Parks Canada Parcs Canada

2011

ANNUAL REPORT

OF

RESEARCH AND MONITORING

IN

TORNGAT MOUNTAINS

NATIONAL PARK

Many people contributed to this report.
We wish to acknowledge them for their commitment to the project,
and their timely submission of reports.

ACKNOWLEDGEMENTS

Information about Parks Canada research and monitoring activities in Torngat Mountains National Park was provided by Parks Canada staff Alain Boudreau, Dr. Darroch Whitaker, and Angus Simpson. Additional information on Parks Canada supported research was supplied by Carol Luttmer of Environmental Sciences Group, Royal Military College of Canada.

Reports on ArcticNet research were provided by: Dr. Trevor Bell, Dr. Sam Bentley, Laura Siegwart Collier, James Wall and Dr. Luise Hermanutz of Memorial University of Newfoundland and Labrador; Tanya Brown University of Victoria and Fisheries and Oceans Canada.

International Polar Year Research reports were provided by: Dr. Luise Hermanutz, Laura Siegwart-Collier of Memorial University of Newfoundland and Labrador; Dr. Donald McLennan of Parks Canada.

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Mandy Arnold provided the report on the kANGIDLUASUk student program. We would also like to extend a special thanks to the students and staff of the kANGIDLUASUk student program who provided valuable assistance to many of the research and monitoring projects described in this document. They are Program coordinator Mandy Arnold and Assistant coordinator Dorothy Angnatok.

This report was compiled by Bonnie Knott, and editorial review was provided by Darroch Whitaker, both from Parks Canada in the Western Newfoundland and Labrador Field Unit.

TABLE OF CONTENTS

INTRODUCTION

Research and monitoring are essential for managing protected heritage areas such as Canadian National Parks. Research activities are conducted to improve our basic understanding of cultural and ecological resources. Monitoring is conducted to document how these cultural-ecological systems change over time, especially in response to human activities and climate change. The information research and monitoring programs generate is vital for measuring the success of management actions and improving future activities, and also for allowing open and informative reporting on the state of the park.

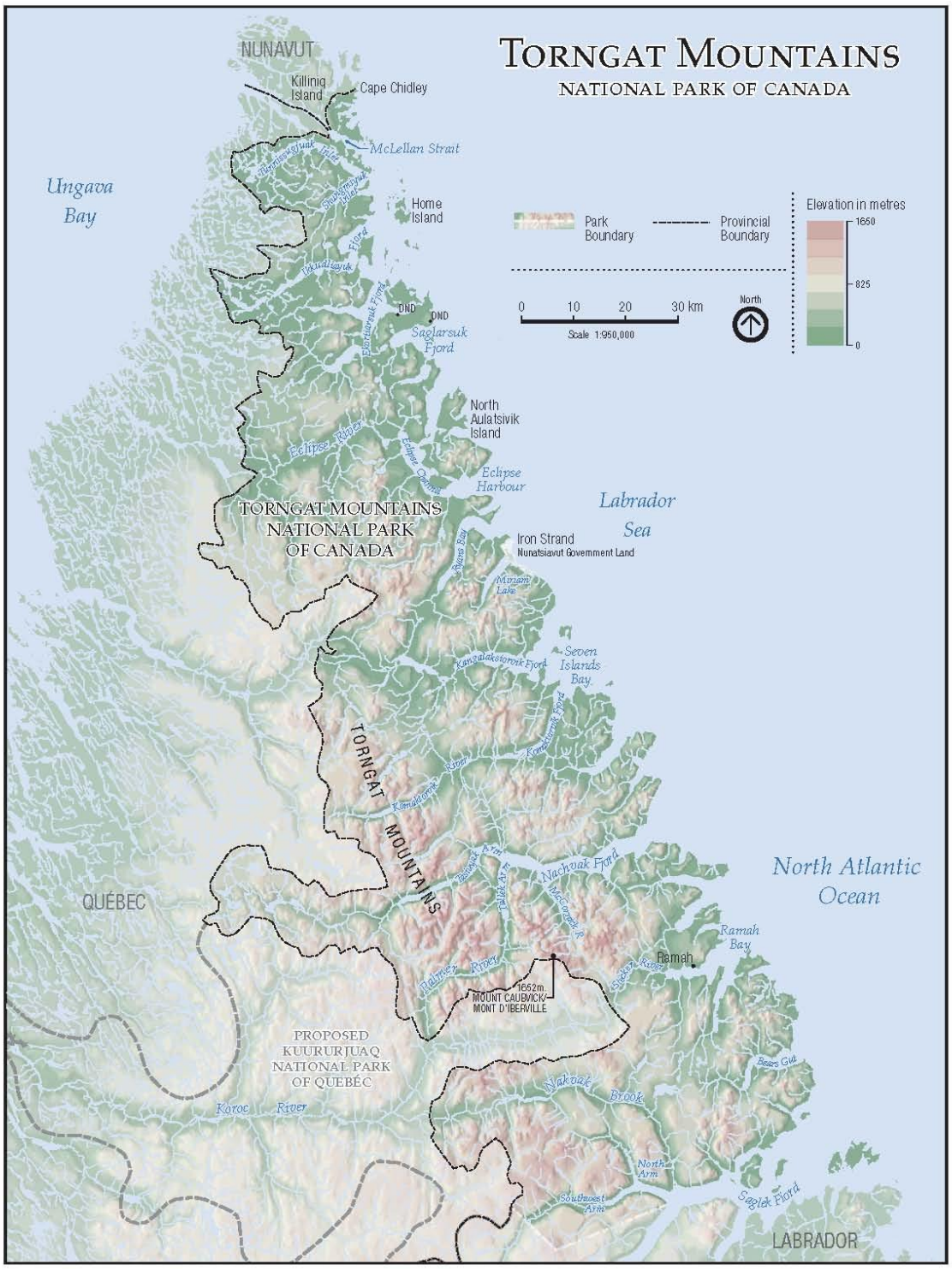
A major challenge to implementing an effective research and monitoring program is making the resulting information widely available and accessible to people outside the science program. Consequently, the purpose of this document is to present a summary of research projects and monitoring programs conducted in the park in 2011 to the Torngat Mountains National Park Cooperative Management Board, to other cooperative management organizations in Nunatsiavut and Nunavik, to government agencies, and to the general public and Parks Canada staff. All research and monitoring activities undertaken in 2011 are included in this document, and key findings and accomplishments are summarized.

This document is divided into two main sections: **Research** and **Monitoring.** Projects in the research section are divided into categories based on the principal affiliation of the researchers as well as their primary source of funding. These categories are:

- Parks Canada Research
- ArcticNet Research
- International Polar Year Research

Projects in the monitoring section represent ongoing opportunistic programs such as the bird checklist and the wildlife cards, as well as focussed monitoring designed to support a long-term Ecological Monitoring Program. Many of the research projects (such as glacier and tundra vegetation research) highlighted in this report will provide valuable baseline information for developing future long-term monitoring programs. The opportunistic monitoring provides ongoing information important to park management and visitor experiences. These programs also provide an excellent opportunity for visitors to contribute to the collection of ecological information.

We hope that this report serves as an informative synopsis of the current research and monitoring program in Torngat Mountains National Park of Canada. We welcome any feedback, and encourage interested readers to contact us for further details on specific projects or to become involved in the research and monitoring program.



Torngat Mountains National Park in Northern Nunatsiavut, Labrador

Torngat Mountains National Park of Canada is a new park that is still in the early stages of program development. It was established in 2005 through the signing of the Labrador Inuit Land Claims Agreement and is managed in partnership with Inuit through Park Impacts and Benefits Agreements (PIBA) signed with both Nunatsiavut and Nunavik Inuit. These agreements provide a blueprint for park management, and in particular call for the development of a research and monitoring program. Direction for establishing and supporting this program in Torngat Mountains National Park comes from a number of sources.

First and foremost, consultation and collaboration are central to developing an effective research and monitoring program for the park. Both the Labrador Inuit PIBA and Nunvik Inuit PIBA require consultation with a variety of research and land management organizations during the development of a research strategy. These institutions include:

- Torngat Mountains National Park Cooperative Management Board;
- Nunasiavut Government;
- Makivik Corporation and any Makivik Designated Organization;
- Torngat Wildlife and Plant Co-Management Board;
- Torngat Fisheries Co-Management Board;
- Torngasok Cultural Institute;
- Government of Newfoundland and Labrador;
- Other institutions the Field Unit Superintendent deems appropriate.

A research strategy will set out the methods that will be used to gather social, cultural and ecological information about the park and will include five components: a traditional knowledge component; an ecosystem component; an ecological monitoring component; a threat specific component; and a communications component. The research strategy will identify research priorities for the park, guide future research and monitoring, inform the State of the Park Reporting and Management Planning processes, and ensure consistency with regional research priorities in Nunatsiavut and Nunavik.

At the national level, the Canada National Parks Act identifies the “maintenance or restoration of ecological integrity through the protection of natural resources and natural processes, as the first priority when considering all aspects of the management of parks.” Accordingly, research is needed to provide a detailed understanding of the natural resources and processes of the park. National parks provide a unique opportunity for researchers to study in relatively natural landscapes free from intensive land use. As such, parks are valuable “laboratories” for learning and research and are ideal for supporting effective education and outreach programs.

Park staff must continuously monitor the state of park ecosystems in order to develop effective management programs and demonstrate that the agency is meeting the expectations of the Canada National Parks Act. Consequently Parks Canada Agency has developed comprehensive guidelines for Ecological Integrity (EI) monitoring in national parks and heritage areas. These EI monitoring programs are used to assess the condition of park ecosystems and the effectiveness of management actions, and are the primary source of information used to evaluate the state of the park’s ecological and cultural integrity. Research underway in Torngat Mountains National Park is integral to the ongoing development of an effective, informative, and scientifically credible monitoring program.

Future initiatives will include collaboration on research and monitoring programs with the newly created *parc national de la Kuururjuaq* in Nunavik, Quebec. This park, which encompasses the entire Koroc River watershed,

shares a common boundary with Torngat Mountains National Park and strengthens and protects the cultural and ecological connections between Nunavik and Nunatsiavut.

STRUCTURE OF THE REPORT

This report covers all research and monitoring projects conducted in 2011. Each project summary follows a common format that provides a brief overview of the project. Contact information for the principle investigator is included for readers seeking more information on particular projects.

Summaries for each project include:

Rationale
A short paragraph describing why the project is being conducted and why it is important.

Objectives
A description of the main objectives of the project

Methods and Information Collected

A brief description of the study site or area, the methods used, and the information collected.

Years of Data

Lists the years for which data are available.

Partners

A list of organizations that were involved in the project.

Funding
A list of organizations that provided funding for the project

Results

A summary of results available at the time this document was prepared.

Contacts

If you require more information about the project we have included the contact information for the principal researchers

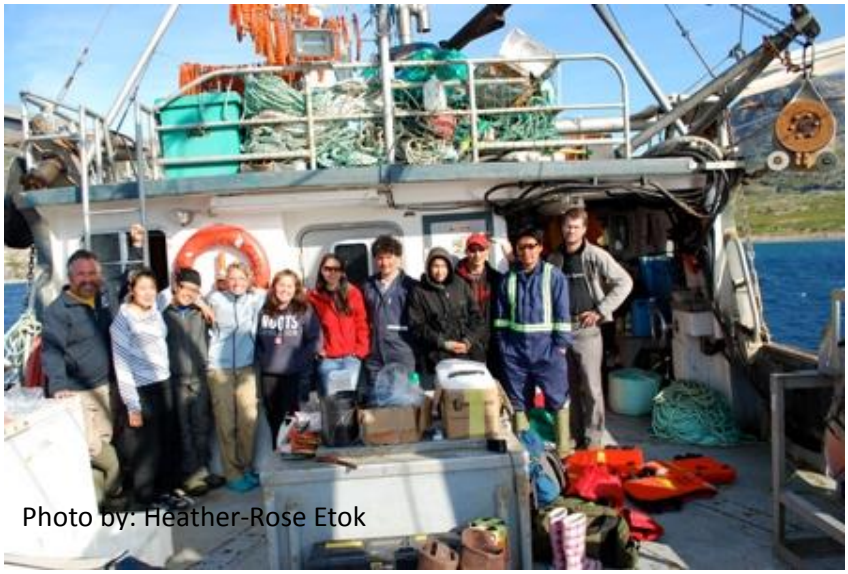


Photo by: Heather-Rose Etok

EDUCATION AND OUTREACH

Photo by Mandy Arnold

Photo by Ocean Wyatt

Photo by Ocean Wyatt

Photo by Heather-Rose Etok

RATIONALE

With the establishment of the Torngat Mountains Base Camp and Research Station, Parks Canada, the Environmental Sciences Group, and the Nunatsiavut Government piloted an outreach initiative to provide opportunities for Inuit youth to work alongside visiting scientists, engage with local Inuit leaders, elders, and international visitors, and experience the Torngat Mountains as a shared Inuit homeland. Since its inception in 2007, the program has successfully expanded its capacity and incorporated as a non-profit entity dedicated to providing positive, meaningful, and transformative experiences for Inuit youth that will inspire new directions, expand minds, build capacity, and strengthen connections to Inuit knowledge, skills, and values.

kANGIDLUASUk STUDENT PROGRAM

OBJECTIVES

Provide an opportunity for Nunatsiavut and Nunavik Inuit youth to:

- Acquire hands-on work experience, build scientific capacity, and gain exposure to the relationships and connections between Inuit ways of knowing, science, and research.
- Explore and experience traditional Inuit skills, values, knowledge and customs while living, learning and working in the shared Inuit homelands of the Torngat Mountains.
- Gain an awareness of and experiences in National Park management, heritage resource conservation, and visitor experiences.
- Develop a variety of leadership and employability skills, as well as the confidence and resilience to use these skills

2011 kANGIDLUASUk participants and staff.

METHODS

The kANGIDLUASUk Student Program provides experiential work, learning, and leadership opportunities integrating Inuit culture, Arctic science, and outdoor adventure. The program is delivered as a multi-faceted 4-week summer internship on the land and at sea for 10 Inuit youth from Nunavik and Nunatsiavut, age 15-25.

YEARS OF DATA

2007, 2008, 2009, 2010, 2011

RESULTS/ACCOMPLISHMENTS

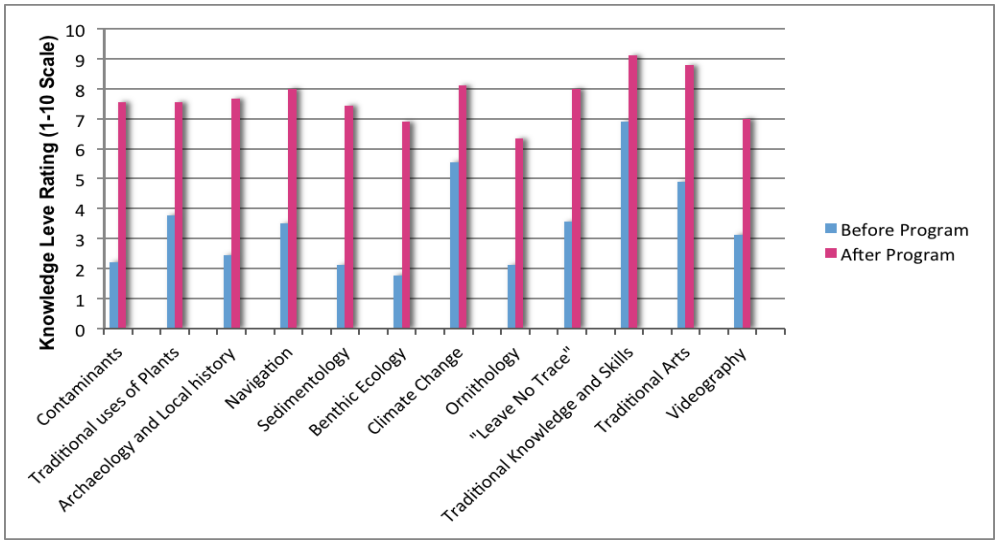


***Figure 1**: Mean self-rated student knowledge levels on various program components before and after participating in the 2011 Summer Field Program.*

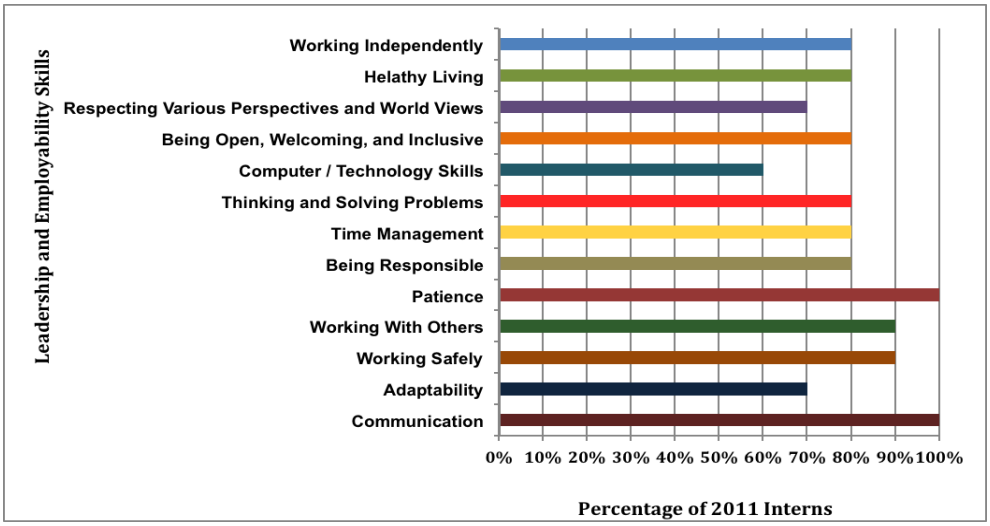


***Figure 2**: The percentage of 2011 participants who identified having developed and/or improved a variety of leadership and employability skills throughout the Summer Field Program.*

"We got to work with different researchers who taught us about things such as marine biology, contaminants, and plants which is fortunately helping me understand my science course this year."

- 2011 Participant

"I think this experience really opened my eyes by showing me what an important, smart, knowledgeable, healthy, and understanding woman I could be."

- 2011 Participant

"I did things that I never would have been confident enough to try before I got here."

- 2011 Participant

FUNDING

- Fednav Ltd.
- ArcticNet
- AANDC – Northern Contaminants Program
- TMNP Cooperative Management Board
- NSERC - PromoScience Program
- Parks Canada
- International Grenfell Association
- Nunatsiavut Government
- Government of Newfoundland and Labrador
- Nasivvik Centre for Inuit Health and Changing Environments
- Service Canada – Canada Summer Jobs
- Husky Energy
- Torngat Services Inc.

CONTACT

Mandy Arnold
Coordinator
kANGIDLUASUk Student Program
P.O. Box 248
17 Sandbanks Road
Nain, NL A0P 1L0
Phone: (709) 922-1045
E-mail: students@kangidluasuk.com

RESEARCH

Research is the scientific search for facts to increase our understanding of the park's cultural or ecological systems. A broad range of research programs are being carried out in Torngat Mountains National Park. The resulting knowledge will contribute significantly to the development of effective monitoring, education, and management strategies.

RATIONALE

In 2008, Parks Canada initiated a long term Visitor Research Program to understand who is visiting Torngat Mountains National Park and what kind of experiences they are having. The program affords an opportunity to better understand visitors and visitor trends. It also provides information the park can use to facilitate future experiences that are relevant and unique.

Parks Canada Research

2011 VISITOR RESEARCH PROGRAM

Objectives

2011 Visitor Survey and Cruise Ship Visitor Survey

The objective of the visitor surveys is to gather feedback from visitors about their visit while also gaining a deeper understanding of the types of experiences they are having in TMNP in hopes of better catering to their needs in the future, and ultimately attracting more tourists to Nunatsiavut.

Methods and Information Collected

The original surveys were developed by TMNP staff in collaboration with social scientists from Parks Canada's Atlantic Service Center in 2008. Slight modifications were made to the surveys each year. Email addresses were collected by TMNP staff from all visitors, park researchers and cruise ship visitors in 2011 and email invitations to complete the respective online surveys were sent out to each group in the fall.

Results

2011 Visitor Survey

Parks Canada performance benchmarks for visitor satisfaction, enjoyment and connection to place:

- 76.9% of visitors were "very satisfied" with their visit while an additional 15.7% were "satisfied". These results surpass both of Parks Canada's targets for visitor satisfaction.
- 87% of visitors enjoyed their visit "a lot" while 6.5% gave a 4 out of 5 rating for enjoyment. These results surpass both of Parks Canada's targets for visitor enjoyment.
- 85% of visitors agreed with the statement "Torngat Mountains National Park is meaningful to me", which meets the performance expectation set by Parks Canada.

Other survey results:

- Canadians accounted for the bulk of visitors in 2011 (87% of the total) with the provinces of Newfoundland and Labrador (38%) and Ontario (26%) generating the lion's share.
- 76% of respondents were visiting the park for the first time in 2011 while the remaining 24% were repeat visitors. Most repeat visitors were in the park for work-related reasons. Visitors spent an average of 8 days in the park at an average cost of about $5,000 per person.
- 50% of survey respondents arrived by Twin Otter in 2011 (10% of them via Québec), 28% were aboard a cruise ship for the Students on Ice expedition and 18% were on a yacht or sailboat.

- 52% of respondents spent at least one night at Base Camp. The remaining 48% had not, although several of them visited the facility and spent time there but slept on the cruise ship, yacht or sailboat that they were travelling on. Visitors were generally quite satisfied with the various services that are offered at Base Camp, although many suggestions for improving Base Camp were offered.
- 72% of visitors reported seeing or encountering polar bears while 63% saw black bears during their visit. 87% of visitors reported being accompanied by Inuit Bear Guards while travelling outside of base camp, which is surrounded by an electric fence that is alarmed during the evening. The individuals who were travelling without the protection of a bear guard were either travelling by water or were visiting the park by float plane.
- Word of mouth is the most common way that visitors found out about Torngat Mountains National Park (49% of visitors found out about the park in this manner). Close to 40% of visitors discovered the park by speaking with Parks Canada staff or visiting its websites. Meanwhile, about 1 in 5 visitors learned about the park from tour operators or travel guides, or thanks to the Newfoundland and Labrador Tourism TV ad featuring the park.
- The top three information sources used by visitors to plan their trip to the park were the base camp information package sent out by Parks Canada & LIDC, visitors' previous experience traveling in remote or northern locations and thirdly, communications with staff from TMNP.
- As we've heard from visitors in previous years, the most common trip highlights include wildlife sightings – especially polar bear sightings – as well as interacting with Inuit elders, youth and staff at base camp over the course of their stay. Beautiful scenery and memorable visits to places such as Hebron and Rose Island were also mentioned on several occasions.
- Most visitors said that (1) the cost of getting to the park, (2) the park's location/remoteness/inaccessibility and thirdly, inclement weather are the main challenges associated with visiting this spectacular park.
- 6 out of 10 visitors expect to return to the Torngats at some point in the future.
- Most visitors feel that the safety information they reviewed before their visit was adequate.

2011 Cruise Ship Visitor Survey

- Results from the 2011 Cruise Ship Visitor Survey were not available at the time of writing.

Years of data

The Visitor Survey was administered for the fourth consecutive year while the Cruise Ship Visitor Survey was administered for the third time in 2011.

Funding

This project was entirely funded by Parks Canada.

CONTACT

Alain Boudreau, Research Officer
Atlantic Service Center, Parks Canada
Phone: (902) 426-2746
Email: alain.boudreau@pc.gc.ca

Angus Simpson, Resource Conservation Supervisor
Torngat Mountains National Park, Parks Canada
Phone: 709-922-1576
Email: angus.simpson@pc.gc.ca

RATIONALE

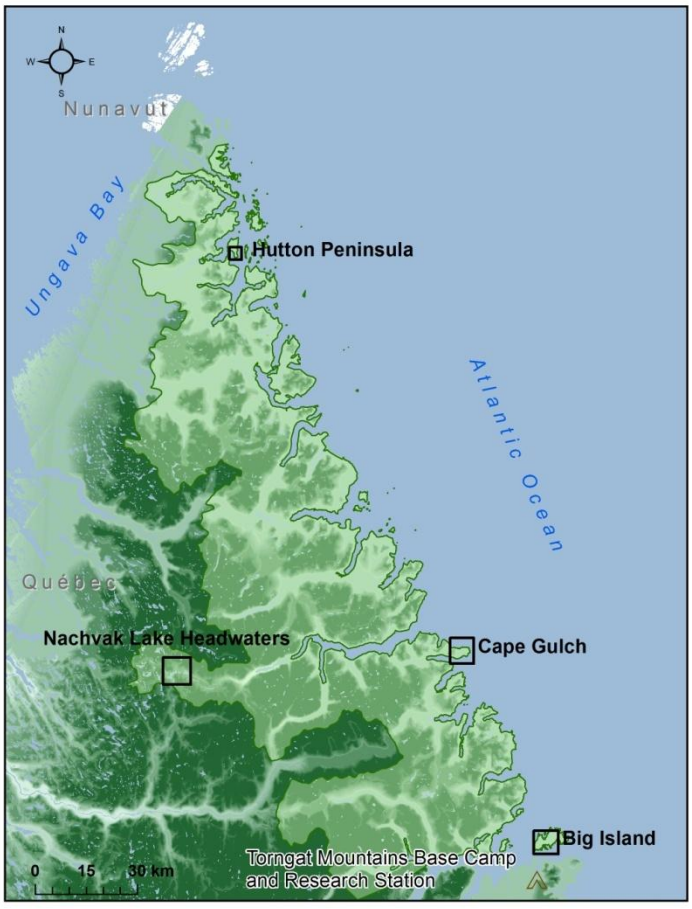
In 2009, Parks Canada initiated a project to assess and remediate contaminated sites in the Park. In 2009 initial assessments were completed. In 2010, assessments and remediation at some of the sites were completed and waste fuel was consolidated and secured at temporary caches. In 2011 the outstanding remediation at Cape Gulch, Nacvhak Lake Headwaters, Big Island and Hutton Peninsula were completed and the waste fuel was removed from the Park.

Parks Canada Research

REMEDIATION OF CONTAMINATED SITES IN TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

- At Hutton Peninsula, remove the battery debris at the site of the World War II-era weather station. Determine the extent of soils contaminated with metals from the batteries (e.g. lead, cadmium) and excavate, if necessary.
- At the Nachvak Lake Headwaters (where an old fuel bladder was found) and Cape Gulch (a historic fuel cache) confirm the extent of fuel contaminated soil and excavate, if necessary.
- On Big Island, determine the extent and excavate the lead-contaminated soil.
- Remove all drums containing waste fuel to prevent the release of fuel into the environment.



METHODS

- Field work was conducted using the Torngat Mountains Base Camp and Research Station as a base.
- Soil was analyzed in the field using a portable X-ray fluorescence meter (XRF) for metals and test kits for fuels. Samples were also collected and sent to southern laboratories for analyses.
- Contaminated soil was excavated by hand.
- Battery debris, contaminated soil and waste fuel were collected by the long-liner, MV *What's Happening,* transferred to the Adventure Canada ship, the MV *Clipper Adventurer,* and was taken to St. John's, N.L., where the articles were disposed and/or recycled at appropriate facilities.

YEARS OF DATA

2009, 2010, 2011

PARTNERS/FUNDING

- Federal Contaminated Sites Action Plan
- Parks Canada
- Environmental Sciences Group
- kANGIDLUASUk Student Program

Assessing lead contamination around old foundations on Big Island.

Soil sampling at Cape Gulch.

RESULTS/ACCOMPLISHMENTS

- At Hutton Peninsula, all of the deteriorating batteries were removed from the site. The dry cell batteries and approximately 1.3 m^3 of soil contaminated with metals from the batteries were excavated and disposed in St. John's NL. There were 32 nickel-cadmium batteries which were sent to Parks Canada archives in Halifax, NS.
- Soil sampling at Nachvak Lake Headwaters showed that that the fuel contamination associated with the former fuel bladder has degraded naturally. There is no fuel remaining, and none of the fuel had migrated to the nearby lake.

Soil sampling at Nachvak Headwaters.

- Soil sampling at the old fuel cache at Cape Gulch confirmed that the contaminated area is very small (<3 m^2) and that fuel is not migrating towards the lake. The fuel is expected to degrade naturally.
- On Big Island, exposed insulation debris and associated soil were removed from the site and disposed in St. John's Newfoundland. Soil sampling confirmed there is no lead contamination remaining.
- All of the waste fuel (16 drums) was removed from the Park.

Removing batteries and soil from Hutton Peninsula.

CONTACT

Angus Simpson
Resource Conservation Supervisor
Torngat Mountains National Park
Box 471, Nain, NL. A0P 1L0
Phone: 709 922 1290
Fax: 709 922 1294
Email: angus.simpson@pc.gc.ca

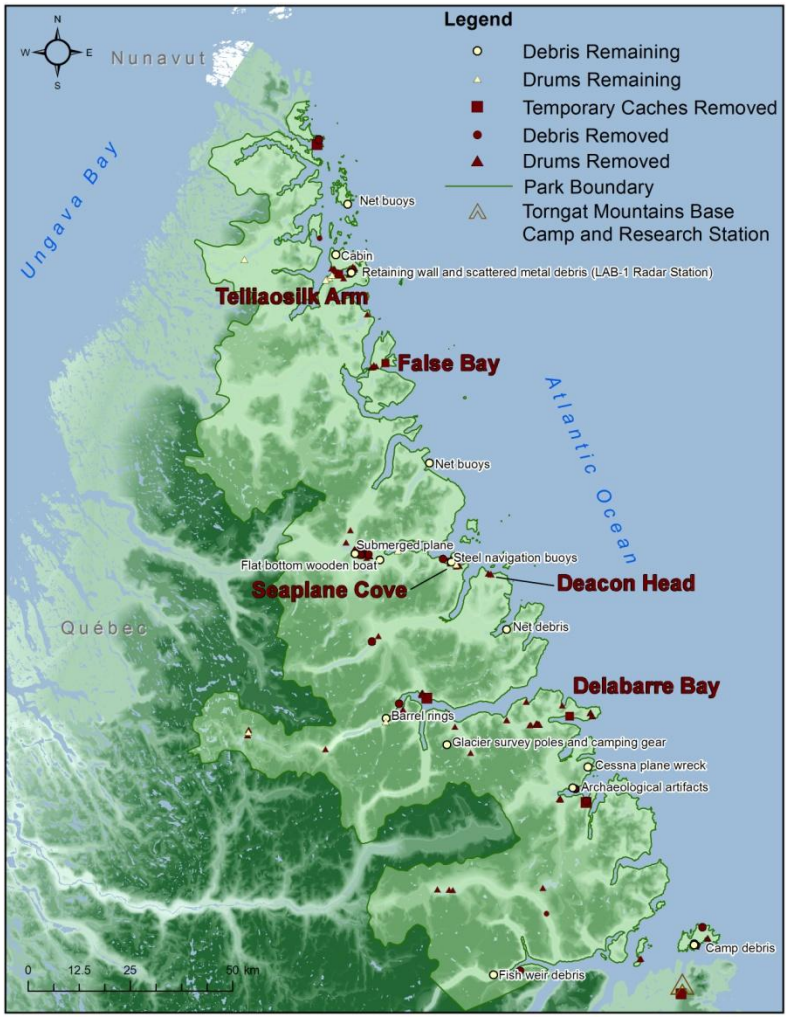
Carol Luttmer
Project Leader
Environmental Sciences Group
Royal Military College of Canada
P.O. Box 17000 Stn Forces
Kingston, ON K7K 7B4
Tel. 613-541-6000 ext. 3633
Fax: 613-541-6593
Email. carol.luttmer@rmc.ca

RATIONALE

When the Park was established, one of the priorities of the TMNP Co-operative Management Board was to remove debris and garbage found in the Park. During the summer of 2010, as part of the contaminated sites assessment project, old fuel drums, other debris and garbage was collected and consolidated at temporary cache sites along the coast. In September 2010, through a partnership with Cruise North Expeditions, an environmental stewardship expedition was organized with numerous partners involved to remove the majority of these caches. In total 14 tons of garbage was removed that fall. In 2011, a new partnership with Joey Angnatok of Putojik Fisheries Ltd. and Adventure Canada allowed us to remove the remaining caches (approximately 7 tons). The cleanup project is now complete.

Parks Canada Research

COMPLETING THE CLEAN UP TORNGAT MOUNTAINS NATIONAL PARK



OBJECTIVES

- Remove remaining drums and debris from the Park.

METHODS

- The long liner, *MV What's Happening,* collected all of the remaining drums, debris and waste fuel from the temporary caches at Telliaosilk Arm, False Bay, Seaplane Cove, Deacon Head and Delabarre Bay.

- The drums and debris were transferred to the Adventure Canada ship, the MV *Clipper Adventurer* and were transported to St. John's, N.L.

- All of the drums and debris were disposed or recycled at appropriate facilities in St. John's N.L.

Crew of the MV What's Happening.

PARTNERS

- Parks Canada
- Environmental Sciences Group
- *Putjolik Fisheries Ltd. -MV What's Happening*
- Adventure Canada

YEARS

- 2010
- 2011

Loading old fuel drums onto the MV Clipper Adventurer

RESULTS/ ACCOMPLISHMENTS

- Over the last two summers, a large amount of debris has been removed from the Park including over 275 drums, 12 m^3 of metal debris, various plastic camp debris such as tarps and jerry cans, 21 propane canisters, 16 drums of waste fuel, an aluminum tower, a fuel bladder, several lead-acid (car) batteries, and deteriorating World War II-era batteries (nickel cadmium and dry-cell). In total Approximately 21 tons (42,000 lbs) of material was cleaned up and removed from the park.
- Other artifacts that were found include a wooden flat bottom boat at Upper Kangalaksiorvik Lake and RCAF navigational buoys at Seaplane Cove. These were left *in situ.*
- Debris that was not removed includes a cabin at Iselin Harbour, a submerged plane in Upper Kangalaksiorvik Lake, a plane wreck at Ramah Bay/Reddick Bight, and some fish weir debris and net buoys- which are not sources of contamination.

Unloading drums in St.John's, NL.

"RCAF" buoys at Seaplane Cove.

Wooden flat-bottom boat at Upper Kangalaksiorvik Lake.

CONTACT

Angus Simpson
Resource Conservation Supervisor
Torngat Mountains National Park
Box 471, Nain, NL. A0P 1L0
Phone: 709 922 1290
Fax: 709 922 1294
Email: angus.simpson@pc.gc.ca

Carol Luttmer
Project Leader
Environmental Sciences Group
Royal Military College of Canada
P.O. Box 17000 Stn Forces
Kingston, ON K7K 7B4
Tel. 613-541-6000 ext. 3633
Fax: 613-541-6593
Email. carol.luttmer@rmc.ca

RATIONALE

Torngat Mountains National Park (TMNP) is home to more than 100 glaciers at the southern limit of glacierization in the eastern Canadian Arctic. Given the regional climate and elevation of the Torngat Mountains, no glaciers should be present. The overall goal of the Torngat Glacier Project is to document recent and historical changes in ice extent and understand these glacier dynamics in the context of geography, topography and climate. The project utilizes field and remotely sensed observations to map glacier margins, ice thickness and abandoned moraines, while geographic and topographic data are derived from digital elevation models and climate data from local climate stations and regional models. A geographic information database of all ice bodies and monitoring stations at select glaciers have been established for ongoing surveillance.

ArcticNet Research

RECENT GLACIER CHANGE IN TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

- To identify all glaciers in TMNP and precisely survey the margins of a selection of them.
- To determine the area of each glacier and its position and setting on the landscape.
- To document how the area of each glacier has changed over varying local climate conditions: 2005-2007, the past 50-60 years, and during the Little Ice Age (LIA; regionally 1800-1900AD).
- To model the sensitivity of glacier melt to climate and project future change based on scenarios.

METHODS AND INFORMATION COLLECTED

Glacier change detection has involved the measurement of recent (2008-2009, 2011) ice surface and frontal change on some of the largest glaciers using a differential global positioning system, comparison of ice margins in 2005 aerial photographs and 2007 SPOT5 satellite imagery and multi-decadal changes in glacier extent using aerial photographs from the 1940s to 1970s. LIA glacier extent was mapped on aerial photographs using the occurrence of prominent ice-cored moraines that lie immediately beyond current and former glaciers. Ice thickness was measured using 100 kHz ground penetrating radar mounted on a sled. Ice surface temperatures were recorded using HOBO sensors on anchored tripods.

Oblique view of the Little Ice Age moraine in front of Hidden glacier (on left). The prominent moraine contains an ice core. (Photo: Darroch Whitaker)

YEARS OF DATA

- Glacier surface elevation and lower margin position for Hidden and Abraham (2008-2009, 2011), Minaret (2008-2009), and Superguksoak and unnamed (2009) glaciers
- Areal extent of TMNP glaciers for 2007, 2005, 1960-64 and 1949-50
- Digitized outlines of over 800 abandoned moraines in front of current and former glaciers.
- Ice thickness profiles for Abraham, Hidden and Superguksoak glaciers (2008-2009, 2011)

- Lichen size measurements at two growth stations (2009, 2011) spanning roughly 30 years
- Topographic attributes of TMNP glacier settings (2011)
- Daily air temperature along elevation transects on Hidden and Minaret glaciers (2009-2011)

Rhizocarbon geographicum lichens from a lichen growth station established in Cirque Valley by Bill McCoy in 1978. The lichens were re-photographed to determine annual growth rates. Note 1cm square scale.

PARTNERS

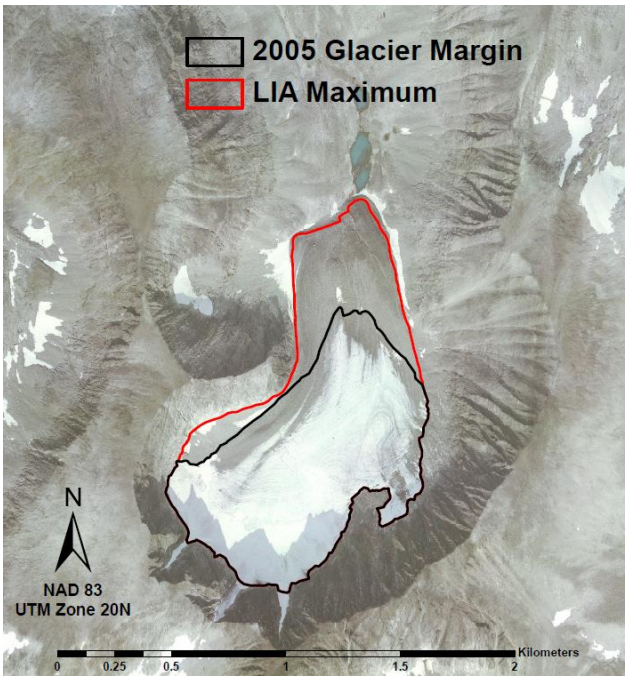
- Memorial University
- University of Alberta
- Parks Canada

FUNDING

- ArcticNet
- Memorial University
- Natural Science and Engineering Research Council
- Northern Science Training Program
- Parks Canada

RESULTS/ACCOMPLISHMENTS

- A comprehensive inventory of Torngat glaciers has been challenged by the discrimination of glacier ice from perennial snow and ice patches on relatively small ice bodies that are heavily debris covered in high relief terrain. As a consequence, preliminary mapping attempts underestimated the total number of glaciers and the total ice coverage.
- A re-assessment in 2011 identified 124 ice bodies on 2005 photography, the smallest of which are likely thin and inactive and not strictly glaciers. Ice thickness measurements on two modestly sized glaciers suggest that they are also thin (30-50 m thick). The total ice area for TMNP was calculated to be 22.5 km^2. The corresponding ice bodies in 2007 had a total area of 21.8 km^2, representing a 3% loss.
- Forty percent of mapped ice bodies are smaller than 0.1 km^2 and 77% smaller than 0.4 km^2. To date only a sample of TMNP ice bodies has been mapped on 1950/60s photography and comparison of ice extent with recent mapping reveals a reduction of 6.7 km^2 or 24%.
- Since the LIA there has been a 47% decrease in total glacier area in TMNP. Individual glacier decline ranged between 11 and 99%, with almost two-thirds of glaciers showing greater than 40% loss in ice surface. These results suggest that TMNP was much more heavily glacierized during the LIA and glaciers were clearly sensitive to cooler conditions during the LIA.



Comparison of ice margins in 2005 and the Little Ice Age (LIA) more than a century earlier on a TMNP glacier. The area between the two margins is made up of debris-covered ice.

CONTACT
Dr. Trevor Bell
Department of Geography
Memorial University
Phone: (709) 864-2525
Email: tbell@mun.ca

RATIONALE

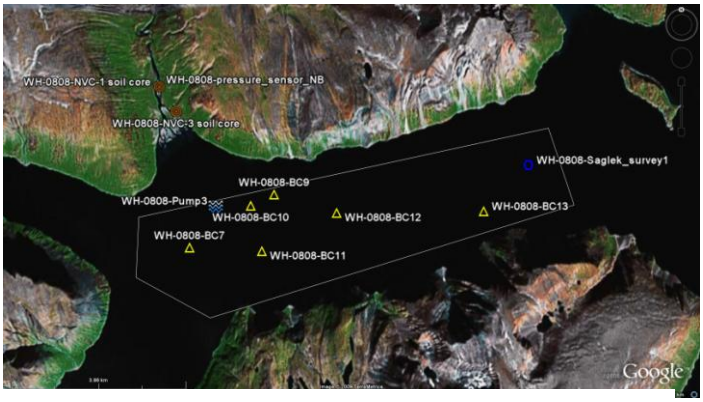
Fresh water and sediments from rivers play important roles in nutrient and other material transport to the coastal ocean, thus influencing both terrestrial and marine ecosystems. The basic purpose of this study is to gain a better understanding of patterns and variability of sediment and fresh water delivery from land to sea in the fjords of Nunatsiavut and Torngat Mountains National Park over time scales extending from seasons to approximately the past several millennia.

ArcticNet Research

MARINE RECORDS OF RIVERINE WATER AND SEDIMENT DISCHARGE, TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

Specific objectives for 2011 were to evaluate decadal to millennial scale patterns in sediment delivery by rivers to park fjords, using data from sediment cores and marine geological surveys conducted from 2007 to 2011.



Satellite image of Saglek Fjord, showing sample and survey locations for Summer 2008-9 field work.

METHODS AND INFORMATION COLLECTED

Sample sites were located in Saglek Fiord and Nachvak Brook (unglaciated river, draining into Saglek Fjord), and in Nachvak Fiord and McCornick River (glaciated river, draining into Nachvak Fjord). Sample types include:

- Sonar surveys of fjords close to rivers, mapping sediment thickness and extent.
- Sediment cores collected from CCGS Amundsen and M/V What's Happening
- Soil cores from ancient marine terraces near the river mouths
- Cores were studied for sediment properties, and sediment age, to change over time of sediment delivery from river to fjord

YEARS OF DATA

2007-2010

PARTNERS

- Nunatsiavut Government, Parks Canada, Environmental Sciences Group of Royal Military College, Kingston, Memorial University of Newfoundland

FUNDING

ArcticNet, Parks Canada, Environmental Sciences Group, Memorial University of Newfoundland, Louisiana State University Foundation, Endowment to the Harrison Chair in Sedimentary Geology

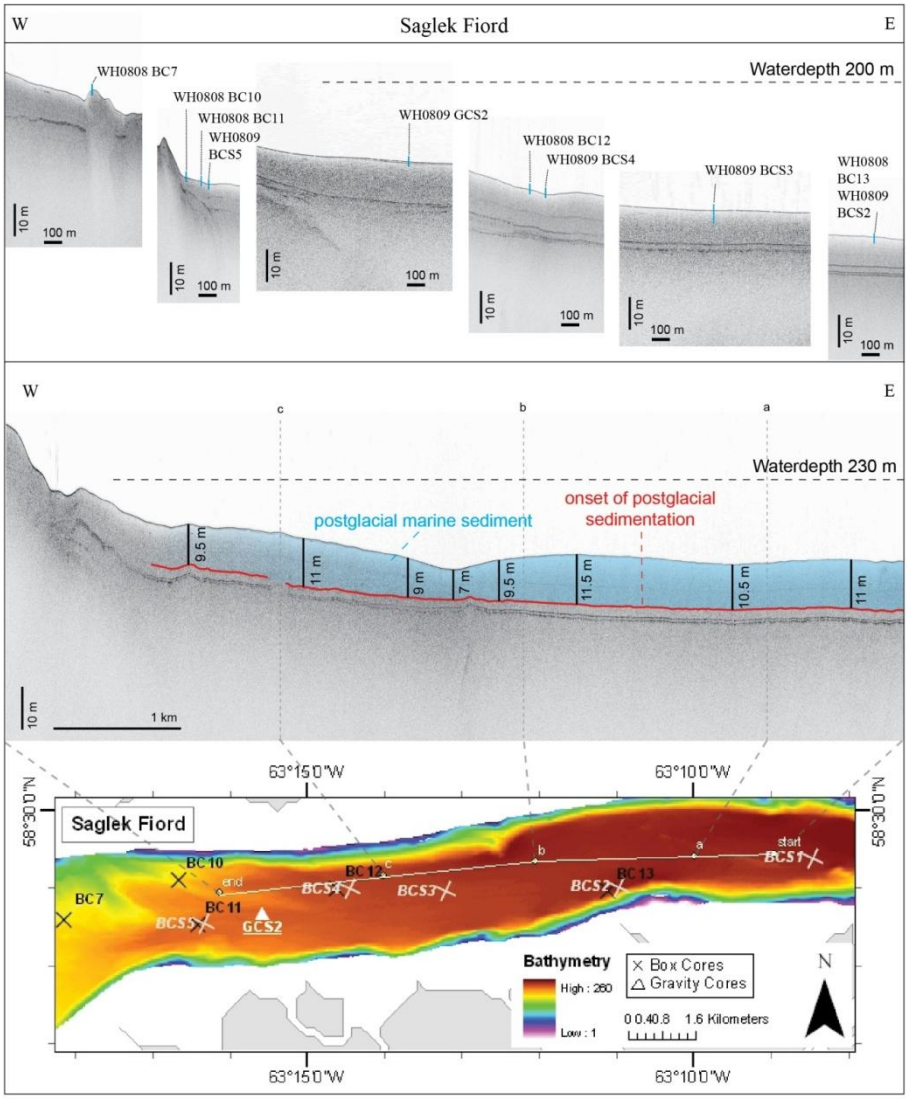


Figure: sonar image of sediment layers (top and middle) and bathymetry(bottom) in Saglek Fjord.

RESULTS/ ACCOMPLISHMENTS

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Measurements show that Nachvak and Saglek fjords are efficient traps for sediments delivered by surrounding river catchments. Core data suggest that sediment delivery is via suspended river plumes submarine sediment flows and landslides.

Comparison of the most recent sediment accumulation measured by two separate methods, suggests that sediment supply from rivers to the marine basins has declined slightly over the past ~130y.

Over longer timescales, core analyses document long-term variations in sediment discharge from rivers that is linked to climate variations over the past ~5000y, with more water and sediment entering the coastal ocean from rivers during warmer periods, and the reverse patterns in colder periods.

CONTACT

Dr. Sam Bentley
Harrison Chair in Sedimentary Geology
Department of Geology and Geophysics
Louisiana State University
Baton Rouge, Louisiana, 70803 USA
225-578-5735
sjb@lsu.edu

RATIONALE

Ringed seals (*Phoca hispida*) are a source of country food to Inuit in Nunatsiavut and play an integral role in their diet and culture. Ringed seals feed opportunistically on a variety of fish and crustaceans and are important prey of polar bears and arctic foxes. As a result, they play a critical role in the dynamics of arctic marine ecosystems. Ringed seals are especially vulnerable to elevated exposure to persistent organic pollutants (e.g. PCBs (polychlorinated biphenyls)), as a result of their diet, large fat reserves and long life. The overarching objective of this project is to establish baseline data that can inform future studies on the effects of environmental change on this important species and provide Inuit with health information regarding a valued component of their traditional diet. Due to historical operations in Saglek Bay, high PCB levels have been measured in some ringed seals (*Phoca hispida*). Our study is designed to characterize the contribution of local versus global sources of contamination in ringed seal food webs and examine whether these elevated PCB levels are affecting the health of ringed seals.

ArcticNetResearch

RINGED SEALS OF THE LABRADOR COAST: HABITAT USE, DIET AND HEALTH

OBJECTIVES

- To characterize the contribution of local versus global sources of contamination in ringed seal food webs in Nunatsiavut using stable isotopes, fatty acid signatures, food web ecology and contaminants.
- To investigate the diet of ringed seals in Nunatsiavut.
- To capture and deploy ringed seals with satellite transmitters (Platform Transmitter Terminals, PTTs) to assess movement and foraging behaviour.
- To assess the health of ringed seals in Nunatsiavut using physiological, biochemical, and molecular measurements.

Fitting a satellite tag on a female juvenile ringed seal.

METHODS AND INFORMATION COLLECTED

This year work focused on live capturing and fitting the two remaining satellite transmitters on ringed seals in Saglek Fjord to record movement, diving, and foraging behaviour. In total, we have tagged 13 free-ranging ringed seals in Saglek Fjord in August and September, 2008, 2009, 2010, 2011. Standard morphometric measurements, a blood sample, fur, and two fat biopsies were taken on each animal. Biological samples (blood, liver, kidneys, heart, lungs, gonads, stomach, lower jaw, thyroid, thymus, left fore flipper, whiskers, claws and hair) from nine harvested ringed seals were collected to assess food web ecology and health. Persistent organic pollutants (POPs), such as PCBs were measured in each of the tagged and harvested seals to assess contaminant concentrations and patterns..

YEARS OF DATA

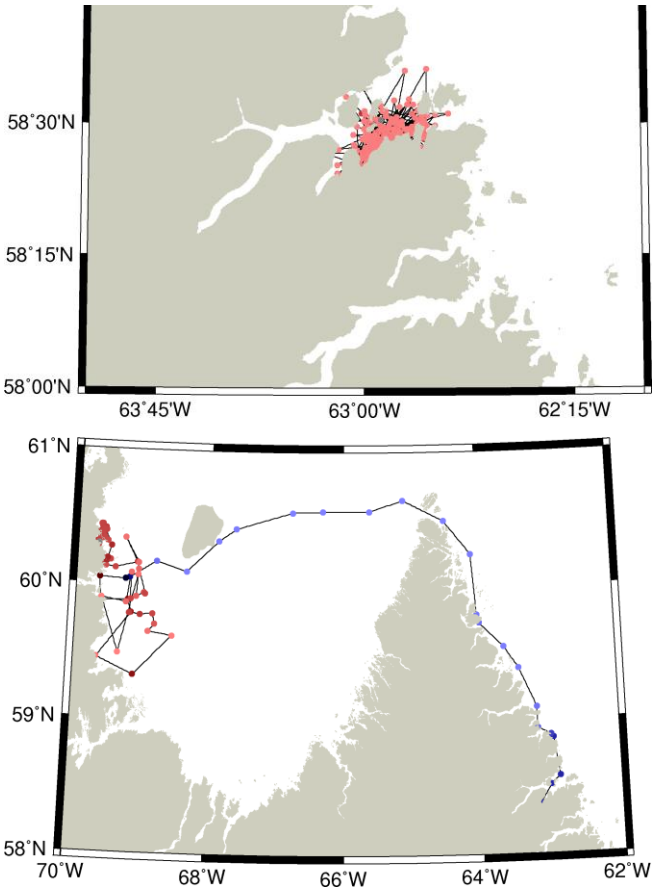
- 2008
- 2009
- 2010
- 2011

PARTNERS

- Torngat Joint Fisheries Board
- Parks Canada
- Fisheries and Oceans Canada
- University of Victoria
- University of Windsor
- Dalhousie University

FUNDING

- ArcticNet
- Parks Canada
- National Defence
- Aboriginal Affairs and Northern Development Canada (NCP & NSTP)
- Fisheries and Oceans Canada
- Nunatsiavut Government
- Nasivvik
- Inuit Pathways



Satellite tracks for an adult male (top) and juvenile female (bottom) ringed seal tagged in Saglek Fjord. The adult male remained in Saglek Fjord, while the juvenile female travelled to the west coast of Ungava Bay.

RESULTS/ACCOMPLISHMENTS

Two ringed seals (1 juvenile female, 1 adult male) were caught in Saglek Bay and fitted with satellite tags to record movement, diving, and foraging behaviour. No drugs were used to sedate the seals and the tag is designed to fall off once the seals moult. Biological samples from nine harvested ringed seals in Saglek Fjord were successfully collected for contaminant, food web and health analyses. Preliminary results from samples collected in 2008, 2009, and 2010 show that PCBs were higher than expected in some ringed seals (both harvested and live-captured) from Saglek Fjord, suggesting that these seals have been exposed to local PCB sources. Tagged ringed seals (2008, 2009, 2010, and 2011) displayed both resident and non-resident (transient) behaviour. Field research is complete, and laboratory (foodweb and health) analyses for all samples collected to date are currently being processed. Tracking data analysis is currently underway for the 2010 and 2011 seals.

CONTACT

Tanya Brown
PhD Candidate (University of Victoria)
Institute of Ocean Sciences
Fisheries and Oceans Canada
P.O. Box 6000, 9860 West Saanich Rd.
Sidney, BC, V8L 4B2
Phone: (250) 363-6810
Cell: (613) 888-3348
Email: Tanya.Brown@DFO-MPO.gc.ca

RATIONALE

Globally, climate change is increasing the abundance and height of upright woody shrub species such as arctic dwarf birch (avâlakiak) and willow (uppigak). In Nain, Nunatsiavut, elders have observed increases in shrub abundance across the landscape. Concurrently, they've also observed declining berry abundance and quality, as well as increased local climate variability. Growth and expansion of woody shrubs is predicted to affect northern berry producing plants such as bakeapple (appik), blueberry (kigutanginak), redberry (kimminak), foxberry/bearberry (Kallak) and blackberry (paungatuinnak), as these plants are sensitive to shading. Climate variability can also influence pollination of berry plants, but very little is known about the types of pollinating insects in northern Labrador. Better understanding of the relationships between upright shrubs, berry plants and pollinators will help to predict the impacts of climate change on berry plant growth and fruit production in northern Labrador.

ArcticNet Research

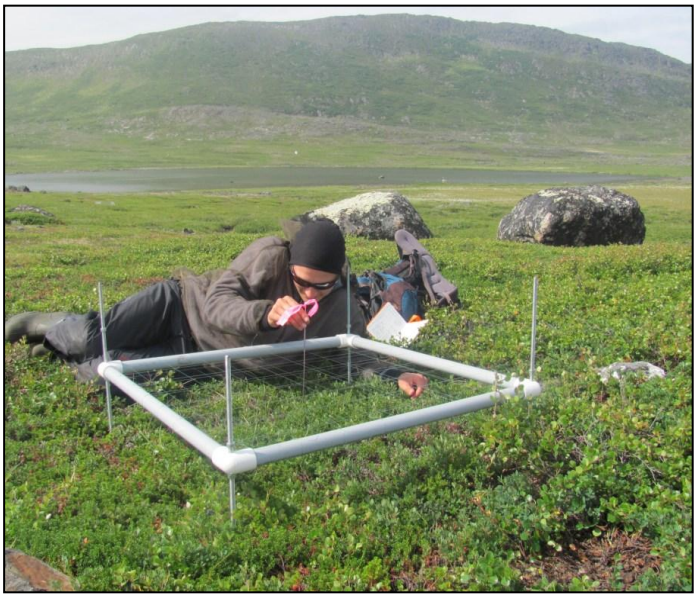
UNDERSTANDING CLIMATE CHANGE IMPACTS ON BERRY SHRUB GROWTH AND FRUIT PRODUCTION IN NORTHERN LABRADOR

OBJECTIVES

- Test the affects of experimental warming on growth of woody shrubs, growth and fruit production of berry plants, and microclimate conditions
- Investigate woody shrub-berry plant interactions and their effects on fruit production
- Continue monitoring annual fruit production of key berry plants near TMNP research station and base camp
- Identify and inventory important berry plant pollinators.
- Investigate plant-pollinator interactions

YEARS OF DATA

- 2009, 2010 and 2011

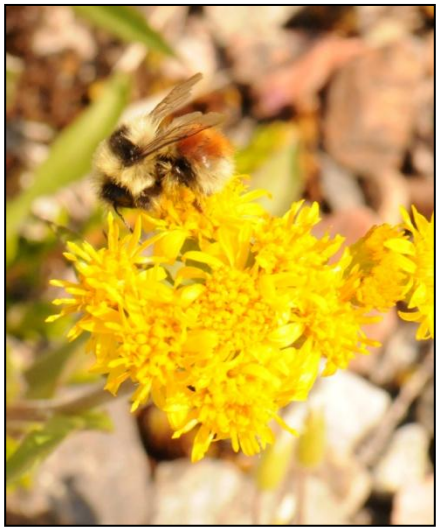


Researcher Laura Siegwart Collier measuring two years of birch and berry plant growth within experimental warming plots in Torr Bay valley

appik	kigutanginak	kimminak	Kallak	paungatuinnak
Bakeapple	Blueberry	Redberry	Foxberry	Blackberry

METHODS AND INFORMATION COLLECTED

Repair OTC's and air temperature sensors that were damaged due to wind, lack of snow and animal interference
Collect second year warming data from 30 OTC/control plots established in summer 2009
Measure: abundance and annual growth of upright shrubs and berry plants, fruit production, and environment variables such as soil temperature, moisture and available light
Retrieve decomposition sticks, replace soil nutrient probes, download and re-launch soil temperature loggers buried within the OTC/control plots
Re-establish and harvest berries from long-term berry monitoring plots around base camp; replace year-round soil nutrient probes
Collect berry plant pollinators such as bees and syrphid flies by setting up pan traps along 90m transects and using live-capture insect nets
Photograph pollinator activity on flower patches using time lapse plant cameras



Bumble bee visiting a goldenrod; late flowering plants like goldenrods are important food sources that support bee populations later in the growing season

Time lapse plant cameras monitoring patches of redberry flowers; digital images will help us determine the composition and rate of visitation by local pollinators

PARTNERS

- Memorial University
- Nunatsiavut Government
- Parks Canada Agency
- CANPOLIN

FUNDING

- ArcticNet
- IPY-CiCAT
- Memorial University
- NSERC
- CANPOLIN
- NSTP

CONTACT
Laura Siegwart Collier
PhD Candidate
Department of Biology
Memorial University
St. John's, NL,
A1B-3X9
lsiegwart@mun.ca
709-864-8258

RESULTS TO DATE:

- **Berry Monitoring Plots**: From 2009-2011, blackberries were the most abundant fruit with an average of 94 fruit/m^2. However, their numbers have decreased from an average of 138 fruit/m^2 in 2009 to 32 fruit/m^2 in 2011. Blueberry counts were low in 2010 (13.3 fruit/m^2), but 2009 and 2011 values were similar around 60 fruit/m^2. Redberry counts have increased yearly from 9.3 fruit/m^2 in 2009 to 58.2 fruit/m^2 in 2011. We are now exploring environmental factors (such as snow depth) that may be linked to these observed patterns
- **Warming Experiment**: After two years of experimental warming, we've seen substantial growth and shoot elongation in birch and blueberry plants. Analyses are underway to determine the affect of warming on growth of all vegetation and fruit set of berry plants
- **Pollinators:** We are currently pinning and databasing bee/syrphid specimens collected in 2011. Identification and validation of the collection will begin in winter 2012. Based on our preliminary specimen identification, we anticipate that we've collected 3-4 species of bumble bees and 3 genera of syrphid flies from Torr Bay, Nakvak and Ivitak areas.

RATIONALE

Balsam poplar *Populus balsamifera* L. is the northernmost occurring hardwood tree in North America and is widespread from Alaska to Newfoundland. Its northern limit in eastern North America is at tree-line along the Hudson Bay and Ungava Bay coasts; however it is known to occur as far north as the shrub tundra of Saglek Fjord, in Torngat Mountains National Park. These stands appear to be the most northerly of this species east of Saskatchewan. It is unclear at this point how these patches of balsam poplar originated, or how they established. Mapping, monitoring and examining how they are spreading will help scientists understand how tree species respond to changing climates in sub-arctic regions.

ArcticNet Research

CLONAL GROWTH OF BALSAM POPLAR AT THE NORTHERN EDGE OF ITS RANGE: NAKVAK BROOK, TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

- Characterise and map the distribution of balsam poplar stands in Nakvak Brook Valley
- Determine the relative ages of balsam poplar clones
- Estimate the expansion rate of clones
- Investigate relationships between age and growth form
- Create a databank of locations, tree identifications tags and associated data for long-term monitoring

Landscape view of the largest balsam poplar patch sampled within the valley. Patch dimensions were 130 m x 10 m along the ridge, and 65 m x 10 m down slope. Balsam poplar trees stand out against neighbouring willow, birch and alder by their tall stature and silvery-white leaves

METHODS AND INFORMATION COLLECTED

- On July 28th, 2011, 3 balsam poplar patches were identified on foot and the dimensions of each patch were measured. Within the patches, 15 balsam poplar clones were tagged and the following measurements/samples taken:
    - Tree structure was estimated by measuring basal diameter, diameter at breast height, tree height and reproductive status of each tree
    - Increment cores were taken at the base of each tree for future aging
    - Small juvenile clones were excavated for aging and growth rate estimates
- On August 13th, 2011, 6 additional balsam poplar patches were identified and photographed by helicopter reconnaissance. The helicopter touched down at 2 large patches, and 4 balsam poplar clones were sampled to estimate tree structure and age (as described above).
- In fall 2011, tree cores and basal sections of juvenile clones were mounted. A microscope was used to measure radial growth and age was estimated by counting annual growth rings.

YEARS OF DATA

- 2011

PARTNERS

- Memorial University
- Nunatsiavut Government
- Parks Canada Agency

FUNDING

- ArcticNet
- IPY-CiCAT
- Memorial University
- NSTP

Close-up view of a balsam poplar patch and the height of trees in relation to data collector. Average tree height was ~4.5 m tall

RESULTS TO DATE

- A total of 9 balsam poplar patches were identified; the largest measuring 130 m x 10 m
- A total of 19 tree clones were sampled and 24 juveniles excavated
- Average tree age ranged from 38 ± 15.6 to 55 ± 32.5 years. Juvenile age ranged from 8.8 ± 2.5 to 9.8 ± 1.9 years
- Further work is underway to examine age-structure relationships and patch expansion rates.

Example of juvenile plant excavated from the edge of a balsam poplar patch showing the vigorous root system that expands the size of the clone without sexual reproduction

Honours student James Wall taking increment cores and tree structure measurements within a large balsam poplar patch

CONTACT

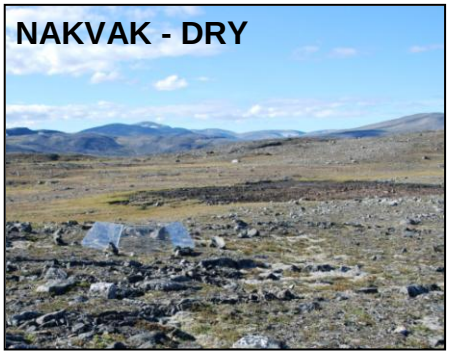
James Wall, Honours Candidate
Dr. Luise Hermanutz, Supervisor
Department of Biology
Memorial University
St. John's, NL
A1B-3X9
jamespatrickwall@gmail.com
lhermanu@mun.ca
709-864-8258

RATIONALE

We are investigating experimental warming effects on key upright deciduous (i.e. arctic dwarf birch, willow, blueberry) and evergreen (i.e. northern Labrador tea) shrubs in wet and dry tundra ecosystems. Warming-related changes in abundance and height of upright shrubs could cause shifts in vegetation composition through changes in snow deposition, soil nutrient availability, litter quality/quantity and shading. Such changes could influence the growth and distribution of low-growing herbs and shrubs, grasses, mosses and lichens, which are important habitat and forage for wildlife in tundra ecosystems. This research is important to predict future vegetation change in northern Labrador.

International Polar Year Research

DETERMINING THE IMPACTS OF CHANGING CLIMATE ON TUNDRA VEGETATION



OBJECTIVES

- Investigate the effects of experimental warming on vegetation composition, abundance and structure, soil characteristics and microclimate
- Monitor snow depths and shrubline change

METHODS AND INFORMATION COLLECTED

Our study area is located north of Saglek Fiord, adjacent to Nakvak Brook, ~400m asl. Between 2007 and 2008, we established 20 open-top warming chambers (OTCs) paired with 20 control plots to predict the impacts of warming on tundra vegetation in wet and dry tundra sites. When plots were established, we collected baseline plant community data using the point frame method. This method was repeated in summer 2010. From 2007-present, a network of ground temperature sensors are being used to monitor changes in soil temperature.

Honours student James Wall repairs an OTC damaged by wind and animal interference.

In summer 2011, we:

- Repaired damaged OTC's
- Downloaded and re-launched our network of ground temperature sensors; measured soil moisture among plots
- Established 4 new snow and shrub monitoring stations along an elevational gradient beginning at the plateaus adjacent to Nakvak Brook, up to the experimental warming site

YEARS OF DATA

- 2007-2011 (microclimate)
- 2007, 2008, 2010 (vegetation)

PARTNERS

- Memorial University (Department of Biology and Geography)
- Parks Canada Agency
- IPY-CiCAT Program
- Montreal Botanical Gardens
- University of Montreal

Researchers retrieve soil temperature data from data loggers that are buried within each OTC and Control plot. Loggers are re-launched annually for year-round data collection.

FUNDING

- IPY-CiCAT Program
- Memorial University
- Parks Canada Agency

RESULTS/ACCOMPLISHMENTS

Nakvak Warming Experiment:

- From baseline data, we determined that wet sites are dominated by sedges, mosses, rushes and upright willows, while dry sites are dominated by lichens, and less abundant evergreen shrubs like northern Labrador tea
- After 2-3 years of warming, we found no significant difference between wet and dry sites in how the tundra vegetation has responded to warming; however as predicted, changes in some target shrubs are apparent

Upright woody shrubs, Alder and birch, growing in the valley leading to Nakvak Brook. Long-term monitoring of their growth will help us to determine if the shrubline is changing in TMNP. Using soil temperature data loggers, we can also determine how shrub change is linked to climate variables like snow depth.

- Abundance of northern Labrador tea appeared to have increased within dry plots
- Nearly all upright woody shrubs increased in height between 2007/2008 and 2010 in OTC and control treatments
    - If low-level shifts in abundance and height of shrubs continue as seen in 2010, we anticipate future impacts on mosses and lichens, which are generally most sensitive to shading

CONTACT

Dr. Luise Hermanutz
Laura Siegwart Collier
Department of Biology
Memorial University
St. John's, NL
A1B-3X9
lhermanu@mun.ca
lsiegwart@mun.ca
709-864-7919

RATIONALE

This work builds on a pilot project carried out in TMNP in 2008 where we developed sampling and modelling approaches for mapping the terrestrial ecosystems of TMNP. In 2008 we sampled the southern end of the park below Nachvak Fiord and developed some draft map products (*see map below*). In 2011 we carried on with the field sampling north of Nachvak Fiord, and will complete an ecological inventory for the entire area of TMNP by March 2012. Such an inventory will provide park co-managers with an ecological basis for managing and communicating many aspects of park ecological integrity, including providing a baseline for ongoing ecosystem change, for predicting future change, for mapping wildlife habitat, and for designing effective monitoring programs.

TERRESTRIAL ECOSYSTEM MAPPING IN NORTHERN TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

The Multi-scale ecological inventory project has the following objectives:

- To acquire and organize aerial photos, different kinds of satellite data, and other map data to aid in the modelling of terrestrial ecosystems at local and regional scales within the park;
- To identify, describe, and classify plant communities in the park;
- To link plant communities to ecological processes through an ecological classification of park ecotypes, and to interpret the ecological drivers that control the distribution of park ecotypes
- To use the distribution of plant communities on zonal sites to delineate and map park bioclimatic zones;
- To develop ecotype mapping for the entire area of TMNP, including detailed sampling and mapping for the two focal watersheds - Ivitak Brook and Nachvak Brook, and;
- To develop tools and training so that parks staff and researchers can use the maps for management, monitoring and research.

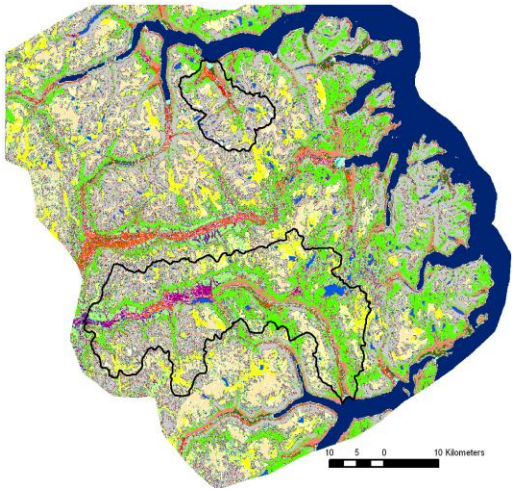
METHODS AND INFORMATION COLLECTED

- The 2008 field plots and ecosystem maps were consulted to develop a sample plan for the 2011 field work; preliminary models of the terrestrial ecosystems in the northern end of the park were also developed. Fieldwork was conducted from a field camp on Upper Kangalaksiorvik Lake from August 16 to 22, 2008 and then from the kANGIDLUASk base camp. The field camp provided exciting wildlife viewing of wolves, black bears, caribou, ranger seals, and peregrine falcons. Angus Simpson and Darroch Whittaker were instrumental in setting up the field camp, and thanks to our excellent guide Eli Merkuratsuk.

Eli with char – Upper Kangalaksiorvik Lake
Photo credit: R. Pither

- Field sampling included the establishment of several levels of ground plots and photos, mostly in the vicinity of the Upper Kangalaksiorvik Lake Camp, with scattered ground plots as weather would allow across the northern end of the park. A new tool is the use of GPS-referenced HD videography which we conducted through helicopter overflights over much of the southern and northern areas of TMNP. The GPS referencing enables the locations of all video data to be accurately referenced to the ground locations over which it was taken. We have found this to be a very useful tool in understanding vegetation patterns, and for verifying our maps.

All field data have been digitized and will be used to formalize the plant community and ecosystem classification. A draft ecosystem map and report for the entire park will be available by March 31, 2012.



Ecotypes of southern TMNP showing Ivitak and Nachvak watersheds

PARTNERS

- Parks Canada Agency - Western Newfoundland Field Unit
- NRCan – Canadian Centre for Remote Sensing

FUNDING

- 'Helping Canadians Adapt to Climate Change' program (Federal Sustainable Development Strategy)

RESULTS

- A collection of over 250 additional vascular plant specimens that include over 175 species
- A preliminary plant community classification following methods consistent with the Canadian National Vegetation Classification approach
- A classification and mapping of park bioclimatic zones
- An ecosystem inventory of the entire area of TMNP
- A binary key for identifying ecotypes in the field
- One page 'Fact Sheets' describing all ecotypes mapped, with management interpretations

Field camp on Upper Kangalaksiorvik Lake – August 2011
Photo credit: R. Pither

CONTACT

Donald McLennan, PhD
Parks Canada Agency/Agence Parcs Canada
National Monitoring Biologist/Biologiste Surveillance Nationale
25 Eddy St (25-S-4), Hull, Quebec, K1A 0M5
Tel: (819) 953-6464 Fax: (819) 997-3380
email/courriel: donald.mclennan@pc.gc.ca

RATIONALE

The early Archean crustal records on Earth are rare and cryptic, and are preserved only in Labrador, Acasta and southern West Greenland. We started to investigate the oldest crust between Saglek and Hebron in Northern Labrador through comprehensive field studies and laboratorial works. Especially, detailed geological works of greenstone belts in the eastern Nain Complex, Labrador area, allow new insight to investigate solid earth evolution, the surface environmental condition, and evolution of life even in the Hadean because the rocks in Labrador are better preserved than other areas. Our study contributes to the increase in knowledge of evolution of the early Earth evolution as well as geological importance of the Labrador area.

Other Research

DECODING THE HADEAN EARTH

OBJECTIVES

- To make detailed geological maps, especially of the supracrustal units (scale of 1:5,000).
- Geochronology and geochemistry of the Earth's oldest rock units (Nanok Gneiss).
- Estimate of the nature of protocrust from chemical and isotopic compositions of early Archean clastic sediments.
- Search for Hadean zircons.
- Estimate of surface conditions on the early Earth based on compositions of chemical sediments.
- The researches will enhance understanding of early crustal evolution and the environment.

METHODS AND INFORMATION COLLECTED

We stayed at the Torngat Mountains Base Camp and Research Station in St. Johns Harbour. And, we visited Big Island, Nulliak Island, Fish Island, Saglek Fjord, the coast of St. Johns Harbour and the surrounding area by a speed boat, a helicopter or on foot with Bear Monitors. We made geological maps there, and collected rock specimen for geochemistry and geochronology.

The southwest area of the Nulliak Island. We made the detailed geological map there.

YEARS OF DATA

- 2011

PARTNERS

- Dr. Bruce Ryan (Geological Survey of Newfoundland and Labrador)
- Parks Canada

FUNDING

- Japanese Government

RESULTS/ACCOMPLISHMENTS

We made detailed geological maps of the Big Island, Nulliak Island, the eastern coast of St. Johns Harbour and the surrounding area. Especially, we found clear lithostratigraphic relationship from ultrabasic rocks, basaltic lava (amphibolite), banded iron formation and paragneiss from the bottom to top in the Nulliak Island, similar to the modern ocean plate stratigraphy or ophiolite sequence.

We collected more than 1,000 samples of granitic gneisses (Uivak and Nanok gneiss) and supracrustal rocks, and will analyse the compositions in Japan.

We separated zircons from the granitic gneisses (Uivak gneiss) and measured their U-Pb ages. At this moment, we discovered the oldest zircon in this area, which preliminarily shows 3.9 billion years ago.

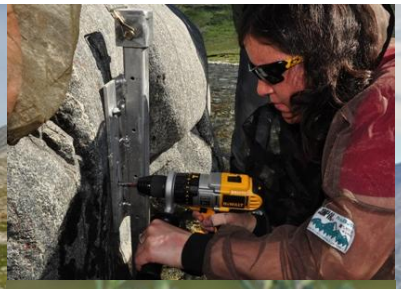
Outcrop of the Uivak gneiss in Tigigakuyuk Inlet.

Outcrop of banded iron formation (BIF) on Big Island.

CONTACT
Dr. Tsuyoshi Komiya
Department of Earth Science & Astronomy
Graduate School of Arts and Sciences
The University of Tokyo
3-8-1 Komaba, Meguro-ku, Tokyo
153-8902, Japan
Tel: +81-3-5454-6609
Fax: +81-3-5465-8244
Email: komiya@ea.c.u-tokyo.ac.jp

MONITORING

Monitoring programs will document how the cultural and ecological systems in Torngat Mountains National Park are changing over time. This information will be vital for measuring the success of management programs and reporting on the health of the park (State of the Park Report) every five years.



RATIONALE

Permafrost is soil or rock that remains at or below 0°C for at least two consecutive years, and forms when the ground cools sufficiently during winter to produce a frozen layer that persists through the summer. An active layer refers to a zone of annual freezing and thawing between ground surface and top of the permafrost. Permafrost plays an important role in ecological processes of cold region ecosystems such as tundra, shrub thickets, wetlands, and coastal zones. For example, permafrost has a strong influence on development of vegetation communities through its influence on rooting depth, soil temperature, soil drainage, and hydrology. Vegetation in turn can influence soil temperatures, composition, and drainage, creating feedback loops that have strong effects on distribution and persistence of both permafrost and vegetation. Permafrost also influences numerous other factors, including soil stability and erosion and the preservation of archaeological remains. Torngat Mountains National Park lies near the southern limit of the continuous permafrost zone in Canada, and may experience changes to permafrost resulting from climate change, including reduced permafrost extent and increased active layer thickness. Consequently monitoring permafrost will provide important information on the state of the park.

Monitoring

PILOTING A PERMAFROST MONITORING NETWORK IN TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

Pilot work was carried out in 2009 when we identified suitable permafrost monitoring sites. In 2010 we partnered with the Geological Survey of Canada to deploy 2 thaw tubes at Ramah Bay and another 2 thaw tubes plus a temperature cable in the Ivitak focal watershed. Our objectives for 2011 included:

- Checking the thaw tubes to see if they now contained ice, which would be indicative of permafrost
- Take thaw tube measurements and add glass beads that would record maximum thaw depth (i.e. active layer thickness) for 2011
- Download initial data from the temperature cable at Ivitak Cove and replace the 5 m cable with one that would measure ground temperature to a depth of 7 m
- Download air temperature and soil surface temperature loggers at each permafrost monitoring site

Taking measurements on a thaw tube at Ramah Bay

METHODS AND INFORMATION COLLECTED

- The Ramah Bay and Ivitak Valley permafrost monitoring sites were visited on August 11, 2011.
- One of the thaw tubes at Ramah Bay had been chewed by either a bear or wolf and was no longer functional. Spare parts will be used to repair it in 2012.
- The other thaw tube at Ramah Bay and the thaw tube at Ivitak Cove contained ice, so indicated the presence of permafrost.
- The thaw tube in the upper Ivitak Valley did not contain ice so likely did not penetrate into permafrost.
- Measurements were taken on all thaw tubes.
- The temperature cable logger at Ivitak Cove was downloaded, giving initial data for the site, and the 5 m temperature cable was replaced with one that extended to a depth of 7 m

YEARS OF DATA

- Initial data was collected in 2011, which reflected conditions since the equipment was deployed in August 2010. However the water-drilling process in 2010 will have warmed the soil so the first valid measurements of permafrost conditions will be collected in summer 2012.

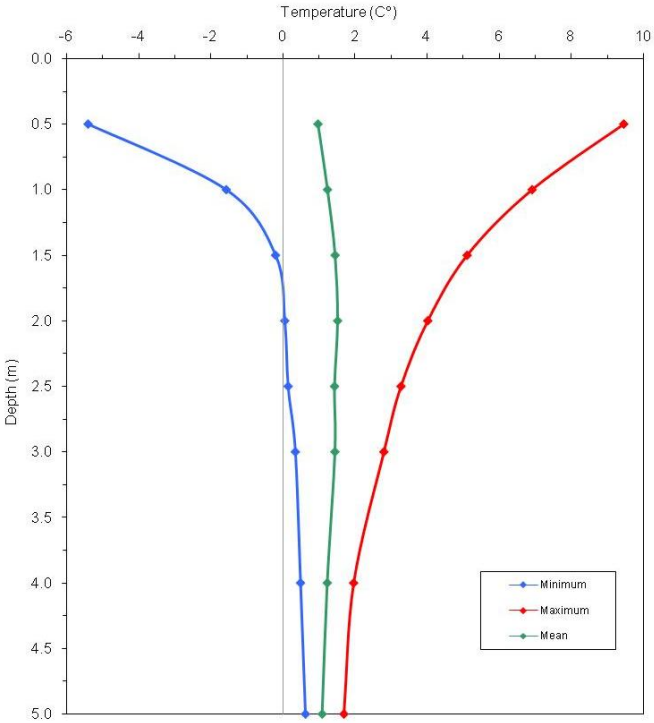
PARTNERS

- Geological Survey of Canada

FUNDING

- Parks Canada
- Geological Survey of Canada

RESULTS/ACCOMPLISHMENTS



Minimum, average, and maximum ground temperatures at depths of 0.5 m to 5 m, as recorded by the temperature cable at Ivitak Cove.

- Initial readings show that soil temperatures around the temperature cable at Ivitak Cove were generally above freezing (see figure). This likely resulted from the water drilling installation work in 2010. This will have warmed the soil around the well so data were not yet reflective of typical conditions
- Initial conditions for the thaw tubes at Ramah Bay and the Ivitak Valley were as follows:

Location	Easting	Northing	Ice depth	Comments
Ramah Bay	479511	6526139	.	Damaged by animal
Ramah Bay	479544	6526145	100.6 cm	Intact
Ivitak Valley	459385	6538747	.	No permafrost
Ivitak Cove	457141	6540414	107.4 cm	Intact

Glass beads were placed in the water-filled inside tube to indicate the depth to the ice

CONTACT

Darroch Whitaker
Monitoring Ecologist
Parks Canada
P.O. Box 130, Rocky Harbour, NL A0K 4N0
Ph: 709-458-3464
Email: darroch.whitaker@gmail.com-don't

Caroline Duchesne and Wendy Sladen
Geological Survey of Canada
601 Booth Street
Ottawa, ON K1A 0E8
Ph: 613-995-7628 (CD)
613-947-8759 (WS)
Email: caroline.duchesne@nrcan.gc.ca
wendy.sladen@nrcan.gc.ca

RATIONALE

Surface hydrology refers to the pattern of runoff of water in terrestrial ecosystems, with key factors including the amount, rate, and variability of flow. A watershed's hydrologic regime affects such things as fish and wildlife habitat, sediment transport, water chemistry, and erosion. Thus hydrology is a key factor affecting biodiversity and the ecological functioning of aquatic and riparian ecosystems. Stream water temperature is also a critical factor in freshwater ecosystems, having direct implications for biodiversity and productivity. Stream hydrology and temperature are being measured as part of Ecological Integrity (EI) monitoring programs in many national parks across Canada. Hydrologic condition is assessed as a function of five factors: the mean annual flow, minimum 30 day flow, timing of minimum flow, frequency of high flow events, and variability or flashiness of flow. Stream temperature is assessed as a function of suitability of the thermal environment for a focal fish species – Arctic Char in the case of Torngat Mountains National Park. In 2011 we piloted a stream hydrology and temperature monitoring network in tributaries flowing into the Ivitak River, the focal watershed for EI monitoring in Torngat Mountains National Park. Because stream hydrology and temperature are affected by such diverse factors as precipitation, air temperature, vegetation cover, and (in the case of the Ivitak watershed) glacier mass balance, these EI measures have the potential to integrate information from a broad range of ecosystem processes.

ESTABLISHING A STREAM HYDROLOGY AND STREAM TEMPERATURE MONITORING NETWORK IN THE IVITAK VALLEY

OBJECTIVES

- Test methods of installing semi-permanent hydrology monitoring stations in tributaries of the Ivitak River
- Deploy water level / water temperature data loggers at these hydrology monitoring stations
- Deploy a similar data logger at a terrestrial site to record local barometric pressure, a covariate needed to correct water pressure readings when measuring water depth
- Measure stream flow at hydrology stations so that water level readings can be related to discharge
- Introduce hydrology monitoring techniques to Inuit students participating in the kANGIDLUASUk student program

METHODS AND INFORMATION COLLECTED

- Welded aluminum housings were developed to protect hydrology data loggers from rock and ice being carried downstream during floods, as well as from curious wildlife
- At each hydrology station a hammer drill was used to drill holes into large boulders or bedrock and then the data logger housings were attached using anchor bolts

- A Hobo® U20-001 data logger was deployed in the housing such that it would sit at the level of the stream bottom and record hourly water level and temperature measurements
- At each station Stream discharge was estimated by recording a series of depth & water velocity readings across the width of the stream, as detailed in the Parks Canada hydrology monitoring protocol

YEARS OF DATA

- Data collection began in July of 2011

FUNDING

- Parks Canada

RESULTS/ACCOMPLISHMENTS

- From July 26-30, 2011 hydrology monitoring stations were established on three glacier-fed tributaries of the Ivitak River. A similar station was established on dry land near the Ivitak Camp to record barometric pressure. These stations are now recording hourly water level and temperature readings throughout the year.
- At least one discharge measurement was recorded at each hydrology station.
- Eight students participating in the kANGIDLUASUk student program provided invaluable assistance and were exposed to hydrology monitoring techniques.
- Lessons from 2011 will be taken into account when planning any future expansion of the hydrology monitoring network.

Hydrology monitoring station locations in Torngat Mountains National Park
(UTM zone 20V, NAD1983)

Station	Stream name	Easting	Northing	Elevation
0	Barometric control	461052	6534389	178 m
1	Waterfalls Brook	460464	6534863	139 m
2	Caubvik Glacier Brook	462020	6532030	404 m
3	Cirque Mountain Glacier Brook	462190	6533793	217 m

CONTACT
Darroch Whitaker
Monitoring Ecologist
Parks Canada
PO Box 130,
Rocky Harbour NL. A0K 4N0
Phone: 709-458-3464
Fax: 709-458-2059
Email: darroch.whitaker@pc.gc.ca

RATIONALE

Recording incidental wildlife observations is an inexpensive and effective method to compile information about long-term trends in the abundance and distribution of wildlife. It is also an activity that park visitors can participate in and thereby contribute to monitoring of park Ecological Integrity. Observations of wildlife in Torngat Mountains National Park, and surrounding areas, are recorded on wildlife cards and the information is stored in a Microsoft Access database. Special attention is paid to observations of Species at Risk such as peregrine falcon, wolverine, polar bear, harlequin duck, barrow's goldeneye, ivory gull, and short-eared owl. Observations of black bear, wolves, caribou and marine mammals are also recorded, as they are good indicators of environmental health.

Monitoring

WILDLIFE OBSERVATIONS

OBJECTIVES

- To collect basic information (presence, distribution, breeding and relative abundance) about wildlife populations in TMNP and surrounding areas.

Healthy male polar bear with an ear tag from the 2005-07 Davis Strait population survey, suggesting possible residency in Northern Labrador

METHODS AND INFORMATION COLLECTED

- Parks Canada staff, base camp guests, contractors and visitors record incidental observations of wildlife on wildlife cards.
- Visitors continue to receive wildlife cards as part of their pre-trip information package.
- All Researchers are asked to record wildlife observations during their time in the park. This is a condition of their research permit.
- Information collected includes: date and time of observation, name of observer, species observed, number of individuals seen, location of observation, elevation, aspect, age, sex of animal, evidence of reproduction, habitat, weather and remarks.
- All information from the wildlife cards is entered into n Access database.
- Summaries of incidental observations and maps of these observations are produced.

YEARS OF DATA

- 2005-2011

FUNDING

- Parks Canada

RESULTS

Skeleton of a young lemming in its nest

- There are currently 521 records in the wildlife cards database. This includes 171 records of polar bear observations, 118 records of black bear observations, 23 records of wolf observations and 49 records of caribou observations.
- A huge male polar bear was observed in the north of the park with an ear tag that is possibly from the 2005-07 Davis Strait population survey. If the tag is from this survey the presence of this bear in Labrador in 2011 may suggest intermittent residency or that he is a frequent visitor to the area. Male bears have much larger home ranges than female polar bears and frequently are found hundreds or thousands of miles from their birth place or capture locations, so it is interesting to find this mature male back in an area where he was 4-6 years ago.
- Over the past two winters northern Labrador has experienced unusual winters. In 2010/11 there was very little snow in the Saglek area below 800-900 feet a.s.l, and the weather was very cold. We found numerous lemming nests containing the skeletons of young lemmings suggesting that many young were unable to survive the cold winter with little snow cover. In the summer of 2010 lemmings were abundant around base camp. In 2011 lemming sightings were very rare.
- During the 2011 summer, numerous black bears were observed in the southern section of the park - below Upper Kangalaksiorvik Lakes. Very few caribou were seen in this area and no young of year. North of Upper Kangalaksiorvik Lakes more caribou were observed and some groups had surviving young- of -year. Black bears were not observed this far north. This appears to suggest that there has been a possible impact on the TMNP caribou population by black bears that are known to predate on young caribou calves.
- Some Wolves were observed approaching campsites looking for food and hanging around char fishermen, suggesting that perhaps food for them was scarce in 2011. With the diminishing number of caribou in the Torngat Mountains herd and the significant drop in small mammals such as lemmings, voles and deer mice, prey for wolves was scarce in 2011. Owls and Rough legged hawks were very scarce in 2011 also.

Wolf hanging around Eli Merkuratsuk who was fishing for char on the opposite bank of the stream.

CONTACT

Angus Simpson
Resource Conservation Supervisor
Torngat Mountains National Park
Box 471, Nain NL. A0P 1L0
Phone: 709-922-1290 or709-922-1576
Fax: 709-922-1294
Email: angus.simpson@pc.gc.ca

RATIONALE

Torngat Mountains National Park spans the transition between low Arctic and northern boreal ecosystems, and includes a diverse range of coastal, estuarine, taiga, tundra, and montane habitats. Consequently a broad range of bird species reach their northern or southernmost range limits in the park, while others use the park as a migration route and staging area. The increase in visitation associated with the creation of Torngat Mountains National Park offer the opportunity to learn more about the birds found in this remote corner of North America. Consequently a bird checklist has been prepared to encourage persons visiting the park to pay attention to the birds they see and report their observations in a standardised manner useful for monitoring. The program was initiated in 2008 as a compliment to the wildlife cards program and will improve our understanding of the status and distribution of birds in Torngat Mountains National Park. It is a cost-effective approach to building our knowledge of park wildlife and over time may contribute to our understanding of changes to park ecosystems resulting from environmental factors such as climate change.

Monitoring

BIRDS OF TORNGAT MOUNTAINS NATIONAL PARK - CHECKLIST AND ATLAS

OBJECTIVES

- To encourage people visiting and working in Torngat Mountains National Park to observe and enjoy birds.
- To build a database on the diversity, status and distribution of birds in the park.
- To document long term changes in park bird communities.

METHODS AND INFORMATION COLLECTED

- In 2008 a checklist of birds potentially occurring in Torngat Mountains National Park was prepared based on published accounts, observations by Parks Canada staff, and local knowledge. The checklist included:
  - A list of all bird species known or expected to occur in the park, including information on their abundance and status.
  - Check boxes to record descriptive information on the observations (location, habitat, weather).
  - A mailing address and request that visitors return a copy of their completed list to the park.
- The checklist is being distributed to individuals visiting or working in the park, and park staff are encouraging these individuals to report their observations to the park office.

Bird Checklist

Kutsitak / White-crowned Sparrow

Torngat Mountains National Park of Canada

This checklist has been prepared based on best available information on the status and distribution of birds in Torngat Mountains National Park of Canada. However the remoteness of this landscape means that much remains to be learned about bird populations in the area. Consequently we hope that you use this form to keep a personal record of any birds you see during your visit, and also ask that you return a copy to the park so that we can use your observations to help us better understand the park ecosystem and monitor its ecological integrity. With this in mind we ask that you please follow the instructions provided on the following page. Also, please complete the checklist summary on the reverse, as information on the locations, habitats, and environmental conditions that apply to your observations will help maximize the knowledge we can derive from your completed checklist. Enjoy your visit! *(updated August 2008)*

Parks Canada Parcs Canada Canada

YEARS OF DATA

- Bird checklist data have been collected from 2008 to 2011

PARTNERS

- Anyone visiting or working in Torngat Mountains National Park

FUNDING

- Parks Canada

RESULTS/ACCOMPLISHMENTS

- Copies of the checklist have been made available to individuals visiting the park from 2008 onwards, including park visitors, tour group leaders, researchers and park staff.
- 136 new records were added in 2011, bringing the database to a total of 465 observations representing 69 species and >3,500 individual birds.
- New observations from 2011 further enhanced our understanding of the regional avifauna:
  - Juvenile and adult Lesser Black-backed Gulls were daily visitors at kANGIDLUASUk throughout August, with up to 7 individuals occurring at once. This European species expanded its breeding range to include Iceland in ~1990 and it has been suggested that it may continue expanding its breeding range to include northern Labrador. It will be interesting to see if Torngat Mountains National Park Becomes home to a new North American breeding bird!
  - A Parks Canada monitoring team spent a week at Kangalaksiorvik Lake, where they observed such tree line species as Wilson's Warbler, Yellow-rumped Warbler, Fox Sparrow, and American Tree Sparrow. This suggests that the range of these species may extend right to the northern limit of shrub thickets in the park, and indeed may be expanding due to the rapid increase in shrub cover being observed in the park.

Least Sandpiper reaches the northern limit of its' breeding range in the Torngat Mountains

The Horned Lark is one of the most common birds along the coast of Torngat Mountains National Park

This Lesser Black-backed Gull at kANGIDLUSUk may have come from Greenland

CONTACT

Darroch Whitaker
Monitoring Ecologist
Parks Canada
PO Box 130,
Rocky Harbour NL. A0K 4N0
Phone: 709-458-3464
Fax: 709-458-2059
Email: darroch.whitaker@pc.gc.ca

RATIONALE

Since park establishment in 2005, the number of visitors to TMNP has steadily increased. Visitors are broadly defined as anyone who spends time in the park, including researchers, contractors and other user groups. Understanding the type of activities people participate in while in the park is valuable for long-term park management. Knowing the interests and needs of visitors helps park managers develop unique, safe and memorable experiences. It also helps to ensure that activities in the park do not affect ecosystem health or come into conflict with wildlife. Increasing visitation to Canada's national parks is a key objective of Parks Canada Agency.

HUMAN USE MONITORING IN TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

- To document the number of people visiting the park and record the type of activities they engage in and the locations they visit.
- To generate information necessary to adapt park planning and programs to best serve park visitors while maintaining park ecological integrity and meeting park management goals.
- To evaluate success in meeting corporate targets for increasing visitation to Canada's National Parks, Historic Sites and Marine Conservation Areas.

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METHODS AND INFORMATION COLLECTED

"Students on Ice" visit Torngat Mountains Base Camp and Research Station

- All visitors entering the park must register with the park administration office.
- The number of people in the park, the dates of their visit and the activities that they conduct are recorded.
- Visitors are categorized as: recreational boaters, cruise ship passengers, guided and non-guided recreational visitors, researchers, contractors, park staff, and other base camp guests who enter the park (everyone not included in the above categories).See Table 1.
- Inuit who are associated with park programs are included in the researchers, contractors, park staff, or base camp guests categories.
- Each fall an online visitor survey is conducted with cruise ship passengers and non-cruise ship visitors (see separate report in the research section of this document).
- Inuit who visit the park for personal reasons are also recorded, but are not required to register.

Table 1: TMNP visitor statistics for 2006-2011

Activity	2006	2007	2008	2009	2010	2011
Recreational Boating	4	4	21	3	8	69
Cruise ship passengers	150	195	364	295	156	268
Guided and Non-guided visitors	12	49	27	76	134	85
Researchers	32	58	55	55	42	42
Contractors	19	24	29	59	53	47
Parks Staff	9	11	15	22	17	17
Base Camp Guests not included above	47	63	58	62	51	73
Others				57		18
Total	**273**	**404**	**569**	**629**	**461**	**619**

YEARS OF DATA

2006-2011

RESULTS/ACCOMPLISHMENTS

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Torngat Mountains Base Camp and Research Station

- Visitor numbers increased significantly in 2011, with the biggest increases coming from the cruise ship visitors and recreational boaters (Table 1)
- A highlight from the summer, was a visit by the Students on Ice Program. 85 students from around the world and 35 support staff, spent three days in the park on board the Adventure Canada Cruise Ship, MV Clipper Adventurer.
- The Torngat Mountains Base Camp and Research Station continued to host a significant number of visitors to the park (See Table 2)

Table 2: *Number of participants at Torngat Mountains Base Camp and Research Station*

Year	# people	Total person days
2006	63	600
2007	146	1381
2008	165	2033
2009	232	2783
2010	244	3242
2011	222	2720

CONTACT
Angus Simpson
Resource Conservation Supervisor
Torngat Mountains National Park
Box 471, Nain NL. A0P 1L0
Phone: 709-922-1290
Fax: 709-922-1294
Email: angus.simpson@pc.gc.ca

RATIONALE

Arctic dwarf birch (*Betula glandulosa* L.) is a widespread woody shrub found across Canada and throughout Torngat Mountains National Park. It is actively expanding its distribution northward, and increasing in height and density in much of its North American range, for example in Nunavik (Myers-Smith et al. 2011. Environmental Review Letters). Parks Canada is using a number of biotic indicators to detect and track changes in natural communities in its northern parks. The indicators should be easy to identify, inexpensive to monitor, and simple to measure for non-experts. Dwarf birch fulfils all these criteria. In the summer of 2011, a series of dwarf birch monitoring plots were established across an elevational gradient in Nakvak Brook valley. These plots will help monitoring biologists and scientists understand how shrubs are changing the tundra vegetation in the park and sub-arctic regions.

USING ARCTIC DWARF BIRCH TO MONITOR TUNDRA VEGETATION CHANGE IN NAKVAK BROOK, TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

- Survey arctic dwarf birch across an elevational gradient from the river valley of Nakvak Brook to higher elevation tundra
- Measure growth and density parameters as baseline for future monitoring
- Monitor soil temperature to detect change
- Establish a long-term data and photographic repository of dwarf birch data

Birch plots at the lowest elevation within Nakvak Brook valley are taller, very dense and produce seeds.

METHODS AND INFORMATION COLLECTED

- On July 28th, 2011, dwarf birch was surveyed across an elevational gradient from the river valley of Nakvak Brook to higher elevation tundra:
    - 4 altitudinal contours were surveyed (Bottom, Ledge 1, Ledge 2 and Top)
    - At each contour, at least five 50 X 50 cm plots were randomly established within a 20 m X 20 m area
    - GPS (NAD 83)coordinates were taken at each plot
    - 3 tidbit temperature loggers were installed and marked 3 m apart at each contour to monitor soil temperature
    - Photographic records were taken of each plot
    - % cover of birch in each plot was estimated to the nearest 5%
    - Other plant species present in the plot were noted
    - Height (cm) and 2010 growth increment (cm) on 5 of the tallest stems were measured

- Presence of female catkins were recorded for each of the 5 stems (above) was recorded to determine reproductive status

YEARS OF DATA

- 2011

FIELD RESEARCHERS

- Alain Cuerrier (U of Montreal)
- Laura Siegwart Collier (MUN)
- James Wall (MUN)
- Darroch Whitaker (PCA)
- Luise Hermanutz (MUN)

PARTNERS

- Memorial University
- Parks Canada Agency
- Nunatsiavut Government

FUNDING

- ArcticNet
- IPY-CiCAT
- Parks Canada Agency

Close-up view of buried soil temperature logger locations tagged with pink flagging tape. Blue flag marks the edge of the plot.

RESULTS TO DATE

- Long-term data sets have been generated by Memorial University and shared with Parks Canada
- Metadata have been generated for the datasets
- Excel files were generated that contain all location information (GPS) and tidbit serial numbers
- Excel files of all birch data have been generated
- Future monitoring is to take place in 5 years to track changes
- This approach maybe applicable to many sites within the park

CONTACT

Dr. Darroch Whitaker
Monitoring Ecologist
Parks Canada
Western Newfoundland and
Labrador Field Unit,
Rocky Harbour, NL
709-458-3464

Dr. Luise Hermanutz
Department of Biology
Memorial University
St. John's, NL, A1B-3X9
lhermanu@mun.ca
709-864-8258

RATIONALE

Environment Canada is currently developing a monitoring program for the Northern Common Eider. Their breeding range covers northern Labrador, the eastern Canadian Arctic and western Greenland, and their wintering range is located along the North Coast of the Gulf of St. Lawrence, Québec and around coastal Newfoundland, and along the south-west coast of Greenland. The current monitoring program consists of a triennial winter survey of the Canadian wintering range in insular Newfoundland and Québec. Local knowledge of Inuit in eastern Canada and satellite tracking studies suggest the Northern Common Eiders may also winter along the coasts of Labrador, Hudson's Strait and Frobisher Bay. However, there has never been an effort to document the number and distribution of wintering eiders in the eastern Arctic.

Monitoring

WINTER DISTRIBUTION OF NORTHERN COMMON EIDER (*SOMATERI MOLLISSIMA BOREALIS*) IN EASTERN NORTH AMERICA.

OBJECTIVES

- To confirm the presence of eiders wintering in Hudson's Strait and the coast of Labrador.
- Continue triennial Atlantic Winter Eider Aerial Survey in Atlantic Canada. Next survey is planned for winter 2011-12.
- Record other incidental wildlife observations, such as Beluga whales, Bowhead whales, Long-tailed Ducks and Glaucous Gulls.

Northern Common Eider Duck

METHODS AND INFORMATION COLLECTED

- We identified possible wintering sites using several sources of information:
    - local ecological knowledge;
    - wintering locations from satellite tracking studies; and
    - use of Radarsat imagery of Frobisher Bay, Hudson's Strait, and coastal Labrador to identify areas of open water.
- Using a Twin-Otter, we attempted to visit as many sites as possible to determine if eiders wintered at these sites.
- Survey flights were conducted at 1000 to 1500 feet ASL.
- Flight tracks and locations of observations were recorded using GPS Voice Recording Software. Flocks were also photographed.

Flock of Common and King Eider ducks at the Button Islands water- February 2010

YEARS OF DATA

- 2010

PARTNERS

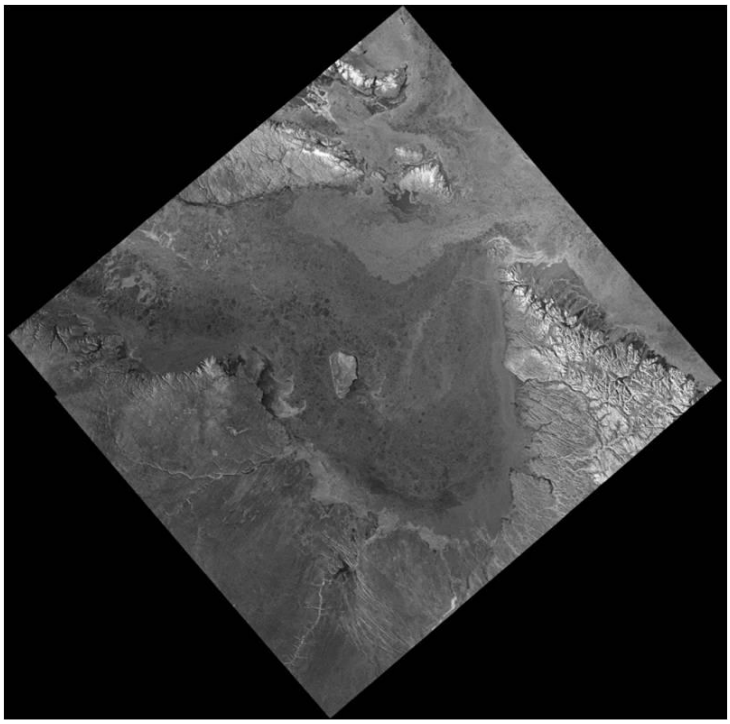
- Québec and Atlantic Regions of the Canadian Wildlife Service.
- Nunatsiavut Government

FUNDING

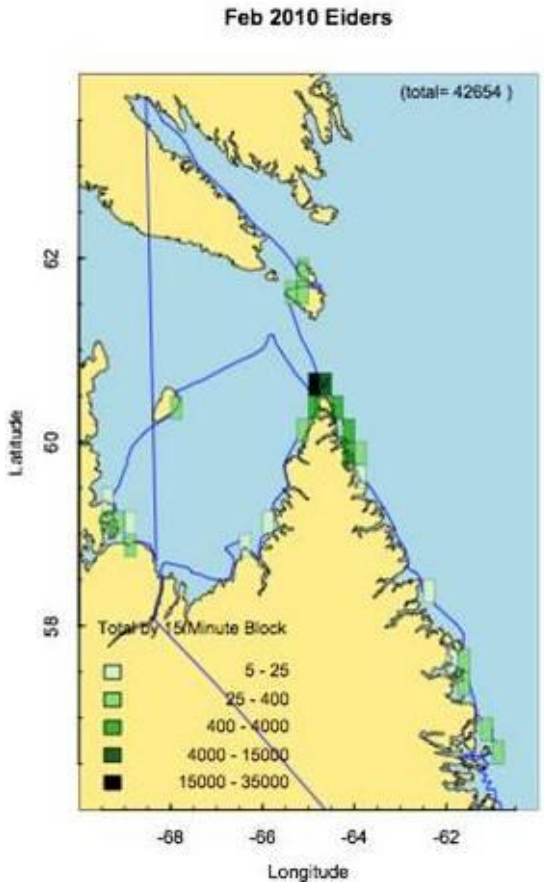
- Québec and Atlantic Regions of the Canadian Wildlife Service

RESULTS/ACCOMPLISHMENTS

- The survey was incomplete in many areas due their remote locations and fuel limitations of the aircraft.
- Small numbers of eiders were detected on the east and west coasts of Ungava Bay, Resolution Island, and coastal Labrador.
- A total of 45,650 Common and King Eiders, most of which (~35,000 birds) were located around the Button Islands.
- We also report observations of 560 Glaucous Gulls, 4140 Long-tailed Ducks, 72 Beluga and 9 Bowhead Whales along the flight track.



Rada Sat image of the study area ice conditions in late Feb 2010. Northern Labrador and the Ungava Peninsula can be seen in the far right corner.



CONTACT

Scott Gilliland
Canadian Wildlife Service
17 Waterfowl Ln.
Sackville, NB
Phone: 506-364-4042
Email: scott.gilliland@ec.gc.ca
or
Christine Lepage
Service Canadien de la Faune
801-1550, avenue
d'Estimauville,
Québec, Québec
Phone: 418-649-6506
Email: christine.lepage@ec.gc.ca