Theme 1. Climate change impacts in the Canadian High Arctic: a comparative study along the East-West gradient in physical and societal conditions

Theme leader:
Yves Gratton

Theme coordinator:
Annie Simard

Theme 1 Geographical area
Research activities

1.1 Warming coastal seas & shrinking sea ice (core information)
1.2 Coastal vulnerability in warming Arctic
1.3 Contaminant cycling in the coastal environment
1.4 Marine productivity and sustained exploitation of emerging fisheries
1.5 Changes in dietary pattern and impacts on chronic diseases emergence
1.6 The Opening of the NW Passage: resources, navigation, sovereignty and security
1.7 Canada’s Arctic waters in international law and diplomacy
Project 1.1 Warming Coastal Seas and Shrinking Sea Ice

Co-leaders: Dave Barber and Yves Gratton

Geographic spread

- Baffin Bay 2006 Moorings
- Beaufort Sea 2006 Moorings
- Community based met station monitoring

Project 1.1 Nodes:
- INRS-ETE
- University of Manitoba
- Fisheries and Oceans Canada
- Royal Military College of Canada
Fall of 2006 sampling stations with complete air, ice and water measurements (among other things)
Project 1.2 Coastal Vulnerability in a Warming Arctic

Co-leaders: **Don Forbes, Wayne Pollard, Trevor Bell**

**Project 1.2 Nodes:**
- McGill University
- Memorial University
- University of New Brunswick
- Natural Resources Canada

Geographic spread and status:
- Orange circles: Community study site (past years)
- Red circles: Community study site (2006)
- Yellow circles: Community study site (proposed)
- Yellow square: Other study site (2006)
Project 1.2: Coastal Vulnerability in a Warming Arctic

Four linked components:

• Biophysical science (sea level raise, snowmelt flooding, break-up processes, coastal erosion, effects on the habitats of benthic populations)
• Integrated Impacts Analysis ⇒ IRIS x 2
• Local Decision-Making ⇒ Adaptation
• Adaptive Capacity & Community Resilience
Project 1.3 Contaminant Cycling in the Coastal Environment

Co-leaders: Gary A. Stern and Robie W. Macdonald

Project 1.3 Nodes:
• Fisheries and Oceans Canada
• University of Manitoba
• McGill University
• NRCanada, Geological Survey

Sources and fate of Hg and other trace elements
Hg Flux to the Beaufort Sea via the Mackenzie River

- Hg correlated with water levels
- 2.2 ± 0.9 tons of $\text{Hg}_T$ discharged annually
- 66-87% in particulate form
- ~55% of Hg flux occurs in spring
- 7-22 kg of MeHg discharged annually

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<th>Water discharge (km²)</th>
<th>Flux of Hg species (kg)</th>
<th>Total Annual Flux (kg/yr)</th>
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Mercury Trends in Zooplankton Across the Canadian High Arctic

- Average THg levels in the Western Arctic higher than in the other areas.
- For instance, there is a spatial variability in THg levels in *Themisto sp.* with a significant relationships with longitude ($r^2=0.525$, $p<0.000$).
- 3 stations in the Western Arctic that are clearly exhibiting low salinity values in surface.
- Significant relationships between surface salinity values and longitude with higher salinity levels as we move eastward ($r^2=0.565$, $p<0.000$).
Project 1.4 Marine Productivity & Sustained Exploitation of Emerging Fisheries

Leader: Jean-Éric Tremblay

Project 1.4 Nodes:
- Laval University
- Fisheries and Oceans Canada
- UQAR/ISMER
- McGill University
- Canadian Museum of Nature

Geographic spread
“Hotspots” and subsurface maxima of chlorophyll fluorescence

Johannie Martin (PhD project), Jean-Éric Tremblay et al.

- Chlorophyll biomass is patchy and generally highest in the western Arctic
- Chlorophyll biomass is concentrated in subsurface layers of variable depth (20-60 m) and thickness (10-40 m)
P 11 and 14 are trying to understand the structure of these hot spots and why they are where they are.

**Green**: fluorescence

**Red**: salinity

**Blue**: temperature
Continuous monitoring of top predators from passive acoustics

Yvan Simard, Louis Fortier et al.
Project 1.5: Changes in Dietary Pattern and Impacts on Chronic Diseases Emergence

**Project Leader:** Éric Dewailly

**4 study regions**

**Project 1.5 Nodes:**
- Laval University
- McGill University
- University of Toronto
Project 1.5: Changes in Dietary Pattern and Impacts on Chronic Diseases Emergence

  - Laboratory work completed. Final statistical analyses also completed.
  - Communication to communities and participants projected for December 2006. Film.
  - Public health policy: 2007


Alaska: On going.
1.6 The Opening of the NW Passage: Resources, Navigation, Sovereignty and Security

Co-Leaders: John Hughes Clarkes and Steve Blasco

Project 1.6 Nodes:
- University of New Brunswick
- Geological Survey of Canada
- UQAR
- Dalhousie University
- Laval University
- Natural Resources Canada
ArcticNet 2006 Achievements:

• 24 box cores collected
• thousands of kilometers of multibeam and sub-bottom data collected throughout the NW Passage

Objectives

- Use box core samples to obtain the climate and sea ice record for the past 2000 years (using microfossils)

- Use multibeam and sub-bottom profiler data to:
  • Increase mapping and charting for navigation purposes in the NW Passage; critical contributions to both Eastern and Western Arctic IRIS’ees by addressing the concerns of shipping and resource clients
  • Study the seabed morphology and geohazards present in the Passage
  • To help select core sites that will contribute to the understanding of the Holocene climate record
Project 1.6 data example – Scott Inlet Seabed Oil Seep Investigation (NE Baffin Island)

- An oil slick was first observed in 1976 that was determined to be a natural seep originating from the seabed by chemical analysis of the water column.

- White “algal” coating observed on the seabed in the area of the seep; oily residue present with the algal material (maybe a unique habitat??)

- The seep was still visible on satellite image in October 2005 (29 years later)
- Project 1.6 has started to use multibeam (with backscatter intensity), sub-bottom profiler, and bottom samples to study the origin and nature of the oil seep and the possibility of a unique benthic habitat existing around the seep.
- Will determine if backscatter intensity technology can be used to image benthic communities on the seabed.
Project 1.7  Canada’s Arctic in International Law & Diplomacy

Leader: Michael Byers

Project 1.7 Nodes:
• University of British Columbia
ONGOING STUDIES

- Diplomacy, Canadian foreign policy, politics of international law
- Sovereignty, regulation of the NW Passage after climate change
- Researching the historical bases of Canada and other countries’ legal and political positions regarding the NW Passage
- Specific effects of climate change and ice forecast on shipping in the Northwest Passage
- Exploring the legal, political and diplomatic nuances of the current Canadian and U.S. policies on the NW Passage