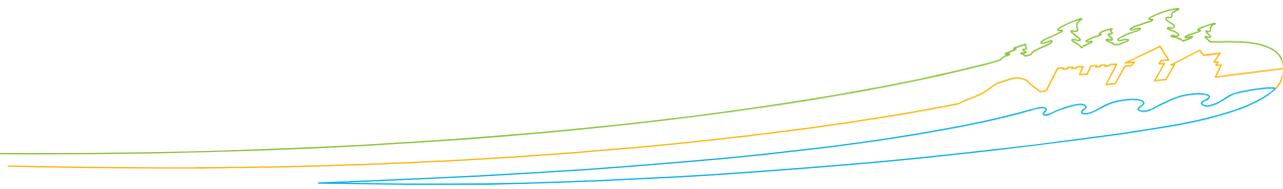




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2010
ANNUAL REPORT
OF
RESEARCH AND MONITORING
IN
TORNGAT MOUNTAINS
NATIONAL PARK



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

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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, Assistant coordinator Abigail Webb and students, Brenda Jararuse, Charlie Annanack, Jason Dicker, Jenni-Rose Campbell, Lizzie Unatweenuk, Patrick Webb, Paul Andersen, Saladie Snowball, Samantha Lyall, and Williami Annanack.

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.

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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.

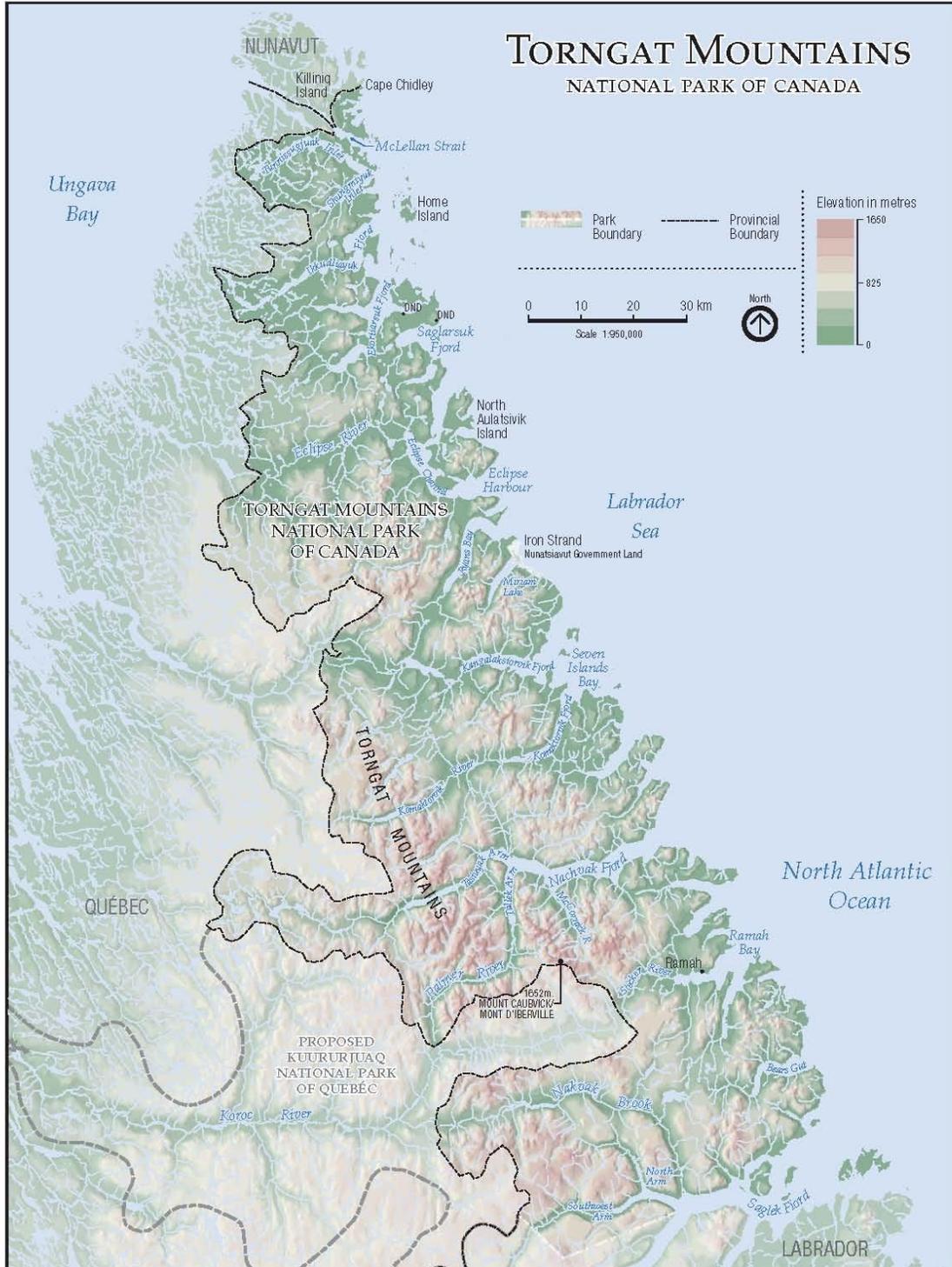
A major challenge to implementing an effective research and monitoring program is making the resulting information widely available and accessible to people outside the science program. Consequently, the purpose of this document is to present a summary of research projects and monitoring programs conducted in the park in 2010 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 2010 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 four categories based on the principal affiliation of the researchers as well as their primary source of funding. These four 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

REPORTING ON RESEARCH AND MONITORING

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 Nunavik 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 2010. 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



EDUCATION AND OUTREACH



RATIONALE

With the establishment of the kangidluasuk Base Camp, 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 an Inuit homeland. Since its inception in 2007, the initiative has evolved in scope and nature, striving to create experiential work and learning opportunities that inspire youth, build capacity, expand minds, and connect science and Inuit culture.

Education and Outreach

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 Inuit homelands of the Torngat Mountains region.
- gain an awareness of aspects of National Park management, heritage resource conservation, and visitor experiences.
- engage in experiences that build self-confidence, inspire creativity, and develop leadership, teamwork, critical thinking, and communication skills while living, learning, working and playing in a wild and awe-inspiring environment.
- increase an understanding and awareness of the education and acquisition of skills required for future employment and entrepreneurial opportunities in the region.



2010 kANGIDLUASUk student interns and staff (photo by Charlie Annanack)

METHODS

The kANGIDLUASUk Student Program provides experiential work and learning opportunities integrating Inuit culture, Arctic science, and outdoor adventure. The program is delivered as a multi-faceted 4-week summer internship for 10 Inuit youth from Nunavik and Nunatsiavut, age 16-25.

RESULTS/ACCOMPLISHMENTS

- In conjunction with the changeover of Base Camp operations this season, the kANGIDLUASUK Student Program successfully transitioned from a pilot outreach initiative to a non-profit organization, raising over \$200,000 for organizational development and program delivery.
- Continued collaboration and support from visiting researchers, TMNP staff, and base camp staff engaged students in a variety of science and research disciplines through presentations, discussions, focused modules, activities, and hands-on fieldwork on the land and at sea. Research, monitoring, and educational initiatives encompassed marine biology and ecology, archaeology, permafrost monitoring, plant ecology, glaciology, contaminants, species at risk, and sedimentology.
- Students participated in environmental stewardship initiatives to assess and clean-up historic debris in the Park and at Hebron in preparation for a culminating clean-up cruise in September.
- Students emerged as ambassadors for the region and Inuit culture while learning, sharing and teaching together with 32 Parks Canada student videographers from across Canada.
- Friendships and connections with the TMNP Co-Operative Management Board members, their families, and Nunasiavut and Nunavik elders were cultivated through boil-ups, discussions, storytelling, music, harvesting, ulu and bread making.
- Students reveled in travels to family homelands and significant natural, historic, and cultural sites in the Torngat Mountains and surrounding region.



Students Brenda Jararuse, Lizzie Unatweenuk, and Program Assistant Abigail Webb assisting with Peregrine Falcon and Harlequin Duck surveys.

YEARS OF DATA

2007, 2008, 2009, 2010

PARTNERS

- ArcticNet
- Environmental Sciences Group
- International Polar Year
- Inuit Tapiriit Kanatami

FUNDING

- Environment Canada – Aboriginal Funds for Species at Risk
- Fednav Ltd.
- Northern Contaminants Program
- First Nations and Inuit Youth Employment Strategy
- Nasivvik Centre for Inuit Health and Changing Environments
- Nunatsiavut Government
- Parks Canada
- Saputiit Youth Association of Nunavik



Kangidluasuk students host a night of Inuit games with Parks Canada's summer videographer students.

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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

Sallikuluk is a focal point of the Inuit cultural landscape in Saglek Fjord. Numerous sod houses and graves are located on the island. In addition more than a dozen archaeological sites illustrate a human history of the island, and surrounding areas, that reaches back more than 5000 years. Visitors to the park often come to Sallikuluk to experience the history and the landscape. Due to the importance of Sallikuluk this project was begun in 2008 to document the archaeology and oral history related to the island.

Parks Canada Research

SALLIKULUK ARCHAEOLOGY AND ORAL HISTORY PROJECT

OBJECTIVES

- Update the information we have about the archaeological sites on Sallikuluk
- Develop recommendations for preserving the cultural resources while providing opportunities for visitors to experience Sallikuluk, it's history and stories
- Explore possible approaches to the management of this special area



Tent Ring on Sallikuluk

METHODS AND INFORMATION COLLECTED

This year work focused on the Tuglavina site, a cluster of sod houses and related features located at the southwest end of the island. In 2009 we mapped the sod houses, so this year we conducted a pedestrian survey – walking systematically across the site – to identify additional cultural features and artifacts visible on the surface. We mapped our finds using a Total Station and GPS technology to record the location, size and shape of each feature. We also took photographs and field notes to document each find while leaving all artifacts in place on the site. A day trip to Sallikuluk included Cooperative Management Board members, elders and students providing us with the opportunity to discuss the importance of the island and to explore options for visitor experiences.

YEARS OF DATA

- Memorial University of Newfoundland projects led by James Tuck 1969-1971
- 2008-2010 Parks Canada

PARTNERS

- Torngâsok Cultural Centre, Nunatsiavut Government
- kANGIDLUASUK Student Program



Stone Circle, possibly a hearth, on Sallikuluk.

FUNDING

Parks Canada

RESULTS/ACCOMPLISHMENTS

We completed the mapping of the Tuglavina site with the addition of tent rings, hearths and graves in the eastern part of the site. A possible trail route for visitors was selected and recorded by GPS. From our visit with Cooperative Management Board members and elders we learned that Sallikuluk is important as a gathering place and as a place where resources are abundant. Several options for visitor experiences and area management were discussed.

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RATIONALE

Torngat Mountains National Park includes hundreds of archaeological sites representing more than 5000 years of human history. Park activities are thus likely to encounter traces of past human use and have the potential to impact the condition of these cultural resources. Archaeological sites also provide opportunities for visitors to experience the park, connecting with Inuit culture and the stories of these special places. In 2010 Parks Canada conducted archaeological assessments in conjunction with the clean-up of debris and contaminated sites and with the development of visitor experience offers.

Parks Canada Research

TORNGAT MOUNTAINS ARCHAEOLOGICAL ASSESSMENTS 2010

OBJECTIVES

- To identify and document archaeological sites within areas scheduled for clean-up.
- To assess the impact of clean-up activities, provide recommendations and assist with work to reduce impacts as needed.
- To document archaeological sites within areas of visitor activity and assess the impact of visitor traffic.
- To collect information for visitor experience programs.



Tent Rings & Caches at North Arm.

METHODS AND INFORMATION COLLECTED

- Known archaeological sites in and near activity areas were identified in the archaeological site inventory and background research was conducted for each one.
- Once in the field the sites were located and were then recorded using GPS technology, photographs and field notes.
- The extent of each site based on surface indications was documented along with the types of cultural features that we observed.
- The clean-up of debris and excavation of contaminated soils were monitored to ensure that cultural features were preserved.

YEARS OF DATA

- Archaeological site inventory data compiled by the Provincial Archaeology Office of Newfoundland and Labrador 1970 to 2005
- Parks Canada 2010

PARTNERS

- Environmental Sciences Group
- kANGIDLUASUK Student Program

FUNDING

- Parks Canada
- Federal Contaminated Sites Action Plan



Recording a feature on Big Island.

RESULTS/ACCOMPLISHMENTS

- Conducted an initial assessment of visitor activity areas in North Arm, Saglek Fjord.
- Assessed clean-up activities on Big Island in Saglek Fjord where we visited a known Inuit site with two sod houses and recorded two additional sites – an Inuit tent camp and an American camp associated with the Saglek radar base.
- Assessed and assisted with clean-up activities at the Ramah Bay Mission site and documented cultural resources at the site.
- Assessed and assisted with clean-up activities on Parmenter Island.



Debris for clean-up at Ramah Bay Mission

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RATIONALE

In 2008, Parks Canada initiated a long term Visitor Research Program to understand who is visiting the 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 and provides information the park can use to facilitate future experiences that are relevant and unique.

Parks Canada Research

2010 VISITOR RESEARCH PROGRAM

OBJECTIVES

2010 Visitor Survey and Cruise Ship Visitor Survey

The objective of these surveys is to gather feedback from different types of visitors 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 Northern Labrador.

Note that a survey specifically designed for scientific researchers was not administered in 2010 because of the large number of returning researchers who had completed a researcher survey in 2008 and/or 2009.

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 2010 and email invitations to complete the respective surveys were sent out to each group in the fall. The online surveys were conducted using SurveyMonkey.com.

YEARS OF DATA

- The Visitor Survey 2008-2010
- Cruise Ship Visitor Survey 2009-2010
- Researcher Survey 2008-2009

FUNDING

This project was entirely funded by Parks Canada.

RESULTS

2010 Visitor Survey

- 81% of the visitors who came to the park in 2010 were visiting the park for the first time.
- The average length of stay was 8 days / 7 nights.
- 74% of respondents stayed overnight at KANGIDLUASUK basecamp during their last visit to TMNP.
- Most visitors arrived to TMNP by air; 45% of them by regular plane (mostly twin otters), 25% by float plane and 15% by helicopter.
- Most visitors found out about TMNP from Parks Canada (staff or websites) and through word of mouth (45% and 33% respectively said this was how they found out about TMNP).



- Close to 7 out of 10 visitors saw polar bears (69%) and black bears (71%) during their last visit to Torngat Mountains National Park.
- The most common source of information used to plan a trip to TMNP was contacting park staff by phone, email or in person (49% had done so). Roughly the same percentage had obtained trip-planning information from tour operators or commercial guides who are familiar with the area.
- Visitor satisfaction with services (e.g. Inuit Bear Guard & Guide services) and other aspects of their visit (e.g. personal safety) was exceptionally high.
- Although a visit to the Torngats is, for many, a once-in-a-lifetime opportunity, 61% of survey respondents said they intend to return to TMNP someday.
- The vast majority of visitors indicated that the safety information they consulted or received prior to visiting the park adequately prepared them for their visit.
- With respect to visitor satisfaction, 89% of visitors were either “very satisfied” or “satisfied” with their visit overall, which narrowly misses the ambitious 90% target that Parks Canada has set for overall visitor satisfaction (4 & 5 out of 5 ratings combined). However, the results far exceed the 2nd performance target with 8 out of 10 visitors providing a 5 out of 5 rating for visitor satisfaction in 2010 (the target is that no less than 50% of visitors should be “very satisfied”).

2010 Cruise Ship Visitor Survey

- The cruise ship visitors that completed this survey were sailing aboard three vessels in 2010; the Wanderbird (visited in late July/ early August), the Polar Star (September/October) and the Lyubov Orlova (September).
- Demographically, the individuals that visited the TMNP area by cruise ship in 2010 were:
 - Primarily from Canada (55%), while the rest came from Europe (25%) and the USA (20%).
 - Evenly split between males and females.
 - A relatively older group, with nearly 70% of them 55 years of age or older.
 - 87% English-speaking / 1% French-speaking / 12% speak other languages at home (German, Inuktitut, etc.)
 - Well educated, with two-thirds of them having obtained a university or professional degree.
 - Fairly affluent, with 42% living in households earning over \$100,000 a year.
 - Most travel parties consisted of family members traveling together (42%).
- 78% of cruise ship visitors were visiting the TMNP for the first time in their lives.
- Only 52% of cruise ship visitors were aware of the existence of the Torngat Mountains National Park prior to taking their cruise through Northern Labrador in 2010. When those who were aware of the park before their visit were asked what influence the park had on their decision to go on this cruise, over 60% of cruise ship visitors indicated that the park had an influence of 8 or higher on a 10-point scale.
- With regards to wildlife viewing, 86% of visitors reported seeing polar bears during their cruise while half of them saw various birds while travelling through the area. 35% of visitors observed seals, 25% saw black bears, 22% spotted caribou and 17% caught a glimpse of whales.
- All of the cruise ship visitors had the opportunity to go onshore during their visit. All of them said they felt safe during their shore-based excursions and all groups were accompanied by Inuit bear guards during their shore-based excursions in Torngat Mountains National Park.
- 96% of cruise ship visitors said that they would recommend a cruise ship as a way to experience Torngat Mountains National Park to others.

With respect to cruise ship visitor *satisfaction*, 84% of visitors that replied to this question were either “very satisfied” or “satisfied” with their last visit to Torngat Mountains National Park overall.

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RATIONALE

Past human activities in TMNP have resulted in various sites with anthropogenic debris such as fuel drums, camping debris, fish weirs, net debris and plane wrecks. An inventory of debris sites had been compiled by Parks staff and local Inuit in 2008. There is potential for some of these sites to contain hazardous materials (such as fuels). The TMNP Co-Operative Management Board identified the cleanup of these sites as a priority. In 2009, Parks Canada initiated a two-year project to assess all of the potentially contaminated sites in the park.

Parks Canada Research

ASSESSMENT OF POTENTIALLY CONTAMINATED SITES IN TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

- Update inventory of debris in the park.
- Complete environmental assessments of the debris sites and the active fuel caches in the park.
- Determine quantity and type of debris, presence and extent of contamination, pathways for contaminant migration, and environmental impacts at each site.

METHODS AND INFORMATION COLLECTED

- Field work was mobilized out of the KANGIDLUASUK basecamp where information could be gathered from elders, locals, researchers, park staff, and pilots.
- During the two field seasons (2009 and 2010) all previously identified debris sites were assessed and additional areas were scanned to ensure as much of the park as possible had been surveyed for debris and areas of potential contamination.
- Over 100 soil samples were collected and analyzed for suspected contaminants including fuel, inorganic elements (i.e. copper, nickel, cobalt, cadmium, lead, zinc, chromium, arsenic) and polychlorinated biphenyls (PCBs).
- All of the drums were consolidated at temporary cache sites (Parmenter Island, Telliaosilk Arm, Nachvak Fiord, Seaplane Cove, Delabarre Bay, Ramah Bay, and KANGIDLUASUK basecamp) where their contents were sampled to determine appropriate disposal requirements.
- Parks Canada provided archaeological assistance to ensure that no potentially archeologically significant features were disturbed during the assessments.



Local guides discussing areas where debris is located.



Removing drums and debris at the Ramah Bay Mission Site in order to sample soil.



Assessing fuel contamination from a fuel bladder at the Nachvak Headwaters.

YEARS OF DATA

- 2009
- 2010

PARTNERS

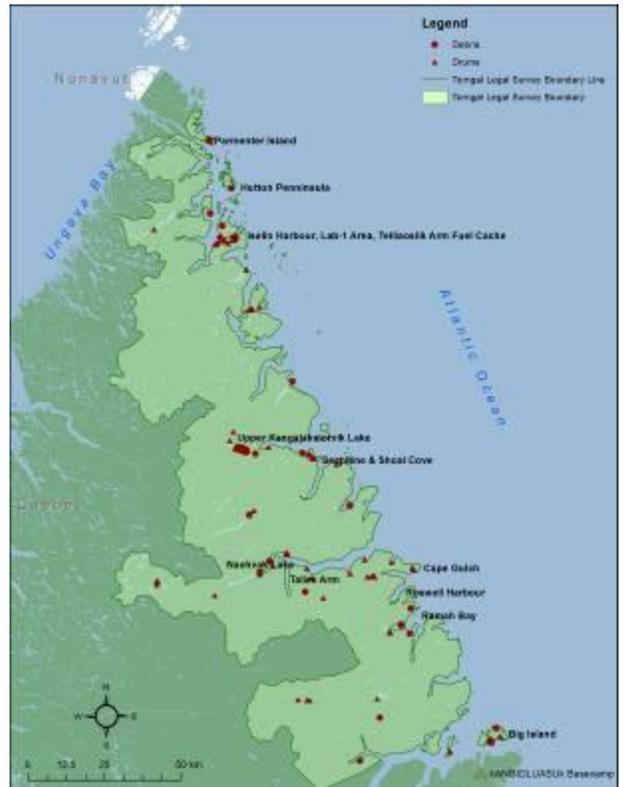
- Parks Canada
- Environmental Sciences Group
- kANGIDLUASUK Student Program

FUNDING

- Federal Contaminated Sites Action Plan
- Parks Canada

RESULTS/ACCOMPLISHMENTS

- Over 200 abandoned drums were found scattered throughout the park.
- Many of the drums were crushed and empty, although some were full or partially full. These contained over 3 500 L (~18 drums) of fuel or fuel/water mixtures.
- The debris found in the park included: two plane wrecks; navigation buoys; fish net debris; domestic/camp debris (e.g. tin cans, stove, jerry cans); rusting metal debris (e.g. bed frames, barrel rings, snowmobile frame); aluminium debris (e.g. plane pontoon, aluminium tower, aluminium siding); batteries; propane canisters; a fuel bladder; wires; ropes; and lumber.
- The majority of the debris was inert, and not contributing to contamination.
- No PCBs were found in the park.
- Fuel contamination was associated with leaking drums at Cape Gulch and Shoal Cove and an old fuel bladder at the Nachvak Headwaters.
- Inorganic element (e.g. lead, cadmium) contamination was associated with batteries found on Parmenter Island (former radio beacon tower site), Hutton Peninsula (former German remote weather station from World War II) and Big Island (former camp).



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RATIONALE

In 2009, Parks Canada initiated a two-year project to assess potentially contaminated sites in the park. During the 2009 field season contamination associated with fuel drums was found at Tallek Arm, Shoal Cove and Cape Gulch. Inorganic element (lead) contamination associated with battery debris was found on Parmenter Island. In 2010, goals were to determine the extent of contamination at these sites and begin remediation.

Parks Canada Research

REMEDIATION OF CONTAMINATED SITES IN TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

- Determine the extent of fuel contamination at Shoal Cove, Tallek Arm, and Cape Gulch.
- Determine the extent of inorganic element (i.e. lead) contamination on Parmenter Island.
- Remove sources of contamination (fuel drums and battery debris) and remediate contaminated soils.



Abandoned fuel drums on Cape Gulch.



Leaking drum on Shoal Cove.



On of three areas with batteries on Parmenter Island.

METHODS AND INFORMATION COLLECTED

- Field work was mobilized out of the KANGIDLUASUK basecamp.
- Soil samples were collected to determine the extent of fuel contamination. Samples were analyzed in a mobile laboratory set up at the KANGIDLASUK basecamp and in southern laboratories.
- A portable X-ray fluorescence instrument was used to determine the extent of inorganic element contamination while on site. Post excavation confirmatory samples were analyzed in southern laboratories.
- Contaminated soil was excavated by hand, shipped off-site and disposed at appropriate facilities in St. John's N.L.
- The fuel drums and battery debris were removed from the site and secured at temporary cache sites (Parmenter Island, Delabarre Bay, Seaplane Cove). Fuel was transferred to jerry cans or other drums, if necessary.



Soil sampling at the Tallek Arm Fuel Cache.

YEARS OF DATA

- 2009
- 2010

PARTNERS

- Parks Canada
- Environmental Sciences Group
- kANGIDLUASUK Student Program



Consolidating waste fuel and removing drums on Cape Gulch.



Analyzing soil samples in the laboratory at the kANGIDLUASUK Basecamp.

FUNDING

- Federal Contaminated Sites Action Plan
- Parks Canada

RESULTS/ACCOMPLISHMENTS

- At Shoal Cove, the leaking drums were removed. No soil contamination was found. Absorbent materials were used to remove fuel from standing water.
- At Tallek Arm, no extensive contamination was found. The fuel detected in soil samples collected in 2009 was most likely from minor spillage from re-fuelling operations.
- At Cape Gulch all of the drums were removed. Soil in one of the drainage ditches was contaminated with fuel. The contamination extended 5 m along the ditch. However, fuel was not reaching the lake. Approximately 10% (0.16m³) of the contaminated soil was excavated.
- At Parmenter Island three areas were identified with soil contamination (lead, nickel, and cadmium) associated with battery debris. All of the contaminated soil (0.35 m³) and battery debris was excavated.



Excavating contaminated soil on Parmenter Island.

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RATIONALE

When the Park was established in 2005, the first priority of the TMNP Co-operative Management Board was to remove historic debris and garbage found in the Park. Between 2005 and 2008, over 80 sites scattered throughout the park were located and documented. In 2009 funding was secured from the Federal Contaminated Sites Action Plan (FCSAP) to conduct site assessments for potential contamination associated with the debris. These assessments were completed and a plan developed to remediate sites found to be contaminated and remove the debris from all the other sites. In 2010 Parks Canada entered into partnership with Cruise North Expeditions to conduct an environmental stewardship expedition in September. This expedition included volunteers from various organizations who collected the empty drums, debris and garbage stockpiled at 7 pickup locations along the coast of the park.

Parks Canada Research

DEBRIS AND GARBAGE CLEAN UP IN TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

- Remove debris and garbage from the Park.
- Provide opportunities to for Park Staff, Inuit, volunteer organizations and visitors to participate in a joint stewardship mission to clean up an Inuit homeland and a spectacular national park.



Eli Merkuratsuk, Joby Unatweenuk, and John Merkuratsuk collecting drums on Upper Kangalaksiorvik Lake.

METHODS AND INFORMATION COLLECTED

- During the summer, drums, debris and garbage was consolidated at 8 cache sites along the coast (Parmenter Island, Telliaosilk Arm, False Bay, Nachvak Fiord, Seaplane Cove, Delabarre Bay, Ramah Bay and KANGIDLUASUK basecamp) (Fig.1). Much of this work was completed by staff and students from the KANGIDLUASUK basecamp, as well as by the crew of the Robert Bradford.
- A Parks Canada archaeologist ensured that any potential archaeologically significant features were not disturbed during the site assessments and garbage removal.
- In September 2010, the debris from four of the cache sites (Parmenter Island, Nachvak Village, Ramah Bay and the KANGIDLUASUK Basecamp) was collected



Removing drums and debris from the Nachvak Fiord Cache.

PARTNERS/FUNDING

- Federal Contaminated Sites Action Plan
- Cruise North Expeditions Inc
- Environmental Sciences Group
- Parks Canada Agency
- Nunatsiavut Government
- Makkivik Corporation
- Torngat Secretariat
- Torngat Wildlife and Plants Co-Management Board



Robert Harris collecting an old jerry can from Upernavik Island.

- Torngat Joint Fisheries Board
- kANGIDLUASUK Student Program
- Jaanimmarik High School/ Ungaluk (Safer Communities Fund)

YEARS

2010

RESULTS/ ACCOMPLISHMENTS

- Approximately 14 tons of debris has been removed including over 150 empty drums, 10 m³ of metal debris, 20 propane canisters, an aluminium tower, and batteries (Fig.1).
- All of the debris was disposed or recycled at appropriate facilities in St. John's N.L.
- Caches remain at Telliaosilk Arm, False Bay, Seaplane Cove and Delabarre Bay.
- Other debris that remain in the park include: batteries at the World War II weather station on Hutton Peninsula, the cabin at Iselin Harbour, a submerged plane and a wooden boat at Upper Kagalaksiorvik Lake, a plane wreck at Ramah Bay/Reddick Bight and several net buoys.



Debris collected during the 2010 Environmental Stewardship Expedition.

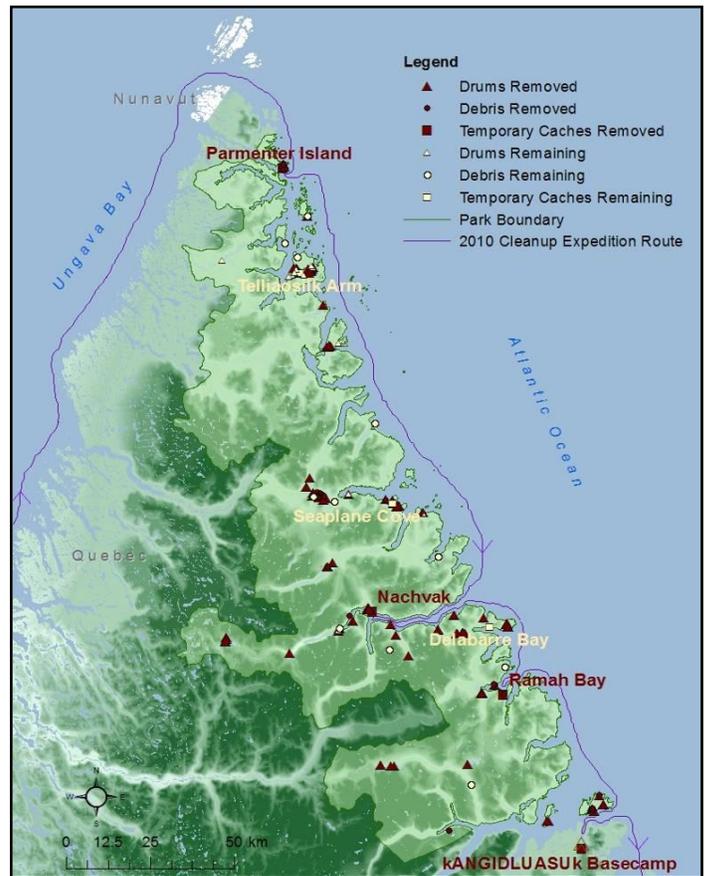


Fig. 1 Summary of debris removed from TMNP.

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RATIONALE

The *simmik* or glaciers of Torngat Mountains National Park (TMNP) are an important component of the natural landscape for Inuit whose word for them translates as *never melting ice*. The earliest known photograph of a TMNP glacier dates to 1908, taken by E.S. Bryant and H.S. Forbes during a coastal expedition of northern Labrador. Despite this early record, the glaciers of TMNP are largely unknown to Canadians and poorly documented by scientists. Their geographic importance – the only glaciers on mainland North America east of the Rocky Mountains and the southernmost glaciers along the mountainous rim of the Eastern Canadian Arctic – underscores their scientific importance and the science questions they pose: Why do they survive so far south at such low elevations? How long have they been there? Are they growing or shrinking? How do they respond to changes in climate? What will happen to them under projected climate warming?

ArcticNet Research

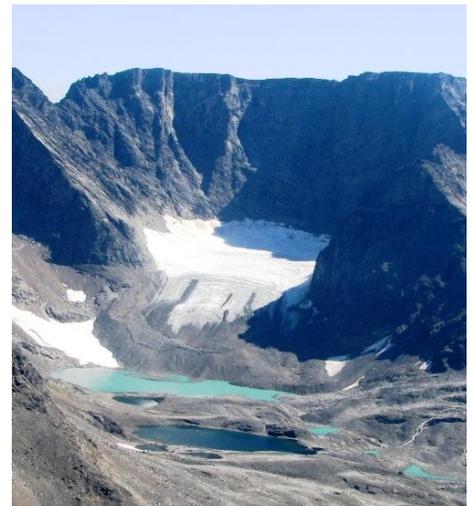
RECENT GLACIER CHANGE IN TORNGAT MOUNTAINS NATIONAL PARK

OBJECTIVES

- To identify all glaciers in TMNP and to precisely survey the surface and lower margin 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, the last century and the last several millennia.
- To model the sensitivity of glacier melting to climate conditions and project glacier change based on future climate scenarios for TMNP.

METHODS AND INFORMATION COLLECTED

- Precise elevation and position surveying (DGPS) of select glaciers in Ivitak Valley, Nachvak Fiord.
- Ground penetrating radar profiles (ice thickness) of select glaciers in Ivitak Valley, Nachvak Fiord.
- Aerial photograph (2005, 1960-64 and 1949-50) mapping of glacier extent of all TMNP glaciers.
- SPOT5 HRS satellite image (2007) mapping of glacier extent of all TMNP glaciers.
- Geographic location (e.g. distance to coast, aspect), topographic setting (e.g. elevation range, slope and height of surrounding terrain) and glacier characteristics (e.g. debris cover) of all TMNP glaciers.
- Daily surface air temperature at 8 locations on Hidden and Minaret glaciers.



View looking south at Abraham glacier near Nachvak Fiord. Note the high valley backwall shades the upper parts of the glacier. Abraham glacier experienced a decline in area of 6% between 2005 and 2007, whereas in the 40 years or so prior to 2005, it shrank in area by roughly one-third.

YEARS OF DATA

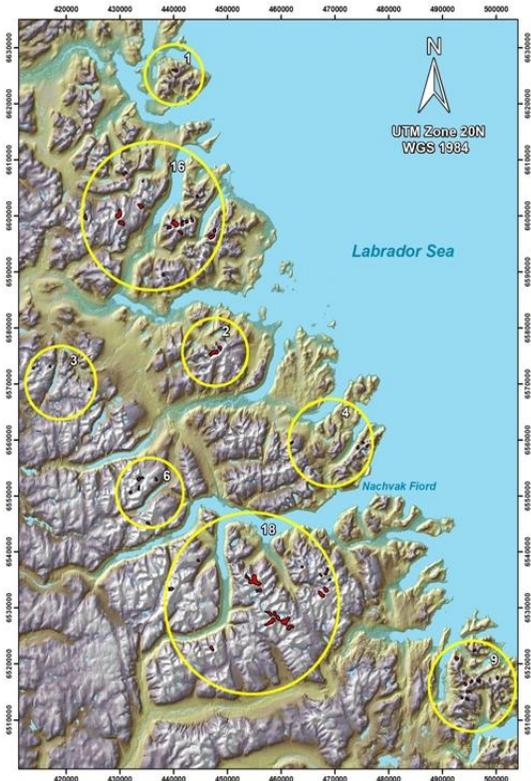
- Glacier surface elevation, ice thickness and lower margin position for Hidden, Minaret, Abraham (2008-2009) Superguksoak and unnamed (2009) glaciers
- Areal extent of TMNP glaciers for 2007, 2005, 1960-64 and 1949-50
- Topographic setting of TMNP glaciers (2005)
- Daily variation in air temperature along elevation transect on Hidden and Minaret glaciers (2009-2010)
- Modeled average monthly temperature and precipitation data for 1948 to 2009 for Nachvak Fiord region (NCEP/NCAR Reanalysis data)

FUNDING

- ArcticNet
- Parks Canada
- Memorial University
- Indian and Northern Affairs Canada (NSTP)
- Natural Sciences and Engineering Research Council

PARTNERS

- Memorial University
- University of Alberta
- Parks Canada



Location of 59 glaciers (red) in TMNP based on 2009 inventory. This number may be adjusted as further mapping is completed.

RESULTS/ACCOMPLISHMENTS

- 2005 inventory of 59 glaciers ranging in size from 0.06 to 1.88 km² for a total glacier area of 21.2 km². Most of the glaciers (64%) were smaller than 0.25 km² and only 2 were larger than 1 km².
- 2007 inventory of 59 glaciers ranging in size from 0.05 to 1.24 km² for a total glacier area of 16.7 km². This represents a decline of 4.54 km² or 21.4% of the 2005 area. Forty-nine or 83% of the glaciers experienced a real decrease in area with an average decline of 0.1 km². The other 17% grew in area by an average of 0.02 km².

- 1949-50 and 1960-64 combined inventories of 64 glaciers ranging in size from 1.9 to 0.06 km² for a total glacier area of 28.5 km². Over the 40-55 years prior to 2005, 14 or roughly one-fifth of the glaciers decreased in area by 50% or more, and 5 had melted completely or become too small to be actively flowing.

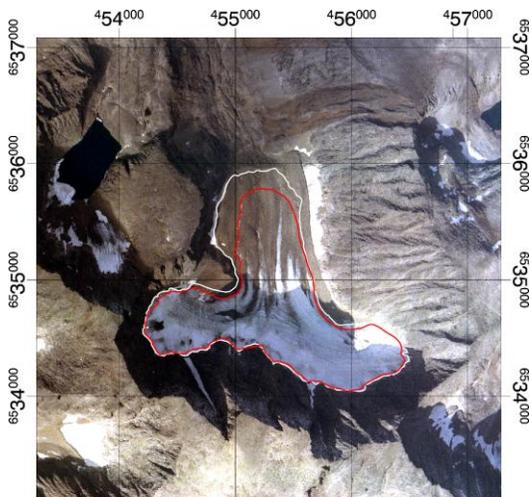
- TMNP glaciers typically occupy deep valleys with high walls and many are heavily rock-covered at lower elevations. Most (63%) face north, which shades the glacier surface from direct sunlight due to high backwalls. The glaciers end at elevations between 285 m and 1080 m above sea level. About 70% of the glaciers are located within 30 km of the Labrador coast.

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Aerial photograph of Superguksoak glacier in 2005, showing the heavily rock-covered snout. The white line shows the 2005 margin, the red line the 2007 margin.

RATIONALE

Fresh water and sediments from rivers play important roles in nutrient and other material transport to the coastal ocean (i.e., contaminants), thus influencing both terrestrial and marine ecosystems; human alteration of the landscape and/or water runoff can alter marine delivery of water and sediment; and fresh water (and probably sediment) delivery is known to be changing in northern Canada, probably in association with climate change. 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 two centuries.

ArcticNet Research

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

OBJECTIVES

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 two centuries. Specific field objectives for the 2008 field season were as follows:

- Map thickness, extent, and age of sediment deposits of riverine origin in marine basins near Nakvak Brook and the Ivitak River, using SONAR systems and boxcoring equipment;
- In stream waters, deploy pressure sensors in the beds of the Ivitak River and Nakvak Brook to determine seasonal magnitude and variability of stream flow;
- In fjord waters, measure concentrations of sediment, and ^{7}Be and ^{210}Pb to assess delivery of these materials from stream to ocean.

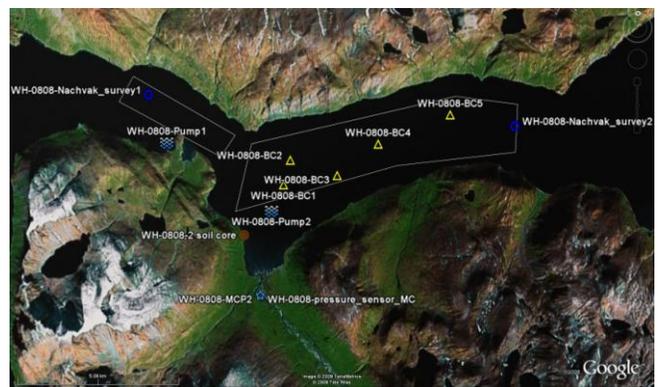
Note: as of the time of this report, all field objectives have been completed, except final recovery of pressure sensors described below, scheduled for summer 2011.

METHODS AND INFORMATION COLLECTED

Pressure sensors were placed in the lower reaches of Ivitak River and Nakvak Brook in Summer 2009 to be recovered one year after positioning. The sensor measures water stage of the river every 30 minutes throughout the year. The data will provide information about a seasonal change of river runoff into the fjord.



Deploying a pressure sensor in Nachvak Brook



Satellite image of Nachvak Fjord, showing sample and survey locations for Summer 2008-09 field work

Name	Location	Dates	Notes
WH-0808-pressure_sensor_NB	59° 30.630' N, 063° 18.807' W	Aug 6, 2010	Ivitak River, Nachvak Fjord. Sensor lost due to large landslide. Sensor not redeployed for 2010-2011.
WH-0808-pressure_sensor_MC	59° 00.214' N, 063° 44.818' W	Aug 3, 2009	in Nakvak Brook, Saglek Fjord, at base of boulder approx. 1 km upstream of river mouth

Note: the 2008-2009 Nakvak Brook sensor was found on the beach 10 m downstream from the deployment location. Sensor data show that the sensor was removed from the water during normal stream conditions in late September, 2009, suggesting that a bear moved the sensor onto the beach. The sensor did record high river stages in 2009-2010, nevertheless, and was replaced for 2010-2011 readings.

YEARS OF DATA

2008-2010

PARTNERS

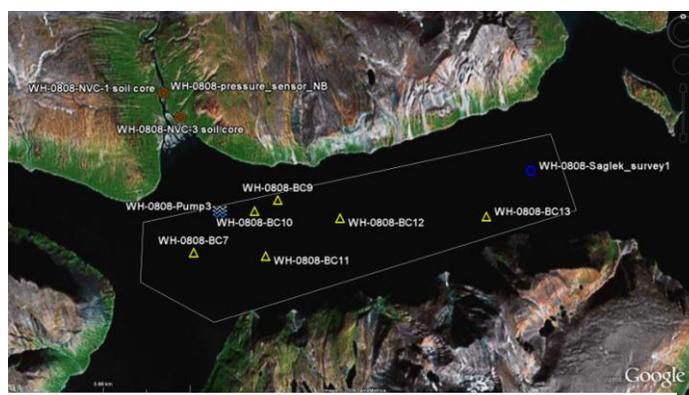
Parks Canada,
Nunatsiavut Government,
Memorial University of Newfoundland,
Environmental Sciences Group Royal Military College

FUNDING

ArcticNet Project: Nunatsiavut Nuluak

RESULTS/ACCOMPLISHMENTS

- Preliminary analysis suggest that the thickness of postglacial sediments in the marine basin for the Ivitak (16km² area, 150-170 m deep) river is 5-10 m, and 10-20m in the basin off Nakvak Brook (20 km², 250m deep), implying that sediment volumes are proportional to catchment area.
- Sediments have been deposited in wedges that thicken towards the river mouth. X-radiographs of sediment cores show very faint layering. The presence of layering suggests that there was rapid sediment delivery (such as by gravity-driven mechanisms), rather than from water-column plumes.
- These layered sediments appear to be well preserved and therefore good indicators of river discharge in the recent past.
- Radioisotope analyses suggest that sediment accumulation rates vary among fjords from 0.3 cm/y in Nachvak Fjord to 0.35 cm/y in the Saglek Fjord, over approximately the past 100y.
- Ongoing work will evaluate core data for possible changes in sediment accumulation rates over the past few centuries that would be indicative of changing river discharge over time.



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

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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), 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.

ArcticNet Research

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

OBJECTIVES

- To assess the health of ringed seals in northern Labrador using physiological, biochemical, and molecular measurements.
- To capture and deploy ringed seals with satellite transmitters (Platform Transmitter Terminals, PTTs) to assess movement and foraging behaviour.
- To measure contaminant levels in ringed seals.
- To determine which prey items are most important to the Labrador ringed seal diet.



Samuel Ittulak, Dorothy Angnatok and Andrew Swales taking the weight of a ringed seal.

METHODS AND INFORMATION COLLECTED

- Prey species (fish, benthic invertebrates, zooplankton) were collected from Nachvak, Saglek, Okak and Anaktalak Fiords.
- Five ringed seals (3 juvenile females, 2 juvenile males) 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.
- Blubber/skin biopsies were collected from live-captured ringed seals from Saglek and Okak Fiords.
- Liver, kidneys, heart, lungs, gonads, stomach, lower jaw, thyroid, thymus, left fore flipper, whiskers, claws and hair were collected from harvested ringed seals.

YEARS OF DATA

- 2008, 2009, 2010

PARTNERS

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



Leo Angnatok, Tanya Brown and Dr. Peter Ross sampling a ringed seal.

FUNDING

- ArcticNet
- Parks Canada
- National Defence
- Northern Contaminants Program
- Fisheries and Oceans Canada
- Nunatsiavut Government
- Nasivvik
- Inuit Pathways



Blubber/skin biopsy collected from a ringed seal for contaminants and fatty acids analyses.

RESULTS/ACCOMPLISHMENTS

Foodweb

- Saglek and Okak ringed seal fatty acid signatures differed significantly from Nachvak and Anaktalak, indicating possible differences in ringed seal feeding behaviour across the four fiords.
- $\delta^{13}\text{C}$ values from ringed seal harvested in Anaktalak Bay are lower relative to Okak, Saglek, and Nachvak, suggesting that Anaktalak Bay ringed seals are feeding in more offshore areas relative to the three northern fiords where ringed seals are feeding in nearshore areas.
- $\delta^{15}\text{N}$ values in ringed seals are elevated in Anaktalak Bay relative to the three northern fiords, which suggests that ringed seals from Anaktalak Bay are feeding at higher trophic levels than ringed seals from further north in Labrador.

Telemetry

- Although data analyses are still being performed, tracks show variable movement patterns among the five seals over a two month period. One of the juvenile females has travelled less than 100 km and has used Saglek, Hebron, Napaktok Bay and Pistolet Bay to similar extents. Another juvenile female travelled over 1,000 km. She remained in Saglek for one week and then travelled offshore and north along the coast to Hudson Strait and onto Chakbak Inlet, just east of Cape Dorset on Baffin Island. The third juvenile female stayed in Saglek Bay for one month and then travelled north to Bears Gut and then south to Hebron, Okak, and Nain Bay. One of the juvenile males remained in Saglek for over one month, and then travelled north to Nachvak Fiord and back south to Saglek, while the other juvenile male seal remained exclusively inside Saglek Fiord.

Health

- Species-specific methods to measure ringed seal health have been developed, tested, and prove to be successful using similar gene-specific tools which have been applied to harbour seals, killer whales, and beluga whales. Data analyses is ongoing. Our preliminary results suggest that ΣPCB levels in approximately 24% of the ringed seal from Saglek Fiord exceed established health effects thresholds in harbour seals (*Phoca vitulina*). While 10%, 5% and 0% of ΣPCB levels in ringed seals from Nachvak, Okak, and Anaktalak Fiords, respectively, exceed harbour seal health effects thresholds. Blood samples are being analyzed for circulatory hormones (thyroid and vitamin A & E). Heart and lungs are being examined for heartworm and lungworm. The radius bone will be analyzed for bone mineral density once a larger sample size is established. Stomachs are being analyzed for stomach contents and for the zoonotic parasite (*Anisakis* spp). The tongue, cheeks, diaphragm muscle, left fore-flipper muscle, and heart muscle are being analyzed for the zoonotic parasite (*Trichinella* sp).

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RATIONALE

Very little is known about the ecology, physical oceanography, and land-ocean linkages and dynamics of Labrador fjords. Phytoplankton are the foundation of the marine food web and zooplankton channel energy from primary producers to fish and marine mammals. Consequently, phytoplankton and zooplankton are vital components of the Arctic marine food web and are excellent indicators of the state of a marine ecosystem. This study represents the first integrated investigation of phytoplankton and zooplankton composition, zooplankton biomass, primary production and nutrient dynamics in Labrador fjords. Detailed annual sampling of these fjords allows us to better understand the oceanographic conditions in these environments and to determine whether the patterns we're observing are due to local anthropogenic factors, natural variability, and/or climate change.

ArcticNet Research

FJORD OCEANOGRAPHIC MONITORING AND ASSESSMENT IN NORTHERN LABRADOR: NACHVAK, SAGLEK, OKAK, ANAKTALAK

OBJECTIVES

Specific field objective for the 2010 field season were as follows:

- Collect and describe zooplankton and phytoplankton communities and productivity in Nachvak and Saglek Fjords.
- Measure physical parameters (e.g. salinity, temperature, depth, irradiance, oxygen, chlorophyll a) in Nachvak and Saglek Fjords.

METHODS AND INFORMATION COLLECTED

- Field Sites: Nachvak Fiord (Torngat Mountains National Park) and Saglek Fiord (Southern border of the park).
- CTD (conductivity-temperature-depth) casts were made at each station.
- Water samples were collected at the mouth and head of the four fjords at 3 optical depths (50%, 15%, and chlorophyll max) in the photic zone.
- Zooplankton samples were collected at mouth and head of the four fjords for composition and biomass estimates using a vertical hydrobios and monster nets and oblique tucker trawls.

YEARS OF DATA

2006 (WINTER)
2007 (SUMMER)
2009 (WINTER)
2010 (WINTER)



Retrieving the vertical Hydrobios net from Nachvak Fiord.

PARTNERS

- ArcticNet
- Parks Canada
- Nunatsiavut Government
- National Defense
- Université du Québec à Rimouski
- Université Laval

FUNDING

- ArcticNet
- Parks Canada
- Nunatsiavut Government
- National Defense



Maxime Geoffroy preparing the horizontal Monster net for deployment.

RESULTS/ACCOMPLISHMENTS

- The mesozooplankton community of the fjords was dominated by calanoid copepods. The most abundant species were *Pseudocalanus* sp. and cyclopoid copepod *Oithona similis*. Higher zooplankton biomass values were recorded in the northern fjords.
- Large calanoids (e.g. *Calanus hyperboreus* and *C. glacialis*) were the most important contributors to the biomass.
- The highest abundances of heterotrophic bacteria and picophytoplankton were observed in Anaktalak Fjord whereas the highest abundance of nanophytoplankton was observed in Nachvak Fjord.
- The highest chlorophyll a biomass was observed at the mouth of Nachvak and Anaktalak Fjords.
- Primary productivity decreased from north to south.
- Microflagellates were the dominate taxa present among the three study areas (Nachvak, Saglek and Anaktalak Fjords), among the two depths sampled (50% light level and at the DCM), and among the two locations sampled in each fjord (mouth and head).



Zooplankton sample from Saglek Fiord.

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RATIONALE

Research on benthic habitats in the Arctic is relatively limited, and very little information has been gathered on the marine habitats of coastal Labrador. It is necessary to identify and understand benthic habitats in these areas in order to better predict long-term environmental impacts, and those habitats sensitive to change. Benthic habitat mapping is an accurate and efficient way of gathering baseline information about the nature and distribution of habitats within coastal environments. Understanding benthic habitats along the Labrador coast is an essential part of developing resource management plans in order to sustainably manage harvesting activities. In the past, benthic habitat mapping products have contributed to fisheries management, long-term monitoring practices and the creation of policies relating to marine protected areas.

ArcticNet Research

BENTHIC HABITAT MAPPING IN NACHVAK AND SAGLEK FIORDS

OBJECTIVES

- To collect baseline information and develop a better understanding of benthic habitats within the fiords of northern Labrador.
- To ensure that all habitats (basins, sills, rockwalls, head and mouth) are thoroughly sampled for sediment and biotic characteristics.
- To sample the shallow environments at the mouths of the fiords, as these areas are usually high in biodiversity.
- To fill in gaps in sampling from previous field seasons (2007, 2009).
- To allow Inuit students to build on their knowledge and skills while working alongside researchers.



(a) Box core used to collect sediment and biota samples.

METHODS AND INFORMATION COLLECTED

- Field Sites: Nachvak Fiord (Torngat Mountains National Park) and Saglek Fiord (Southern border of the park)
- Box corer (a) is used to collect sediment and biota. A drop video camera (b) is used to collect information on biota and substrates too large to be sampled with the box core. A remotely operated vehicle (c) was used to sample rock wall habitats



(b) Dorothy Agnatok using the drop video camera to collect video transects.

YEARS OF DATA

Multibeam data was collected in 2001, 2003 and 2007 by the CCGS Matthew, Pippit and Plover as well as the Amundsen.

Sediment and video samples were taken in 2007, 2009 and 2010.

PARTNERS

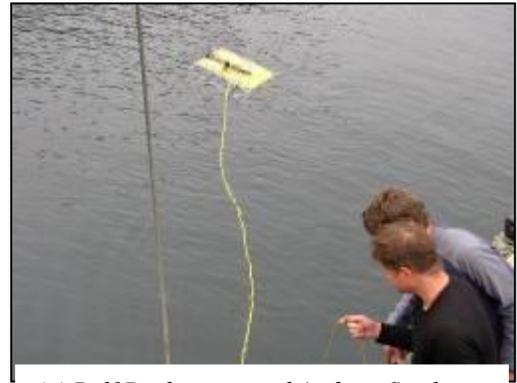
- Memorial University
- Environmental Sciences Group
- Parks Canada
- Torngat Wildlife, Plants and Fisheries Secretariat
- Canadian Museum of Nature

FUNDING

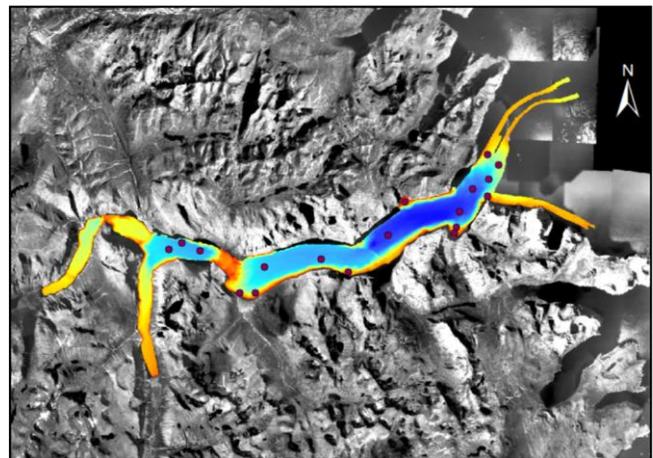
- ArcticNet
- Parks Canada
- Torngat Wildlife, Plants and Fisheries Secretariat
- Nunatsiavut Government

RESULTS/ACCOMPLISHMENTS

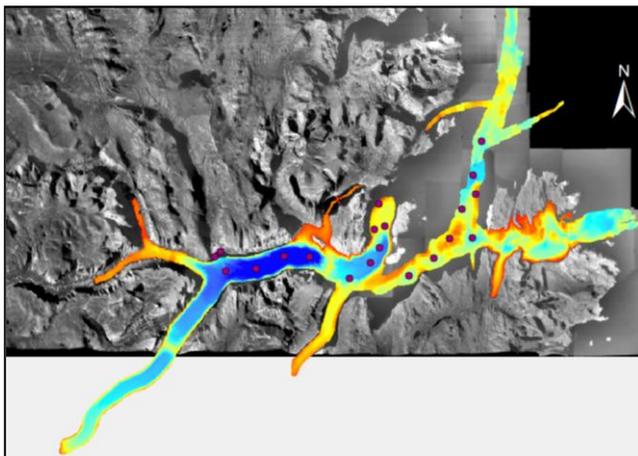
- 60 sites were sampled for sediment and biota in Nachvak fiord (d).
- 60 sites were sampled for sediment and biota in Saglek fiord (e).
- Initial results suggest 4 habitat types in the fiords, soft substrate, hard shallow substrate (sills), rock walls and head (high sedimentation areas). Further analysis is necessary to verify this.



(c) Ralf Bachmayer and Andrew Swales deploying the ROV off of the *What's Happening*.



(d) 2010 sampling sites in Nachvak fiord.



(e) 2010 sampling sites in Saglek fiord.

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RATIONALE

Across the tundra, climate warming is increasing the abundance and height of shrubs like arctic dwarf birch (avâlakiak) and upright willow (uppigak). Their growth and expansion is predicted to affect berry producing plants such as bakeapple (Appik), blueberry (kigutanginak), redberry (kimminak), foxberry/bearberry (Kallak) and blackberry (Paungatuinnak), as these plants are in most cases intolerant to shading. Inuit in Nunatsiavut have observed changes in berries related to climate warming, such as berries appearing drier, smaller and less plentiful than in the past. This is a concern because of the importance of berries in tundra ecosystems to wildlife, human health and indigenous culture. Warming could also influence pollination of berry shrubs, but very little is known about the diversity of pollinating insects in northern Labrador. Understanding these processes and interactions is important to predict the impacts of climate warming on tundra berry shrub communities.

ArcticNet Research

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

OBJECTIVES

- Evaluate experimental warming effects on tundra plant communities.
- Investigate warming effects on upright and berry shrub growth, plant interactions and habitat conditions.
- Predict long-term warming impacts on berry shrub abundance, distribution and fruit production.
- Continue monitoring fruit production of 5 key berry shrubs near KANGIDLUASUK base camp.
- Identify and inventory important berry shrub pollinators.
- Investigate plant-pollinator interactions.



2010 KANGIDLUASUK student interns visiting an open-top warming chamber (OTC) established in Torr Bay valley, TMNP;
Photo credit: Mandy Arnold

YEARS OF DATA

- 2009 and 2010

Appik	kigutanginak	kimminak	Kallak	Paungatuinnak
Bakeapple	Blueberry	Redberry	Foxberry	Blackberry



METHODS AND INFORMATION COLLECTED

Researchers and student interns worked together to:

- Repair OTC's and air temperature sensors that were damaged due to harsh weather and animal interference by fox, black bear and polar bear.
- Collect first year warming data from 30 OTC/control plots established in Torr Bay valley in summer 2009.
- Measure annual growth of upright shrubs and berry shrubs, fruit production, and environment variables such as soil temperature, moisture and available light.
- Bury decomposition sticks, 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; bury year-round soil nutrient probes.
- Set up pan traps along 90m transects; use live-capture insect nets to collect pollinators such as syrphid flies and bees following standard CANPOLIN protocols.
- Collect flowers from vegetation around base camp, and remove samples of pollen from the anthers to create pollen voucher specimens for future research.



Student intern Jason Dicker shows soil moisture probe and meter he used to measure soil moisture in OTC/control plots in Torr Bay valley; Photo credit Jason Dicker

RESULTS/ACCOMPLISHMENTS

- After 1 year of experimental warming, we do not expect significant changes in plant abundance or fruit production, however we are investigating early effects of warming on annual growth of shrubs as well as soil variables.
- Although we did not observe/capture many pollinators visiting berry plants in 2010 (berry plants flowered early!), pollinators were collected from pan traps and nearby flowering plants (i.e. northern Labrador tea) and are currently being identified.



Student intern Jenni-Rose Campbell (right) and researchers Daniel Myers (middle) and Laura Siegwart Collier (left) work together to collect vegetation and soil data within OTC/control plots in Torr Bay valley; Photo credit Jason Dicker

PARTNERS

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

FUNDING

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

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RATIONALE

Climate warming is well-established across the Canadian Arctic. However, climate models suggest future warming will not be uniform across all regions. Mountainous areas have a range of climatic conditions that are only coarsely reflected in regional summaries, but generally lack adequate climate records. An observational climatology program is needed if we are to better understand climate-related processes within Torngat Mountains National Park and prepare for the climates of the future.

International Polar Year Research

CONSTRUCTING CLIMATOLOGIES FOR TORNGAT MOUNTAINS NATIONAL PARK - UPDATE

OBJECTIVES

- To obtain climate data, particularly on air and soil temperature, at selected areas within Torngat Mountains National Park in support of ecological and climate-change studies.
- To establish relationships between the local climate and the long-term regional climate data in order to make projections regarding past and future climate change.

METHODS AND INFORMATION COLLECTED

Primary climate data are gathered within the park area, using automated climate stations at key locations. Additional observations of soil temperature and other parameters are made using portable instruments and miniature temperature loggers. These short-term records are compared statistically with records from permanent meteorological stations in the region to provide estimates of the local seasonal and long-term climate.

YEARS OF DATA

- 2007-2010, with some gaps

PARTNERS

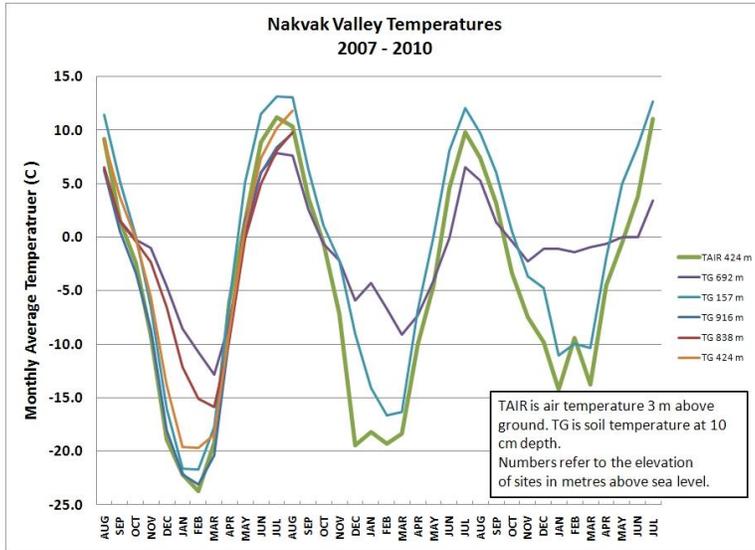
- Memorial University (Departments of Biology and Geography),
- Torngat Mountains National Park,
- IPY-CiCAT program

FUNDING

- International Polar Year - CiCAT
- Memorial University of NL
- Parks Canada
- ArcticNet



Nakvak Brook below the Memorial University IPY tundra study site. Local climates are affected by small to large-scale variations in topography. (Photo credit: J. Jacobs)



Air and soil temperature record from sites above Nakvak Brook

Measurements of soil temperatures from an array of 8 sensors at the 420 m a.s.l. Nakvak IPY site showed similar annual mean temperatures but large differences in winter and summer temperature associated with snow cover and soil moisture. Dates of snow-on were similar in 2009 (late October) but snow-off dates in 2010 ranged from mid-May to early July.

- Bears present a challenge - The automated climate station at Nakvak Brook IPY site was damaged by bears in 2009. In summer 2010 it was repaired and moved to a site above the Ivitak Valley to support glaciology and ecological studies there. Miniature temperature loggers buried at 5 to 10 cm depth in the soil have not been disturbed and so continue to be a reliable means of monitoring temperature over a wide area.



Climate station installed July 2010 at 480 m a.s.l. in the valley below Abraham Glacier on Cirque Mountain. (Photo credit: J. Jacobs)

RESULTS/ACCOMPLISHMENTS

- Every Year is Different - Three years of climate observations have shown significant year-to-year variations in seasonal temperature and precipitation.

- Winter 2009-10 was warm - Mild air temperatures and more snow resulted in much warmer soil temperatures in some areas, even at higher elevations.

- Site Elevation affects temperature - Summer soil temperatures in the lower Nakvak Valley (157 m) were 6°C warmer than on upper slopes (692 m). Air temperature at 424 m averaged 8.5 °C in summer and -17°C in winter.

- Microtopography affects soil climate-

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RATIONALE

Vegetation composition within the Ivitak (McCornick) watershed is strongly influenced by elevation, aspect, topography and drainage, resulting in distinct plant communities ranging from high-elevation alpine to low-shrub tundra. Our goal is to monitor vegetation changes in these plant communities and use this information to make long-term predictions about the impacts of climate warming among similar plant communities throughout Torngat Mountains National Park. To monitor these changes effectively, we must first understand the limitations of field sampling in each plant community, and investigate the best method of tracking vegetation change through time.

International Polar Year Research

DEVELOPING A VEGETATION MONITORING PROTOCOL FOR THE IVITAK RIVER VALLEY

OBJECTIVES

- Revisit a subset of sites that were sampled in 2009 (N=12) to re-measure vegetation using higher resolution sampling (point frame method).
- Determine the best methods for detecting changes in plant cover and diversity by comparing sampling techniques across plant communities in the Ivitak River Valley.
- Develop a vegetation monitoring protocol for tundra plant communities based on our sampling trials.

METHODS AND INFORMATION COLLECTED

Building on previous years' field sampling protocols, we:

- Revisited 2 low shrub tundra plant communities that were sampled in 2009.
- In each site, we sampled vegetation using the point frame method within 70 x 70 cm quadrats (N=6/site).
- To compare the point frame method with 2009 sampling techniques, vegetation was further sampled by taking digital photos and visual percent cover estimates within each quadrat.



Glacier camp (above) and Mc09 (below); Two low-shrub tundra plant communities within Ivitak watershed revisited in 2010 to conduct point frame vegetation sampling





Digital photos of 70 x 70cm point frame quadrats taken in wet (below) and dry (above) areas of Glacier camp. Plant composition and cover will be estimated from digital photos using analysis techniques developed in 2009



YEARS OF DATA

- 2008, 2009 and 2010

PARTNERS

- Memorial University (Department of Biology)
- Parks Canada, Torngat Mountains National Park
- IPY-CiCAT program

FUNDING

- IPY-CiCAT program
- ArcticNet program
- Memorial University of Newfoundland

RESULTS/ACCOMPLISHMENTS

- Digital photos of vegetation taken in 2009 have been fully analyzed using our Image J photo analysis protocol.
- The protocol has since been refined and recommendations are being put together to improve image quality and analysis.

- Cover estimates (2009) derived from image analysis and field estimates (presence/absence, cover classes and biomass measures) were compiled in a database.
- The 2010 point-frame data are being added to this database so that estimates of plant composition, abundance and diversity can be compared among sampling techniques and plant community types (alpine, low, tall and riparian shrub tundra)

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Grasses (left) and herbs (right) growing alongside streams in low-shrub tundra plant communities.

RATIONALE

Monitoring ecosystem health and change in a large and remote area such as Torngat Mountains National Park presents a major challenge. One solution is to monitor a landscape unit that can serve as a reference of the Park's ecosystems. Watersheds are natural sub-divisions of landscapes that represent the area drained by a single river. Research and monitoring within a selected watershed serves as a pilot study and early step in the development of the park's ecological integrity monitoring program. Monitoring different systems such as glaciers, tundra, freshwater, and fiord sediments within one watershed can lead to a better understanding of ecosystems, their interconnections, and changes affecting their health. The watershed approach integrates different perspectives, experience and expertise and the information gathered can be used to understand and monitor other park areas and the overall park.

International Polar Year Research

INTEGRATING MONITORING PLOTS FROM SEA TO SKY WITHIN THE IVITAK (McCORNICK) VALLEY

OBJECTIVES

- Bring together, share and integrate different sources of knowledge and expertise to better understand the ecosystems of a watershed as a functioning unit.
- Develop integrated monitoring programs to measure ecosystem health and change.
- Develop and test monitoring methodologies adapted to Northern context.
- Determine the number and types of samples needed to obtain an effective monitoring design at different spatial scales and for different ecosystems.
- Collect local climate/weather information.



*Ivitak Watershed: glaciers, tundra, freshwater, climate, permafrost and more
(Photo credit: J. Jacobs)*

METHODS AND INFORMATION COLLECTED

- The MUN Labrador Highlands Research Group, in collaboration with Parks Canada staff, conducted three main research projects as part of this integrated research and monitoring project:
 - Tundra vegetation sampling and method testing – detailed point framing based on ITEX methodology and requiring botanical expertise, and quick tundra vegetation assessment using pictures of plots that non-expert can collect in the field (see pages 46-47). Moreover, quick vegetation assessment was also tried with a smaller quadrat (0.5 m²) and a camera on tripod to provide a more standardized method.
 - Installation of a permanent climate station, moved from the Nakvak Brook area to the side valley plateau below Abraham Glacier on Cirque Mountain (see pages 40-41).
 - The portable climate station, damaged by bear in 2008,2009, was repaired and re-installed, with the help of Northern students, in a different location in the main valley (near station MC11 where vegetation and freshwater are also sampled).
 - The climate stations provide information on air temperature, relative humidity, amount of sunlight, wind speed, precipitation, and soil temperature. Individual loggers in different locations across the watershed also collect information on air and soil temperature and relative humidity.
- Permafrost monitoring: installation of frost tubes and a temperature deep well (see page 50-51)
- The Torngat Glacier Project survey observed late deep snow in the Ivitak watershed which prevented the downloading of sensors on those glaciers (see page 28-29) for their work elsewhere in Torngat Mountains National Park).

YEARS OF DATA

2008, 2009, 2010

PARTNERS

- Memorial University (Depts. of Biology, Earth Science, Geography)
- Parks Canada (Torngat Mountains National Park and Western and Northern Service Centre-Winnipeg)
- Geological Service of Canada (permafrost)

FUNDING

- International Polar Year: CiCAT and BIONET projects
- ArcticNet
- Parks Canada
- Memorial University of Newfoundland and Labrador (MUN)

RESULTS/ACCOMPLISHMENTS

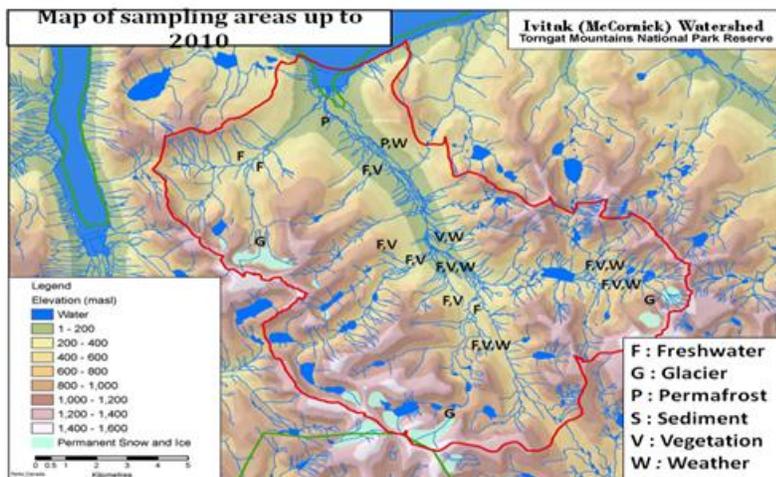
- Collaboration between researchers from different disciplines lead to collection of air, water and soil temperatures at multiple stations across the watershed and in different years.
- Some of the stations, sampled in the same area for different systems (glacier, water, air, soil), can provide related information.
- Weather and helicopter time limited number of stations that were sampled within the Ivitak watershed; however, co-location of stations within a shared area facilitated climate, vegetation and glacier observations.
- Northern students were involved in 4 out of the 5 projects that took place in the Ivitak watershed in 2010.
- See also individual project summaries in this report and in the 2008 report for a detailed summary of each project.



Tundra vegetation: Testing different quadrat sizes. (Photo credit: C. Ouimet - Parks Canada)



Portable weather station on bottom of the Ivitak valley, near station MC11 (Photo credit: C. Ouimet – Parks Canada)



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RATIONALE

Climate monitoring and experimental warming of tundra vegetation are underway in Torngat Mountains National Park (TMNP) to predict future vegetation change. 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 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.

International Polar Year Research

DETERMINING THE IMPACTS OF CHANGING CLIMATE ON TUNDRA VEGETATION

OBJECTIVES

Investigate the effects of experimental warming on:

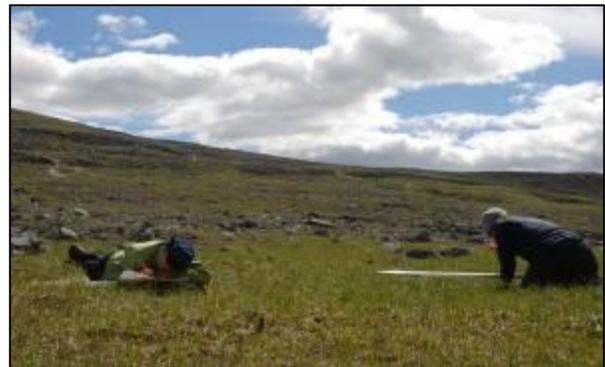
- vegetation composition, abundance and soil conditions among wet and dry tundra ecosystems.
- abundance and height of key upright deciduous and evergreen shrubs.

METHODS AND INFORMATION COLLECTED

Our main study area is located north of Saglek Fiord, adjacent to Nakvak Brook. 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. Ten OTC/control pairs were assigned to each wet and dry tundra sites. When plots were established in 2007 and 2008, we collected baseline plant community data using the point frame method. A network of ground temperature sensors was also installed to monitor changes in soil temperature.

In summer 2010, we:

- Repeated point frame vegetation sampling in 20 OTC/control pairs.
- Downloaded and re-launched our network of ground temperature sensors; measured soil moisture among plots.
- Repaired OTC's that were damaged due to



Researchers using the point frame protocol to sample vegetation in Nakvak Brook



harsh weather and interference by animals.

YEARS OF DATA

- 2007, 2008, 2010

PARTNERS

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

FUNDING

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

RESULTS/ACCOMPLISHMENTS

2007/2008 Baseline Data:

- 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.
- Upright shrubs such as blueberry and arctic dwarf birch are present yet in low abundance in both wet and dry tundra ecosystems.

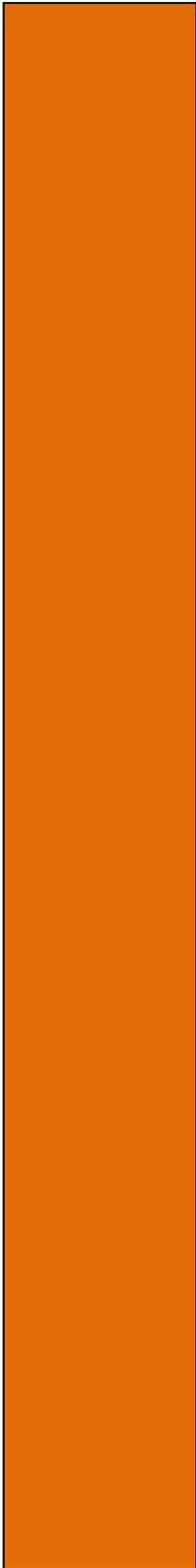
2010 Warming Data:

- We found no significant difference between wet and dry sites in how the tundra vegetation has responded to warming in the 2-3 years since the OTCs were established; however as predicted changes in some target shrubs are already obvious.
- Abundance of northern Labrador tea appeared to increase within dry plots.
- Nearly all of the key upright 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.



Northern Labrador tea growing near OTC/control plots in dry tundra ecosystems

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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 frozen throughout the year, 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 in 2009 identified two sites that appeared to be suitable for installation of permafrost monitoring equipment. Our objectives for 2010 included:

- Installing permafrost monitoring equipment at these sites including frost tubes, which measure thaw depth and frost heave, and temperature cables that measure ground temperature at various specified depths.
- Searching for additional suitable sites.
- Introducing Inuit students and our partners to permafrost monitoring techniques.

METHODS AND INFORMATION COLLECTED

- Wash boring, where pressurised water is forced down a steel pipe, was used to create boreholes of sufficient depth to install monitoring equipment that penetrated the permafrost table.
- Where soil conditions permitted creating a borehole of 2-3 m depth frost tubes would be installed.
- If a borehole of 5-10 m depth could be created then a temperature cable would be installed. The cable, which has 8 temperature sensors spaced at fixed distances below the soil surface, is attached to a data logger taking readings at 6 hour intervals all year long.
- At each permafrost monitoring site data loggers would also be used to record temperatures 10 cm below the soil surface, at ground level, and 1.5 m above ground level.



Charlie Annanack and Williemi Annanack, both of Kangiqsualujjuak, assist Caroline Duchesne with wash boring at Ramah Bay



A completed frost tube including a screen to measure frost heave, Ramah Bay

YEARS OF DATA

- The first data from the equipment deployed in 2010 will be recovered in summer 2011

PARTNERS

- Geological Survey of Canada

FUNDING

- Parks Canada
- Geological Survey of Canada

RESULTS/ACCOMPLISHMENTS

- Permafrost Monitoring equipment was deployed at three sites:

Ramah Bay: A 1 hectare permafrost probing grid was established at this site in 2009, and we installed 2 frost tubes within this grid on August 1, 2010. A low density of rock and gravel in the soil slowed our efforts at this site and made it impossible to bore deep enough to install a temperature cable.

Ivitak Terrace: A second 1 hectare permafrost probing grid was established at this site in 2009, and we attempted to install frost tubes in 2010. However a layer of coarse gravel was consistently encountered at ~1 m depth and this limited our ability to penetrate the soil with wash boring. We did install one frost tube at this site but it is not certain that it will yield useful data.

Ivitak Cove: A thick deposit of glacial lacustrine sediment at the confluence of the Ivitak River and a tributary draining the valley containing Superguksoak Glacier was identified as a potential permafrost monitoring site. This proved to have good, rock-free soil and we successfully installed both a frost tube and a temperature cable. The borehole for the temperature cable was 7.35 m deep and was equipped with a 5 m cable having 8 temperature sensors. A custom 7 m cable will be used to replace the 5 m cable in summer 2011.

- Six Inuit students assisted us with the hard work of installing the permafrost monitoring equipment and were introduced to the concepts and techniques involved in permafrost monitoring.



Angus Simpson bear-proofing the temperature cable near Ivitak Cove. The cable will record soil temperature to a depth of 7 m every 6 hours all year long.

Table 1. Locations where permafrost monitoring equipment was deployed in summer 2010. (UTM coordinates, NAD 1983, zone 20V).

Location	Easting	Northing	Equipment deployed
Ramah Bay	479511	6526139	Frost tube
Ramah Bay	479544	6526145	Frost tube
Ivitak Terrace	459385	6538747	Frost tube
Ivitak Cove	457141	6540414	Frost tube
Ivitak Cove	457154	6540417	Temperature cable

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RATIONALE

Benthic invertebrates are used as indicators of water quality in many parts of the world and offer a promising approach to monitoring ecological change in northern parks. However, northern ecosystems differ considerably from those where these tools were developed. As such, research is required to better understand the characteristics of “healthy” invertebrate communities in northern ecosystems and to assess the value of this approach as a biomonitoring tool in the North.

Monitoring

ASSESSMENT OF WATER QUALITY AND BASELINE INVENTORY OF BENTHIC INVERTEBRATES IN SAGLEK AND NACHVAK FJORDS

OBJECTIVES

- To describe characteristic macro-invertebrate communities, water chemistry and primary production in streams in Torngat Mountains National Park. This information will contribute to describing “reference conditions” for healthy areas in northern Labrador.
- To assess the feasibility of collecting and using benthic invertebrates for park monitoring. Sampling the same sites over multiple years will provide information on our ability to detect change in the North’s unique ecosystems.
- To integrate local Inuit into this element of the monitoring program.



Freshwater life-stage of a midge (chironomid) – the dominant benthic invertebrate in freshwaters of TMNP

METHODS AND INFORMATION COLLECTED

This sampling program is fashioned after a set of field protocols developed by the Canadian Aquatic Biomonitoring Network (CABIN). These methods have been widely applied in more southerly areas of Canada to characterize stream habitat and the “stream bug” (benthic macroinvertebrate) community structure. At each site, habitat is characterized, periphyton is scraped from the rocks, water samples are taken and benthic invertebrates are collected by “kick-netting.”



Samuel and Dorothy from 2008 doing periphyton scrapes.

YEARS OF DATA

2006-2010

PARTNERS

- Environment Canada, Nunatsiavut Government, University of New Brunswick

FUNDING

- Arctic Net, International Polar Year, Parks Canada

RESULTS/ACCOMPLISHMENTS

- Primary production (i.e. the bottom of the food chain) is very low in TMNP. Periphyton growing on the surface of rocks is only 6% of that found in low productivity sites of Terra Nova National Park.
- Midges (54%), *Baetis* mayflies (21%) and blackflies (6%) contributed the bulk of all TMNP benthic invertebrates. Midges and blackflies are typically considered tolerant of environmental stress in southern areas, whereas *Baetis* mayflies are relatively intolerant. The severe environmental conditions in northern Labrador affect the species we find in these healthy systems, making them very different from what is found in more well-studied areas of Canada.
- Fifty-eight aquatic invertebrate families found in TMNP (an average of 11.7 (range of 2-22) families per site). In comparative Terra Nova National Park averages 28 families per site, while impacted urban streams of St. John's (NL) average 17 families. The lower diversity of insects may affect our ability to detect change.
- Preliminary results indicate benthic invertebrates from Saglek and Nachvak are similar, with year to year differences being more important than differences between fjords.
- Inuit have been integral to this component of the monitoring program. To date more than 12 Inuit students and bear monitors have been trained and participated in field collections



The freshwater lifestage of a Baetis mayfly – a invertebrate that is common in TMNP and is considered less tolerant of environmental stress.



The larval stage of the infamous blackfly – an important component to the TMNP benthic invertebrate community.

FUTURE ACTIVITIES

- Complete identifications of 2010 samples.
- Use environmental variables (e.g. water chemistry and periphyton) to explain the differences amongst sites.
- Assess year to year differences in communities to determine the likelihood of detecting change associated with environmental stress (e.g. climate change).
- Resample sites in 2013 to continue long term monitoring.

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RATIONALE

The remoteness and ruggedness of Torngat Mountains National Park has meant that there have been few surveys of Species at Risk (SAR) in the park. This has resulted in an incomplete understanding of SAR populations and their distributions in the park. Ten SAR are believed to use the park. Some such as Harlequin Ducks and Peregrine Falcons are known to breed in the park while others such as the Ivory Gull and Red Knot are likely only occasional visitors. In 2007, a survey was conducted to determine the distribution and abundance of Harlequin Ducks in the park, however only watercourses in the southern half of the park were surveyed. A survey of those more northern rivers was necessary to determine the true distribution and status of Harlequin ducks in the park. Peregrine Falcon nest sites have been monitored, in what is now the park, since 1988. These surveys have been conducted to coincide with the North American Peregrine Falcon Survey, which is scheduled for this year.

Monitoring

MONITORING SPECIES AT RISK IN TORNGAT MOUNTAINS NATIONAL PARK



Short-Eared Owl



Female Harlequin Duck with Brood



Peregrine Falcon

OBJECTIVES

- Conduct a survey of known Peregrine Falcon nest sites.
- Determine the distribution and number of Harlequin Ducks on rivers in the park north of Komaktorvik Fiord.
- Record observations of other SAR found in the park.
- Involve KANGIDLUASUK students in SAR surveys to help develop their wildlife survey skills.

METHODS AND INFORMATION COLLECTED

A helicopter was used to survey known Peregrine Falcon nest sites and to conduct Harlequin Duck surveys. To locate actual Peregrine Falcon nests, the pilot placed the helicopter in a hover off potential nesting ledges giving observer's time to search the ledges for falcon activity, eggs, chicks and adult birds. Potential ledges were identified based on fresh 'wash' and orange lichen growth resultant from bird activity (defecation and decomposition of animal matter). To survey Harlequin Ducks we flew up or down predetermined watercourses at low altitude (30-60 metres) and low speed to allow observers to locate and identify ducks. Locations of Harlequin Ducks were captured using a Garmin GPSmap 76CSx handheld GPS. The size and age of observed Harlequin Duck broods was recorded. Fiords and bays within the park were opportunistically surveyed for molting Barrow's Goldeneye using a helicopter to locate potential Barrow's and ground based observations using a spotting scope for confirmation. Opportunistic observations of other species at risk were also recorded during helicopter surveys and ground based activities.

YEARS OF DATA

1988-2010



Barrow's Goldeneye

Polar Bear

PARTNERS

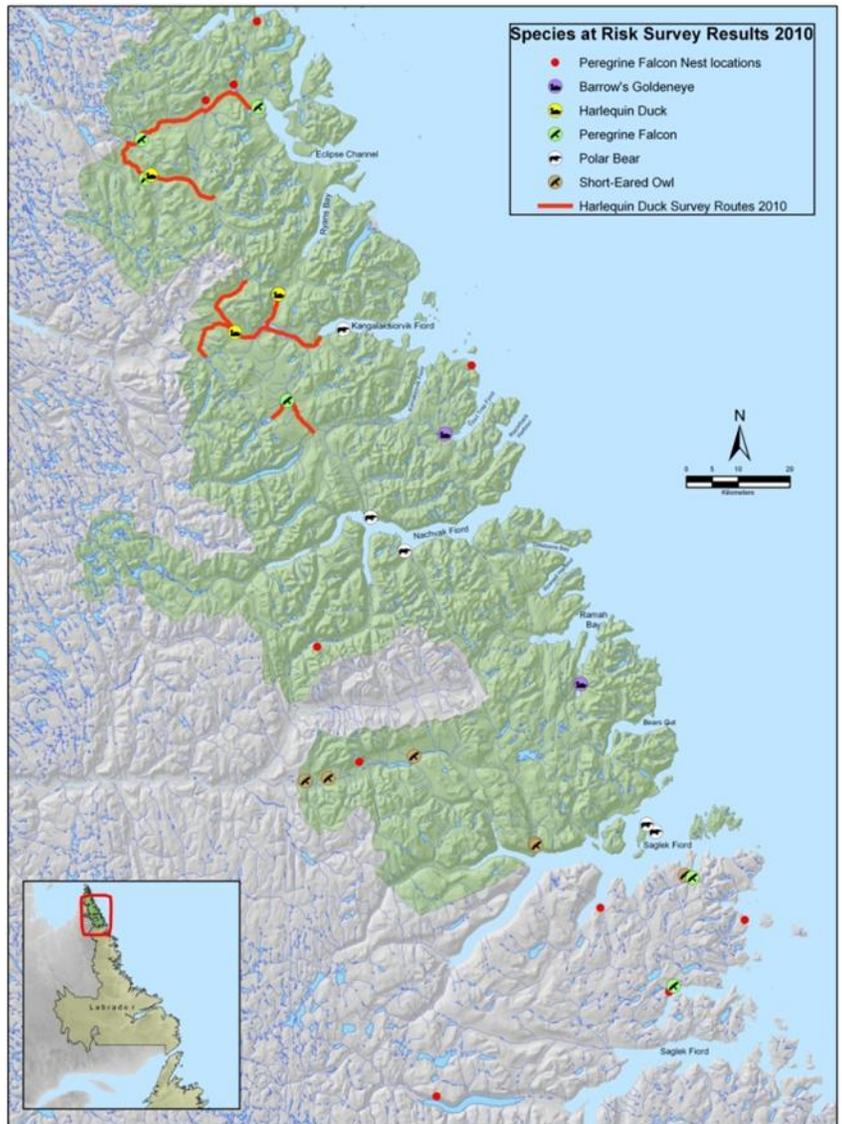
kANGIDLUASUK student program

FUNDING

Parks Canada
Aboriginal Funds for Species at Risk

RESULTS/ACCOMPLISHMENTS

- Ten known Peregrine Falcon nest sites were surveyed.
- No Peregrine Falcon chicks were observed at any nest sites, however, seven Peregrine Falcons were observed while conducting the survey.
- Three Peregrine Falcons were observed flying close to the Hebron nest site suggesting young may have already fledged.
- Three watercourses north of Nachvak Fiord were surveyed for Harlequin Ducks: a tributary of the Komaktorvik River, Kagalaksiorvik River and the Eclipse River.
- A female Harlequin Duck with 4 ducklings and another female acting broody were observed on the Kagalaksiorvik River, the farthest north in the park where breeding has been confirmed for the species.
- Two female Harlequin Ducks were observed together on the upper reaches of the eclipse River.
- Eight Barrow's Goldeneye Ducks were observed at Trout Trap Fiord and a male and female Barrow's Goldeneye were observed in Little Ramah Bay.
- Three lone adult Short Eared owls and an adult with fledglings were observed in the Nakvak River valley. A single adult Short-Eared Owl was also observed near base-camp at Torre Bay.
- Polar Bears were observed at many locations with the greatest concentration being observed in Saglek Fiord.



Survey areas and locations of species at risk observed in and around Torngat Mountains National Park in 2010.

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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 EI. 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 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.

METHODS AND INFORMATION COLLECTED

- Parks Canada staff, base camp guests, contractors and visitors record incidental observations of wildlife on wildlife cards.
- Information collected includes: date and time of observation, name of observer, species observed, number of individuals seen, location of observation, elevation, aspect, age and sex of animal, evidence of reproduction, habitat, weather and remarks.
- All information from the wildlife cards is entered into a master database.
- Summaries of incidental observations and maps of these observations can then be produced.



A curious polar emerging from the water and fog to investigate visitors on Parmenter Island



Wolf in the Ramah Bay area

YEARS OF DATA

2005-2010

FUNDING

Parks Canada

PARTNERS

Anyone visiting or working in TMNP

RESULTS

- There are currently 451 records in the wildlife cards database. This includes 156 records of polar bear observations, 84 records of black bear observations, 20 records of wolf observations and 38 records of caribou observations.
- 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.
- In 2009 a rare Short eared owl sighting was recorded near base camp and a feather found near Ramah Bay. In 2010, 6 additional sightings of short eared owls were recorded. Short eared owls are listed as a Species of Special Concern under the Species at Risk Act. Rodent populations exploded in the park in 2010 and this may have accounted for the increased presence of short eared owls.
- In 2010 there were two other notable observations. One was the sighting of a walrus in St. John's Harbour, Saglek Bay in September. Inuit historically hunted walrus in this area in the fall, but recent years have seen a marked absence of walrus along the Labrador coast. Atlantic Walrus is listed as extirpated under Schedule 1 of the Species at Risk Act. It is likely that this animal is a migrant from Davis Strait populations. The other notable sighting was of a pod of Killer Whales in Sagalk Bay in late August. The pod consisted of 10-12 whales with at least one juvenile.



Male Killer Whale in Saglek Bay- August 2010 (Photo Geoff Goodyear)



Bearded Seal, Komoktoravik

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RATIONALE

Tornjat 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. Accessibility has hindered bird surveys in past so the distribution and status of many bird species in the region are poorly understood. Indeed for many species it is not even clear whether or not they occur in the park. Consequently a bird checklist has been prepared in order to encourage persons visiting the park to note 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 Tornjat 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 Tornjat 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 Tornjat Mountains National Park was prepared based on published accounts, observations by Parks Canada staff, and local knowledge. The checklist included:
 - A list of all 94 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.

YEARS OF DATA

- Bird checklist data have been collected from 2008 to 2010



Bird Checklist



Kutsitak! White-crowned Sparrow

**Tornjat Mountains National
Park of Canada**

This checklist has been prepared based on best available information on the status and distribution of birds in Tornjat 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 

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.
- 73 new records were added in 2010, bringing the database to a total of 323 observations representing 66 species and >2,500 individual birds.
- New observations from 2010 further clarified uncertainties regarding regional avifauna:
 - Two species not previously known to occur in the park were observed – Gadwall and Great Blue Heron. These southern species were likely vagrants but documenting such occurrences may offer important insight into changes in park fauna in the face of such factors as global climate change.
 - Observations in 2009 indicated that Spotted sandpiper, a species not previously known to breed north of Okak on the Labrador coast, was breeding at Saglek and possibly Nachvak Fiords. A confirmed observation on Big Island and a probable sighting of a pair at Komaktorvik Fiord provide further evidence that a breeding population is established and widespread in the southern half of the park.
 - A brood of Northern Pintails was observed along Kangalaksiorvik River during a Harlequin Duck survey being carried out by park staff and Inuit students. This represents the first known breeding record for the species in the park and indeed the first such record north of Hebron.
 - Short-eared owl, a federally listed species at risk, was observed at both Ramah Bay and near kANGIDLUASUK in 2009, and additional individuals and family groups were observed at Torr Bay and upper and lower Nakvak Brook in 2010.
- New information from 2010 was used to prepare a revised checklist for future use.



Short-eared owl, Nakvak Brook



Great Blue Heron, Rose Island (Photo Gary Baikie)

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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.

Monitoring

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.

METHODS AND INFORMATION COLLECTED

- 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 (everyone not included in the above categories).
- Inuit who are associated with park programs are included in the researchers, contractors, park staff, and base camp guests categories.
- An online visitor survey was 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.



Hiking up Nachvak Brook – a traditional Inuit travel route



Participants of “Canada’s Greatest Summer Job” spent a week at KANGIDLUASUK experiencing the park

YEARS OF DATA

2006-2010

Table 1: Visitor statistics for years 2006-2010, categorized by major activity groups.

Activity	2006	2007	2008	2009	2010
Recreational boating/sailing visitors	4	4	21	3	8
Cruise ships passengers	150	275	364	295	156
Guided and non-guided visitors	12	49	27	76	134
Researchers	31	58	51	55	42
Contractors	19	24	29	59	53
Park Staff	9	11	15	22	17
Base Camp guests	47	63	58	62	51
Inuit not affiliated with park programs				57	
Total	272	484	565	629	461

RESULTS

- Overall visitation was down in 2010 (Table 1).
- However, a significant increase was experienced in the guided and non-guided visitor category. This is a very positive trend and likely reflective of increased marketing and advertising in 2009/10.
- The number of cruise ship visits declined again in 2010 and this is the primary reason for the overall decline in visitor numbers. Only 2 of the 4 planned cruise ship visits occurred in 2010 due to cancellations because of mechanical issues. (Figure 1).
- The kANGIDLUASUK base camp has operated at the southern boundary of the park since 2006. This camp, which was run by an Inuit business in 2010, facilitates access to the park for Parks Canada staff, visitors, researchers, Inuit and others. It also serves as an orientation, reception and access point for visitors. The number of participants at kANGIDLUASUK continues to increase (Table 2).



kANGIDLUASUK base camp

Table 2: Number of participants at kANGIDLUASUK each year

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

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Figure 1: Number of private recreational boats and cruise ships visiting TMNP between 2006-2010

