, J., Halsall, C.J., Muir, D.C.G. 2007. Endosulfan and HCH in the Arctic: An assessment of surface seawater concentrations and air-sea exchange. Environ. Sci. Technol. 41, 7570-7576. 4. Jantunen, L.M., Helm, P.A., Kylin, H., Bidleman, T.F. 2007. Air-water exchange of currently used pesticides in the Canadian Archipelago. Presented at the 15th annual Northern Contaminants Program Research Results Workshop, Lake Louise, AB.

**INUIT PERSPECTIVES ON SAFETY MEASURES IN AND AROUND AUYUITTUQ NATIONAL PARK, NUNAVUT**

Johansson, Karin1 (karinjohans@gmail.com) and M. Manseau1,2

1Natural Resources Institute, University of Manitoba, Winnipeg, Manitoba, R3T 2N2
2Western and Northern Service Centre of Parks Canada, Winnipeg, Manitoba, R3B 0R9

With growing social and environmental change, land-use safety has become a major concern in many Inuit communities. The current system of risk assessment and safety regulations, conducted through the framework of Parks Canada, are not necessarily aligned with the concerns and approaches taken at the community level. The purpose of this research is to reduce this local gap by documenting the processes and challenges associated with the management of safe land-use practices in and around Auyuittuq National Park, Nunavut. This research relies on a collaborative micro-ethnographic approach involving the community of Qikiqtarjuaq, NU, which is located to the north of Auyuittuq National Park and where a community working group first raised concerns of safety. Specific research objectives include 1) seeking to understand Inuit perspectives and responses to safety issues; 2) exploring the current systems of local decision making in regards to safety; 3) examining the social and environmental changes that may be challenging Inuit safety adaptations; and 4) looking at ways Inuit knowledge can enhance the knowledge, experiences, and values...
MICROBIAL BIODIVERSITY IN AQUATIC HABITATS ENDANGERED BY CLIMATE CHANGE, QUTTINIRPAQ NATIONAL PARK, NUNAVUT

Jungblut, Anne D. 1 (anne-dorothee.jungblut.1@ulaval.ca), C. Lovejoy 2 and W. F. Vincent 1

1 Centre d’études nordiques & Département de Biologie, Université Laval, Québec, Québec G1V 0A6
2 Québec-Océan & Département de Biologie, Université Laval, Québec, Québec G1V 0A6

Quttinirpaaq National Park is located at the northern limit of Nunavut. It harbours a remarkable diversity of unique freshwater ecosystems ranging from meromictic lakes on Ellesmere Island, meltwater ponds on Ward Hunt and Markham Ice Shelves, to shallow lakes such as Ward Hunt Lake on Ward Hunt Island, an ArcticNet climate change monitoring site. Most of these aquatic systems are dominated by microbial life including complex sustainable microbial mat communities of bacteria, Archaea and eukaryotes. A major functional group in these consortia are cyanobacteria (oxygenic phototrophic bacteria). Because of their ability to adapt to persistent cold temperatures, frequent freeze-thaw cycles, extreme fluctuations in nutrient supply rates, salinity and irradiance, including ultraviolet radiation (Vincent 2008, Zakhia et al. 2007), they represent the major primary colonizers and predominant phototrophs. Climate models and recent observations indicate that climate change is occurring more rapidly in Polar Regions than at lower latitudes. The resultant environmental changes and break up of ice shelves in the Arctic could rapidly alter and endanger ice-based microbial habitats and the diversity within. This would not only result in a loss of biodiversity but also potentially affect carbon and nutrient cycling in this region of the coastal High Arctic. Current understanding of microbial biodiversity in these unique Nunavut ecosystems is limited. Therefore as part of ArcticNet and the International Polar year program “Microbiological and Ecological Responses to Global Environmental Changes in Polar Regions” (MERGE), we have begun investigations of the diversity of microscopic life in a variety of aquatic habitats in Quttinirpaaq National Park, including Ward Hunt Lake, Markham and Ward Hunt Ice Shelves, Lake A, Antoniades Pond and Quttinirpaaq Lagoon. Microbial mat communities were analysed via direct microscopic examination and phylogenetic analysis based on 16S rRNA gene sequencing, which was directly performed on the environmental samples. Our primary emphasis was on cyanobacteria given their importance in these ecosystems. This polyphasic approach identified a number of phyllo- and morphotypes belonging to the cyanobacterial orders Oscillatoriales, Nostocales (that are capable of nitrogen-fixation) and Chroococcales. The habitats were characterized by nutrient concentrations (total nitrogen and total phosphorus) and physico-chemical properties including temperature, pH and conductivity. This ongoing study will provide insights into the diversity and distribution patterns of a major ecosystem component, cyanobacteria, among different freshwater ecosystems in Quttinirpaaq National Park. It will also enable a bipolar comparison with Antarctic ecosystems and address questions concerning the global evolution and biogeographical distribution of cyanobacteria. Finally, the findings will enable the creation of molecular profiles of the present cyanobacterial diversity for future monitoring of climate related changes in Quttinirpaaq National Park, Nunavut. References Vincent, W.F. 2008. Cyanobacteria. In: Likens, G. (ed.) Encyclopedia of Inland Waters. Elsevier, The Netherlands (in press). Zakhia, F., Jungblut, A.-D., Taton, A., Vincent, W.F. and Wilmotte A. 2007.Cyanobacteria in cold environments. In: Margesin, R., Schinner, F., Marx, J.C. & Gerday, C. (eds) Psychrophiles: from Biodiversity to Biotechnology. Springer-Verlag (in press).

NEUROCHEMICAL CHANGES ASSOCIATED WITH MERCURY EXPOSURE IN POLAR BEARS (URSUS MARITIMUS)

Krey, Anke 1 (krey@unbc.ca), Michael Kwan 2 and Laurie Chan 3

1 University of Northern British Columbia, Community Health Sciences, Natural Resources and Environmental Studies, 3333 University Way, Prince George, BC, V2N 4Z9, Canada
2 Nunavik Research Center, Kuujjuaq, QC
3 Community Health Sciences, University of Northern British Columbia, Prince George, BC

Several contaminants in the environment are toxic to the central nervous system of mammals. In the Arctic environment, mercury (Hg) is especially important because its levels have been rising and its
derivate, methylmercury (MeHg), easily bio-accumulates in the food web. This study will examine the neurochemical disruption associated with Hg and MeHg exposure in polar bears (Ursus maritimus). Polar bears are useful sentinel species for assessing the disruption of neurochemical pathways in Arctic wildlife as they bioaccumulate neurotoxicants from their environment and are found throughout the circumpolar north. Neurochemical responses to neurotoxicant exposure have been measured in wildlife. It has been shown that higher Hg and MeHg levels correlate with the disruption of neurotransmitter systems in wild mink and river otter. Interruptions of neurochemical receptors and enzymes in the nervous system have been connected to behavioral changes in laboratory animals. The project expands these findings to examine the neurotoxic effects of Hg and MeHg in polar bears. For this purpose, brain tissues of free-ranging polar bears have been collected in the Canadian Arctic in collaboration with local hunters and government scientists. Activities of neurotransmitter receptors and enzymes in the central nervous system and their associations with the Hg and MeHg burden will be studied. This study will improve our understanding of the effects of environmental toxicants on the flagship species in the Arctic. It is important to monitor any subtle changes in Arctic wildlife as indicators of environmental health.

THE IMPLICATIONS OF LIGNIN DISTRIBUTION AND COMPOSITION IN HUDSON BAY SEDIMENTS FOR RIVERINE SOURCES AND TRANSPORT PATHWAYS

Kuzyk, Zou Zou1,2 (kuzykz@dfo-mpo.gc.ca), Rob Macdonald1,3, Miguel Goni4 and Gary Stern1,2

1Centre for Earth Observation Science, University of Manitoba
2Freshwater Institute, Fisheries and Oceans, 501 University Crescent, Winnipeg MB, R3T 2N6
3Institute of Ocean Sciences, Fisheries and Oceans, PO Box 6000, Sidney BC, V8L 4B2
4College of Oceanic and Atmospheric Sciences, Oregon State University, 104 Ocean Admin Building, Corvallis OR, 97331 5503

Understanding land-ocean interactions in Hudson Bay and potential climate-related effects are central objectives of ArcticNet. The Hudson Bay system is one of the largest mediterranean marine bodies in the world, with a huge watershed area that captures about 30% of total Canadian runoff. Major climate-related changes in watershed characteristics, river discharge, and sea ice cover have been projected for the system, similar to other Arctic marine systems, and it has been suggested that changes may be greater and perhaps faster, owing to its more southerly latitude and close contact with terrestrial systems. To obtain baseline data of relevance for assessing these changes, and to investigate changes that are already underway, we are examining the record preserved in 13 marine sediment cores, collected in September-October 2005. Here, we present results for lignin, an unambiguous tracer of terrestrial organic matter. Our results show that lignin is distributed in the Bay’s sediments in a way that reflects the latitudinal gradient in vegetation around the Bay’s perimeter (from tundra in the north to boreal forest in the south), as well as the effects of the Bay’s cyclonic (counter-clockwise) surface circulation, which transports materials from southern (riverine) sources northward up the east side of the bay. Sediments on the northeast shelf contain moderately degraded lignins from both angiosperm and gymnosperm sources to the south; we do not find these at equivalent latitude on the northwest shelf. The evolution of the lignin signature from source to sink suggests that the transport of materials involves hydrodynamic sorting, with fine-grained materials undergoing preferential transport, and probably, in many areas, extensive resuspension and redeposition. Sediments from the interior of the bay reflect a combination of highly sorted inputs and, occasionally, a more direct input from one of the shelf areas. Downcore (temporal) variations also point to the influence of southern Hudson Bay sources on the northeast and interior of the bay. Similar long term trends are found in the sediments from the southeast, northeast, and the more easterly parts of the interior whereas a different trend is found in the sediments of the northwest shelf and slope. There is an indication of either increased variability or a change in the long term trend in several of the more recent sediments we have examined.

UPDATE OF EXPOSURE LEVELS TO KEY CONTAMINANTS FOR INUVIALUT SETTLEMENT REGION, NUNAVUT AND LABRADOR

Labarré, Elisabeth1 (e.labarre@hotmail.com), Olivier Receveur1 and Laurie Chan2

1Department of Nutrition, Université de Montréal: 2375, ch de la Côte-St-Catherine Montréal Montréal (Québec) H3C 3J7
2BC Leadership Chair In Aboriginal Environmental Health University of Northern British Columbia: 3333 University Way Prince George, BC V2N 4Z9

Traditional food is well integrated in Inuit’s life. The quantity consumed as well as the variety of this type of food has been documented extensively. The contamination of this food by mercury, chlordane, PCB and toxaphene is a source of preoccupation. To check if the daily intakes of contaminants may have changed recently, new samples of traditional food were collected and obtained from Dr Stern, Dr Muir
and Dr Evans and the exposure levels updated based on 24h recalls collected in 1998-99 for Inuits of Inuvialuit Settlement Region, Labrador and Nunavut. The variation of the daily intakes was estimated according to two different methods namely the 24h recall and the food frequency questionnaire. A comparison of exposure estimates is made using the two different methods and the data set from Chan (Chan, 1998). Overall in this study, the 24h recall underestimates the daily intake and the food frequency questionnaire overestimates it as was expected from the literature. New data on contaminant concentrations from key traditional food sources do not affect notably previous exposure estimates. The estimates for organochlorines intake can be considered updated as the five food-types for which new concentrations were available represent most of the total exposure. For mercury, updated data for caribou, narwal, beluga muktuk and lake trout would be needed to generate more precise updates. The exposure estimates are at greatly affected by the methodology used for the determination of the daily traditional food intake, particularly where traditional food consumption is lower. Batal, M; Gray-Donald, K; Kuhlein, H.M and Receveur, O. 2004. Estimation of traditional food intake in indigenous communities in Denendeh and the Yukon. International Journal of Circumpolar Health 64: 1. Chan, L.H. 1998. A comparison of exposure estimates is made using the two different methods and the data set from Chan (Chan, 1998). Overall in this study, the 24h recall underestimates the daily intake and the food frequency questionnaire overestimates it as was expected from the literature. New data on contaminant concentrations from key traditional food sources do not affect notably previous exposure estimates. The estimates for organochlorines intake can be considered updated as the five food-types for which new concentrations were available represent most of the total exposure. For mercury, updated data for caribou, narwal, beluga muktuk and lake trout would be needed to generate more precise updates. The exposure estimates are at greatly affected by the methodology used for the determination of the daily traditional food intake, particularly where traditional food consumption is lower. Batal, M; Gray-Donald, K; Kuhlein, H.M and Receveur, O. 2004. Estimation of traditional food intake in indigenous communities in Denendeh and the Yukon. International Journal of Circumpolar Health 64: 1. Chan, L.H. 1998. A database for environmental contaminants in traditional foods in northern and Arctic Canada: development and applications. Food Additive Contaminants 15(20): 127-134. Kuhnlein, H.V; Receveur, O; Chan, L and E. Loring. Assessment of Dietary Benefit/Risk in Inuit Communities. Centre for Indigenous Peoples’ Nutrition and Environment (CINE), McGill University, 377 pages, August 2000.

GROWTH SELECTION AND SURVIVAL OF YOUNG ARCTIC COD IN CANADIAN ARCTIC

Lafrance, Pascale1
(pascale.lafrance@giroq.ulaval.ca), J.A. Gagné2 and L. Fortier1

1Québec-Océan, Pavillon Vachon, Université Laval, Québec, Canada, G1K 7P4
2Maurice Lamontagne Institute, Department of Fisheries and Ocean, 850 route de la Mer, P.O. Box 1000, Mont-Joli, Québec, Canada, G5H 3Z4

Arctic cod is an abundant and ubiquitous fish in the Arctic Ocean. Previous studies showed interannual and spatial variations in the hatching seasons of this key species, ranging from late winter hatching under the ice in heavily ice-covered seas to late spring hatching in areas characterized by the presence of springtime polynyas(s). The survival of young-of-the-year Arctic cod seems closely influenced by environmental factors such as sea surface temperature and sea ice concentration. These variations in larval survival may be in fact related to variations in larval and juvenile growth, as indicated by several studies on fish recruitment. Accordingly, we tested the hypothesis that fast growing Arctic cod increased their survival by reaching a greater size at the beginning of the first winter. Four annual cohorts of young Arctic cod (2002, 2003, 2004 and 2005) were sampled in Beaufort Sea. In 2005, sampling extended to Baffin Bay, Lancaster Sound and Hudson Bay, which allowed spatial comparisons of growth rates among fish collected. Otoliths of 840 Arctic cod were analyzed in total. Somatic length-at-age was back-calculated from the width of lapillar increments using the biological intercept method. Estimated growth histories were compared between newly-hatched larvae collected in early spring and juveniles collected during the boreal summer of 2004; the latter being considered as the survivors of the 2004 larval cohorts. We further compare interannual and spatial variability in growth trajectories and assess the impact of different growth rates on Arctic cod population.

HOLOCENE CHRONOSTRATIGRAPHY AND SEDIMENTOLOGY OF EASTERN HUDSON BAY AND WESTERN HUDSON STRAIT

Lajoie, Michel1,3 (Michel.Lajoie@uqar.qc.ca), Guillaume St-Onge1,3 and Patrick Lajeunesse2

1Institut des Sciences de la mer de Rimouski (ISMER), 310, allée des Ursulines, C.P. 3300, Rimouski (Québec) Canada G5L 3A1.
2Centre d’études nordiques & Département de géographie, Université Laval, Québec (Québec) Canada G1K 7P4.
3GEOTOP-UQAM-McGill.

Several piston and box cores were collected in 2005, 2006 and 2007 on board the CCGS Amundsen and Pierre Radisson in eastern Hudson Bay and western Hudson Strait in order to understand the sedimentology of the area and to construct a robust Holocene high resolution chronostatigraphic framework. To date, CAT-Scan, Multi Sensor Core Logger (MSCL), grain size, spectrophotometer and 14C AMS analyses were performed while paleomagnetic measurements are currently being performed on u-channel samples at 1 cm intervals. These analyses reveal high frequency variations in the magnetic and physical properties of the sediments, as well as important changes in sedimentation regime. Three sedimentary units are observed. Unit 1 is predominantly composed of olive grey to dark grey postglacial clayey silts. Unit 2 is degradal in origin and is observed in cores AMD0509 28 PC (western Hudson Strait), AMD0509 27b LEH (northeastern Hudson Bay) and PRAD0906 02 PC (Western Hudson Strait), where a reddish turbidite associated with the final drainage of Lake Agassiz around 8500 cal BP.
can be identified (St-Onge and Lajeunesse 2007). Unit 3 is a glacimarine unit characterized by 40% of clays and 60% of silts. In the postglacial period (<8 500 cal BP), silty sedimentation was predominant, clay content decreased and sandy sedimentation appears episodically. Preliminary age model derived from three AMS 14C dates in core AMD0509 20PC (near Lac-Guillaume-Delisle) in conjunction with spectral analysis of the magnetic susceptibility and CT number profiles reveal significant periods of 24, 14 and 11 years. These periods were previously associated with solar variability (11 and 22 yrs) and the North Atlantic Oscillation (14 yrs), suggesting that the sedimentary regimes in Hudson Bay are highly influenced by climatic variations. Finally, paleomagnetic, geophysical and geochemical data will be presented and correlation between the cores will be attempted in order to construct the regional chronostratigraphic framework.

HYDROLOGICAL IMPACT OF EXTENSIVE PERMAFROST DISTURBANCE IN A HIGH ARCTIC WATERSHED, CAPE BOUNTY, MELVILLE ISLAND

Lamoureux, Scott (scott.lamoureux@queensu.ca) and Melissa Lafrenière
Department of Geography Queen’s University
Kingston, ON, K7L 3N6

Comprehensive watershed process monitoring initiated in 2003 and expanded in 2005 to include hydrochemical flux measurements has provided a long-term data set to explore the linkages between climate change, hydrological processes, and fluxes of water, sediment, nutrients and solutes to coastal lakes. During July 2007, we observed exceptional and persistent warm temperatures that are unprecedented since records have been kept in the 1950s. In an area where mean daily July temperatures are typically c. 5°C, we recorded frequent temperatures above 15°C and several days with temperatures exceeding 20°C. These conditions resulted in rapid deepening of the active layer to well below 50 cm depth, the depth reached in the previous year. The thickened active layer, together with a 12 mm rainfall event in late July resulted in widespread detachment slides across the West watershed at Cape Bounty between July 25 and August 1. Measurements indicate that thaw depths were at least 100 cm and in many instances, detachments revealed underlying ground ice. Mapping indicates that approximately 2-3% of the watershed was directly impacted by disturbances. The immediate fluvial impact of the detachments was primarily in the form of sharp rises in river discharge, turbidity and electrical conductivity. Turbidity records reveal short-lived pulses associated with initial hydrological connection of major detachment slides, including a number substantially isolated from the main channel. Additionally, a large detachment dammed the river over a length of 200 m, resulting in significant upstream ponding. While the impact of detachments had an immediate and substantial impact on river conditions, it is clear that erosion of unstable material and solute-rich soil waters are likely to have a sustained impact on watershed fluxes in future years. Continued monitoring of this system will yield a comprehensive dataset to understand the impact of permafrost disturbance on coastal watersheds, water quality and hydroecological conditions. Additionally, we anticipate that the frequency of similar disturbances will be apparent through ongoing analysis of the sedimentary record in the lake.

CONTRIBUTION OF THE TERRESTRIAL ECO- SYSTEMS OF SURROUNDING LOWLAND TO CARBON AND MERCURY OBSERVED IN THE WATER OF HUDSON BAY

Lapenskie, Kathryn1,2 (kathrynlapenskie@hotmail.com), D. Lobb1, G. Stern2,3, F. Wang2, M. Tenuta1, T. Papakyriakou2, D. Armstrong2, K. Snelgrove4, R. Macdonald2,5

1Department of Soil Science, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2
2Department of Environment and Geography, University of Manitoba, Winnipeg, Manitoba, Canada
3Freshwater Institute, Department of Fisheries and Oceans, Winnipeg, Manitoba, Canada
4Department of Civil Engineering, Memorial University, St. John’s, Newfoundland and Labrador, Canada
5Institute of Ocean Sciences, Department of Fisheries and Oceans, Sidney, British Columbia, Canada

The terrestrial ecosystems of the Hudson Bay Lowland shed water into Hudson Bay and, in doing so, affect the water quality of the marine ecosystems of the Bay. However, little is known about the nature of materials flowing into the Bay. Such knowledge is expected to be important to understanding the relationships between these ecosystems and climate and the impacts of climate change. In 2006 and 2007 a study was carried out, focusing on the delivery of carbon and mercury to the Bay from the surrounding Lowland. Water sampling was carried out in selected water bodies and waterways in the lower region of the Churchill River watershed. Samples were collected at locations where hydrometric stations had been established. Samples were collected over a range of water level and flow conditions over the course of the each summer. Water samples were analyzed for a wide variety of constituents: dissolved organic carbon, cations (Na+, K+, NH4+, Mg2+, Ca2+), anions (F-, Cl-, Br-, NO2-, NO3-, SO42-, PO42-), trace metals, total mercury, and methyl mercury. Suspended sediment samples

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were analyzed for total suspended solids, organic carbon, total nitrogen, 137Cs and 210Pb. Flow data at the time of sampling was used to determine the loading of water constituents. At the time of sampling, in-situ measurements were taken of water temperature, pH, dissolved oxygen, oxidation reduction potential, electrical conductivity, and total dissolved solids.

VARIABILITY IN THE SINKING EXPORT OF ORGANIC MATERIAL IN HUDSON BAY AND HUDSON STRAIT DURING THE FALL

Lapoussière, Amandine1,2, (amandine.lapoussiere@uqar.qc.ca), Christine Michel2, Michel Gosselin1 and Michel Poulin 3
1Institut des sciences de la mer de Rimouski, Université du Québec à Rimouski, QC, G5L 3A1
2Freshwater Institute, Fisheries and Oceans Canada, Winnipeg, MB, R3T 2N6
3Division de la recherche, Musée canadien de la nature, Ottawa, ON, K1P 6P4

Spatial variations in the sinking export of organic material were assessed in Hudson Bay and Hudson Strait during the second oceanographic expedition of ArcticNet, on board the CCGS Amundsen in early fall 2005. We estimated the sinking export of particulate material from the euphotic zone, using short-term free-drifting sediment traps deployed from the ship at 50 m during 8 to 20 h at eight stations in various hydrographic regions of the Hudson Bay system. We studied the amount and the composition of the collected material by analyzing chlorophyll a (chl a) and pheopigments, particulate organic carbon (POC), biogenic silica, phytoplankton composition and abundance, fecal pellet abundance and biovolume, and bacterial abundance. The maximum sinking export of pigments (chl a and pheopigments) and of POC was observed in Hudson Strait. In Hudson Bay, a decreasing gradient in the sinking export of chl a and POC was observed from the northernmost station towards the southeast. Low sedimentation rates of pigments were observed in the central and western sectors of the Bay. For biogenic silica, sedimentation rates were in agreement with the phytoplankton specific composition. Higher diatom biomass in Hudson Strait and in the eastern sector of the Bay were associated with higher biogenic silica sinking export than in the western sector where the dinoflagellates dominated. In term of the exported organic material composition, the POC sinking export was dominated by intact phytoplanktonic cells in Hudson Strait. In Hudson Bay, the POC sinking export was dominated by fecal pellets in the east and by bacteria in the west.

THE INFLUENCE OF GEOMORPHIC DISTURBANCES AND SNOW LOAD ON HIGH ARCTIC BIOGEOCHEMICAL FLUXES

Laurin, Emil (6el9@queensu.ca), M. Lafrenière and S.F. Lamoureux
Department of Geography, Queen's University, Kingston, Ontario K7L 3N6

Terrestrial sources of dissolved organic carbon (DOC) and nitrogen (N) to Arctic watersheds are important components of aquatic and marine ecosystems. There is growing concern regarding how environmental change will affect water quantity and quality and biogeochemical cycles in the High Arctic. Additionally the flux of carbon from terrestrial watersheds to the Arctic Ocean is considered an important global carbon sink. The goal of this research is to determine the impact of Snowpack depth and geomorphic disturbances on the biogeochemical cycles of DOC and N in a continuous permafrost catchment at Cape Bounty, Melville Island, Nunavut (74.5°N, 109.5°W). This presentation addresses the study method and initial findings of this research. The study examines the impact of active layer detachments by comparing of an old slope detachment (<50yrs) with an adjacent undisturbed site and by studying a slope detachment that occurred in 2007. The impact of snow load has been examined by comparison of experimental sub-catchments that have been amended with snow fences to enhance snow accumulation with other unaltered sites. These paired sites have been chosen on both polar desert and shrub tundra vegetation locations. Discharge has been derived from stage for each catchment and sub-catchment recorded at 10 min intervals using square-notch weirs and pressure transducers. Electrical conductivity and turbidity were be monitored continuously at 10 min intervals. Peak and low flow samples were analyzed for DOC, N and other major ions. Soil moisture, and temperature were monitored at 2hr intervals at a site within each catchment or sub-catchment; soil water samples were be collected periodically from lysimeters and analyzed for DOC, N as well as other major ions. These observations will be used to interpret and elucidate both seasonal trends and total annual yield of DOC and N from the terrestrial catchments.

PALYNOLOGICAL EVIDENCE OF THE HOLOCENE THERMAL MAXIMUM IN THE NORTHWEST PASSAGE: A POSSIBLE SHIFT IN THE ARCTIC OSCILLATION AT MILLENNIAL TIME SCALE

Ledu, David1, André Rochon1 (andre_rochon@uqar.qc.ca), Anne de Vernal2 and Guillaume St-Onge1

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Instrumental data from the Arctic revealed a dramatic modification of the hydrographic parameters over the past 30 years. It is therefore of primary importance to better understand the climate variability in the Arctic, which cannot be assessed from short-term observational data, but requires longer time series. We have consequently collected 4 piston cores (~6 m) for palynological analysis along the Northwest Passage in Lancaster, Barrow, Victoria and Dease straits. Here, we present the results of two cores 2004-804-009 and 2005-804-004, from Lancaster and Barrow straits respectively. Both cores have been sub-sampled every 10 cm for the analysis of dinoflagellate cyst (dinocysts) assemblages, which will allow us using transfer functions in order to reconstruct the sea surface hydrography parameters. Radiocarbon ages indicate that both core span the last 10,000 cal BP. The age model indicates a sedimentation rate of 0.57 mm/yr and 0.45 mm/yr for the 009 and 004 respectively, allowing for a secular time-scale resolution of the Holocene climate oscillations. Grain size and geochemical analyses of core 2004-804-009 show a prevalence of the fine fraction in the major part of the core, indicating hemipelagic sedimentation. The base of the core records a higher percentage of sand and CaCO3 and high values of the C/N ratio, which suggest an erosive dynamic with a large inflow of freshwater indicating a terrestrial sedimentation that we associate with meltwater inputs associated with the retreat of the Laurentide Ice Sheet. Dinocysts analyses show a strong opposition between the two cores. The 2004-804-009 sequence shows four different zones. The first zone at the base of the core covers the early Holocene (11,775 to 10,990 cal BP) and indicates a maximum abundance of pre-Quaternary palynomorphs with an absence of cyst in the lowermost 40 cm of the core consistent with a high meltwater input. The second zone covers the early to middle Holocene (10,990 to 4500 cal BP) and is dominated by the heterotrophic taxa Brigantedinium sp. and Islandinium minutum. The third zone covers the middle Holocene (4500 to 2500 cal BP) where the percentage of autotrophic taxa increases with Spiniferites frigidos/elongatus, Operculodinium centrocarpum, Pentapharsodinium dalei. The fourth zone represents the modern conditions with the dominance of heterotrophic taxa. In contrast, core 2005-804-004 shows a dominance of the heterotrophic taxa Brigantedinium sp., Islandinium minutum, Echinidinium aculeatum in the major part of the sequence. A large increase of such taxa between 6600 and 5500 cal BP suggests a correlation with the third zone of the 2004-804-009 core. This zone is accompanied by an increase in both core of the reconstructed August T°C of about +3°C and a decrease of the sea ice cover of about 1.5 month/yr relative to modern conditions, suggesting the Holocene thermal optimum. We associate this period with a strong vertical mixing of Atlantic water in Barrow strait due to Ekman pumping triggered by a possible shift in the Arctic oscillation at millennial time scale which enhanced upwelling and support heterotrophic taxa, while autotrophic taxa are limited by the thinning of the euphotic zone.

### BIOGEOCHEMICAL CYCLING OF METHYLATED MERCURY SPECIES IN HIGH ARCTIC MARINE WATERS

Lehnerr, Igor1 (lehnerr@ualberta.ca), J. L. Kirk1, V. L. St. Louis1 and H. Hintlemann2

1Department of Biological Sciences, University of Alberta, Edmonton, Alberta, T6G 2E9
2Department of Chemistry, Trent University, Peterborough, Ontario, K9J 7B8

Monomethyl mercury (MMHg), a vertebrate neurotoxin which bioaccumulates through foodwebs, is found in some Arctic marine mammals at levels that may be harmful to northern peoples consuming them as traditional food. Unfortunately, the sources of MMHg to polar marine food webs remain unknown, in part due to the complex nature of Hg cycling in polar marine waters. During the past two ArcticNet cruises aboard the CCGS Amundsen we have measured elevated concentrations of MMHg and dimethyl Hg (DMHg, a toxic and volatile form of Hg) in deeper regions of the water column, despite low total Hg (THg) concentrations, at sites ranging from the NOW Polyna to the Northwest Passage. Therefore, we hypothesize that MMHg and/or DMHg are produced in situ in the water column from inorganic Hg(II) species, which are themselves not as toxic or as readily bioaccumulated. We tested this hypothesis during the 2006 ArcticNet cruise using stable-isotope Hg tracers to quantify the rates of production of methylated Hg species from Hg(II) during incubation experiments. Seawater samples were amended with 198Hg(II) and incubated for 8,16 or 24 hours to measure the production of MM198Hg and DM198Hg, as well as gaseous elemental 198Hg(0), over time. A different tracer, MM199Hg, was also added to seawater samples to quantify both the production of DM199Hg and 199Hg(0) from MM199Hg and demethylation rates of MMHg in the water column of polar oceans. Preliminary results indicate that methylation of Hg(II) to MMHg occurs in the water column, but that the rate of methylation is low. We also show that DMHg is produced fairly rapidly from MMHg in deeper regions of the water column (below the oxycline), and more slowly from Hg(II). Furthermore, both MMHg and Hg(II) can be reduced to gaseous elemental Hg(0).
throughout the water column, but MMHg reduction is slower and sometimes restricted to surface waters. Rate constants for some of the major processes involved in the biogeochemical cycling of Hg (methylolation/demethylation, and reduction) will be calculated from the results of these experiments, which will provide valuable information for Hg models. This research will not only help to determine sources of MMHg to polar marine organisms, it will also broaden our understanding of Hg cycling in the Arctic.

PHENOLOGY, REPRODUCTIVE EFFORT AND CLIMATE VARIABILITY: A 13-YEAR STUDY IN THE CANADIAN ARCTIC

Levasseur, Lucie-Guylaine
(Lucie@guylaine.levasseur@uqtr.ca) and Esther Lévesque (esther.levesseque@uqtr.ca)
Department of Chemistry-Biology, Université du Québec à Trois-Rivières, Trois-Rivières, G9A 5H7

Long-term records of plant phenology and reproduction dynamics in relation with climate variability are sparse in the Arctic and rare in the High Arctic. We are presenting here the results of 13 years of detailed observations of the phenology and reproductive effort of Dryas integrifolia Vahl., a dominant vascular plant species over wide areas of the North American and Greenland tundra biome. Our data come from the low arctic site Baker Lake (64°N) and the high arctic site Tanquary Fjord (81°N), both located in Nunavut, Canada. These sites are part of the ITEX (International Tundra Experiment) network, a circumpolar effort to assess impact of climate change on tundra plant species and communities. Our goal was to characterize the climate variability of our sites and to find out which environmental factors have an impact on the phenology (timing of budding, flowering and fruiting) and on the interannual variation of reproductive effort of D. integrifolia. During our study period (1990-2005), there was a great variation in thawing degree-days and liquid precipitation totals accumulated annually at both sites. In addition, the seasonal and annual mean surface temperatures were generally well above the 1971-2000 normal. Our results indicate that D. integrifolia is showing a strong phenological response to climate variability. Onset of budding varied on a nearly 20 days range between 1992 and 2005 at both sites. At Tanquary (high arctic site), Dryas population gradually advanced its budding varied on a nearly 20 days range between 1992 and 2005 at both sites. At Tanquary (high arctic site), Dryas population gradually advanced its

MICROBIOLOGICAL QUALITY OF BLUE MUSSELS (MYTILUS EDULIS) IN NUNAVIK: A PILOT STUDY

Lévesque, Benoit1,2,3 (benoit.levesseque@inspq.qc.ca), É. Lavoie2, M. Simard4, C. Barthe5, B. Dixon6, D. Murphy7, B. Doidge4, J.-F. Proulx8

1Département de médecine sociale et préventive, Université Laval, Québec, G1K 7P4
2Unité de recherche en santé publique, CHUL-CHUQ, Québec, Canada
3Institut national de santé publique du Québec, Québec, Canada
4Centre de recherche du Nunavik, Kuujjuaq, Canada
5Ministère de l’agriculture, pêcheries et de l’alimentation du Québec, Québec, Canada
6Health Products and Food Branch, Health Canada, Ottawa, Canada
7Laboratoire de santé publique du Québec, Institut national de santé publique du Québec, Sainte-Anne-de-Bellevue, Canada.
8Direction régionale de santé publique du Nunavik, Régie Régionale de la Santé et des Services Sociaux du Nunavik, Kuujjuaq, Canada

Objective Inhabitants of Nunavik eat mussels and other molluscs, raw or cooked. This pilot study was aimed at documenting the presence of fecal indicators and various pathogens in mussels from three communities in Nunavik. Material and methods Mussel samples were collected at low tide. Two Kg of mussels by sample were collected and kept on ice. Two samples were collected in the first village and one sample in the other two villages. Mussels were shipped by plane to the laboratory where they were analysed, in the case of one village, for the following indicators (fecal streptococcus, E coli, F-specific coliphages, Clostridium perfringens) and pathogens (Norovirus, Salmonella sp., Campylobacter sp., E coli O157:H7, Shigella sp. and Yersinia enterocolitica) by molecular identification. For the other two communities, for logistic reasons, E. coli was not tested; however in addition to the aforementioned list, three parasites (Giardia duodenalis, Cryptosporidium spp., Toxoplasma gondii) were also examined by

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microscopy and molecular methods. Results For the first community, the samples were negative for all indicators and pathogens except for low concentrations of F-specific coliphages (850/100g. and 2625/100g.) and the presence of a non pathogenic strain of Yersinia enterocolitica. A non pathogenic strain of Yersinia enterocolitica was also observed in the samples of the other communities, along with a low concentration of Clostridium perfringens (100/g.) for the second village and a PCR positive for Giardia duodenalis but negative by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy. The presence of oocysts of Cryptosporidium spp. was documented by microscopy.

BEAUFORT SEA BELUGA DIET DESCRIBED BY FATTY ACID ANALYSIS WITH INSIGHTS INTO ARCTIC COD DISTRIBUTION

Loseto, Lisa1 (losetol@dfo-mpo.gc.ca), G.A. Stern2,3, B. Gemmill3, D. Deibel4, T. Connelly4, A. Prokopowicz5, L. Fortier5, S.H. Ferguson2

1Dept of Zoology, University of Manitoba, 500 University Cres., Winnipeg MB, R3T 2N2, Canada
2Freshwater Institute/Fisheries and Oceans Canada, 501 University Cres., Winnipeg MB, R3T 2N6, Canada
3Dept of Environment & Geography, University of Manitoba, 500 University Cres., Winnipeg MB, R3T 2N2, Canada
4Ocean Sciences Centre, Memorial University, St John’s NL, A1C 5S7, Canada
5Dept de Biologie, Université Laval, Pavillon Vachon, Quebec QC, G1K 7P4, Canada

Beaufort Sea beluga whales (Delphinapterus leucas) are dimorphic and segregate into distinct habitats by length, sex and reproductive status during summer in the eastern Beaufort Sea. Although the specific diet composition of this beluga population is not known, recent fatty acid analysis showed variation in fatty acid profiles related to habitat use and body size. To further evaluate beluga diet, potential prey items were collected in the beluga summer region and discriminated from one another using multivariate analysis of fatty acids. Next, the relative contribution of various prey items to beluga diet across body size ranges was investigated using multivariate and univariate techniques. Fatty acids effectively partitioned prey items into groups associated with their habitat and ecology. Generally, beluga appeared to feed predominantly on the marine fish, particularly, arctic cod and Pacific herring. However, diet seemed to vary as a function of body size, whereby larger beluga preferred offshore arctic cod, and medium and smaller sized beluga preferred arctic cod collected from the Mackenzie shelf and other nearshore fish species. Juvenile belugas had a more diverse fatty acid composition than did larger whales suggesting a more complex diet, likely caused by inexperience and/or diving limitations. Beluga habitat use matched well with preferential feeding on different sizes of arctic cod and provided new information about arctic cod occurrence and behaviour. The beluga diet preferences related to body size and habitat use was
supported by mercury and stable isotopes measured in previous studies.

**Physiological Mechanisms Linking Body Condition, Climate Change and the Timing of Reproduction in an Extreme Capital Breeding Bird**

Love, Oliver P. 1 (olovea@sfu.ca), Joël Béty 1 and Grant H. Gilchrist 3

1 Départ. de Biologie et Centre d’Études Nordiques, Université du Québec à Rimouski, Rimouski, QC G5L 3A1
2 Canadian Wildlife Service and Carleton University, Ottawa, Ontario K1S 5B6

Conservation physiology can provide the causal mechanisms underlying subtle human-induced changes to individual condition, behaviour and reproductive decisions that proximately affect individual organismal fitness, ultimately affecting population dynamics. As such, understanding individual variation in physiological traits can help provide conservation biologists with the underlying (usually unrecognized) reasons for why a population may be in decline due to human-induced change. In particular, determining how and why physiological mechanisms link individual reproductive decisions (e.g., whether to initiate breeding, the timing of breeding, quantity versus quality of offspring) with energetic condition and variation in environmental variables may be key to interpreting how climate change ultimately influences the persistence of some sensitive Arctic populations. As a model to better understand the underlying mechanisms that connect climate change, energetic body condition and reproductive decisions in Arctic birds, we have been examining numerous physiological indicators in pre-breeding Common eiders (Somateria mollissima) breeding at East Bay, Nunavut. Work has revealed that extreme capital-breeding birds such as the common eider in part rely on reaching a body-condition threshold to begin reproduction. Since this threshold for breeding is directly affected by access to pre-breeding resources, it is influenced by climatic variation via its effects on access to ice-free foraging grounds and to optimal nesting habitat. However, body condition alone does not explain all of the individual variation in the decision of when to initiate egg-laying. More subtle interactions between condition and climate, such as effects on individual stress levels and energetic feed-back pathways, may help to explain some of the unexplained variation. Using data on inter-year variability in climatic conditions we can examine how and why climate variation influences the timing of breeding through alterations of key physiological mechanisms that individuals rely on to maximize reproductive output. Specific physiological traits that we are examining in pre-breeding common eiders include: 1) the stress hormone corticosterone, 2) triglycerides - an indicator of energetic status, 3) leptin - a lipid storage feedback hormone and 4) oxidative stress levels. Using data collected from two recent field seasons with marked differences in climatic conditions, we can firstly examine how physiology mediates key life-history trade-offs that are at the heart of reproductive decisions, namely those between 1) current reproduction and condition, 2) current and future reproduction, and 3) the number and quality of offspring. Secondly, this information enables a more complete understanding of how individuals of varying condition and physiological make-up are differentially affected by the ongoing changing climatic conditions in the Arctic. Ultimately, this information will allow for a better identification of the relative vulnerability of Arctic-breeding vertebrates to global warming.

**Population Declines in Snow Buntings (Plectrophenax Nivalis): Discussion of Climate-Change-Induced Mechanisms and Alternative Explanations**

Ludkin, Rick 1 (rludkin@rogers.com), Oliver P. Love 2 and Grant H. Gilchrist 3

1 Ruthven Park National Historic Site Banding Station, Cayuga, Ontario N0A 1E0
2 Départ. de Biologie et Centre d’Études Nordiques, Université du Québec à Rimouski, Rimouski, QC G5L 3A1
3 Canadian Wildlife Service and Carleton University, Ottawa, Ontario K1S 5B6

Recent analyses by the National Audubon Society have reported that the North American population of snow buntings (Plectrophenax nivalis) has declined by as much as 64% in the past 40 years. This conclusion has been based on population sizes calculated from data obtained during Christmas Bird Counts (CBCs). Although the sole mechanism for this decline has been presented as the climate-change-induced warming of their Arctic breeding habitats, little direct evidence supporting this hypothesis has been included with the current trend analysis. Furthermore, no alternative hypotheses have been forwarded to offer strength to this primary explanation for the species’ decline. However, potentially the most parsimonious, and yet un-examined, explanation for this dramatic decline has been the marked changes in agricultural practices that have occurred in this species’ wintering habitat in the Northern United States and Southern Canada over the past four decades. Moreover, changes in agricultural practices may interact with climate-change-induced shifts in wintering distributions towards the north, which may also account for some of the reported declines. Firstly,
to examine alternative explanations for the apparent population decline recently reported, we have been examining correlations between changes in agricultural practices (changes in the use of ‘fallow’ land during crop rotations, types of crops grown and use occurrence of “herbicide-ready” varieties) and yearly CBC counts for snow buntings. Secondly, using CBC data we have been examining the alternative hypothesis that climate change may have induced a northern shift in wintering populations rather than a gradual deterioration of breeding habitat. Finally, we examine the possibility that snow bunting populations, like many arctic populations, follow a cyclical pattern influenced by changes in global climate patterns, a factor that may contribute to the estimated severity of the reported population decline. Taken together, this information should provide a more informed perspective on the mechanism(s) behind apparent declines in this species’ abundance.

SEA ICE RESPONSE TO STRATOSPHERE-SURFACE COUPLING IN THE BEAUFORT SEA

Lukovich, Jennifer V. and D.G. Barber
Centre for Earth Observation Science (CEOS), University of Manitoba, Winnipeg, Manitoba, R3T 2N2

Increased frequency of reversals in the Beaufort Gyre indicates an increased influence of cyclonic activity on surface processes in the northern hemisphere. Previous studies have also demonstrated a lagged response between stratospheric and surface cyclonic activity. In this study we examine the relationship between polar stratospheric zonal flow variability and surface cyclonic activity in the form of surface air temperature (SAT) gradients. Of particular interest is the nature of the correlation between the lower and middle stratospheric NAM index and SAT gradients. Here we explore possible correlations between the NAM index and SAT gradients at different latitudes as a function of time lag. Statistical analyses demonstrate that SAT gradients in the tropics are highly correlated with strain in the middle (10 mb) and, to a lesser extent lower (50 mb) polar stratosphere, while SAT gradients in high-latitude regions are highly correlated with polar middle and lower-stratospheric zonal winds. Also of interest are time lags between stratospheric and surface processes, and the implications of stratosphere-surface coupling for sea-ice variability in the Beaufort Sea region.

GREGARIOUS BEHAVIOUR OF NARWHALS ON THEIR SUMMERING GROUNDS

Marcoux, Marianne (marianne.marcoux@mail.mcgill.ca), M. Auger-Méthé and M. Humphries
1Natural Resource Sciences, MacDonald Campus, McGill University, Ste-Anne-de-Bellevue, QC, H9X 3V9
2Biology Department, Dalhousie University, Halifax, NS, B3H 4J1

The narwhal is an important resource for northern communities. Current knowledge about their behavioural biology and group formation is limited. For a social species, such as the narwhal, living in group offer several benefits and may influence the fitness of individuals. During the summer, narwhals travel in large herds of greater than fifty individuals. These herds are made up of multiple smaller groups where individuals are less than ten body width apart. The objective of this aspect of our research was to determine the composition and size of narwhal groups. We observed narwhal herds and groups moving in and out of Koluktoo Bay, NU. We noted the group composition (sex, age class) and the behavioural states (milling, resting, foraging, and socializing) of the group members during the summers 2006-2007. Group sizes ranged between 2 to 25 individuals of different composition (male only, female only, male-female, female-calf, male-female-calf) and herd size went up to 1200 individuals. Ninety-four percent of the narwhals observed were travelling. Our results also show that the groups are more mixed than previously thought. A better understanding of the behavioural biology of the narwhal is needed for an efficient management of this species in a changing environment.

SILL EVOLUTION IN MARINE INUNDATED BASINS, SACHS HARBOUR, BANKS ISLAND, NWT

Martin, Bryan G. (bgmartin@mun.ca), T. Bell, R. Smith, D.L. Forbes
1Environmental Science Program, Memorial University of Newfoundland, St John’s, NL, A1B 3X9
2Department of Geography, Memorial University of Newfoundland, St. John’s, NL, A1B 3X9
3Geological Survey of Canada, 3303 - 33 Street North West, Calgary, AB, T2L 2A7
4Geological Survey of Canada, Bedford Institute of Oceanography, Dartmouth, NS, B2Y 4A2

Realistic projections of future relative sea-level rise are critical for assessing future erosion and flooding impacts, and thus are necessary components
of an integrated regional impacts study (IRIS) involving coastal communities and habitats. One of the goals of ArcticNet Project 1.2 is to refine the record of past sea-level change and validate model projections for future change across the Canadian Arctic. This presentation focuses on the interpretation of past sea-level records, specifically the process of marine inundation of former freshwater basins on coastal lowlands in the western Arctic, although it is broadly applicable to submerging coasts elsewhere. The inundation basin approach in sea-level studies relies on the accurate determination of the former height of the basin sill over which the marine water flooded, but this can be particularly challenging due to post-inundation erosion and deposition altering sill morphology and elevation. Shallow seismic profiles and core samples of sills from marine-inundated basins at Sachs Harbour, Banks Island, are being used to identify key processes in the remodeling of sill morphology following submergence and to define a range of attributes that may be used to characterize sill reworking. The former glacial outwash plain that terminates at Sachs Harbour is dotted with kettle lakes that have gradually been inundated by rising sea level. Basin sills (1.3-5.0 m depth) progressively shallow from west to east, reflecting the sequential inundation of higher basins. Sills have steep slopes and relatively flat tops, which in places are incised by channels that are interpreted to be palaeo-basin outlets. The local Sachs River terminates in an estuarine basin 12 km farther east, but its drowned palaeo-channel can be traced to a submerged delta in front of the community. Thirteen sediment cores, retrieved through vibracoring and percussion coring from the sea-ice surface in 2006 and 2007, vary in length from 46 to 176 cm. X-rays and textural analysis of the cores reveal pervasive fine to very fine laminated mud and fine sand. Three sedimentary units have been identified across all cores, although their stratigraphic position and prominence may vary between cores. One unit consists mostly of mud with minor amounts of fine sand and appears to infill former outlet channels and the submerged Sachs River channel. Organic carbon is generally highest in this unit, varying between 10 and 15% with a relatively low (3-5%) inorganic carbon content. Unit two is composed largely of fine to very fine sand with small amounts of mud and varying amounts of medium to coarse sand. This unit is divided into three sub-units, one very finely laminated with a higher (5%+) mud content, one coarsely laminated, and the other more massive. Unit three is composed of medium to coarse sand and characterized by the lowest organic and inorganic carbon content (as low as 2%) in the cores. The next stages of the project are to correlate the acoustic and core stratigraphy to reconstruct the broad architecture of the sills and to formulate a depositional and erosional history for the observed sedimentary sequences.

Introduction

Most of Labrador communities are equipped with water plants, however Nunatsiavumit like to drink surface water from creeks, rivers and lakes. Reasons for this practice, are numerous: ancestral habits, taste (no chlorine), freshwater, etc. Nevertheless, the consumption of untreated water increases the risk for gastrointestinal diseases, especially for children, elders and immunocompromised individuals. Climate change, with warmer temperatures, brings an additional element of risk related to incidences of gastroenteritis diseases and may even contribute to the reappearance or the emergence of certain other infectious diseases. The main objective of the study was to assess drinking water quality in the northernmost and southernmost Nunatsiavut communities. Methods In 2005 and 2006, we had the opportunity to visit 16 sites used as an untreated source of drinking water. Samples from 8 containers used to harvest and store raw water, were analyzed. Twenty tap water samples (chlorinated water) were also analyzed. Total coliforms, Escherichia coli and enterococci were selected as indicators of water quality and they were detected using ColilertTM and EnterolertTM techniques. We also took field information like water temperature, pH and mean daily rain precipitation into consideration as well as weather historical data. Results Among the 16 outside sampling sites visited in 2006, 3 were equal or superior to 1 E.coli /100 ml (range : 2 to 32,4 CFU/100 ml) and 2 were equal or superior to 1 Enterococcus/100 ml for (range : 2 to 42,9 CFU/100 ml). For plastic containers (n=8), 2 samples contained 1 E.coli /100 ml and 1 contained 1 Enterococcus /100 ml. Tap water samples (n=20), in both communities, were found satisfactory for water microbiological quality. Discussion and conclusion Nunatsiavumit indicated that their sources of natural water, were drying up. In Labrador, historical data showed an increased in mean annual temperature and a decrease in precipitation between 1953 and 2006.
Both water quality and weather conditions should be monitored in each community. Considering the presence of E. coli as the best indicator of fecal contamination, preliminary results show that quality of raw water, on a microbiological standpoint, was better in the northernmost community than in the southernmost community. Lake water was more contaminated than running water. Water stored in plastic containers was of poor microbiological quality. Containers should be disinfected on a regular basis. Raw water from rivers, lakes and brooks could be at risk and should always be boiled 1 minute before drinking.

THE EFFECT OF SUBSURFACE CHLOROPHYLL MAXIMA ON THE ESTIMATION OF MARINE PRODUCTIVITY BY ORBITING SENSORS IN THE CANADIAN ARCTIC

Martin, Johannie1 (johannie.martin.1@ulaval.ca), J.-É. Tremblay1 and P. Larouche2

1Département de Biologie et Québec-Océan, Université Laval, Québec, QC, G1K 7P4
2Institut Maurice-Lamontagne, Pêches et Océans Canada, Mont-Joli, QC, G5H 3Z4

Results collected in 2005 and 2006 revealed that subsurface chlorophyll maxima (SCM) are ubiquitous and long-lived structures of the water column in the Canadian Arctic, where the strong stratification and seasonal ice cover limit the renewal of nutrients at the surface. Depending on its vertical position and configuration, the SCM may be invisible to orbiting remote sensors of ocean colour that can only see the first few meters of the water column. Because a large fraction of the total phytoplankton biomass is at or near the SCM, orbiting sensors may seriously underestimate the productivity of the marine ecosystem. This study aims to determine how the vertical position and shape of the SCM affect the detection of chlorophyll from orbiting sensors. Observations made in situ during ArcticNet expeditions were compared with remote sensing data in order to assess the conditions under which the SCM is detectable. The position and the shape of the SCM relative to different physical structures of the water column affected the accuracy of the estimations. The location of the SCM relative to the pycnocline changed the relationship between what is detectable at the surface and total water-column biomass. When the SCM is above the pycnocline it is more susceptible to mixing and statistically related to surface chlorophyll concentrations. Otherwise, orbiting sensors may be unable to estimate water-column biomass accurately.

YOUTH-LED RESEARCH: ASSESSING THE VULNERABILITY OF INUIT YOUTH IN ARCTIC BAY TO SOCIAL AND ENVIRONMENTAL CHANGE

McKenna, Meghan1 (mmckenna@uoguelph.ca) and Melissa Reid2

1Global Environmental Change Group, Department of Geography, University of Guelph, Guelph, Ontario N1G 2W1
2Nunavut Youth Consulting, P.O Box 141, Arctic Bay, Nunavut X0A 0A0

The purpose of this project is to characterize the vulnerability of Inuit youth to changing environmental and social conditions in Arctic Bay, Nunavut. A youth-led participatory action research model, including a focus group of twelve participants and sixty-five online surveys, was used to gain insight into the risks and adaptive strategies associated with social and environmental change. Further, nine in-depth interviews were conducted with adults working on youth programs and policies to determine community concerns regarding the ability of Inuit youth to adapt to social and environmental change. Preliminary findings indicate that interacting social and environmental changes are placing increased pressure on an already stressed section of the population. Environmental change has compromised the ability of youth to acquire Inuit qaujimajatuqangit and increased the risks associated with traveling on the land and sea ice. The speed and extent at which social change continues to occur poses additional threats. Inuit youth find it difficult to participate in the wage economy; pursue education, travel, and sport opportunities; and continue to practice their culture, which was identified as essential to their identity and well being. The ability to adapt to changing social and environmental conditions is realized differently amongst Inuit youth, citing access to income, employment, education, community services and infrastructure, and involvement in local youth activities as key determinants of adaptation. The results highlight the importance of addressing current problematic conditions in Arctic communities in order to strengthen the adaptive capacity of Inuit youth to deal with climate and other changes. The future of the Arctic lies within its large Inuit youth population. Inuit have shown that they have a considerable ability to adapt, however, adaptation options for Inuit youth are limited by social and environmental conditions which require the implementation of the land claim agreements as well as the development of programs and policies that reduce social and economic disparities and promote cultural identity within a changing society.
Determining dioxin-like compounds in plasma samples from Inuit adults using the DR-CALUX bioassay

Medehouenou, Marc[1,2]
(marc.medehouenou@inspq.qc.ca), C. Larochelle[2,3], P. Dumas[1,2], E. Dewailly[1,2] and P. Ayotte[1,2,3]
1Département de médecine sociale et préventive, Université Laval, Québec, Québec G1K 7P4
2Unité de recherche en santé publique, Centre Hospitalier Universitaire de Québec-CHUL, Québec G1V 2M2
3Direction de la toxicologie humaine, Institut national de santé publique du Québec, Quebec, G1V 5B3

Polychlorinated aromatic hydrocarbons that share structural similarities with 2,3,7,8-tetrachlorodibenzo-p-dioxin, which are referred to as dioxin-like compounds (DLCs), bind the aryl hydrocarbon receptor and can elicit a wide variety of toxic effects. Inuit people living in Nunavik (Northern Québec, Canada) are exposed to DLCs and other persistent organic pollutants through their traditional diet that comprises large amounts of sea mammal fat. In the course of a prospective epidemiological study initiated in Nunavik during fall 2004, we analysed plasma samples obtained from 479 Inuit adults for DLCs using the dioxin-receptor chemically-activated luciferase expression (DR-CALUX) bioassay. This bioassay is cheaper and requires a smaller volume of sample than the conventional analytical chemistry method and is therefore well suited for epidemiological studies. The geometric mean plasma DLC concentration in participants was 10.2 pg TEQ/g lipids with values ranging from ≤5 to 88.7 pg TEQ/g lipids. Univariate statistical analyses revealed that plasma DLC concentrations were correlated to age (Pearson’s r = 0.53; p < 0.0001), body mass index (r = 0.10; p = 0.04), and marine mammal fat consumption (r = 0.17; p = 0.001). Multivariate analysis indicated that only age was associated with plasma DLC concentrations (total adjusted R2 = 0.28, p < 0.0001). Plasma concentrations of PCB congeners nos. 105, 118, 153, 156, 157, 167 and 189 were determined by high-resolution gas chromatography-mass spectrometry and were found to be correlated to DLCs concentrations (r = 0.52-0.58, p < 0.0001). This cohort study will allow examining associations between exposure to DLCs and the risk of chronic diseases in the Inuit population.

Research within the Inuvialuit Settlement Region

Michel, Jonathon (jmichel@irc.inuvialuit.com)
Inuvialuit Regional Corporation Bag Service 21, Inuvik, NT X0E 0T0

The Inuvialuit Health and Environment Research Coordinator (HERC) is the Inuit Research Advisor for the Inuvialuit Settlement Region. With combined support from the Northern Contaminants Program, ArcticNet and Nasivvik, the Inuvialuit HERC supports human health and environmental research projects within the region. Conducting research in the Inuvialuit Settlement Region (ISR) requires conformity with the Inuvialuit Final Agreement. The Inuvialuit HERC maintains contact with all regional organizations involved in the research process. This contact includes organizations involved in permitting, proposal development and review, funding and potential collaboration. The Inuvialuit HERC also maintains ongoing contact with the ISR communities, a vital component of any research being considered within the region. The ISR, like the three other Inuit regions, is witnessing a major increase in all fields of human and environmental research. This in turn places increased demands on the capacity of the region’s environmental review, regulatory, and project support structures. This increased level of activity also impacts the ability of our communities to be aware of, comment on, and be fully involved in the conduct of this research. These challenges reinforce the need for early contact with the Inuvialuit HERC on all research projects within the region.

Freshwater and terrestrial foraging by beavers revealed with stable isotope analysis

Milligan, Heather (heather.milligan@mail.mcgill.ca) and M. Humphries
Natural Resource Sciences, McGill University, Ste-Anne-de-Bellevue, Quebec H9X 3V9

Climate change is predicted to impact the distribution and abundance of wildlife species in northern Canada. Our research investigated the contribution of aquatic vegetation to the diets of beavers, using field survey and stable isotope approaches, to improve models of beavers’ responses to climate change. Current models are based solely on terrestrial vegetation, but aquatic vegetation may be especially critical in northern landscapes where trees and shrubs are scarce. We investigated the contribution of aquatic plants in the diets of beavers from Eastern James Bay by collecting freshwater and terrestrial plants and beaver teeth (from Cree trappers) for stable isotope analysis. Carbon (d13C) and nitrogen (d15N) stable isotopes present in animal tissues provide an estimate of their diet and differentiate freshwater and terrestrial dietary sources. We examined d13N and d15N signatures from sections of beaver incisor teeth, which grow 1 mm/day, to estimate freshwater and terrestrial dietary contributions during summer, fall, and winter.
detected no seasonal differences in beaver diet from different tooth sections; however beavers living on lakes had an aquatic dietary signal relative to beavers living on creeks. Our results indicate aquatic plants are an important secondary food resource for beavers when they are available in the habitat. Models of beaver response to climate change should include freshwater and terrestrial vegetation, since both ecosystems are likely to be impacted differently by climate change.

THE GASEOUS CARBON (CH4 AND CO2) INTERACTION OF TUNDRA PONDS AND THE ATMOSPHERE IN THE HUDSON BAY LOWLAND

Mojdehi, Patrick (pmojdehi@yorku.ca) and Richard Bello

Department of Geography York University Toronto, Ontario M3J 1P3

Methane’s high global warming potential (~25 fold compared with CO2) and its increasing concentration in the atmosphere is a phenomena that needs to be fully investigated. The majority (~40%) of CH4 production originates from wetlands. Therefore better understanding the role arctic ponds play in terms of atmospheric CH4 contribution is crucial because very little is known about this region whose landscape is dominated (40%+) by lakes and ponds. One pond and 5 pools were selected as they represented extremes in depth, sediment thickness and area in the Hudson Bay Lowlands just east of Churchill, Manitoba. Floating methane traps (n=32) were selectively placed at locations close to the shore from May through August, 2007. Data shows that average CH4 ebullition fluxes throughout the study period from the pond and the pools were similar (120 and 122 mL CH4 m-2 d-1, respectively). Recorded pond sediment temperatures suggest that it is correlated with CH4 ebullition; this is evident by the seasonal variability in ebullition. As the gas travels up through the water column to the atmosphere, there is a 31% decrease in CH4 concentration as molecules diffuse into the water. Pond sediment composition influences whether or not methane is released from hotspots. Hotspots produce methane fluxes several orders of magnitude greater than non-hotspot (background) areas. Results indicate that the methane flux was highly variable due to the temporal and spatial patchiness of emissions. To determine a valid estimate of entire-pond methane emissions, we captured a representative flux from the hotspots, and determined their spatial distribution and variability within the pond. By capturing the diffusive flux in conjunction with the ebullition flux, we’ve developed an accurate CH4 flux for the entire pond to help develop a model for the region. A silicone dissolved gas diffuser connected to an infrared gas analyzer was used to measure the concentration of dissolved CO2 in the pond. The ambient CO2 concentrations were analyzed using the LICOR LI7500 open path infrared gas analyzer. The interactions of CH4 and CO2 fluxes in this area and their role as contributors of atmospheric greenhouse gases are discussed.

BIOACCUMULATION AND BIOMAGNIFICATION OF BROMINATED FLAME RETARDANTS AND CURRENT USE PESTICIDES IN A CANADIAN ARCTIC MARINE FOOD-WEB

Morris, Adam D.1,2, D.C.G. Muir2, S., Sturman1,2, C. Teixiera1, A.T. Fisk3 and K.R. Solomon1

1Centre for Toxicology, Department of Environmental Biology, University of Guelph, Guelph, Ontario, Canada N1G 2W1
2National Water Research Institute, Environment Canada, Burlington, Ontario, Canada L7R 4A6
3Great Lakes Institute for Environmental Research, University of Windsor, Windsor, Ontario, Canada N9B 3P4

Persistent organic pollutants (POPs) and pesticides can be distributed globally by several vectors including atmospheric and oceanic currents and by particle-mediated transport. Recently, brominated flame retardants (BFRs) such as polybrominated diphenyl ethers (PBDEs), hexabromocyclododecane (HBCD) and pentabromoethylbenzene (PBE) have been detected in polar bears (Ursus maritimus), ringed seals (Phoca hispida) and fish. Current use pesticides (CUPs) such as endosulfan, daethal, and chlorothalonil have been reported in seawater, snow and in Arctic air. We investigated the potential pathways for bioaccumulation and biomagnification of several BFRs and CUPs in the Canadian Arctic by sampling key components of the arctic marine food-web; ocean water (dissolved and particulate), under-ice-algae, crustaceans, arctic cod (Boreogadus saida), and ringed seals. Sampling was conducted in the Barrow Strait (Nunavut, Canada) during June 2007, a period of ice-melting and high primary productivity in the upper ocean layers. Several BFRs including PBDEs, HBCD, and PBE were detectable in seals and fish but near or at detection limits in sea water and algae. Several CUPs, including endosulfan and daethal were present in seawater and in invertebrates but near detection limits in fish and seals.
NEGOTIATING RESEARCH RELATIONSHIPS WITH INUIT COMMUNITIES

Moss-Davies, Pitsey¹ (pmoss-davies@inuitcircumpolar.com) and Meghan McKenna² (mckenna@ltk.ca)

¹Inuit Circumpolar council, 170 Laurier Avenue West, Suite 504, Ottawa ON K1P 5V5
²Inuit Tapiriit Kanatami, 170 Laurier Avenue West, Suite 510, Ottawa ON K1P 5V5

Conducting research in the Arctic presents a unique set of challenges and responsibilities. ArcticNet researchers are increasingly aware of the expectations of Inuit communities as well as the challenges associated with conducting research in the Arctic. Some of these challenges include – which organizations and departments to consult; how to communicate with and involve Inuit at all stages of research; methods to address Inuit concerns; and how to initiate and maintain meaningful contact. Given the diversity of the Inuit regions and the variety of objectives and methods present in ArcticNet projects it has been difficult to establish research guidelines. Steps that can be followed to effectively engage Inuit in research have been published in the document, Negotiating Research Relationships with Inuit Communities (2007). In addition to this research guidelines document, an Inuit Research Advisor (IRA) position has been established in each of the four Inuit regions of Canada (the Inuvialuit Settlement Region, Nunavut, Nunavik and Nunatsiavut). The IRAs provide assistance to researchers to ensure that Inuit are partners in, and benefit from, research. The purpose of this poster is to summarize the guidelines outlined in the document Negotiating Research Relationships with Inuit Communities (2007). Further, this poster highlights the relationship between the international, national and regional organizations representing Inuit, as well as relevant government and community contacts. It is hoped that this information will assist ArcticNet researchers in the development of projects that work with and include Inuit.

INVESTIGATING RELATIONSHIPS BETWEEN CLIMATE WARMING AND MERCURY IN ARCTIC AND SUBARCTIC LAKE SEDIMENTS

Muir, Derek¹ (derek.muir@ec.gc.ca), M.S. Evans², T.A. Jackson¹, H. Klink³, D. Antoniades⁴, M. Douglas⁵, R. Pienitz⁶, J. Smol⁷, X. Wang¹ and F. Yang¹

¹Environment Canada, Burlington ON L7R 4A6
²Environment Canada, Saskatoon, SK S7N 3H5
³Algal Taxonomy and Ecology, Winnipeg, Manitoba, MB R3T 2X8
⁴Centre d’études nordiques, Université Laval, Québec, QC G1K 7P4
⁵Canadian Circumpolar Institute, University of Alberta, Edmonton, AB T6G 1K8
⁶Department of Biology, Queen’s University, Kingston, ON K7L 3N6
⁷Dept. of Biology, Queen’s University, Kingston ON
⁸Dept. of Biology, York University, Toronto, ON

Mercury profiles and microfossil records were compared in dated sediment cores from eight Arctic and subarctic lakes in Canada to determine whether Hg deposition has varied with other indicators of climate change. The microfossils included algae (chlorophytes, chrysophytes, and bacillariophytes), protozoans, zooplankton fecal material, plant remains, and carbonaceous (coal or charcoal) particles. These data were compared with profiles of total Hg and other trace elements, stable Hg isotope ratios, and organic carbon and nitrogen. Abundances and fluxes of diatoms and other microfossils in recent sediment horizons were particularly high in three high Arctic lakes, much lower in two subarctic lakes in the Mackenzie River basin, and nonexistent in a core from Labrador, whereas Hg fluxes (ng/m²/yr) generally showing an increase after 1950 with maxima in the late ’90s and early ’00s. The results suggest that recent increases in total Hg concentrations recorded in Arctic and subarctic lake sediments are not directly related to increased biological activity reflected in increased diatom production, although they could signal increased methyl-Hg production. However, bulk sedimentation rates (estimated from Pb210 using the CRS model) increased in 6 of 8 lakes suggesting an indirect effect of climate may be increased natural and anthropogenic Hg inputs due to higher precipitation in recent decades. Lack of a direct link of increasing Hg fluxes with microfossils is consistent with the hypothesis that trends in the Arctic are mainly the result of anthropogenic emissions in the mid-latitudes (e.g. North American and Asian sources from coal combustion).

SPATIAL TRENDS AND HISTORICAL INPUTS OF MERCURY AND LEAD IN NORTHERN CANADA INFERRED FROM LAKE SEDIMENT CORES

Muir, Derek¹ (derek.muir@ec.gc.ca), F. Yang¹, X. Wang¹, T. Jackson¹, M. Evans², M. Douglas³, G. Köck³, R. Pienitz⁴, J. Smol⁴, W. Vincent⁵, R. Quinlan⁶ and S. Lamoureux⁷

¹Environment Canada, Burlington ON
²Environment Canada, Saskatoon, SK
³Canadian Circumpolar Institute, University of Alberta, Edmonton, AB T6G 1K8
⁴Institute of Zoology and Limnology, University of Innsbruck, Innsbruck, Austria
⁵Centre d’Etudes Nordiques, Université Laval, Québec QC
⁶Dept. of Biology, Queen’s University, Kingston ON
⁷Dept. Biologie, Université Laval, Québec, QC
Deposition and historical temporal trends of mercury (Hg) and lead (Pb) were examined over a broad geographic area from southwestern NWT to Labrador and from the US northeast to Northern Ellesmere Island using dated sediment cores from 52 remote lakes. Possible post-depositional movement was examined using manganese (Mn) and iron (Fe) geochemical markers as well as organic carbon. Hg concentrations in surface slices of each core varied from 0.017-0.283 ug/g (dry wt) and Pb from 2.8-41.5 ug/g (dw). Distinct increases of Hg over time were observed in almost all cores. However, mercury concentrations in lake sediments have leveled off in the 1990s in mid-latitude and in some sub-arctic/arctic lakes. Sedimentation rates were >10% higher in the period 1990-2000 than in 1800-1900 years in 26 of 52 cores; 11 of 52 had 2x higher rates. This suggests greater erosional inputs from lake catchments. Thus Hg fluxes (concentrations x sedimentation rate) show less leveling off in recent horizons. Mercury flux ratios (FRs) showed a weak but statistically significant negative correlation with latitude (r =0.13) but not with longitude reflecting high anthropogenic fluxes in several mid-latitude and sub-arctic lakes. Lead FRs were significantly negatively correlated with latitude reflecting much higher Pb deposition to mid-latitude Ontario, Quebec and northern USA lakes than in the Arctic. Fewer distinctive geographical trends in FRs of both elements were seen after adjusting for recent increased sedimentation. The results for Hg, Pb and As are consistent with the greater density of anthropogenic sources in Eastern North America such as coal burning power plants and other industrial sources, and in the case of Pb, with proximity to former emission areas for alkyl lead. Increased particle sedimentation rates in about 50% of the lakes suggests greater erosional inputs from lake catchments and implies a possible climate linkage.

RIVERINE EXPORT AND THE EFFECTS OF CIRCULATION ON DISSOLVED ORGANIC CARBON IN THE HUDSON BAY SYSTEM, CANADA

Mundy, CJ¹ (christopher-john.mundy@uqar.qc.ca), Michel Gosselin², Michel Starr² and Christine Michel³

¹Institut des sciences de la mer (ISMER), Université du Québec à Rimouski, Rimouski, Québec, Canada
²Institut Maurice-Lamontagne, Pêches et Océans Canada, Mont-Joli, Québec, Canada
³Freshwater Institute, Fisheries and Oceans Canada, Winnipeg, Manitoba, Canada

The distribution of dissolved organic carbon (DOC) in Hudson Bay (HB), Foxe Basin (FB) and Hudson Strait (HS) was examined during 1-14 August 2003. The Hudson Bay system displayed relatively high DOC concentrations with medians of 109, 90 and 100 µM for measurements made in HB, FB and HS, respectively. Waters were significantly modified as they circulated through the Hudson Bay system. A dominant influence of marine derived DOC was inferred for waters entering the system from northern HS and FB into northwestern HB, whereas a considerable input of terrigenous DOC was observed as waters circulated in HB. In particular, DOC laden rivers in southern Hudson Bay modified the DOC concentration and displayed a conservative behavior as water exited the Bay along the southern coast of HS. Additionally, the late stages of ice melt observed during this study showed a significant dilution effect on surface DOC concentrations within eastern HB. Finally, a range for total riverine DOC export was estimated for the HB system from a conservative value of ~3.7 Tg C yr⁻¹ to a maximum of ~6.0 Tg C yr⁻¹. This range equates to approximately 15 - 25% of the annual DOC input from rivers to the Arctic Ocean and therefore represents an important contribution of terrigenous carbon to northern seas.

REMEMBERING THE C.D. HOWE IN AMUNDSEN HEALTH RESEARCH: POND INLET EXPERIENCE

Okalik, Loosie¹ (okalik@itk.ca), G. Egeland²

¹Inuit Tapiriit Kanatami, Ottawa
²Center for Indigenous Peoples’ Nutrition and Environment (CINE), McGill University, Montreal

For many communities in the Arctic, the arrival of the CCGS Amundsen for health related survey work sparks memories of the C.D. Howe’s last medical visit in northern communities over 30 years ago. While the C.D. Howe performed needed medical services for remote communities, it also transported tuberculosis patients to southern sanatoriums. While many did recuperate and come home again, and while a potential disastrous T.B. epidemic was thwarted, there were many that perished to T.B. For families throughout the Arctic, the sound of the C.C. Howe’s horn blowing three times is the last memory they have of their loved ones. It was common that there was never a word of where or when loved ones died and where they were buried. With no closure, the arrival of the CCGS Amundsen sparked remembrance ceremonies in Pond Inlet and Iqaluit where Elders and other community members gathered in commemoration of those they patiently waited to return home. Yet, Inuit wanted to participate in the survey. As one community assistant stated, folks really want to participate as they see this will be of benefit to future generations. At the same time, there was the need to reflect on the past, to mourn collectively, while at the same time taking part in an activity with hopes for the
future health and well being of generations to come. Photographs and video tape clippings of Elders' recollections best capture the impact through the eyes of northerners.

ESTIMATED DIETARY EXPOSURE TO PERFLUORINATED COMPOUNDS FOR INUIT IN NUNAVUT

Ostertag, Sonja1 (ostertag@unbc.ca), John Moisey2, Murry Humphries3, Sheryl Tittlemier2 and Laurie Chan4

1Natural Resources and Environmental Studies, University of Northern BC, Prince George BC, V2N 4Z9
2Food Research Division, Health Canada, Ottawa ON K1A 0K9
3Dept. of Natural Resource Sciences, McGill University, Macdonald Campus, Ste-Anne-de-Bellevue QC H9X 3V9
4Community Health Program, University of Northern British Columbia, Prince George, British Columbia, V2N 4Z9

Dietary exposure to perfluorinated compounds (PFCs) was estimated for Inuit in Nunavut based on the analysis of perfluorooctane sulfonate, perfluorinated carboxylates (C7-C11) and fluorotelomer unsaturated carboxylic acids (6:2, 8:2 and 10:2 FTUCAs) in archived traditional and store-bought food samples. Dietary exposure was estimated using PFC levels measured in traditional and store-bought foods consumed by Inuit. Total PFC concentrations were highest in caribou liver (6.2±5.5 ng/g), ringed seal liver (7.7, 10.2 ng/g), polar bear meat (7.0 ng/g), and beluga meat (7.0, 5.8 ng/g). Mean daily dietary exposure was estimated to range from 210 to 610 ng-person-1 and the highest estimated exposure was for men between the ages of 41 and 60. Traditional foods contributed a higher percentage of PFC exposure than market foods in all age and gender groups. In general, caribou meat, arctic char meat and cookies contributed most to dietary exposure for Inuit, with caribou flesh contributing 43 to 75 percent of daily PFC dietary exposure. Health risks associated with these exposure levels are minimal based on current toxicological data available from animal feeding studies.

LONG-TERM RESEARCH, MONITORING AND OUTREACH PARTNERSHIPS AND NEEDS FOR MANAGING ECOLOGICAL INTEGRITY OF THE NORTHERN NATIONAL PARKS

Ouimet, Chantal (chantal.ouimet@pc.gc.ca)

Parks Canada Agency, Western and Northern Service Centre, 145 McDermot Avenue, Winnipeg, MB R3B 0R9

Long-term research, long-term monitoring and outreach in Canada's northern national parks are a challenge that requires long-term partnerships between park managers, scientists, aboriginal people and communication staff. Northern national parks are large wilderness areas set aside and managed in cooperation with aboriginal people for the conservation of a diversity of northern ecosystems and landscapes from glaciers and icefields, tundra, forest, wetlands, freshwater ecosystems to coastal and marine ecosystems. Parks Canada's national monitoring framework includes measures of biodiversity, ecosystem processes and stressors to determine the state of and the trend in park ecological integrity. Thus, information will be reported on a 5-year basis to park managers and the public. However, many measures require further research and monitoring to improve our understanding of ecosystems functioning and change. In the northern bioregion monitoring program development and implementation is challenging due to park size, remoteness and lack of basic information and expertise on many species and ecosystems. Parks Canada and partners, such as the Canadian Centre for Remote Sensing (CCRS), academic other governmental agency researchers, are developing and testing several tools for inventory and monitoring in northern parks using both remote sensing and field sampling of different ecosystems. Moreover, in the northern bioregion, some monitoring programs have started to put greater emphasis on the integration of traditional ecological knowledge and scientific knowledge in the long-term monitoring program. However, much remains to be done and Parks Canada is building and looking for further long-term partnerships between park managers, aboriginal people, and scientists for long-term research and monitoring to sustain the conservation and management of northern ecosystems. Outreach and public education are also mandated priorities for Parks Canada. Knowledge acquired through traditional knowledge and scientific projects will be used to develop projects and products to disseminate information to and improve understanding by visitors, schools and the public of the functioning and the state of northern ecosystems. Many common goals and methods are shared between Parks Canada and ArcticNet. This should facilitate the development of long-term partnerships in research, monitoring and outreach between the two networks. Let's talk and define projects together.
INUVIALUIT’S PUBLIC HEALTH SURVEILLANCE IN RESPONSE TO A CHANGING CLIMATE: A BASELINE STUDY

Pardhan, Aliya1 (apardhan@uoguelph.ca), P. Gosselin2, C. Furgal3, V. Edge4, J. Wilson1,4, S. McEwen1, R. Reid-Smith4

1Department of Population Medicine, University of Guelph, Guelph, Ontario, N1G 2W1
2L’Institut national de santé publique du Québec, Québec, Québec, G1V 5B3
3Department of Indigenous Studies and Department of Environmental Resource Studies/Science, Trent University, Peterborough, Ontario, K9J 78B
4Public Health Agency of Canada, Guelph, Ontario, N1H 8G1

Rapid environmental changes such as climate, weather and contaminants, have begun to disrupt the relationship between Northern Inuit populations and the ecosystem in which they live. Hunters, elders and youth have begun to observe and document changes in migration patterns, the ability to find and hunt certain species, and access to clear, natural sources of drinking water. Such disruptions in environmental integrity are predicted to have a negative impact on northern populations, particularly in the areas of human health and disease as well as nutritional status and food security. In response, a baseline study was conducted in the four Inuit regions of the Canadian Arctic. The Inuvialuit Settlement Region (ISR) case study was conducted to document and review the existing health surveillance and environmental monitoring network and activities in that region in order to identify existing challenges and strengths in the system and help design and implement pilot projects to address these issues in the future. Key informant interviews provided insight about present and emerging conditions that may be relevant to understanding health surveillance and environmental monitoring activities in the ISR. The manner in which surveillance data is collected, stored, analyzed and utilized is also discussed in order to identify strengths, gaps and priorities. The study highlights opportunities for improvement and collaboration as well as develops principles to guide strategies that support surveillance in an Inuit context. The case study also provides recommendations for data collection and analysis, knowledge translation, and dissemination of accurate information for early detection of environmental influences, including those related to climate change, on health.

THINGS CHANGE, WE CHANGE: COMMUNITY ADAPTATION DYNAMICS

Parewick, Kathleen (paerewyck@hotmail.com)

Department of Geography, Memorial University, St. John’s, Newfoundland Canada, A1B 3X9

It is being demonstrated that the most nuanced understandings of the impacts of climate change in the Canadian Arctic are arising from research efforts that accommodate a variety of “ways of knowing”: combining physical and social science insights; ecological and technological approaches; and, local knowledge and “outsider” expertise. Besides grappling with the fundamental challenges of reconciling quantitative and qualitative information, these types of projects must operate within the scope of available resources while dealing with the vagaries of emerging community circumstances. In addition to providing useful answers to their original questions though, many participants observe that learning to work this way – that is, adaptively – has its own rewards. This poster examines the ups and downs of recent research experience in three Arctic case study communities where participatory local planning processes have been undertaken with the benefit of a variety of local geohazard-related studies, climate change observations, and organizational engagement. A basic analytical framework derived from resilience theory is presented and used to illustrate specific factors conditioning each community’s response to environmental changes. Implications for future community adaptations are discussed, with reference to cross-scale interactions, change management practices and institutional dynamics.

COMMUNITY COLLABORATION AND ENVIRONMENTAL CHANGE RESEARCH IN THE CANADIAN ARCTIC

Pearce, Tristan1 (tpearce@uoguelph.ca), B. Smit1, J. Ford2, G. Laidler3, F. Duerden4, M. Allarut5, M. Andrichuk1, S. Baryluk6, A. Dialla7, P. Elee8, A. Goose9, T. Ikummaq10, R. Inuktalik9, E. Joamie9, F. Kataoyak9, E. Loring11, S. Meakin12, K. Shappa5, J. Shirley13, J. Wandel1

1Department of Geography, University of Guelph, Ontario, Ontario N1G 2W1
2Department of Geography, McGill University, Montreal, Quebec H3A 2T5
3Department of Geography, University of Ottawa, Ontario K1N 6N5
4Department of Geography, Ryerson University, Toronto, Ontario M5B 2K3
5Arctic Bay, Nunavut, X0A 0A0
6Inuvialuit Joint Secretariat, Inuvik, Northwest Territories X0E 0T0
Research on climate change impacts, vulnerability and adaptation, particularly those aiming to contribute to practical adaptation initiatives, requires active involvement and collaboration with community members. Arctic communities are already experiencing and adapting to environmental and socio-cultural changes, and researchers have a practical and ethical obligation to engage communities who are the focus of the research. This paper draws upon the experiences of researchers working with communities across the Canadian Arctic together with the expertise of Inuit organizations, northern research institutes, and community partners to outline key considerations for effectively engaging arctic communities in collaborative research. These considerations include: initiating early and ongoing communication with community, regional and national contacts; working with communities to develop a research proposal; facilitating opportunities for local involvement; and dissemination of research findings. Examples of each consideration are drawn from studies of vulnerability conducted with communities in the Canadian Arctic.

INUVIALUIT YOUTH AND ENVIRONMENTAL CHANGE RESEARCH IN ULUKHATOK

Pearce, Tristan1 (tpearce@uoguelph.ca), J. Jr. Akhoaksion2, C. Bryant3, F. Duerten4, J. Ford5, D. Inuktalik2, K. Inuktalik2, R. Inuktalik2, B. Irish2, P. Joss2, F. Kataoyak2, H. Kataoyak2, E. Kudlak2, M. Lebourdais5, J. Memogana2, S. Nigiyok2, G. Ogina2, T. Okheena2, G. Omingmak2, B. Smit1

1Department of Geography, University of Guelph, Ontario, Ontario N1G 2W1
2Ulukhaktok, Northwest Territories X0E 0S0
3Helen Kalvak Elihakvik School, Ulukhaktok, Northwest Territories X0E 0S0
4Department of Geography, Ryerson University, Toronto, Ontario M5B 2K3
5Department of Geography, McGill University, Montreal, Quebec H3A 2T5

Communities in the Canadian arctic have undergone rapid social, political, economic, and environmental changes in the past half century. These changes have often acted synergistically to affect Inuit livelihoods. In previous environmental change research in Ulukhaktok, adult community members and educators identified a concern for the sensitivity of youth to these changes, pointing to the continued loss of traditional land-based skills coupled with a lack of work-place relevant skills among the growing population of youth. This research worked with what are ultimately the second and third cohorts of settlement-reared community members who have limited experience with traditional subsistence beyond organized youth camps and occasional hunting trips, but comparatively more experience with southern media, formal education and training for wage labour employment. This research involved community youth as researchers to examine the vulnerability of youth in Ulukhaktok between the ages 8 and 24 years to changing conditions (e.g. who is vulnerable, to what conditions, how, and what is aiding or constraining the ability to adapt?) The research sample consisted of fifty-two youth with equal gender representation. To date, data has been collected through youth-led focus groups, participatory mapping, semi-structured interviews and analysis of secondary documents and reports. Current exposures identified by youth include, increased hazards when traveling on the sea ice and land in the spring (late May and June), concerns about proposed resource development, rising prices (e.g. fuel), substance abuse, and limited employment opportunities. Issues that contribute to the sensitivity of youth to these conditions and influence adaptation include, lack of confidence in local education standards, loss of traditional knowledge and skills, and lack of community activities and opportunities for youth. The next stages in the research are to further examine the interplay of these conditions using additional methods (e.g. pile sorting, free listing, follow-up interviews), and work with youth collaborators to identify policy entry points for enhancing the capacity of community youth to deal with future changes.

EDDY COVARIANCE FLUX ESTIMATES OF PEAT PLATEAU EVAPORATION AND CARBON DIOXIDE

Pokharel, Bipin1 (bipin@yorku.ca), Richard Bello1, Tim Papakyriakou2, Mario Tenuta3

1York University, Geography Department, Toronto
2Faculty of Environment of Geography, University of Manitoba, Winnipeg
3Department of Soil Science, University of Manitoba, Winnipeg

The Subarctic peatland carbon feedback results from accelerated decomposition of peatlands because respiration increases as polar soils warm while plant photosynthesis cannot balance the increased losses of carbon. The release of CO2 or CH4 further enhances global warming which leads to warmer soils and enhanced decomposition. There is
Prinsenberg, Simon

Canadian Archipelago

Oceanographic fluxes through the 1998 to 2004 variability of observation and simulation by models: 2007. Supplementary measurements of net radiation, Campbell CR3000 datalogger during the summer of 2007. Supplementary measurements of net radiation, soil heat flux, insolation and the ground temperature profile (to 70 cm) were also taken. The evaporation from the peat plateau is highly variable over time being driven primarily by radiant energy supply. But it is also very sensitive to rainfall events and specifically to the amount of water intercepted by the non-vascular plant community since it dominates the flora on the peat plateau. The remaining vascular plants are ericaceous shrubs which are physiologically adapted to dry conditions and do not transpire readily. The one exception is the herb, cloudberry (Rubus chamaemorus), which expands its leaves rapidly in the spring in a short period of time and both transpires and photosynthesizes actively. Diurnal net CO2 exchange shows a characteristic uptake during the day and release at night. But the daytime exchange is asymmetric with slightly stronger fluxes before noon, before plants desiccate, particularly during intervals with little rain. During these periods, Bowen ratios averaged 1.39 and evaporation and ground heating consumed 39% and 8% of net radiation, respectively. Net summertime plateau CO2 exchange is also seasonally variable partly because of phenological changes in the growing plants but also because of abrupt shifts in temperature corresponding to offshore and onshore winds from Hudson Bay.

OBSERVATION AND SIMULATION BY MODELS: THE 1998 TO 2004 VARIABILITY OF OCEANOGRAPHIC FLUXES THROUGH THE CANADIAN ARCHIPELAGO

Prinsenberg, Simon
(prinsenbergs@mar.dfo-mpo.gc.ca), Jim Hamilton, Youyu Lu and Jie Su

Dept. Fisheries and Oceans, Bedford Institute of Oceanography, Dartmouth, Nova Scotia

A mooring program supported by Canadian Coast Guard icebreakers has been successful since August 1998 to obtain yearly mooring data from the Lancaster Sound, the southern most Strait in the Canadian Archipelago connecting the Arctic Ocean and Baffin Bay. Oceanographic fluxes through Lancaster Sound derived from the mooring data show large interannual and seasonal variabilities that are generated by atmospheric forcing in the offshore Arctic Ocean and in the Beauforts sea shore regions. Model simulations are being used to unseparate the various forcing parameters and their contributions to the observed oceanographic fluxes. Mooring observations and model simulations will be presented.

PALEOCEANOGRAPHIC STUDIES OF THE IMPACTS OF NATURAL AND ANTHROPOGENIC PERTURBATIONS IN THREE LABRADOR FJORD ECOSYSTEMS (NACHVAK, SAGLEK AND ANAKTALAK): PRELIMINARY RESULTS

Richerol, Thomas1 (thomas_richerol@yahoo.fr), Reinhard Pienitz2 and André Rochon2

1Centre d’Études Nordiques, Université Laval, Québec, Québec G1K 7P4
2Institut des Sciences de la Mer, Université du Québec à Rimouski, Rimouski, Québec G5L 3A1

We present the preliminary results of sedimentological, geochemical, and biostratigraphic analyses performed on short sediment cores from three fjord ecosystems located along Labrador’s East coast, sampled in November 2006 from CCGS Amundsen. Labrador Inuit depend on the sea and sea ice for their hunting and harvesting activities. They are concerned about the ecological integrity of the marine environment of northern Labrador especially with respect to the impacts of climate change, industrialization (maritime navigation, mining) and contamination of their traditional foods. The cores have been analyzed for various physical and chemical properties, such as sediment density, magnetic susceptibility and contaminant levels. The biostratigraphic analyses involved sediment subsampling at 1-2 cm intervals to determine changes in the composition and concentration of fossil diatoms and dinoflagellate cysts (dinocysts) throughout the cores. These are two important proxy indicator organisms in marine environments that allow for reconstructions of past climatic and environmental trends (e.g. changes in sea-surface temperature and salinity, sea-ice duration and ocean productivity) in both pelagic and benthic habitats. The chronology of each core has been established based on AMS-14C dates on marine shells preserved within the sediments. The cores retrieved from northernmost pristine Nachvak fjord, next to the Torngat Mountains National Park Reserve, will be used to study the natural variability of environmental conditions in Labrador fjord ecosystems, while serving as a reference for the assessment of human-induced perturbations in the two other southern fjords (Saglek and Anaktalak). Saglek fjord sediments have been contaminated with PCBs (PolychloroBiphenyl) due to erosional inputs from a former military site. We will try to track the ecosystem response to this kind of contamination by comparing pre- and post-
The Anaktalak fjord is extensively used by Inuit for harvesting and traveling. Since the beginning of mining activities by the Voisey's Bay Nickel Company (VBNC), the fjord's Anaktalak Bay has received mining effluents and wastes from shipping. This project aims at determining the impacts of these activities, as well as developing appropriate indicators for the long-term monitoring of the environmental and ecological conditions within this fjord ecosystem.

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**A TRIBUTE TO MINNIE GREY: USING A DVD TO ASSIST IN ADMINISTERING INFORMED CONSENT FOR THE NUNAVUT INUIT HEALTH SURVEY: “QANUIPPITALI, WHAT ABOUT US, HOW ARE WE?”**

Rosol, Renata¹, V. Boulet², A. Ford², G. Tagak², H. Saudny-Unterberger¹ (helga.saudny-unterberger@mcgill.ca), G. Egeland¹

¹School of Dietetics and Human Nutrition and Centre for Indigenous Peoples' Nutrition and Environment (CINE) McGill University, Montreal Quebec, Canada
²Iqaluit, Nunavut

University Research Ethics Boards require that an extensive amount of detailed information be provided to individuals who are potential participants in research projects. The informed consent forms include the rationale, nature and scope of research projects, the specific aspects involved in participating, clear language on the potential benefits and harms, amount of time that will be spent undergoing tests or answering questions, the various uses of the data, the short and long-term storage of the data, confidentiality and privacy, and other pertinent information. It is not surprising then that consent forms can now be longer than 11 pages and that translated versions can be cumbersome to read with research concepts and terminology not easily expressed in Indigenous languages. Minnie Grey, originally from Nunavik, suggested that a DVD needed to be made to facilitate the informed consent process for Inuit of Nunavik participating in a 2004 health survey. Her suggestion was precedence setting in that we are not aware of DVDs being used elsewhere to inform potential research participants and to help usher them through cumbersome written informed consent forms.

The added benefit to DVD production for health research is that it guarantees a fair degree of quality control on communication to potential participants especially when research involves multiple communities and bilingual community research assistants working among unilingual Inuit with little supervision. Dialects and changes in language use between older and younger generations continue to challenge health communication.

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**STRUCTURE OF ABUNDANCE OF THE BEAVER IN QUEBEC AND ITS IMPLICATIONS IN A WARMER CLIMATE**

Samson, Jason (jason.samson@mail.mcgill.ca) and M. Humphries

Natural Resource Sciences Macdonald Campus, McGill University 21,111 Lakeshore Road Ste-Anne-de-Bellevue, QC H9X 3V9

The density of individuals varies greatly across a species distribution. The patterns of abundance can be seen as the end result of all the mechanisms regulating local abundance. Resource availability and biotic interactions are thought to determine local and regional densities whereas climate and dispersal barriers explain well the densities at the larger scale. Recent advances in ecological modelling have lead to climate envelope models, where one correlate climate variables with species presence in order to predict change in distribution according to future climate scenarios. Such models are however difficult to include in mitigation policies because indigenous people and wildlife managers are often more concerned about changes in the abundance of key game species. We have created a simple climate model of beaver abundance across the province in Quebec based on standard climate scenarios and it shows that beaver abundance should increase across the province but that the steepest change should be in Northern Abitibi. The next step is to include environmental variables and use regional climate scenarios in collaboration with the Ouranos Consortium. We also worked with the Cree Nation of Wemindji to better understand the regional determinants of beaver abundance. Based on interviews with trappers and elders, we focused our study on forest fire and the structure of plant communities in the riparian zone. The pace at which beaver abundance will react to climate change must ultimately be driven by the change in food availability and diversity.
DISTRIBUTION AND AVAILABILITY OF MARINE INVERTEBRATES IN THE VICINITY OF EAST BAY MIGRATORY BIRD SANCTUARY (SOUTHAMPTON): IMPORTANT FACTORS AFFECTING ARCTIC-NESTING COMMON EIDERS

Sénéchal, Édith (edith.senechal01@uqar.qc.ca), J. Béty and G. Gilchrist

1Centre d'Études Nordiques, Université du Québec à Rimouski, Rimouski, Québec, G5L 3A1
2Canadian Wildlife Service, Raven Road, Ottawa, Ontario, K1A 0H3

The abundance and diversity of arctic marine invertebrates is likely to vary with climate warming and shortened periods of ice cover. These organisms are the main food source for several arctic migratory birds, including the common eider, Somateria mollissima. Several female eiders have been observed feeding intensively on marine invertebrates during the pre-laying period, suggesting that they are strongly dependent on food acquired on the breeding grounds to produce their eggs and breed successfully. Very little information is available on the distribution and availability of prey for arctic seabirds like eiders. The main goal of this project was to characterise the marine habitat of the East Bay Migratory Bird Sanctuary on Southampton Island, Nunavut. In mid-late July 2007, we collected information on water depth, described the underwater substrate and inventoried marine invertebrates at various sites in the bay. Divers collected invertebrates at 56 locations (3 m to 28 m deep) previously identified as foraging sites for pre-laying eiders. Though some species of bivalves were observed in high density, no mussel spp. was found. Amphipods and polychaetes were abundant at many sites and likely represent a significant food source for pre-laying eiders, and potentially for other marine birds. Using stable-isotope signatures and mixing-models, we will quantify the relative contribution of body reserves and food items acquired in the bay to egg formation of common eiders. Data gathered through this study will also contribute to our understanding of the interaction between marine invertebrates and numerous wildlife species foraging in the East Bay region (marine birds, bearded and ringed seals, walrus, beluga whales). Furthermore, documentation of the actual distribution, abundance and diversity of marine invertebrates is essential to detect changes in the marine ecosystem and identify the vulnerability of various marine species to global warming.

TOXOPLASMA GONDII IN THE ARCTIC: A SEROLOGIC SURVEY IN SEALS FROM NUNAVUT

Simon, Audrey (audrey.simon@umontreal.ca), Michel Bigras-Poulin, Rebecca A Guy, Brian J. Ward, Benoit Levesque and N. H. Ogden

1Department of pathology and microbiology, Université de Montréal, Saint-Hyacinthe, Quebec J2S 7C6
2Laboratory for Foodborne Zoonoses, Agence de la Santé Publique du Canada, Saint-Hyacinthe, QC J2S 8E5
3Montreal General Hospital, Université McGill, Montréal, Quebec H3G 1A4
4Institut National de Santé Publique, Sainte-Foy, Quebec G1V 5B3

Toxoplasmosis, caused by the protozoan parasite Toxoplasma gondii, is one of the most common world wide zoonosis. Infection is mainly acquired by ingesting food or water contaminated by oocysts or by eating undercooked meat containing tissue cysts. In the Arctic, there is evidence of high rates of exposure in Inuit people. The population of domestic cats, the principal felids that shed this parasite, are not believed to represent a major source for the Inuit. An important route of infection in this population might be consumption of tissue cysts in uncooked meat of marine mammals. Using a modified direct agglutination test, blood samples collected from seals hunted in the Nunavut Inuit communities between 1986-2006 were used to estimate Toxoplasma seroprevalence (primarily Ringed seals: Phoca hispida). An initial estimate of seroprevalence based on 100 samples was 11%, with a small number having very high titers. Investigation of effects of sex, age, location, and date of sample on antibody prevalence is underway to increase our understanding of the transmission of this parasite in the Arctic. These initial results suggest the presence of a link between marine and terrestrial transmission cycles of T. gondii and that seal meat could be an important source of infection for Inuit communities. These data raise also the question of how T. gondii moves between the terrestrial and marine environments.

NUNATSIAVUT NULUAK BASE CAMP: BRINGING TOGETHER INUIT KNOWLEDGE, SCIENCE, AND LAND MANAGEMENT

Simpson, Angus (Angus.Simpson@pc.gc.ca), William Barbour, Judy Rowell, Gary Baikie, Thomas W. Knight, and Jacko Merkeratsuk

1Torngat Mountains National Park Reserve, Box 471, Nain NL A0P 1L0
2Minister, Lands and Natural Resources, Nunatsiavut Government, P.O. Box 70 Nain, Nunatsiavut, NL A0P 1L0
3Parks Canada, Western Newfoundland and Labrador Field Unit, Box 130 Rocky Harbour, NL A0K 4N0

The Nunatsiavut Nuluak base camp, established by Parks Canada in Saglekt Fiord,
GIS-BASED APPROACH FOR THE DETECTION OF SPATIO-TEMPORAL CORRELATIONS WITHIN LIMNOLOGICAL AND PALEOLIMNOLOGICAL DATA OF THE CIRCUMPOLAR DIATOM DATABASE (CDD)

Sirois, Martin (martin.sirois.1@ulaval.ca) and Reinhard Pienitz

Laboratoire de paléolimnologie et de paléoécologie, Département de géographie, Centre d’études nordiques, Université Laval, Québec, QC, G1V 0A6, Canada

The Circumpolar Diatom Database (CDD) has been created in 1997 as a tool to facilitate access to palaeolimnological data, especially diatom occurrences and limnological information. The database includes data from limnological and paleolimnological surveys completed over the past 17 years in northern Québec, Labrador, the Northwest Territories, Nunavut, Yukon, Alaska, Siberia, as well as other parts of the circumpolar region. The regional data sets and results originating from these individual projects are rarely compared and synthesized in a larger context. The overall structure of the dataset allows for analyses at different spatial and temporal scales within powerful geographical information systems (GIS), such that correlations and patterns can be detected among the biological and limnological data. Similar efforts that are based on pollen data have resulted in the spatio-temporal reconstruction of postglacial vegetation patterns in North America (Grimm and Keltner, 1998). The nature of the data contained in the CDD should be useful for reconstructions of climatic and environmental changes and the biogeographic dispersal of species following the last deglaciation, as well as help identify transport patterns of atmospheric contaminants. Grimm, Eric C., and Keltner, John, 1998. The global pollen database. NOAA Paleoclimatology Program, United States. Illinois State Museum, Research and Collections, Springfield, IL, United States. Palynology; v. 22;1; p. 242-243

CONTRASTING THE EFFECTS OF WEATHER AND PREDATORS ON SHOREBIRD NEST SUCCESS

Smith, Paul A.¹ (paullallen.smith@ec.gc.ca), H. Grant Gilchrist² and Mark R. Forbes¹

¹Dept. of Biology, Carleton University, Ottawa, ON, K1S 5B6
²National Wildlife Research Centre, Ottawa, ON, K1A 0H3

Shorebird populations are declining across North America. An understanding of the factors regulating reproductive success of shorebirds is critical for their conservation, and particularly so in the context of a changing Arctic. We demonstrate that the low and variable nest success of shorebirds may be cause for conservation concern. Between 2000 - 2007, we monitored 565 shorebird nests in the eastern low Arctic (East Bay, Nunavut). Hatch success ranged nearly six-fold between years, and species means ranged from 1.5% - 36%. Although local weather conditions influenced timing of nest initiation, we found no significant relationship between hatch success and general weather conditions such as date of 50% snow loss, mean daily temperature or mean daily wind-chill low during the nesting season. The low rate of nest abandonment further demonstrates the ability of shorebirds to withstand the range of weather conditions encountered at this low arctic site. The vast majority of failed nests (304/316) were depredated; hatch success and indices predator abundance (based on daily counts) were strongly correlated. For bi-parentally incubating shorebirds, hatch success was predicted best by the abundance of arctic fox (Alopex lagopus) (R² = 0.70, P < 0.01), whereas for uniparental shorebirds, hatch success was correlated only with abundance of jaegers (Stercorarius spp.) (R² = 0.73, P < 0.05). Abundance of lemmings (primarily Dicrostonyx torquatus), was not significantly correlated with nest success or predator abundance. We conclude that substantial fluctuations in local weather do not account for variation in shorebird nest success. In contrast, even moderate changes in the abundance of predators had dramatic impact on nest success.
and easily predictable effects on shorebird vital rates. We further demonstrate that the low nest success of half of the species of shorebirds at this site is insufficient to maintain stable populations.

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**OASIS-CANADA**

**Staebler, Ralf** (ralf.staebler@ec.gc.ca), Jan Bottenheim and Alexandra Steffen

Air Quality Research Division Environment Canada
4905 Dufferin St Toronto M3H 5T4

Little is currently known about the chemistry in the boundary layer air over the Arctic Ocean. With changes in climate already apparent in the Arctic, there is now an urgent need to understand the relevant chemical, physical and biological processes in a rapidly changing environment. It is now well established that activation of halide ions from seasalt leads to the production of highly reactive halogen atoms such as Cl and Br that cause often dramatic depletion of O3 from the marine boundary layer. Concurrent with ozone depletion gaseous elementary Hg is depleted; its ultimate fate is hotly debated. Active photochemistry in the snow and ice has been identified as one driving force, but overall many details are very poorly delineated. The project “OASIS-Canada”, which is a Canadian contribution to the international, multi-disciplinary OASIS (Ocean-Atmosphere-Sea Ice–Snowpack) program, will study these processes directly over the Arctic Ocean in several ways. Instrumented chemical buoys (“O-buoys”) will be developed and deployed, allowing for the first time year round measurements of atmospheric chemistry in the marine boundary layer directly on the Arctic Ocean. Long term data are also collected from the two year drift expedition of the French sailboat TARA, frozen in the Arctic Ocean. Specially designed Arctic sleds will be instrumented to determine the flux of key chemical components (O3, Hg, CO2) to the frozen ocean surface autonomously (the OOTI “Out On The Ice” project). And last but not least, OASIS-Canada will join two other IPY studies on Canadian territory. Collaboration with the Circumpolar Flaw Lead (CFL) project conducted on the CCGS Amundsen will permit the opportunity to join forces with researchers from different fields of expertise (biology, oceanography, computer modeling) to study the air, ice, ocean, and the life they contain, in an unprecedented comprehensive manner. OASIS-Canada will also participate in the COBRA (impact of combined iodine and bromine release on the Arctic atmosphere) project on the Hudson Bay near Kujujwarzik/Whapmagoostui, Quebec, where British scientists are spearheading a comprehensive OASIS-IPY campaign. This paper will provide an overview of OASIS and specifically how the Canadian component will address some of the important questions about the chemistry near the atmosphere/sea ice/snowpack interface and its role in a changing Arctic Ocean environment. OASIS-Canada is sponsored by the Federal Government Program of the IPY (project #2006-SR1-MD-065), and contributes to the international OASIS-IPY program (IPY#38);

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**THE OOTI SLED: ATMOSPHERIC CHEMISTRY MEASUREMENTS OUT ON THE ICE**

**Staebler, Ralf** (ralf.staebler@ec.gc.ca), Jan Bottenheim, Alexandra Steffen, Stoyka Netcheva, Patrick Lee and Andrew Sheppard

Air Quality Research Division Science & Technology Branch Environment Canada

Over the past couple of decades it has become apparent, as a result of several major field studies, that air-snow, air-ice, biosphere-snow-ice-atmosphere, and air-ocean interactions in the Polar regions have a substantial impact on the composition of the overlying atmosphere. Furthermore, it is clear that since the nature and extent of snow and ice cover is changing, a sound quantitative understanding of these interactions is essential to the development of a predictive capability regarding the future state of the atmosphere in Polar regions, and how that relates to global climate change. However, our understanding of the fundamentals of the associated surface chemical, physical, and biological exchange processes that occur at relevant interfaces is very limited. An international, interdisciplinary program has recently been developed to study these processes, called the “Ocean Atmosphere Sea-Ice Snowpack” (OASIS) Interactions Program. An important aspect of the OASIS/IPY proposal is to study the air-surface flux of key atmospheric components such as ozone and mercury. Environment Canada has a proud history in this field: the dramatic loss of both ozone and gaseous mercury after polar sunrise from the boundary layer air was discovered by EC scientists. Over the years it has become clear that these phenomena are driven by air-surface interactions, but determining the type of surface involved remains elusive. Recent speculation includes frost flower fields on new ice, fresh snow/diamond dust, or wind-transported frost flower fragments. To resolve this issue, actual field observations are essential. Such observations on the Arctic Ocean were virtually nonexistent until the recent OOTI (“Out On The Ice”) campaigns conducted by us in 2004 (Alert, NU) and 2005 (Barrow, AK). The centerpiece of the OOTI campaigns is a fully autonomous instrumented sled that can be pulled to a surface of interest by snowmobile and left unattended for 2-3 days while collecting data on vertical gradients of ozone, mercury and carbon dioxide. Bromine oxide, a key component in the O3 and Hg depletion chemistry, will be monitored using a differential optical absorption spectrometer (DOAS). These
measurements are augmented with turbulent wind flow data from a sonic anemometer, and supporting meteorological information such as air, snow and ice temperatures, humidity, barometric pressure, solar irradiance and Albedo. Data can be remotely monitored through a wireless Ethernet link. One of our OOTI sleds will be deployed from the Amundsen in the late winter and early spring of 2008 for observations on relevant surface types within reach from the ship, while another one will be making measurements on Hudson Bay near Kuujjuarapik. This paper will describe the design of the OOTI sled and review the results from the previous two OOTI studies.

ARCTIC COASTAL DYNAMICS UNDER CHANGING RELATIVE SEA-LEVEL AND ENVIRONMENTAL FORCING, CANADIAN ARCTIC ARCHIPELAGO

St. Hilaire, Dominique1 (dominique.sthilaire@hotmail.com), T. Bell1, D.L. Forbes1,2 and R.B. Taylor2

1Department of Geography, Memorial University of Newfoundland, St. John’s, NL, A1B 3X9
2Geological Survey of Canada, Natural Resources Canada, Bedford Institute of Oceanography, Challenger Drive (PO Box 1006), Dartmouth, NS, B2Y 4A2

Two environmental variables that will have a significant impact on the Arctic coastline in the context of climate change are relative sea-level (RSL) rise and reduced sea-ice cover. Both can alter the wave energy regime at the coast, causing flooding, accelerated or increased shoreline change, and influencing the morphology and sedimentology of depositional landforms. Such changes represent increased hazard risk for community infrastructure, nearshore benthic habitats, and coastal resources. Projecting the future response of the coastal system to these changes in environmental forcing is a prerequisite to an effective adaptation strategy. The primary goal of this research is to define gravel shoreline sensitivity and response to rising sea level and changing environmental forcing in the context of anticipated climate change in the Arctic. It will contribute to an improved understanding of coastal hazards and climate-change impacts in the coastal zone and will inform decision-making for community and government adaptation strategies to climate change. Two complementary approaches are being used to achieve this goal: (1) the study of past responses under time-varying conditions as recorded in the geological record and (2) the study of present responses under spatially varying forcing as interpreted from modern processes. Selected study sites are located along a longitudinal transect in the central and eastern Canadian Arctic encompassing gradients of both RSL trends and coastal exposure to different levels of energy. The coupled study of submerging and emerging coastal sites gives insights into the dynamics and processes associated with coastlines under various scenarios of sediment supply, basement topography, exposure, and rate and direction of RSL change. It offers therefore a unique opportunity to decipher the role of individual controls on beach morphodynamics. The westernmost study sites, located in Barrow Strait, are characterized by falling RSL. Thus far, these emerging coastal sites have provided valuable information on the role of sea-ice and storms on beach morphodynamics. The easternmost sites, located in Lancaster Sound, Navy Board Inlet and Baffin Bay, are characterized by stable or rising RSL. These sites provide important analogues for ongoing and predicted global sea-level rise. Onshore research is being conducted using multi-temporal analysis and mapping of modern and relic (raised) coastal systems using airphotos, satellite imagery, LiDAR and RTK surveys. Land-based work supports temporal studies on the modern coastline using both historical records and ongoing monitoring programs. Shallow-water mapping of transgressive coastal systems is carried out using multibeam sonar, single-beam and side-scan echo-sounders, sub-bottom profiler and sediment cores. Sea-floor imagery and sub-bottom profiles enable a better understanding of past coastal responses to rising RSL and indicate how coastal bathymetry and sediment composition are influencing the development of coastal systems under both rising and falling RSL. This research contributes to the objectives of ArcticNet Projects 1.2 and 2.4 and the IPY CAVIAR (Community Adaptation and Vulnerability in Arctic Regions) project. It also forms part of a larger integrated regional impact study (IRIS) of climate change in the eastern Arctic.

INFLUENCE OF SEASONAL VARIABILITY ON TISSUE DISTRIBUTION AND WHOLE BODY BURDEN OF POLYFLUORINATED COMPOUNDS IN RINGED SEAL (PHOCA HISPIDA) FROM THE CANADIAN ARCTIC

Sturman, Sabrina1 (ssturman@uoguelph.ca), Jeff Small2, Christine Spencer2, Keith Solomon1, and Derek Muir2

1University of Guelph, Department of Environmental Biology, 2120 Gordon St., Guelph ON, N1G 2W1
2Environment Canada, National Water Research Institute, 867 Lakeshore Road, Burlington, ON L7R 4A6

The persistence of polyfluorinated compounds (PFC) in arctic marine ecosystems has been demonstrated by accumulation in apex predators, specifically polar bear. Ringed seal are
identified as a major component of the polar bear diet and several studies demonstrate the bioaccumulative potential of these compounds; however as liver or plasma samples are typically utilized as surrogates for whole body burdens, these estimates may be overstated. This study investigated the tissue distribution of PFCs in ringed seal from two populations near coastal communities in the Canadian Arctic: Nain, Nunatsiavut and Resolute Bay, Nunavut. PFC analyses were performed by LC-MS/MS. Stable isotope (δ948;15N and δ948;13C) and fatty acid analyses were utilized to reveal differences in diet and trophic position between populations. Consistent with previous studies, PFOS and PFNA were the predominant compounds in all tissues however contaminant profiles varied amongst tissues. The highest PFOS concentrations were detected in liver samples collected near Nain. Whole body burdens estimates and tissue contamination profiles varied by location suggesting different routes of PFC exposure between populations. Blood, muscle and liver contribute the greatest to whole PFC body burden; blubber demonstrated greatest seasonal variability. Geographical and seasonal trends were consistent with those documenting atmospheric long-range transport as the primary route of contaminant exposure in the Arctic. Seasonal fluctuations in feeding strategies, behaviour and resulting blubber content are potential factors of PFC loading in ringed seal.

THE MIGRATORY CARIBOU OF NORTHERN QUÉBEC-LABRADOR: FACTORS AFFECTING THE BODY CONDITION OF FEMALE-CALF PAIRS IN TWO HERDS OF DIFFERENT POPULATION SIZES

Taillon, Joëlle1 (joelle.taillon@bio.ulaval.ca), S. D. Côté1, V. Brodeur2 and M. Festa-Bianchet3

1Department of Biology, Université Laval, Québec, Québec G1K 2P4
2MRNF, Direction de l’aménagement de la faune, Nord-du-Québec, Chibougamau, Québec, G8P 2Z3
3Department of Biology, Université de Sherbrooke, Sherbrooke, Québec, J1K 2R1

More than one million migratory tundra caribou are distributed in Northern Québec and Labrador. They range over nearly one million square kilometres and are one of the world’s largest wild ungulate populations. Caribou are a key element of the northern ecosystem and are intimately linked to the culture and the economy of Northern Québec/Labrador. Two populations are recognized, the Rivière-aux-Feuilles herd is very large and appears to be declining; the Rivière-George herd is about half the size of the Rivière-aux-Feuilles herd but appears to be increasing. The factors influencing changes in body condition of tundra caribou are still poorly understood, but are essential to our understanding of natural and human-induced variations in the survival and reproductive success of individuals and the demography of herds. This research will quantify variations in the body condition of females and their calves and compare the condition and parasite load of females and calves between herds. In June 2007, we culled 20 female-calf pairs on the calving grounds of each herds to evaluate the body condition of individuals. Adult females from the Rivière-George herd were heavier (80.4 ± 1.8 kg) than those from the Rivière-aux-Feuilles herd (73.0 ± 1.8 kg), but they did not differ in skeletal size (hind foot length was 54.0 cm in both herds). Calves from the Rivière-George herd had a greater body mass and hind foot length (6.2 ± 0.2 kg and 33.2 ± 0.3 cm) than those from the Rivière-aux-Feuilles herd (5.2 ± 0.2 kg and 31.9 ± 0.3 cm). A lower body mass at birth is likely to decrease calf survival and growth. We also observed a positive relationship between the body mass of a female and that of her calf for the Rivière-aux-Feuilles herd, but not for the Rivière-George herd. These results suggest that under constraining conditions, i.e. at high population size, differences in females’ body condition are more likely to affect the condition of their offspring than under more favourable conditions. All adult females were parasitized either by warble flies, taenias (in lungs or muscles) or liver flukes, or a combination of these parasites. Warble flies were much more common in the Rivière-aux-Feuilles herd than in the Rivière-George herd. Liver flukes were almost absent in the Rivière-aux-Feuilles herd, but common in the Rivière-George herd. Taenias in lungs and muscles were rare in both herds. These data from early summer will be compared with data to be collected on female-calf pairs in November 2007. Combining these two dataset, we will quantify the influence of herd size on adult female body condition following lactation and on calf body condition and early growth.

SEASONAL VARIATIONS IN SPACE USE BY REPRODUCTIVE ARCTIC FOXES

Tarroux, Arnaud (arnaud.tarroux@uqar.qc.ca), D. Berteaux and J. Béty

Département de Biologie Université du Québec à Rimouski 300, allée des Ursulines, Rimouski QC G5L 3A1

The Arctic fox is an opportunistic, circumpolar predator that samples all year round the terrestrial or marine food chain, and that has developed some of the most dramatic physiological and behavioural adaptations to the cold Arctic environment. It is strongly and negatively affected by southern competitors invading its habitat, such as the red fox. For these reasons, the Arctic fox is becoming one...
indicator species for environmental effects of climate change in the North. Yet some basic aspects of its life history need a deeper understanding to enable a sound interpretation of its response to climatic variation. In this study we focus on the patterns of space use in reproductive individuals and how these patterns may change throughout the year. We also pay a particular attention to differences that may exist between sexes. This project uses newly available satellite technology that allows us to follow individuals for periods ranging from a few weeks to several months. Our poster presents preliminary results of an ongoing study on Bylot Island (Sirmilik National Park of Canada, Nunavut), where the arctic fox population is monitored since 2003. We describe quantitatively the home ranges of arctic foxes and their seasonal movements. In June-August 2007 we fitted 21 individuals with GPS or Argos satellite collars. The Argos units will continue gathering position data until the next summer. We present here the methodological advances that this study is providing, the biological hypotheses that it is testing, the preliminary results that it is generating, and the contribution that it is expecting to make.

MODELLING GROWTH AND SURVIVAL OF LARVAL ARCTIC COD

Thanassekos, Stéphane
(stephane.thanassekos.1@ulaval.ca), F. Dupont, L. Fortier
Québec Océan, Pavillon Alexandre-Vachon, Laval University

The Arctic cod, Boreogadus saida, affects an estimated 93% of the energy transfer between zooplankton and upper trophic levels in the Arctic marine food web. Year-class strength and the overall abundance of Arctic cod populations depend largely on the survival of the larval and juvenile stages which, in turn, depend on biotic (prey and predator abundance) and abiotic factors (sea-ice, temperature). The on-going regression of the ice cover in Arctic seas is expected to impact severely the population dynamics of Arctic cod and other ice-dependent hyper-specialists. We developed a numerical Individual-based model of the early life of Arctic cod larvae with the objective of exploring survival and growth under various climate scenarios for spatial scales ranging from the regional (e.g. the North Water polynya) to the hemispheric (pan-Arctic regime shifts). The central equation of the model calculates growth based on the metabolic balance between energetic gains (by consumption) and losses (e.g. by respiration and excretion). A negative balance eventually leads to death by starvation and increases vulnerability to predators. Temperature limits metabolic processes, thereby affecting growth efficiency. A preliminary predation module mimics the impact of a piscivorous fish on Arctic cod larval survival. In order to generate a heterogeneous population, stochasticity is added to parameters such as the daily intake of prey, based on variance reported in the literature. The model correctly reproduces the increased survival of fast-growing individuals. Growth calculation is validated by comparison with age-length distributions sampled in three regions of the Arctic Ocean (Beaufort Sea, North Water, and Northeast Water). Model results indicate that larval growth is limited primarily by prey consumption and/or foraging costs in the field. The offline coupling of the biological model with a physical model of ocean circulation in the Canadian Arctic (F. Dupont) allows tracking the trajectories of the larvae in a Lagrangian framework. The first bio-physical simulations suggest superior growth and survival in known nursery areas of the species such as the Amundsen Gulf and Baffin Bay.

A 1000-YEAR RECORD OF HYDROCLIMATIC VARIABILITY FROM A LAKE AT THE NORTHERN EXTREME OF CANADA

Tomkins, Jessica D.1 (0jdt@queensu.ca), Scott Lamoureux¹, Dermot Antoniades² and Warwick Vincent³

¹Department of Geography, Queen’s University, Kingston, Ontario K7L 3N6
²Centre d’études nordiques, Université Laval, Québec, Québec G1K 7P4

In meromictic Lake A, Ellesmere Island (83°00’N, 75°30’W), highly-seasonal sediment delivery combined with bottom water anoxia create conditions conducive to the formation and preservation of annual laminae (varves) in the lake’s sedimentary record. From these sediments, a 1000-year record of environmental change at northern limit of the Canadian High Arctic has been developed. Sedimentation and organic content records demonstrate century-scale changes in climate and lake productivity. Varve thickness and particle size within lake sediments are a largely function of discharge intensity, which is controlled by hydroclimate. Therefore, increased varve thickness and sand content within the sedimentary record from AD 1000-1200 suggests above average melt season conditions and/or precipitation during this time. Below average varve thickness and finer sediments from AD 1400-1800 indicate generally cool and/or dry conditions in the study area. Other arctic proxy climate records have shown below average temperatures within the same period as Lake A’s cool period (e.g., Lamoureux and Bradley, 1996, J. Paleolimnol., 16: 239-255). Thicker varves and the presence of sand in Lake A’s sedimentary record during the past 200 years suggest above average temperatures and/or
precipitation, but not as high as conditions from AD 1000-1200. Average to below average carbon to nitrogen ratios (C/N) within the past 200 years of sedimentation further reinforce this hypothesis. Lower C/N values suggest increased aquatic productivity during warmer conditions. Aquatic productivity in Lake A is likely light limited, and the lake’s perennial ice cover greatly hinders penetration of solar radiation (Bezile et al. 2001, Can. J. Fish. Aquat. Sci., 58: 2405-2418). Warmer conditions would likely produce thinner annual ice cover and a larger summer moat. The varve thickness record indicates that the early 1900s were likely warmer than the latter half of the century, as is evident in other arctic proxy climate records (Overpeck et al., 1997, Science, 278: 1251-1256) and instrumental meteorological series (ACIA, 2004). The varve thickness records of Lake A and a similar lake, Lake C2 (35 km west, Lamoureux and Bradley, 1996), show similarities from AD 1600 to present, and suggest regional coherence in climatic influences on sedimentation during the past few centuries. The most recent sediments in Lake A are structurally unique and indicative of recent environmental change in the study lake and its surrounding area. These sediments are more organic-rich and contain a band of small pellets, believed to be ice-rafted debris after recent ice-out (AD 2000) and low ice cover (AD 2003) events. Meteorological records since AD 1951 from Alert, Nunavut (175 km east), show increased mean annual temperatures in the area, particularly since the mid-1980s. The adjacent Ward Hunt Ice Shelf underwent major fracturing in AD 2002 (Mueller et al., 2003, Geophys. Res. Lett., doi:10.1029/2003GL017931) and the nearby Ayles Ice Shelf detached from land and floated into the Arctic Ocean in 2005. These regional changes, in combination with ice cover changes in Lake A, suggest ongoing environmental change at the northern extreme of Canada.

CLIMATE CHANGES IN NUNAVIK: NORTHERN STRATEGIES FOR A SAFE ACCESS TO TERRITORIAL AND RESOURCES

Tremblay, Martin1 (mtremblay@krg.ca), Chris Furgal2, Tuumasi Annanack1 and Michael Barrett1

1Renewable Resources Department, Kativik Regional Government, P.O. Box 9, Kuujjuarap, Québec, J0M 1C0
2Indigenous Environment Studies, Trent University, Peterborough, Ontario, K9J 7B8

Trail networks in Nunavik and Northern Québec are very important for local populations. These networks provide links between the communities because no road network exists in the region and communities are only accessible by plane or by boat. Thus, trails are used to conduct traditional activities such as hunting, fishing and trapping as well as basic travel. However, since the mid-1990s, Nunavik has been affected by warmer temperatures, which have already had consequences for the environment. Local populations report warmer and shorter winters, which affect the ice season (i.e. delayed freeze-up, thinner ice and earlier break-up) and consequently human access to local harvesting areas and resources. These new climatic conditions result in increased risks for travel during the winter season associated with changes in ice and weather characteristics. During the first phase of this project, an integrated community-based monitoring program was developed in Nunavik to document the impacts of climate changes on trail access and use and human safety and to generate adaptation tools to support safe access to land and resources through participation in community-based monitoring activities. The project approach has brought together partners (northern communities, organizations and Canadian universities) having various perspectives on the issues surrounding land and resources in Nunavik. The project has brought together traditional knowledge and scientific knowledge, linking data collected through semi-structured interviews, local ethno-cartographic interviews, ice monitoring activities, data gathered at weather stations and climate scenarios. River mouths and the near shore sea ice environment were mentioned as being potentially the most hazardous in the new climate conditions. A second phase of the project will be initiated to consolidate the winter risk assessment and management tools associated with the access to territory and resources by sea ice (International Polar Year Initiatives). The main objectives are i) to understand the socio-economic and demographic factors that influence exposure to the hazardous meteorological events and perception of the climate and environmental changes related to the access of territory and resources and ii) to document and characterize the spatial development and use of sea ice related to its use for traditional activities. The project activities will include semi-structured interviews, local ethno-cartographic interviews, community-based ice monitoring activities, and will be complemented with data gathered at weather stations and remote sensing image analysis.

SEASONAL VARIATIONS OF VERTICAL FLUXES OF PARTICULATE ORGANIC CARBON IN COASTAL HUDSON BAY: FIRST INSIGHTS FROM 2005-2006

Valdenaire, Bérangère, A. Forest, C. Lalande (catherine.lalande.1@ulaval.ca) et L. Fortier
Québec-Océan, Département de biologie, Université Laval, Québec, G1K 7P4

Vertical fluxes of particulate organic carbon (POC) and carbon:nitrogen ratios (C:N) were recorded
at ~100 m depth in coastal Hudson Bay (Northern Canada) by use of two sequential sediment traps moored from October 2005 to September 2006. In general, the magnitude of vertical fluxes was function of ice conditions and meteorological events (e.g., storms). Distinct seasonal patterns were however observed between the two locations (western vs. eastern coast). In the fall, a large peak of POC flux (particularly high at the east, up to >80 mg C m^-2 d^-1) was likely related to resuspension and coastal erosion induced by strong northwesterly winds (>50 km h^-1) blowing over Hudson Bay. In winter, the POC fluxes remained relatively high at the west (~30 mg C m^-2 d^-1) while daily POC fluxes decreased progressively from December to May at the east (down to <10 mg C m^-2 d^-1). We suggested lateral input of particles from Arctic waters to explain the constant POC fluxes during winter in western Hudson Bay. In spring 2006, the ice break-up occurred earlier (June) in eastern Hudson Bay than at the west (July). Accordingly, we proposed that ice-related biomass (e.g., ice algae, gelatinous exopolymers, old biogenic matter) made up the bulk of sinking POC at the two mooring sites during the months of ice melting. In summer (open-water season), vertical POC fluxes reached higher values at the west (up to 50 mg C m^-2 d^-1) than at the east (<30 mg C m^-2 d^-1). We linked this difference to increased biological production in the western pelagic ecosystem of Hudson Bay, as previously reported in the literature. Hence, over the annual cycle, our results showed that the most important sedimentation events are dissimilar in the two ecoregions of Hudson Bay. Further investigations (e.g., microscopic observations, interannual studies) should help to better understand the vertical POC flux dynamics in this complex hydrographic system.

ASSOCIATION BETWEEN MERCURY LEVELS AND BLOOD PRESSURE IN NUNAVIK INUIT ADULTS

Valera Beatriz1 (beatriz.valera@crchul.ulaval.ca), E. Dewailly1 and P. Poirier2,3

1Public Health Research Unit, CHUL-CHUQ, Quebec, Canada
2Faculty of Pharmacy, Laval University, Quebec, Canada
3Quebec Heart and Lungs Institute, Laval Hospital Research Center, Canada

Background: Recent epidemiological evidence suggests a deleterious effect of methyl mercury (MeHg) on the cardiovascular system. However, data regarding the influence of MeHg on blood pressure (BP) are not consistent. Objective: To study the impact of MeHg levels on BP among Nunavik Inuit adults taking into account possible confounding factors such as age, gender, insulin sensitivity (measured as HOMA-IR), LDL-cholesterol, HDL-cholesterol, triglycerides, waist circumference, smoking, alcohol consumption as well as n-3 fatty acids and selenium levels. Methodology: In fall 2004, the «Qanuippitaa?» Health Survey was conducted in the 14 communities of Nunavik and information was collected among 866 adults more or less; 18 years old. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured during a clinical visit and pulse pressure (PP) was calculated as the difference between SBP and DBP. Pearson correlation was used to analyse simple relation between MeHg and BP parameters while multiple regressions were carried out to control for confounders. Also, variance analysis (ANOVA) was performed to compare BP means by group of mercury exposure according to Health Canada recommendations (acceptable concentration: < 100 nmol/L vs. concentration at increased risk: 100 - 500 nmol/L). Means were also adjusted for the confounding factors using ANCOVA analysis. Results: MeHg correlated with SBP (r= 0.15; p< 0.0001) and PP (r= 0.17; p< 0.0001) while the correlation with DBP did not reach statistical significance. After adjusting for confounders, the association with SBP (β= 2.41; p< 0.0001) and PP (β= 1.07; p= 0.03) remained statistically significant while the association with DBP became significant (β= 1.01; p= 0.03). SBP was lower in individuals with acceptable MeHg concentrations than in those with at risk MeHg concentrations (116 mmHg ± 0.6 vs. 121 mmHg ± 0.9; p< 0.0001). Significant differences were also observed in PP (43 mmHg ± 0.9 in individuals with acceptable blood MeHg concentrations vs. 47 mmHg ± 0.6 in individuals with at risk blood MeHg concentrations; p< 0.0001). After adjusting for confounding factors, differences in SBP and PP remained statistically significant. Conclusion: The results of this study suggested a subtle negative influence of mercury on BP in Nunavik Inuit adults.

EPI SHELF LAKES AS SENTINELS OF CLIMATE CHANGE: IMPLICATIONS OF ARCTIC ICE SHELF BREAK-UP

Veillette, Julie1 (julie.veillette.2@ulaval.ca), D.R. Mueller2, D.Antoniades1 and W.F. Vincent1

1Centre d’études nordiques and Department of Biology, Université Laval, Québec, Québec G1V 0A6
2Geophysical Research Institute, University of Alaska Fairbanks, Fairbanks, AK, 99775 USA

Epishelf lakes are an unusual class of polar aquatic ecosystems in which a layer of freshwater is in tidal contact with the sea in an ice-dammed fiord or embayment. These highly stratified ecosystems are physically fragile since they depend on the integrity of an ice shelf for their existence. Several examples are...
known from Antarctica including Beaver Lake (East Antarctica), Ablation Lake (Antarctic Peninsula), and Transkriptsi Gulf in the Bunger Hills Oasis. However, this ecosystem type is much rarer in the Arctic. The central aim of this paper is to evaluate the potential of epishelf lakes as sentinels of climate change. Our study area is the northern coastline of Ellesmere Island in the Canadian High Arctic, and includes the northern sector of Quttinirpaaq National Park, Nunavut, where major changes are being detected in aquatic ecosystems (Vincent et al., 2002; Antoniades et al., 2007). The epishelf lake contained in Milne Fiord is the best current example of an arctic epishelf lake dammed by an ice shelf. In situ profiling measurements in our summer 2007 ArcticNet field season revealed a freshwater layer of 16 m thick and a sharp halocline with an increase of 22 ppt in a stratum of 2m in thickness. This freshwater is derived from terrestrial snow, precipitation and ice melt water. Milne Fiord is fed by a glacier and has a steep surrounding terrain that could contribute towards its ongoing cold ice conditions. Other fiords and embayments in this region have a upper freshwater layer including Markham Fiord, Taconite Inlet and Serson Bay. However, this freshwater layer is much shallower with a thickness around 5 m and they are considered as intermediary structure but not real epishelf lakes. Our work on the largest remaining epishelf lake, Disraeli Fiord, showed that this contained an unusual combination of marine and freshwater zooplankton species. However this ecosystem was lost in 2002 with the fracturing of the Ward Hunt Ice Shelf (Mueller et al., 2003) and profiles of 2003 to 2006 show that there is no return to past conditions of the epishelf lake structure. Another ongoing drastic change that occurred along this coastline is the 2005 break-up of the Ayles Ice Shelf and loss of epishelf stratification in the fiord. At the turn of last century, a continuous ice shelf fringe occurred along this coastline and we estimate that this may have retained about twenty epishelf lakes. Over the course of the 20th century, this vast expanse of ice fractured into smaller ice shelf remnants, resulting in loss of most of these epishelf systems. There may now be only one surviving deep epishelf lake in the Northern Hemisphere: Milne Fiord. Hence, the potential of epishelf lakes as sentinels of climate change in the Arctic at present is greatly reduced. Nevertheless, they can be used as indicators of past changes in the Arctic and as ongoing sentinels in Antarctica where they are more numerous. Finally, our observations underscore the importance of long term monitoring of these ice-dependant ecosystems, especially Milne Fiord in the Canadian High Arctic.

Global warming is expected to be more extreme in the Arctic than in temperate regions. However, the amplitude, the rate of warming, and the impact of the warming can only be predicted with a quantity of uncertainty. In this research project we will examine patterns in the vertical (down-core in lake sedimentary deposits) and horizontal (between-lake) changes in biota from lakes at Bylot Island (Arctic Canada) and Spitsbergen (Arctic Norway). The lakes are positioned along a gradient with the oldest lakes (6000 years old) facing the sea and the youngest (being formed today) facing the glacier. We will focus on developing a better understanding of lake conditions during early lake evolution in newly formed landscapes and their influence on aquatic biota. This may aid in understanding future responses to environmental change of northern lakes and surrounding terrestrial ecosystems. The fauna in northern lakes compose mainly of non-biting midges (chironomids). These midges are key organism in Arctic terrestrial and freshwater ecosystems since they are the most important food for other invertebrates, fish, and birds. In the study, we will also investigate the climate history of Bylot Island and Spitsbergen by use of fossil chironomids. Paleoclimate records from Bylot Island and Spitsbergen, where one is situated at the northern limit of the North Atlantic Current, can potentially provide valuable information on the influence of the North Atlantic Current on North Atlantic climates. This information will provide empirical data for general circulation modelling of past temperatures in the north Atlantic region and may aid in lowering the uncertainties of future climate scenarios.

MOISTURE LIMITATIONS TO NON-VASCULAR PLANT PHOTOSYNTHESIS IN THE HUDSON BAY LOWLANDS

Verma_Sarah (sdv@yorku.ca)\(^1\), Richard Bello\(^1\), Mario Tenuta\(^2\) and Tim Papakyriakou\(^3\)
\(^1\)Department of Geography, York University, Toronto
\(^2\)Department of Soil Science, University of Manitoba, Winnipeg
The peatland carbon feedback mechanism has the potential to significantly increase concentrations of global atmospheric CO2 because temperatures in polar regions are increasing more rapidly than elsewhere and because the Subarctic contains the largest stores of soil carbon. The long term imbalance between photosynthesis and respiration which created peatlands is imperiled by climate change. The present study measures the sensitivity of productivity and decomposition to changes in moisture supply induced by excluding natural precipitation from the dominant moss Dicranum elongatum growing on polygonized peatlands in the Hudson Bay Lowland near Churchill, Manitoba. Fluxes were measured from June 11 to August 21, 2007 using clear and dark chambers with a Licor LI8100 infrared gas analyzer. Estimates of mean (n=11) photosynthesis were significantly (p=0.005) lower in rain deprived moss at 1.22 gC m-2 day-1 compared to those growing in the open at 1.55 gC m-2 day-1. However there was no significant difference in respiration between the wet and dry cushions at 1.75 and 1.70 gC m-2 day-1, respectively. The corresponding influence on net ecosystem exchange is that drought significantly (p=0.01) increases carbon release to the atmosphere from 206 to 581 mgC m-2 day-1, a factor of 2.83. The evidence suggests that the moss covered portions of the peat plateau were already in disequilibrium and degrading in 2007 and the induced drought accelerated net decomposition. The effects of cushion size and moss biomass on the net ecosystem exchange of CO2 are discussed.

MOVEMENT AND DIVING OF NORTHERN HUDSON BAY NARWHAL: RELEVANCE TO STOCK ASSESSMENT AND HUNT CO-MANAGEMENT

Westdal, Kristin1 (k.westdal@umanitoba.ca), P.R. Richard2 and R.R. Riewe3

1Centre for Earth Observation Science, Clayton H. Riddell Faculty of Environment, Earth, and Resources, 463 Wallace Building, University of Manitoba, Winnipeg, Manitoba, R3T 2N2, Canada
2Department of Fisheries and Oceans, Freshwater Institute, 501 University Crescent, Winnipeg, Manitoba, R3T 2N6, Canada
3Faculty of Science, Department of Zoology, Z320 Duff Robin Building, University of Manitoba, Winnipeg, Manitoba, R3T 2N2, Canada

The northern Hudson Bay narwhal (Monodon monoceros) population gathers in the area of Repulse Bay, Nunavut in the summer season. This population is hunted by local Inuit and co-managed by the Nunavut Wildlife Management Board and the Department of Fisheries and Oceans. There is some uncertainty as to its size, where this population migrates to in the winter, if its habitat overlaps with that of other narwhal populations and whether it is hunted by additional communities. The purpose of this research is to improve population estimates of narwhals summering near Repulse Bay, to determine if this stock is geographically separate from other narwhal populations, to identify summer movement in the Repulse Bay area and to add to written documentation of local knowledge of the species. This project focuses on combining satellite telemetry data and local knowledge to gain a greater understanding of the population for management purposes. Research methods include scientific analysis of satellite telemetry data from five narwhal tagged in August of 2006 and four in August of 2007 in the Repulse Bay area as well as analysis of local knowledge from seventeen interviews conducted with hunters and elders in the community of Repulse Bay in July and August of 2007. Research results will benefit co-management bodies and the community of Repulse Bay by providing written documentation of local knowledge of the species and by improving the current population estimate of narwhal from which sustainable harvest levels can be managed. Narwhal play an important role culturally, spiritually and economically to the people of Repulse Bay and involving the community in this research and in future research is the key to successful management partnerships and meaningful research.

ASSESSING THE EFFICACY OF CONSTRUCTED WETLANDS IN THE TREATMENT OF MUNICIPAL WASTEWATER IN NORTHERN COMMUNITIES

Wootton, Brent C.1 (bwootton@flemingc.on.ca), A. Durkalec1, D. Shrestha2, C.D. Metcalf3

1Centre for Alternative Wastewater Treatment, Fleming College, 200 Albert St., PO Box 8000, Lindsay, Ontario, K9V 5E6
2Watershed Ecosystems Graduate Program, Trent University, Peterborough, Ontario, K9J 7B8
3Environmental and Resource Studies Program, Trent University, Peterborough, Ontario, K9J 7B8

We are examining the use of wetlands to treat wastewater in the Canadian Arctic. Treatment wetlands improve water quality by taking advantage of complex natural wetland processes that involve microorganisms, plants, substrate (such as soil or aggregates), water, air and the sun. They can remove pathogens (such as E. coli and fecal coliform bacteria), excess nutrients (nitrogen and phosphorus) and other types of contaminants. Wetlands are currently being used for sewage treatment in many Northern communities, primarily because the use of
conventional sewage treatments plants is not feasible for a variety of reasons, including: high infrastructure, operational and maintenance costs; limitations imposed by climate, geography, or remoteness; and limited community capacity caused by personnel shortages or other unavailable servicing requirements. While treatment wetlands are in use in many locations, there is a significant paucity of knowledge about their efficacy. Research is needed that will assess treatment performance and that will examine design options most suitable to Arctic conditions, particularly in the context of changing community needs as populations grow and settlement patterns shift. The purpose of this research project is to contribute to safe, practical and low-cost wastewater solutions, and to help protect the long-term health of Northern water resources and peoples. Research activities will encompass: 1) Assessment of the efficacy of the existing range of wetland treatment systems; 2) Optimization of a prototype design specific to Arctic needs through intensive monitoring of controlled experimental systems; 3) Bench scale mesocosm experimentation focusing on microbial processes unique to Arctic environments; 4) Enhancement of local capacity in the area of community sanitation through training and education of community members and technicians. Data that are collected will be used to develop guidelines for treating wastewater with wetlands in the North and can inform regulatory agencies that currently lack sound scientific evidence upon which to base regulations. It is expected that wetlands in some communities will be found to be highly effective in the treatment of regulated parameters, while others may be found to be significantly ineffective at treating one or more parameters, at particular times of the year, or under high loading conditions. This is anticipated because of the array of local conditions, differences in treatment systems, and the ranges in strength of sewage effluent. Insights into the limitations and upper performance thresholds of various systems will provide greater understanding of treatment wetland bio-chemical processes unique to Arctic environmental conditions and allow for a validation of a pilot scale prototype design that can be scaled up. Infrastructure and logistical limitations to implementation will also be examined and noted. In summary, this research initiative has the potential to make significant contributions to the health and well-being of Northern peoples and their environment by improving our understanding of safe and appropriate wastewater treatment solutions.

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A POND WATER BALANCE STUDY IN A POLYGONAL PEAT PLATEAU IN THE HUDSON BAY LOWLANDS

Yee, Stanley1 (stanley.yee@yorku.ca), Richard Bello2, Mario Tenuta3 and Tim Papakyriakou4

1Department of Geography, York University, Toronto, Ontario M3J 1P3  
2Department of Soil Science, University of Manitoba, Winnipeg, Manitoba R3T 2N2  
3Department of Environment & Geography, University of Manitoba, Winnipeg, Manitoba R3T 2N2

This study examined the water balance for a polygonal peat plateau watershed over the summer of 2005 and 2006 in the Subarctic near Churchill, Manitoba. The catchment was divided into representative terrains units to better understand their relative contributions. At present, there are no studies on water balance or hydrological processes for polygonal peat plateau wetlands. Polygonal peat plateau wetlands occupy an area of 12,000 km2 in Manitoba and more studies are required to integrate this wetland type into Subarctic hydrology. Field methodology involved measurements of rainfall using a tipping bucket rain gauge, evaporation using the Bowen Ratio Energy Balance method, subsurface flow was measured using piezometer nests distributed across the polygonal peat plateau, changes in water levels were measured with a pressure transducer and bank overflow outputs from the pond were determined from residual from the measured water balance components. The 2005 summer precipitation was average, approximately 2% greater than the long term normal precipitation recorded by Environment Canada. Conversely, summer 2006 precipitation exceeded normals by 48% making it exceptionally wet. Both summers exhibited a ‘drying phase’ early in the summer and ‘wetting phase’ later in the summer resulting in noticeable shift in water balance components. Evaporation exceeded precipitation by 30% and 8% in the two summers respectively. Subsurface flow made up the largest component of inflow to the pond in each year, while water loss from bank overflow made up the largest component of outflow. Lateral flow was attenuated by the pond in 2005. However in the wet year of 2006 the pond augmented lateral flow to downstream watersheds. These different hydrologic roles under a future changing climate are discussed.
PARTICIPANTS
<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cunsolo Willox, Ashlee</td>
<td>University of Guelph</td>
<td><a href="mailto:ashelee@uoguelph.ca">ashelee@uoguelph.ca</a></td>
</tr>
<tr>
<td>Davis, Matthew</td>
<td>ROMOR Atlantic Limited</td>
<td><a href="mailto:mmdavis@romor.ca">mmdavis@romor.ca</a></td>
</tr>
<tr>
<td>De Abreu, Roger</td>
<td>Canadian Ice Service</td>
<td><a href="mailto:roger.deabreu@ec.gc.ca">roger.deabreu@ec.gc.ca</a></td>
</tr>
<tr>
<td>Delaronde, Joanne</td>
<td>DFO - Freshwater Institute</td>
<td><a href="mailto:delarondej@dfo-mpo.gc.ca">delarondej@dfo-mpo.gc.ca</a></td>
</tr>
<tr>
<td>Demers, Christine</td>
<td>ArcticNet</td>
<td><a href="mailto:christine.demers@arcticnet.ulaval.ca">christine.demers@arcticnet.ulaval.ca</a></td>
</tr>
<tr>
<td>Denomme, Daneen</td>
<td>Trent University</td>
<td><a href="mailto:daneendenomme@trentu.ca">daneendenomme@trentu.ca</a></td>
</tr>
<tr>
<td>DeSantis, Ruth</td>
<td>University of Guelph</td>
<td><a href="mailto:rdesanti@uoguelph.ca">rdesanti@uoguelph.ca</a></td>
</tr>
<tr>
<td>Desmarais, Natalie</td>
<td>ArcticNet</td>
<td><a href="mailto:natalie.desmarais@arcticnet.ulaval.ca">natalie.desmarais@arcticnet.ulaval.ca</a></td>
</tr>
<tr>
<td>Devlin, Jane</td>
<td>University of Toronto</td>
<td><a href="mailto:devlinj@geog.utoronto.ca">devlinj@geog.utoronto.ca</a></td>
</tr>
<tr>
<td>Doidge, Bill</td>
<td>Makivik Corporation</td>
<td><a href="mailto:b_doidge@makivik.org">b_doidge@makivik.org</a></td>
</tr>
<tr>
<td>Doiron, Madeleine</td>
<td>Université Laval</td>
<td><a href="mailto:madeleine.doiron.1@ulaval.ca">madeleine.doiron.1@ulaval.ca</a></td>
</tr>
<tr>
<td>Dubien, Danielle</td>
<td>INRS – ETE</td>
<td><a href="mailto:danielle.dubien@ete.inrs.ca">danielle.dubien@ete.inrs.ca</a></td>
</tr>
<tr>
<td>Duchesne, David</td>
<td>Université Laval</td>
<td><a href="mailto:david.duchesne.2@ulaval.ca">david.duchesne.2@ulaval.ca</a></td>
</tr>
<tr>
<td>Duerden, Frank</td>
<td>Ryerson University</td>
<td><a href="mailto:fduerden@ryerson.ca">fduerden@ryerson.ca</a></td>
</tr>
<tr>
<td>Dumont, Dany</td>
<td>INRS – ETE</td>
<td><a href="mailto:dany_dumont@ete.inrs.ca">dany_dumont@ete.inrs.ca</a></td>
</tr>
<tr>
<td>Dunford, Andrew</td>
<td>Nunavut Research Institute</td>
<td><a href="mailto:adunford@nac.nu.ca">adunford@nac.nu.ca</a></td>
</tr>
<tr>
<td>Dupont, Christiane</td>
<td>INRS – ETE</td>
<td><a href="mailto:christiane.dupont@ete.inrs.ca">christiane.dupont@ete.inrs.ca</a></td>
</tr>
<tr>
<td>Durkalec, Agata</td>
<td>Fleming College</td>
<td><a href="mailto:adurkale@flemingc.on.ca">adurkale@flemingc.on.ca</a></td>
</tr>
<tr>
<td>Edge, Victoria</td>
<td>Public Health Agency of Canada</td>
<td><a href="mailto:Victoria_Edge@phac-aspc.gc.ca">Victoria_Edge@phac-aspc.gc.ca</a></td>
</tr>
<tr>
<td>Edwards, Kate</td>
<td>University of Toronto</td>
<td><a href="mailto:edwards@eeb.utoronto.ca">edwards@eeb.utoronto.ca</a></td>
</tr>
<tr>
<td>Edwards, Patti</td>
<td>Environment Canada</td>
<td><a href="mailto:patti.edwards@ec.gc.ca">patti.edwards@ec.gc.ca</a></td>
</tr>
<tr>
<td>Egeland, Grace</td>
<td>CINE - McGill University</td>
<td><a href="mailto:grace.egeland@mcgill.ca">grace.egeland@mcgill.ca</a></td>
</tr>
<tr>
<td>Everell, Marc-Denis</td>
<td>Natural Resources Canada</td>
<td></td>
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<tr>
<td>Faraj, Nancy</td>
<td>McGill University</td>
<td><a href="mailto:ipy.cine@mcgill.ca">ipy.cine@mcgill.ca</a></td>
</tr>
<tr>
<td>Finkelstein, Sarah</td>
<td>University of Toronto</td>
<td><a href="mailto:Finkelstein@geog.utoronto.ca">Finkelstein@geog.utoronto.ca</a></td>
</tr>
<tr>
<td>Fischer, Kathleen</td>
<td>IPY Federal Program Office</td>
<td><a href="mailto:kfsicher@ainc-inac.gc.ca">kfsicher@ainc-inac.gc.ca</a></td>
</tr>
<tr>
<td>Fishback, LeeAnn</td>
<td>Churchill Northern Studies Centre</td>
<td><a href="mailto:fishback@churichillscience.ca">fishback@churichillscience.ca</a></td>
</tr>
<tr>
<td>Fleming, Laura</td>
<td>University of Guelph</td>
<td><a href="mailto:Ifleming@uoguelph.ca">Ifleming@uoguelph.ca</a></td>
</tr>
<tr>
<td>Fletcher, James</td>
<td>Queen’s University</td>
<td><a href="mailto:6jahf@queensu.ca">6jahf@queensu.ca</a></td>
</tr>
<tr>
<td>Flowers, Tiffany</td>
<td>Memorial University of Newfoundland</td>
<td><a href="mailto:tiff_flowers6@hotmail.com">tiff_flowers6@hotmail.com</a></td>
</tr>
<tr>
<td>Folliott, Jadah</td>
<td>University of Western Ontario</td>
<td><a href="mailto:jfolliott@uco.ca">jfolliott@uco.ca</a></td>
</tr>
<tr>
<td>Forand, Luc</td>
<td>DRDC Valcartier</td>
<td><a href="mailto:luc.forand@drdc-rddc.gc.ca">luc.forand@drdc-rddc.gc.ca</a></td>
</tr>
<tr>
<td>Ford, James</td>
<td>McGill University</td>
<td><a href="mailto:james.ford@mcgill.ca">james.ford@mcgill.ca</a></td>
</tr>
<tr>
<td>Forest, Alexandre</td>
<td>Université Laval</td>
<td><a href="mailto:alexandre.forest@giroq.ulaval.ca">alexandre.forest@giroq.ulaval.ca</a></td>
</tr>
<tr>
<td>Forget, Suzette</td>
<td>ArcticNet</td>
<td><a href="mailto:suzette.forget@arcticnet.ulaval.ca">suzette.forget@arcticnet.ulaval.ca</a></td>
</tr>
<tr>
<td>Forsyth, Freyja</td>
<td>Churchill Northern Studies Centre</td>
<td><a href="mailto:fa.forsyth@gmail.com">fa.forsyth@gmail.com</a></td>
</tr>
<tr>
<td>Fortier, Louis</td>
<td>ArcticNet</td>
<td><a href="mailto:louis.fortier@bio.ulaval.ca">louis.fortier@bio.ulaval.ca</a></td>
</tr>
<tr>
<td>Fortier, Martin</td>
<td>ArcticNet</td>
<td><a href="mailto:martin.fortier@arcticnet.ulaval.ca">martin.fortier@arcticnet.ulaval.ca</a></td>
</tr>
<tr>
<td>Franke, Alastair</td>
<td>University of Alberta</td>
<td><a href="mailto:alastair.franke@afhe.ualberta.ca">alastair.franke@afhe.ualberta.ca</a></td>
</tr>
<tr>
<td>Freeman, Milton</td>
<td>Canadian Circumpolar Institute</td>
<td><a href="mailto:milton.freeman@ualberta.ca">milton.freeman@ualberta.ca</a></td>
</tr>
<tr>
<td>Friendship, Katelyn</td>
<td>Trent University</td>
<td><a href="mailto:ktfriendship@yahoo.ca">ktfriendship@yahoo.ca</a></td>
</tr>
<tr>
<td>Fudge, Robert</td>
<td>Fisheries and Oceans Canada</td>
<td><a href="mailto:fudger@dfo-mpo.gc.ca">fudger@dfo-mpo.gc.ca</a></td>
</tr>
<tr>
<td>Furgal, Chris</td>
<td>Trent University</td>
<td><a href="mailto:chrisfurgal@trentu.ca">chrisfurgal@trentu.ca</a></td>
</tr>
<tr>
<td>Gagné, Jacques</td>
<td>DFO - Institut Maurice-Lamontagne</td>
<td><a href="mailto:gagneja@dfo-mpo.gc.ca">gagneja@dfo-mpo.gc.ca</a></td>
</tr>
<tr>
<td>Galbraith, Peter</td>
<td>DFO - Maurice Lamontagne Institute</td>
<td><a href="mailto:GalbraithP@dfo-mpo.gc.ca">GalbraithP@dfo-mpo.gc.ca</a></td>
</tr>
<tr>
<td>Gantner, Klaus</td>
<td>University of Guelph</td>
<td><a href="mailto:ngantner@uoguelph.ca">ngantner@uoguelph.ca</a></td>
</tr>
<tr>
<td>Gascon, Gabrielle</td>
<td>McGill University</td>
<td><a href="mailto:gabrielle.gascon@mail.mcgill.ca">gabrielle.gascon@mail.mcgill.ca</a></td>
</tr>
<tr>
<td>Gauthier, Gilles</td>
<td>Université Laval</td>
<td><a href="mailto:gilles.gauthier@bio.ulaval.ca">gilles.gauthier@bio.ulaval.ca</a></td>
</tr>
<tr>
<td>Gavrel, Jean-Claude</td>
<td>Networks of Centres of Excellence</td>
<td><a href="mailto:jean-claude.gavrel@nce.gc.ca">jean-claude.gavrel@nce.gc.ca</a></td>
</tr>
<tr>
<td>Gearheard, Shari</td>
<td>Ittaq Heritage and Research Centre</td>
<td><a href="mailto:shari.gearheard@nsidc.org">shari.gearheard@nsidc.org</a></td>
</tr>
<tr>
<td>Gérin-Lajoie, José</td>
<td>Université du Québec à Trois-Rivières</td>
<td><a href="mailto:jglajoie@globetrotter.net">jglajoie@globetrotter.net</a></td>
</tr>
<tr>
<td>Nickels, Scot</td>
<td>Inuit Tapiriit Kanatami</td>
<td><a href="mailto:nickels@itk.ca">nickels@itk.ca</a></td>
</tr>
<tr>
<td>Nicol, Heather</td>
<td>Trent University</td>
<td><a href="mailto:heathernicol@trentu.ca">heathernicol@trentu.ca</a></td>
</tr>
<tr>
<td>Ogden, Nick</td>
<td>Université de Montréal</td>
<td><a href="mailto:nicholas.ogden@umontreal.ca">nicholas.ogden@umontreal.ca</a></td>
</tr>
<tr>
<td>Okalik, Looee</td>
<td>CINÉ - McGill University</td>
<td><a href="mailto:okalik@itk.ca">okalik@itk.ca</a></td>
</tr>
<tr>
<td>Ohokannoak, Joe</td>
<td>Nunavut Tunngavik Incorporated</td>
<td><a href="mailto:joohokannoak@ntilands.com">joohokannoak@ntilands.com</a></td>
</tr>
<tr>
<td>Okalik, Looee</td>
<td>CINE - McGill University</td>
<td><a href="mailto:okalik@itk.ca">okalik@itk.ca</a></td>
</tr>
<tr>
<td>Ostertag, Sonja</td>
<td>University of Northern British Columbia</td>
<td><a href="mailto:ostertag@unbc.ca">ostertag@unbc.ca</a></td>
</tr>
<tr>
<td>Ouimet, Chantal</td>
<td>Parks Canada Agency</td>
<td><a href="mailto:chantal.ouimet@pc.gc.ca">chantal.ouimet@pc.gc.ca</a></td>
</tr>
<tr>
<td>Pacey, Angela</td>
<td>McGill University</td>
<td><a href="mailto:angela.pacey@mail.mcgill.ca">angela.pacey@mail.mcgill.ca</a></td>
</tr>
<tr>
<td>Palluq, Billy</td>
<td>Hamlet of Clyde River</td>
<td><a href="mailto:cedoclyde05@qiniq.com">cedoclyde05@qiniq.com</a></td>
</tr>
<tr>
<td>Papakyriakou, Tim</td>
<td>CEOS - University of Manitoba</td>
<td><a href="mailto:papakyri@cc.umanitoba.ca">papakyri@cc.umanitoba.ca</a></td>
</tr>
<tr>
<td>Paquin, Viviane</td>
<td>Royal Military College of Canada</td>
<td></td>
</tr>
<tr>
<td>Pardhan, Aliya</td>
<td>University of Guelph</td>
<td><a href="mailto:apardhan@uoguelph.ca">apardhan@uoguelph.ca</a></td>
</tr>
<tr>
<td>Parewrick, Kathleen</td>
<td>Memorial University of Newfoundland</td>
<td><a href="mailto:paerewyck@hotmail.com">paerewyck@hotmail.com</a></td>
</tr>
<tr>
<td>Paterson, Tom</td>
<td>Fednav Limited</td>
<td><a href="mailto:tpaterson@fednav.com">tpaterson@fednav.com</a></td>
</tr>
<tr>
<td>Pearce, Tristan</td>
<td>University of Guelph</td>
<td><a href="mailto:tpearce@uoguelph.ca">tpearce@uoguelph.ca</a></td>
</tr>
<tr>
<td>Pennesi, Karen</td>
<td>University of Western Ontario</td>
<td><a href="mailto:pennesi@uwo.ca">pennesi@uwo.ca</a></td>
</tr>
<tr>
<td>Piekarz, Darrell</td>
<td>Environment Canada</td>
<td><a href="mailto:darrell.piekarz@ec.gc.ca">darrell.piekarz@ec.gc.ca</a></td>
</tr>
<tr>
<td>Pienitz, Reinhard</td>
<td>Université Laval</td>
<td><a href="mailto:reinhard.pienitz@cen.ulaval.ca">reinhard.pienitz@cen.ulaval.ca</a></td>
</tr>
<tr>
<td>Poissant, Laurier</td>
<td>University of Ottawa - Environment Canada</td>
<td><a href="mailto:laurier.poissant@ec.gc.ca">laurier.poissant@ec.gc.ca</a></td>
</tr>
<tr>
<td>Pokharel, Bipin</td>
<td>York University</td>
<td><a href="mailto:bipin@yorku.ca">bipin@yorku.ca</a></td>
</tr>
<tr>
<td>Pollard, Wayne</td>
<td>McGill University</td>
<td><a href="mailto:Pollard@felix.geog.mcgill.ca">Pollard@felix.geog.mcgill.ca</a></td>
</tr>
<tr>
<td>Poulin, Michel</td>
<td>Canadian Museum of Nature</td>
<td><a href="mailto:mpoulin@mus-nature.ca">mpoulin@mus-nature.ca</a></td>
</tr>
<tr>
<td>Power, Michael</td>
<td>University of Waterloo</td>
<td><a href="mailto:m3power@sciborg.uwaterloo.ca">m3power@sciborg.uwaterloo.ca</a></td>
</tr>
<tr>
<td>Prinsenberg, Simon</td>
<td>DFO - Bedford Institute of Oceanography</td>
<td><a href="mailto:prinsenburgs@mar.dfo-mpo.gc.ca">prinsenburgs@mar.dfo-mpo.gc.ca</a></td>
</tr>
<tr>
<td>Prno, Jason</td>
<td>University of Guelph</td>
<td><a href="mailto:jprno@uoguelph.ca">jprno@uoguelph.ca</a></td>
</tr>
<tr>
<td>Proust, Françoise</td>
<td>Université Laval</td>
<td><a href="mailto:francoise.proust@crchul.ulaval.ca">francoise.proust@crchul.ulaval.ca</a></td>
</tr>
<tr>
<td>Reid, Donald</td>
<td>Wildlife Conservation Society Canada</td>
<td><a href="mailto:dreid@wcs.org">dreid@wcs.org</a></td>
</tr>
<tr>
<td>Reid, Melissa</td>
<td>Nunavut Youth Consulting</td>
<td><a href="mailto:koonoo_@hotmail.com">koonoo_@hotmail.com</a></td>
</tr>
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<td>Reimer, Deborah</td>
<td>Royal Military College</td>
<td><a href="mailto:deborah.reimer@rmc.ca">deborah.reimer@rmc.ca</a></td>
</tr>
<tr>
<td>Reimer, Ken</td>
<td>Royal Military College</td>
<td><a href="mailto:reimer-k@rmc.ca">reimer-k@rmc.ca</a></td>
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<tr>
<td>Richerol, Thomas</td>
<td>CEN - Université Laval</td>
<td><a href="mailto:thomas_richerol@yahoo.fr">thomas_richerol@yahoo.fr</a></td>
</tr>
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<td>Roach, Patrick</td>
<td>Indian and Northern Affairs Canada</td>
<td><a href="mailto:roachp@inac.gc.ca">roachp@inac.gc.ca</a></td>
</tr>
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<td>Rochon, André</td>
<td>ISMER - Université du Québec à Rimouski</td>
<td><a href="mailto:andre_rochon@uqar.qc.ca">andre_rochon@uqar.qc.ca</a></td>
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<td><a href="mailto:judy.rowell@pc.gc.ca">judy.rowell@pc.gc.ca</a></td>
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<td><a href="mailto:jason.samson@mail.mcgill.ca">jason.samson@mail.mcgill.ca</a></td>
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<td>McGill University</td>
<td><a href="mailto:helga.saudny-unterberger@mcgill.ca">helga.saudny-unterberger@mcgill.ca</a></td>
</tr>
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<td>Schmidt, Robert</td>
<td>University of Western Ontario</td>
<td><a href="mailto:rchristianschmidt@hotmail.com">rchristianschmidt@hotmail.com</a></td>
</tr>
<tr>
<td>Schuster, Roseanne</td>
<td>University of Northern British Columbia</td>
<td><a href="mailto:reschuster@gmail.com">reschuster@gmail.com</a></td>
</tr>
<tr>
<td>Seidlitz, Dennis</td>
<td>ConocoPhillips Canada</td>
<td><a href="mailto:dennis.seidlitz@conocophillips.com">dennis.seidlitz@conocophillips.com</a></td>
</tr>
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<td>Séchéhal, Édith</td>
<td>Université du Québec à Rimouski</td>
<td><a href="mailto:edith.senechal01@uqar.qc.ca">edith.senechal01@uqar.qc.ca</a></td>
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<td>Sharp, Martin</td>
<td>University of Alberta</td>
<td><a href="mailto:martin.sharp@ualberta.ca">martin.sharp@ualberta.ca</a></td>
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<td>Indian and Northern Affairs Canada</td>
<td><a href="mailto:ShearerR@ainc-inac.gc.ca">ShearerR@ainc-inac.gc.ca</a></td>
</tr>
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<td>Royal Military College of Canada</td>
<td><a href="mailto:tom.sheldon@rmc.ca">tom.sheldon@rmc.ca</a></td>
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<td>INRS - ETE</td>
<td><a href="mailto:annie_simard@ete.inrs.ca">annie_simard@ete.inrs.ca</a></td>
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<tr>
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<td>ISMER - Université du Québec à Rimouski</td>
<td><a href="mailto:yvan_simard@uqar.qc.ca">yvan_simard@uqar.qc.ca</a></td>
</tr>
<tr>
<td>Simon, Audrey</td>
<td>Université de Montréal</td>
<td><a href="mailto:audrey.simon@umontreal.ca">audrey.simon@umontreal.ca</a></td>
</tr>
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<td>Parks Canada</td>
<td><a href="mailto:angus.simpson@pc.gc.ca">angus.simpson@pc.gc.ca</a></td>
</tr>
<tr>
<td>Sirois, Martin</td>
<td>CEN - Université Laval</td>
<td><a href="mailto:martin.sirois.1@ulaval.ca">martin.sirois.1@ulaval.ca</a></td>
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