



# ANNUAL REPORT OF RESEARCH AND MONITORING IN NATIONAL PARKS OF THE WESTERN ARCTIC 2005

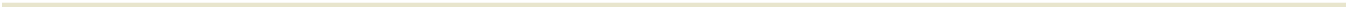




## ACKNOWLEDGEMENTS

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Information about research and monitoring activities were provided to Parks Canada by: Dr. Wayne Pollard of McGill University, Dr. Donald Walker and Martha Reynolds of the Institute of Arctic Biology (University of Alaska), Dr. John England of the University of Alberta, John Nagy and Marsha Branigan of the Government of the Northwest Territories, Ramona Maraj of the Government of Yukon, Lois Harwood of the Department of Fisheries and Oceans, Pamela Sinclair of the Canadian Wildlife Service, Bruce Bennett of NatureServe Yukon (Government of Yukon), Catherine Kennedy of the Government of Yukon, Dorothy Cooley of the Government of Yukon and Gavin Manson of the Geological Survey of Canada (Atlantic).



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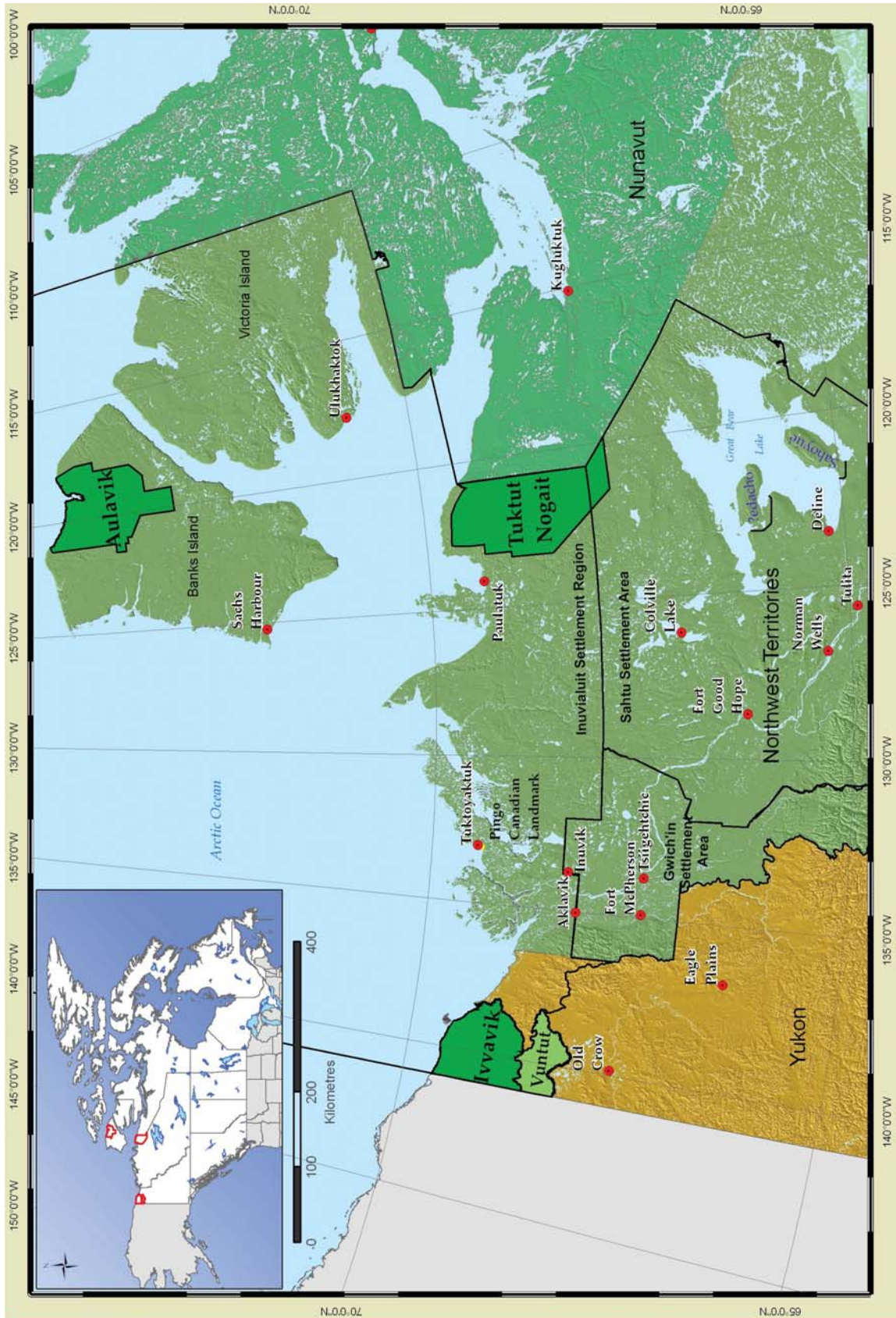
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## INTRODUCTION

Research and monitoring are essential for managing protected heritage areas, such as Canadian national parks, historic sites and the Pingo Canadian Landmark. Both activities lead to a better understanding of the ecological and cultural resources of these areas and how these resources are being affected by natural changes and human-caused disturbances. The Western Arctic Field Unit of Parks Canada uses research and monitoring to improve our understanding of ecological and cultural resources of protected heritage areas in the western Arctic and to understand how these resources may be changing.

One challenge of implementing an effective research and monitoring program is making information about, and collected by, the program available to people. The goal of this report is to present information about research and monitoring activities conducted in protected heritage areas in the Western Arctic Field Unit to Inuvialuit, Gwich'in and Sahtu organizations, wildlife co-management boards, government agencies and the public. All research and monitoring projects conducted in 2005, and ongoing monitoring projects not conducted this year, are included in this report.

The Western Arctic Field Unit manages three national parks and the Pingo Canadian Landmark. Aulavik National Park of Canada is located on northern Banks Island and represents the Western Arctic Lowlands natural region. Ivvavik National Park of Canada is located in the northern Yukon and represents the Northern Yukon and Mackenzie Delta natural regions. Tuktut Nogait National Park of Canada is located east of the community of Paulatuk, inland from the Arctic Ocean, and represents the Tundra Hills natural region. All of these parks are relatively large compared with national parks in southern Canada, and all three represent areas of northern wilderness. The Pingo Canadian Landmark, the only landmark in Canada, represents the permafrost and pingo terrain of the Tuktoyaktuk Peninsula.





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## Structure of the Report

This report is divided into two sections. Section 1 summarizes research projects that were conducted in 2005. Section 2 summarizes all ongoing monitoring projects. These monitoring projects are divided into seven categories: Wildlife; Habitat; Human Use; Climate Change; Solid Waste; Long Range Transport of Pesticides; and Cultural Resources.

### Summaries for each project include:

#### *Rationale*

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

#### *Objectives*

A description of the main objectives of the project.

#### *Methods and Information Collected*

A brief description of where the work was conducted, how the project was conducted and what information was collected.

#### *Update/Results*

A summary of results, or recent activities, related to the project.

#### *Years of Data*

How many years of data currently exist.

#### *Partners*

Other organizations that were involved in the project.

#### *Funding*

A list of organizations that provided funding for the project.

#### *Contacts*

Contact information.

## Research and Monitoring Activities in National Parks of the Western Arctic

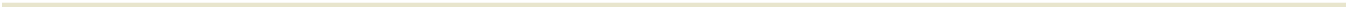
	Aulavik National Park	Ivvavik National Park	Tuktut Nogait National Park
<b>RESEARCH</b>			
Arctic Coastal Climate Change		X	
The Role of Patterned-Ground Ecosystems	X		
Investigating Environmental Change in the Western Arctic Archipelago	X		
Eastern Inuvialuit Settlement Region			X
Grizzly Bear Population Study - Phase 1			
Yukon North Slope Grizzly Bear Population Study		X	
Fishery Survey of Brock Lake			X
PRISM Breeding Shorebird Survey		X	
Rare Plant Inventory of the Yukon North Slope Coastal Plain			X
Yukon North Slope Vegetation Change Measurements		X	
<b>MONITORING</b>			
<i>Wildlife</i>			
Wildlife Cards	X	X	X
NWT-Nunavut Bird Checklist Survey	X	X	X
Peregrine Falcon Survey	X	X	X
Breeding Bird Survey		X	
Lemming Monitoring	X		
Eastern Ivvavik National Park Moose Survey		X	
Yukon North Slope Muskoxen Population Monitoring		X	
Tuktut Nogait Muskoxen Survey			X
Banks Island Peary Caribou Monitoring	X		
Banks Island Muskoxen Monitoring	X		
Bluenose-West Caribou Herd Monitoring			X
Porcupine Caribou Herd Monitoring		X	
<i>Habitat</i>			
Satellite Monitoring of Northern Ecosystems	X	X	X
Pingo Monitoring	Location: the Pingo Canadian Landmark		
<i>Human Use</i>			
Firth River Campsite Monitoring		X	
Human Use Monitoring	X	X	X
<i>Climate Change</i>			
Weather and Permafrost Monitoring	X	X	X
River Water Flow Monitoring		X	X
Coastal Mapping, Change Monitoring and Hazard Assessment		X	
	Location: the Pingo Canadian Landmark		
<i>Solid Waste</i>			
Komakuk Beach Clean-Up Monitoring		X	
<i>Long Range Transport of Pesticides</i>			
Water Quality Monitoring	X	X	X
<i>Cultural Resources</i>			
Ivvavik Coast Cultural Resources Monitoring		X	



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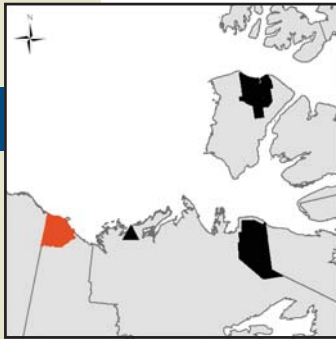
# RESEARCH





## Rationale

Arctic coastlines are particularly vulnerable to climate change impacts because expected changes will affect the atmosphere (rising temperatures), the land (thawing permafrost) and the ocean (rising sea level, less sea ice, longer open water season). Dr. Wayne Pollard's team from McGill University has been investigating ground ice and permafrost conditions in the northern Yukon since the mid 1980s. The current focus of the research involves a field and modelling program to investigate how climate change can alter the coastal climate system along the south Beaufort Sea, and to see how this affects the thawing of permafrost and erosion along the Yukon coast. This project is expected to take approximately three years to complete.



## Research

### ARCTIC COASTAL CLIMATE CHANGE

Dr. Wayne Pollard, McGill University

#### Objectives

- To determine the physical and climatic forcings that influence erosion of ice-rich permafrost.
- To understand the mechanics of coastal erosion in a permafrost region.
- To establish how much organic carbon there is in permafrost soils and how much is currently being eroded.
- To determine how future climate change will affect rates of coastal erosion and the transfer of organic carbon to the ocean.

#### Methods and Information Collected

- An automatic weather station and a series of shallow ground temperature cables were installed at King Point.
- Ten major coastal retrogressive thaw slumps were investigated and surveyed in order to assess their short-term dynamics. Information from the survey will also serve to ground truth the satellite images of these features.
- Shallow soil cores were obtained and examined for lithology, moisture content and ground ice content. Soil from these cores will also be used for carbon analysis.
- Surveys of massive ground ice and wedges were conducted on Herschel Island and at King Point.
- Data was collected on surface and ground ice conditions in these areas, including ice contents, cryostratigraphy and ice distribution.
- A series of shallow soil cores (approximately 2 m deep) were drilled at six sites on Herschel Island, King Point and at Komakuk Beach. The cores were taken from different types of terrain.

## Update/Results

- The soils on Herschel Island and King Point are very ice-rich and represent some of the highest ice contents per unit of coast. Ice contents by weight ranged between 10% for relatively low ice sections of coast to as much as 12,000% (the latter corresponds to roughly 99% ice by volume). Along Thetis Bay on Herschel Island and at King Point, thick (15-20 m) layers of massive ice were exposed for up to 900 m.
- Mean annual retreat rates for the headwalls of retrogressive thaw slumps were compiled by comparing the 2004 outlines of these slumps with remote sensing imagery from 2000 and 2001. The retreat is 7.6 m/yr for the 2000-2001 period and 9.6 m/yr for the 2001-2004 period.
- The morphology or shape of the retrogressive thaw slumps strongly affects how quickly they retreat, as does the presence of other adjoining slumps.
- There appears to be no correlation between the annual retreat rate of these slumps and how frequently they occur.
- Presentations on these results were made at the 5th International Arctic Coastal Dynamics Workshop, the ArcticNet Annual Science Meeting, and the American Geophysical Union Fall Meeting.

## Funding

- ArcticNet National Centres of Excellence
- Fonds Québécois de la recherche sur la nature et les technologies
- National Science and Engineering Research Council
- Polar Continental Shelf Project

## Contacts

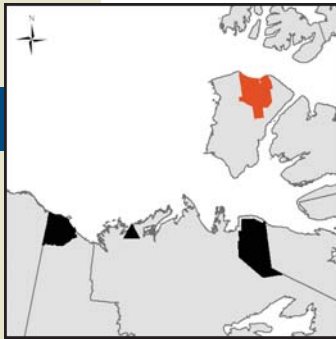
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## Rationale

Small patterned ground features such as frost boils, earth hummocks and small polygons are common landforms in most Arctic landscapes. They are a product of frost heaving, cracking and other processes related to frozen ground. Although these features have been extensively studied by geomorphologists, their role in Arctic ecosystems has not been examined in any detail. This project examines the complex links between climate, vegetation, soils and geomorphic processes related to patterned ground formations along the complete Arctic bioclimate gradient, from treeline to the coldest parts of the Arctic. The processes that create these landforms drive biogeochemical cycling and vegetation succession in the Arctic, and affect other important aspects of ecosystems such as carbon sequestration, energy and trace-gas fluxes, biodiversity and the use of these systems by wildlife. The work conducted in Aulavik National Park is part of a larger research effort along a south-north transect of sites from the Alaska North Slope to Prince Patrick and Ellef Ringnes Islands. Four sites are being studied in Canada: a boreal forest site at Inuvik; a Middle Arctic site at Green Cabin in Aulavik National Park; and two High Arctic sites at Mould Bay and Isachsen.



## Research

### THE ROLE OF PATTERNED-GROUND ECOSYSTEMS

Dr. Donald Walker, Institute of Arctic Biology  
University of Alaska

#### Objectives

- To study the interaction between vegetation, soil and climate in patterned-ground ecosystems.
- To understand the links between biogeochemical cycles, vegetation, disturbance and climate across the full summer temperature gradient in the Arctic in order to better predict the response of ecosystems to changing climate.

#### Methods and Information Collected

- Three sites, representative of vegetation in the area, were chosen. Vegetation was characterized by identifying species, plant communities and cover within representative areas (relevés). A small soil plug at each vegetation relevé was removed for analysis. Small samples of plants were collected for identification.
- At each site, a 10 x 10 m grid was marked. A climate station was set up at one grid to collect soil temperature and moisture data at different depths, and ground surface and air temperature. The depth of the active layer was measured every 0.5 m within the grid. Heave recorders were placed in frost boils and in adjacent inter-boil areas to measure the amount of annual frost heave. Temperature sensors were placed at the soil level to measure the insulative value of the plant cover. Vegetation maps were made of each grid at two different scales (10 x 10 m grid, and representative 1 x 1 m plots).
- Soil pits were dug at each grid. The sides of the soil pits were photographed, mapped and described, identifying the different soil types and layers, and the permafrost

## Methods and Information Collected (continued)

characteristics. Small samples of the different types of soils were taken for physical and chemical analysis. The pits were filled, replacing the soil in approximately the same order in which it was excavated.

- Data were collected to characterize frost boil ecosystems for vegetation modeling. Leaf Area Index (LAI), Normalized Difference Vegetation Index (NDVI) and plant biomass were measured on frost boil areas and between frost boils so that values could be compared. These data were summarized to determine the biomass of plant groups, and the carbon and nitrogen content of the plant tissue.
- Soil respiration and nitrogen fixation were measured. Soil samples were taken to measure total carbon and nitrogen, and rates of nitrogen mineralization were compared to rates using the buried bag method.

## Update/Results

- In 2005 we established our research site at Isachsen, Ellef Ringnes Island. Data reports are available from the authors for the Green Cabin and Mould Bay sites, and we are currently preparing the data report for Isachsen. 2006 will be our final year of data collection. We will sample snow at all sites in spring to understand how snow characteristics influence the soil and vegetation. We will also collect climate data at the end of the summer so as to have a full year of data from Ellef Ringnes Island.
- Once all the data are collected, they will be analyzed to determine how the plant communities, soils and patterned-ground forms vary with climate in the Arctic.
- Although most of the scientific journal papers written for this project do not yet include data from Green Cabin, over 20 peer-reviewed papers have been written that describe some of the results of the first two years of the project. Similar papers will be written using data from the Canadian Arctic, and synthesis papers will summarize the complete gradient from tree-line to snow-line.

## Partners

- University of Alaska
- United States Department of Agriculture, Forest Service
- VECO Polar Resources
- University of Virginia
- University of Cincinnati
- Agriculture and Agri-Food Canada
- Institute of Plant Ecology, Muenster
- Komarov Botanical Institute, St. Petersburg
- Russian Academy of Sciences, Moscow

## Funding

- U.S. National Science Foundation

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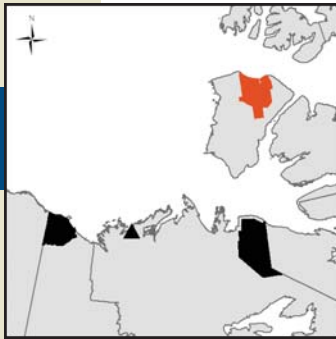
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## Rationale

The project's objective is to document how the geology and geomorphology of Arctic islands have developed from the ice ages to the present. Developing a long-term record of environmental conditions contributes to a better understanding of current and possible future environmental changes in the climatically sensitive Arctic. This information can also be used to better assess and predict the possible impacts of human-induced environmental change. During the previous three decades an environmental transect has been completed across the Canadian Arctic Archipelago, from Ellesmere Island, Nunavut, to Melville Island, Northwest Territories. Extending this research to Banks Island is critical as previous geological reconstructions propose that it constitutes the northwest extremity of ice-free Beringia during the last glaciation. However, this model needs to be tested in the light of evidence on adjacent Melville Island that now supports more extensive Late Wisconsinan glaciation involving both the Laurentide Ice Sheet (primarily mainland-based) as well as local island-based ice caps.



## Research

### INVESTIGATING ENVIRONMENTAL CHANGE IN THE WESTERN ARCTIC ARCHIPELAGO

Dr. John England, NSERC Northern Chair  
University of Alberta

#### Objectives

- To clarify the absolute ages of different till sheets ascribed to multiple glaciations by the Laurentide Ice Sheet on north and northeast Banks Island (especially those purported to be pre Late Wisconsinan).
- To clarify the extent of glaciation during the Late Wisconsinan on northern Banks Island and to determine its relationship to grounded or floating ice in M'Clure Strait.
- To clarify the regional pattern of deglacial and postglacial sea levels as a measure of regional glacial unloading (former ice sheet size).
- To document changes in sea-ice cover and surface circulation in the Arctic Ocean and the channels of the Archipelago.
- To determine whether the driftwood record provides evidence for recent and ongoing coastal submergence.
- To determine the modern species diversity of non-vascular vegetation (bryophytes) and to determine whether this flora provides evidence of late Pleistocene refugia.

#### Methods and Information Collected

- Field surveys of northern Banks Island were made by ATV outside of Aulavik National Park and by foot and helicopter surveys in the park. This work included mapping raised marine sediments and shorelines.
- Fossil molluscs, mollusk fragments, sediments, samples of driftwood and a limited collection of rock samples were collected from the surface of the ground, or from selected sections where stratigraphic relationships were established.

## Methods and Information Collected (continued)

- Age-control for former ice margins will be based on cosmogenic surface exposure dating of till sheets of purportedly different ages. Where former ice margins contacted the sea, fossil marine molluscs collected from raised marine deposits will be radiocarbon dated. This requires only small fossil shell fragments. Fine-grained deposits (possibly marine) that do not contain shells will be dated by thermoluminescence.
- Samples of driftwood will be radiocarbon dated to assist with determining regional patterns of deglacial and postglacial sea levels, including recent/ongoing sea level adjustments.
- Bryophyte collections were made during helicopter surveys across northern Banks Island and are being identified and curated in the Cryptogamic Herbarium of the University of Alberta. Samples of sub-surface peat deposits were also made outside the park to determine the age and composition of sub-fossil mosses that will be radiocarbon dated.

## Update/Results

- Our recent work indicates that the elevation of raised shorelines across northern Banks Island fall on the same profile (gradient) recorded by other deglacial shorelines dated to the Late Wisconsinan on adjacent Melville and Victoria islands. Deglacial shorelines on northeastern Banks Island were surveyed up to 86 meters above sea level (m asl) and descend westward to ~50 m asl in Mercy Bay. Furthermore, the deglacial shoreline (marine limit) in Mercy Bay was deposited in contact with Laurentide ice that retreated inland (up the Thomsen River drainage) and not northward out of the bay. During our visit to Mercy Bay, we collected marine shells that underlie the 50 m asl deglacial shoreline and these provided a radiocarbon date of 12,000 yrs, clearly indicating ice retreat from the last (Late Wisconsinan) glaciation. A similar deglacial date (11,700 yrs) was obtained just to the east of the park, along M'Clure Strait, between Parker Point and Passage Point. Our observations demonstrate more extensive Late Wisconsinan ice across northern Banks Island that deposited deglacial shorelines of similar age and elevation to those on the adjacent coast of Melville Island mapped during 2002-2005. This reconstruction, based on radiocarbon-dated deglacial sediments, refutes the previous conclusion that Aulavik National Park served as an ice-free biological refugia for at least the last 120,000 yrs, and indeed for >800,000 yrs.
- Our research also suggests that the ice-moulded till deposited by the Thomsen Glaciation, en route to Mercy Bay, may simply mark a warm-based ice stream embedded in more expansive, surrounding ice that was cold-based. If so, the most extensive Banks Glaciation (Bernard Till) would also be Late Wisconsinan. We note that at no locality overlying these reputedly ancient till sheets (assigned to the Thomsen and Banks glaciations) have field workers reported in situ fossils of animals or plants predating the last glaciation (as is common in unglaciated parts of the Yukon). Rather, all of the material radiocarbon-dated older than the last glaciation has, so far, been done on redeposited material. Hence, we feel that the revision reported here stands on firm evidence, indeed the very evidence (dated deglacial shorelines) that is used across northern Canada to establish

**Update/Results  
(continued)**

the chronology of ice retreat. All deglacial shorelines surveyed during 2005, both inside and outside Aulavik National Park, were not reported by field workers during the 1970s and 1980s. We cannot explain this omission. During the late stages of deglaciation we did map and date the readvance of the Viscount Melville Sound Ice Shelf (Hodgson and Vincent 1984) that deposited a prominent moraine between Passage Point and Parker Point. This advance occurred at or immediately before 10,400 yr making it synchronous with the Winter Harbour Till (also ascribed to an ice shelf) on south Melville Island. This ice shelf did not reach Aulavik National Park, but terminated just west of Parker Point where it entered an unnamed bay ~15 km to the west, along M'Clure Strait. Bryophytes collected within and outside the park are being identified to determine species diversity and to determine whether there are any apparent disjunctions that would be indicative of a Beringian flora. This work will also test whether there are any species previously unreported from the park. Sub-fossil peat deposits are also being radiocarbon dated to determine the age of organics exposed in high-centered tundra polygons bordering Prince of Wales Strait (outside the park). Collectively, this will add to our understanding of the modern and late Pleistocene environment on Banks Island.

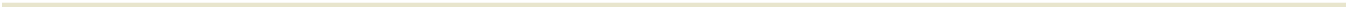
**Funding**

- NSERC Northern Research Chair, Department of Earth and Atmospheric Sciences
- NSERC Discovery Grant, Canadian Circumpolar Institute (University of Alberta)
- Polar Continental Shelf Project

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## Rationale

Population estimates are crucial for setting harvest quotas for grizzly bears in the Inuvialuit Settlement Region (ISR). Current population estimates are required to review existing quotas for grizzly bears, in part because many people living in communities in the ISR feel that grizzly bear populations have increased in recent years and that an increase in the number of bears that can be harvested is warranted. This project, which was initiated in 2002, is being conducted in the Northwest Territories in the eastern portion of the ISR. A similar project will be conducted, in approximately the same time frame, in the Yukon in the western portion of the ISR. This project is being conducted by the Department of Environment and Natural Resources (ENR), Government of the Northwest Territories.



## Research

### EASTERN INUVIALUIT SETTLEMENT REGION GRIZZLY BEAR POPULATION STUDY - PHASE 1

John Nagy and Marsha Branigan, Government of the Northwest Territories

#### Objectives

- To estimate the number of grizzly bears in the ISR between the Mackenzie Delta and the Northwest Territories-Nunavut boundary.
- To obtain current information on the distribution and movements of grizzly bears in the ISR between the Mackenzie Delta and the Northwest Territories-Nunavut boundary.
- To obtain current information on body condition, size, age structure, reproductive status, litter sizes, age of first reproduction and diet of grizzly bears in the area.
- To determine the levels to which grizzly bears in the region have been exposed to rabies.

#### Methods and Information Collected

- Capture work is done in May/early June when most bears have emerged from their dens. Fixed wing aircraft are used to locate bears for capture, and bears are immobilized by firing a dart from a helicopter.
- Weight, length, girth and other measurements are taken for each bear that is captured.
- A pre-molar is extracted to determine age.
- Blood samples are taken to determine condition and to test for exposure to rabies.
- Samples of fecal material, hair, skin, fat and claw shavings are taken for DNA and diet analyses.
- Each bear is tattooed with a unique number on the lower lip, and is ear tagged, to ensure identification once the collar is removed or lost.

**Methods and Information  
Collected (continued)**

- Bears are equipped with an ARGOS ST14/ST18 satellite collar programmed to provide one location every two days. Each collar is equipped with a VHF transmitter so that the collar/bear can be located from an aircraft or from the ground. These collars have a “breakaway” feature so they automatically fall off if the bears cannot be recaptured.
- Female bears collared in previous years are located by fixed wing aircraft in mid June to determine reproductive status.
- Stationary collars are picked up in July / August to determine if the collar has slipped or if the bear has died.
- Traditional knowledge about grizzly bears is collected during meetings and workshops with Hunters and Trappers Committees and co-management boards in the region.

**Update/Results**

- In June 2004, three collars were deployed in the Anderson River area. In June most collared females were relocated to determine their reproductive status.
- Stationary collars were picked up later in the season.
- A total of 18 bears (13 females, 5 males) are currently equipped with satellite collars. Another study, in the Mackenzie Gas Project development area, currently has another 22 bears equipped with GPS collars.

**Partners**

- Government of the Northwest Territories, Department of Environment and Natural Resources (project lead)

**Funding**

- Government of the Northwest Territories, Department of Environment and Natural Resources

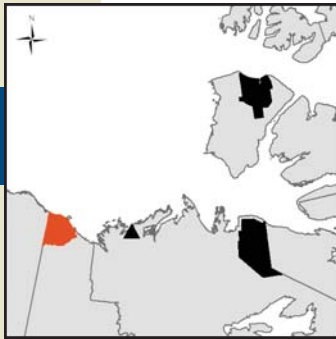
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## Rationale

Population estimates are crucial for setting harvest quotas for grizzly bears in the Inuvialuit Settlement Region (ISR). Current population estimates are required to review existing quotas for grizzly bears, in part because many people living in communities in the ISR feel that grizzly bear populations have increased in recent years and that an increase in the number of bears that can be harvested is warranted. This project is being conducted on the coastal plain of the Yukon North Slope, in the western portion of the ISR. A similar project is being conducted in the Northwest Territories in the eastern portion of the ISR. This project is being conducted by the Government of Yukon, Department of the Environment. Parks Canada is a partner in the project, contributing funds and other resources.



## Research

### YUKON NORTH SLOPE GRIZZLY BEAR POPULATION STUDY

Ramona Maraj, Government of Yukon

#### Objectives

- To estimate the number of grizzly bears on the Yukon North Slope.
- To obtain current information on the distribution and movements of grizzly bears on the Yukon North Slope.
- To obtain current information on body condition, size, age structure, reproductive status, litter sizes, age of first reproduction and diet of grizzly bears on the Yukon North Slope.

#### Methods and Information Collected

- 24 bears were equipped with GPS collars that are programmed to provide one location every four hours. Each collar is equipped with a VHF transmitter so that the collar/bear can be located from an aircraft or from the ground. Weekly telemetry flights are conducted over the study area to pinpoint the location of the collar and to record survival information. Six additional female bears were collared with VHF transmitters only. These bears will be monitored on telemetry flights.
- The following information, or samples, were taken from each bear that was captured: sex; weight and body measurements; body condition; presence of parasites; reproductive state; fat; tooth wear; tooth; blood; hair; milk; and scat samples, when possible. Age is determined from collection of a premolar tooth.
- Traditional knowledge about grizzly bears will be collected through interviews with community members, and during meetings and workshops with regional Hunters and Trappers Committee's and co-management boards.



A grizzly bear captured on the Yukon North Slope  
PHOTO: GOVERNMENT OF YUKON.

## Update/Results

- Grizzly bear captures were conducted in April to continue the collaring work that was initiated in the spring of 2004. By June a total of 30 grizzly bears were collared (19 females and 11 males).
- All bears, weather permitting, were monitored throughout the summer. A den survey was conducted in June, 2005, and microsite surveys were conducted for six dens.
- Teeth and hair samples collected from all bears will be analyzed this winter to determine the age of the bears and coarse-level dietary information.
- An experimental flight-resight component of the study was conducted. Despite numerous attempts, we were unable to complete this work because of bad weather.
- Parks Canada and Canadian Wildlife Service staff collected bear scats.
- The direction of the study, bear management issues and observations of bear ecology were discussed in February, 2005 with local hunters.
- Information that was collected in 1998 and 1999 by the Government of the Northwest Territories through interviews with local hunters was reviewed. A literature search was initiated in June, 2005 to determine what information had already been collected on local knowledge of bear ecology. The local knowledge component of the study will be continued in 2006.

## Partners

- Government of Yukon, Department of Environment (project lead)
- Parks Canada

## Funding

- Government of Yukon, Department of Environment
- Parks Canada

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## Rationale

The Hornaday River was, and continues to be, an important source of Arctic char for the community of Paulatuk. However, the size of the Hornaday River char stock has declined and volunteer restrictions on subsistence char fishing have been put in place through the Paulatuk Char Management Plan, 2003-2005. Brock Lake, in Tuktoyaktuk National Park, is being evaluated as a new fishing site for Arctic char and other species of fish. This project is part of a larger group of research projects that focus on Arctic char in the Paulatuk area. These projects are being coordinated by the Department of Fisheries and Oceans on behalf of the Fisheries Joint Management Committee.



## Research

### FISHERY SURVEY OF BROCK LAKE

Lois Harwood, Department of Fisheries and Oceans

#### Objectives

- To gather basic biological, physical, and chemical information about Brock Lake, including bathymetry and water quality, during the open water season 2004.
- To estimate the relative abundance and diversity of fishes in the lake.
- To examine the movements of Arctic char from Brock Lake to neighbouring systems.
- To examine the relative rates of exploitation of lake trout and Arctic char in the Brock Lake.
- To prepare a bathymetric map of Brock Lake.
- To examine the strontium profile (record of trips to sea) of Arctic char from Brock Lake.
- To develop local expertise in the delivery of fisheries and fish habitat assessment projects.
- To provide knowledge to support and implement the Paulatuk Char Management Plan, 2003-2005.
- To determine the relationship of Arctic char from Brock Lake to Arctic char of the Hornaday River.

#### Methods and Information Collected



A lake trout caught in Brock Lake. PHOTO: NIC DEGRAFF.

- Water quality, bathymetry and bottom substrate characterization were done at Brock Lake in July, 2004.
- Index netting, using gill nets and standard gang test nets, was conducted to determine the species composition of fish in Brock Lake.
- Lake trout that were captured in the test nets were sampled for length and weight, tagged and then released. Two Arctic char captured at Brock Lake in July 2004 were tagged to determine if they move to areas near Paulatuk, including the Hornaday River.

## Methods and Information Collected (continued)

- Lake trout (n=12) and Arctic char (n=3) were dead sampled according to standard protocols. Weight, length, sex and maturity were determined, and stomach contents, otoliths and muscle samples were collected. Dead sampled fish were distributed to the community members in Paulatuk or were eaten by the project crew.

## Update/Results

- A bathymetric map and baseline water chemistry have been completed.
- Four species of fish were caught in Brock Lake: Arctic char, lake trout, slimy sculpin and Arctic grayling.
- Sea run Arctic char appear to be using the area for spawning based on captures of sexually mature fish in November and in July, and the presence of fry and small juveniles during July.
- Arctic char using Brock Lake for over wintering are anadromous, based on the presence of strontium in the otoliths from November, 2003, the absence of sub-adult size classes (250 to 550 mm fork length) in the July, 2004 and July, 2005 test netting, and the low density of adult Arctic Char in the 61 one hour gillnet sets during July 2004 and 2005 when the fish are expected to be at sea.
- The two adult char that were caught during July, 2004 were current year spawners, and did not go to sea in their spawning year. Strontium profiles of three Arctic char dead sampled at Brock Lake in July, 2005 are forthcoming.
- Plankton samples and stomach contents from lake trout and char will be used to document the lower trophic levels of Brock Lake.
- Lake trout abundance was approximately one fish per net hour which is relatively high compared to other lake trout lakes such as those tested with a similar method in the Yukon.
- Fishing with gillnets in Brock Lake has the potential to catch a significant proportion of lake trout. The lake is relatively small and a significant harvest of fish from the lake could reduce abundance rapidly.
- The diet of the lake trout during July is largely insectivorous due to the lack of forage species, however larger piscivorous (cannibalistic) lake trout did occur in the lake.
- There was a small but significant presence of artefacts such as anchor rocks and camp sites indicating past human usage of the resources and area.

## Partners

- Department of Fisheries and Oceans (project lead)
- Paulatuk Hunters and Trappers Committee
- Parks Canada

## Funding

- Fisheries Joint Management Committee
- Parks Canada

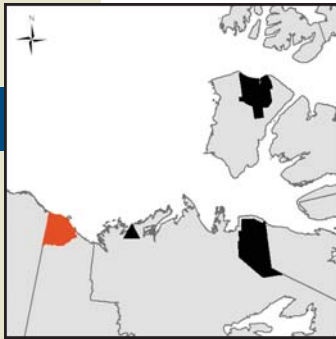
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## Rationale

Shorebird populations are declining worldwide. Of the 16 regularly occurring Yukon bird species which are considered “highly imperiled” or of “high concern” continentally, nine are shorebirds. The Yukon North Slope, much of which lies within Ivvavik National Park, is one of the richest areas for wildlife in the territory. Of the eight breeding bird species in Ivvavik which are considered “highly imperiled” or of “high concern” continentally, six nest exclusively or most abundantly on the Yukon North Slope, and four of these are shorebirds. For some shorebirds (long-billed dowitcher, buff-breasted sandpiper, stilt sandpiper), the Yukon North Slope may support a significant portion of the Canadian, North American or global population. Yet there is very little current information on shorebirds of the Yukon North Slope, including the portion in Ivvavik National Park. This project is part of the Program for Regional and International Shorebird Monitoring (PRISM) Arctic Breeding Survey that is conducted throughout the North American Arctic. The PRISM program intends to repeat these surveys every 10 years in order to track changes in the numbers and distribution of birds.



## Research

### PRISM BREEDING SHOREBIRD SURVEY

Pam Sinclair and Mike Gill (Canadian Wildlife Service)  
Ian McDonald (Parks Canada)

#### Objectives

- To estimate the size of shorebird populations across the North American Arctic, and to monitor changes in their numbers over time.
- To provide current information on the status and distribution of shorebirds on the Yukon North Slope.

#### Methods and Information Collected

- Two field crews of two people each surveyed a total of 26 survey plots (each plot was 12 ha in area, or 300m x 400m) across the Yukon North Slope over five days. 12 of these plots were within Ivvavik National Park, 12 were outside the park on the mainland of the Yukon Coastal Plain, and two were in Herschel Island Territorial Park.
- Plots were surveyed systematically searching on foot and recording observations for about 1.5 hours, and then assessing the number of territorial pairs of each species present within the plot.
- The survey plots were reached by helicopter. The survey plots were paired, so that both crews could access their plots from the same helicopter landing area.
- The study area took place during June 7-9th. Plot surveys followed standardized PRISM survey protocol.
- In addition the crew conducted 104 km (89 minutes) of aerial transect surveys while flying between plot survey sites. These transects were conducted 30 m above the ground, flying at 80-90 kph. The transects were non-random, and consist of a single line, in 2 km segments, following a fairly direct route. Birds were recorded if they were within 100 m of the aircraft.



Mike Gill conducting PRISM shorebird surveys on the Yukon North Slope. PHOTO: IAN MCDONALD/PARKS CANADA.

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## Results

Analysis of breeding bird densities will be completed over the winter. Preliminary results are as follows:

- A total of 48 bird species were recorded during the study (both on surveys and incidentally), including 13 species of shorebirds.
- A total of 314 breeding pairs of birds, of 22 species, were recorded within survey plots. These included 32 shorebird pairs, of nine species. Shorebird species recorded within the plots included, in order of abundance, pectoral sandpiper, red necked phalarope, stilt sandpiper and long billed dowitcher, Wilson's snipe, semipalmated sandpiper and American golden plover, and whimbrel and Baird's sandpiper.
- An additional 596 birds of 46 species were noted incidentally. These included four additional shorebird species: semipalmated plover, lesser yellowlegs, hudsonian godwit and least sandpiper.
- On aerial surveys, 377 individuals were recorded, including 240 birds identified to species (22 species) and 137 birds not identified to species (e.g., "ptarmigan" or small "shorebirds"). Shorebirds identified were American golden plover, pectoral sandpiper, whimbrel and red-necked phalarope.
- Fourteen bird nests were found incidentally, including 10 Lapland longspur nests, 2 rock ptarmigan nests, a whimbrel nest and a parasitic jaeger nest.

## Partners

- Canadian Wildlife Service
- Parks Canada

## Funding

- Canadian Wildlife Service
- Parks Canada

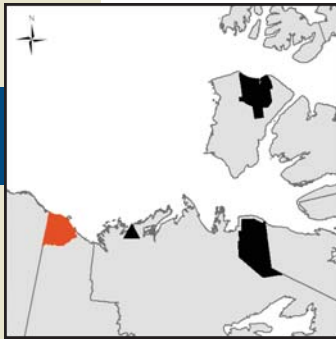
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## Rationale

Plant inventories are a crucial part of documenting which species at risk are found in an area. This project will assess the presence, abundance and distribution of rare vascular plant species on the coastal plain of the Yukon North Slope (including Ivvavik National Park), and will determine the presence or absence of rare plants that have been found adjacent to this area. In addition to documenting rare plants, this work will provide essential baseline information on plant species presence, distribution and abundance, which will be needed for future assessments on the impacts of climate change on the coastal plain of the Yukon North Slope.



## Research

### RARE PLANT INVENTORY OF THE YUKON NORTH SLOPE COASTAL PLAIN

Bruce Bennett, NatureServe Yukon, Government of Yukon

#### Objectives

- To document the vascular plant species that occur on the coastal plain of the Yukon North Slope, including the coastal regions of Ivvavik National Park.
- To describe the taxonomic, ecological and geographic characteristics of vascular plant species of special management concern.
- To acquire additional information about the relative abundance of selected species of vascular plants of special management concern.
- To gather a set of voucher specimens of vascular plant species for local and national plant collections.
- To acquire new inventory information in a format compatible with ongoing plant inventory efforts in NatureServe Yukon.

#### Methods and Information Collected

- Plant inventories were conducted at Blow River, Shingle Point, Clarence Lagoon, Kay Point, Komakuk DEW Line Station and Ptarmigan Bay.
- Fieldwork was conducted from the second week of July to the first week of August in order to view and collect plants during the desired phenological stage.
- The location of each site was recorded.
- A description of each site was made, and significant landforms and vegetation communities at each site were described. Vegetation community descriptions included vegetation type, slope, aspect, elevation, topographic position, moisture, soil types, parent material, cover classes of life forms and bare ground, dominant species by life forms and a general description of the vegetation type.



Location of study sites for the rare plant inventory conducted on the Yukon North Slope coastal plain in 2005.

## Methods and Information Collected (continued)

- A complete floristic reconnaissance was conducted at each site. All of the plant species that were encountered were recorded. Plant species were attributed to a vegetation community type.
- As the survey was conducted, new vegetation community types that were encountered were recorded, and a species list was compiled for each community type. A cumulative species list was compiled as the survey was conducted.
- The sites were photographed from the ground. Vegetation communities, notable plants and unique landforms were also photographed.
- Voucher specimens were collected for those species that were considered to be new to Ivvavik National Park or to the region, a species at risk, a geographic or ecological range extension, or a species that was not identifiable in the field.
- Leaf tissue was collected for selected species and held in silica gel for genetic analysis.

## Update/Results

- 590 vascular plant collections were made (222 collections from Ivvavik).
- 271 species of vascular plants were recorded.
- 196 species were collected (~76% positively identified).
- 3 of these species were previously unreported in the Yukon.
- 28 of these species were new to the coastal plain of the Yukon North Slope.
- 21 species were new to Ivvavik National Park.
- 8 species were not previously known in the Inuvialuit Settlement Region in the Yukon.

Genetic material was collected and sent to the following institutions:

- University of Zurich, Switzerland
- Kansas State University
- University of California, Berkley
- University of, Alaska, Fairbanks
- University of Victoria, BC
- Royal BC Museum, Victoria BC

## Funding

- NatureServe Yukon, Government of Yukon, Department of Environment
- Parks Canada

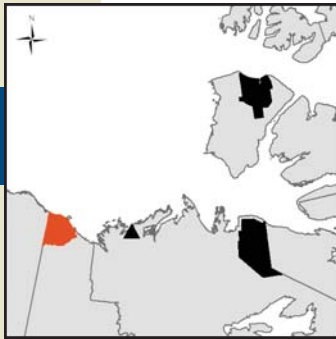
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## Rationale

Changes in the vegetation of the Yukon North Slope, including areas of Ivvavik National Park, are being assessed. On some areas of Herschel Island, situated in the Beaufort Sea adjacent to Ivvavik National Park, much of the upland vegetation has changed since 1985 from a forb and low shrub-dominated tundra to a grass-dominated tundra. Most notably, polar grass (*Arctagrostis latifolia*), a native grass species, is invading areas all over Herschel Island. Initial vegetation change measurements were taken on the coastal plain of Ivvavik National Park in 2001 to investigate if the changes that were observed on Herschel Island were taking place in Ivvavik. The work conducted in 2005 builds on initial vegetation surveys that were conducted in Ivvavik National Park in 1988 and 1989, and an initial set of vegetation change measurements that were taken in 2001.



## Research

### YUKON NORTH SLOPE VEGETATION CHANGE MEASUREMENTS

Catherine Kennedy, Government of Yukon

#### Objectives

- To assess changes in vegetation on the coastal plain of Ivvavik National Park.

#### Methods and Information Collected

- In 2005, sites in Ivvavik National Park that were sampled in 1988, 1989 and 2001 were re-visited. The survey crew was transported to and between sites by helicopter. Site descriptions included depth to permafrost, elevation, aspect, slope, percent of bare soil, site position and soil moisture.
- The plant species composition and species percent cover were recorded at each site. Voucher specimens of plants were collected for identification when required.

#### Update/Results

- 16 sites along the Yukon North Slope, including Ivvavik National Park, were visited between July 24-25, 2005. Data collected in 2005 will be analyzed and compared to data collected from surveys in 1988, 1989 and 2001.



Catherine Kennedy investigating a vegetation change site in Ivvavik National Park.

PHOTO: GOVERNMENT OF YUKON.

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## Funding

- Government of Yukon
- Wildlife Management Advisory Council (North Slope)

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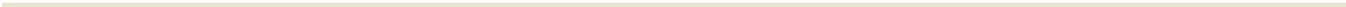






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# MONITORING



## Rationale

Recording incidental wildlife observations is an inexpensive method of collecting information about wildlife populations. Observations of wildlife made in Aulavik, Ivvavik and Tukturnogait national parks, and surrounding areas, are recorded on wildlife cards and the information is stored in a computer database.



## Wildlife

### WILDLIFE CARDS

#### Objectives

- To collect basic information (presence, distribution and relative abundance) about wildlife populations in Aulavik, Ivvavik and Tukturnogait national parks and surrounding regions.

#### Methods and Information Collected

- Parks Canada staff, researchers and park 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, sex of animal, evidence of reproduction, habitat, weather and remarks.



- Information from the wildlife cards is entered into a database.
- Summaries and maps of incidental observations are produced as required.

Porcupine Caribou crossing Joe Creek in Ivvavik National Park.  
PHOTO: IAN MCDONALD/PARKS CANADA.

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**Update/Results**

- There are currently 1,732 observations in the wildlife cards database. These records date back to 1973 in the case of Ivvavik National Park and other regions of the Yukon North Slope.

**Years of Data**

- 1973 - ongoing

**Funding**

- Parks Canada

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## Rationale

The NWT-Nunavut Bird Checklist Survey is part of a national effort to collect scientific information about the distribution, abundance and breeding status of birds in the north. Checklist survey data can provide useful information about birds that is difficult to collect in large, remote areas, and can be used as baseline information for further studies, environmental assessments, mapping bird distributions and detecting major changes in bird populations. The survey was initiated in 1995 by the Canadian Wildlife Service in response to a need for information identified in the Canadian Landbirds Monitoring Strategy. Parks Canada collects data for the survey and has assisted with the project's development.



Wildlife

## NWT-NUNAVUT BIRD CHECKLIST SURVEY

Canadian Wildlife Service

### Objectives

- To collect information about the geographic distribution, abundance and breeding status of birds in the western Arctic for use with national bird monitoring efforts.

### Methods and Information Collected

- Checklists are completed for Aulavik, Ivvavik and Tukturnogait national parks.
- The number of birds of each species, and evidence of breeding, is recorded on the checklists.
- Checklists are completed for a 24-hour or shorter period in a 10 x 10 km or smaller area.
- Additional information is also recorded on the checklist (e.g., birding ability of the observer, survey location, habitat, presence of predators).

### Update/Results

- Information about the NWT-Nunavut Bird Checklist Survey is available through the internet at [www.pnr-rpn.ec.gc.ca/checklist](http://www.pnr-rpn.ec.gc.ca/checklist).



Long-tailed Jaeger.  
PHOTO: IAN MCDONALD/PARKS CANADA.

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**Years of Data**

- 1995 - ongoing

**Funding**

- Canadian Wildlife Service

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## Rationale

Raptors, especially peregrine falcons, can be used as indicators of ecosystem health. Surveying raptors when they are in the western Arctic to breed provides an indicator of the health of their populations and the condition of the ecosystem throughout their range. The raptor survey conducted in Aulavik, Ivvavik and Tuktut Nogait national parks coincides with the Canadian Peregrine Falcon Survey, a national effort to monitor the status of peregrine falcon populations in North America every five years.



## Wildlife

### PEREGRINE FALCON SURVEY

#### Objectives

- To determine if selected peregrine falcon territories in Aulavik, Ivvavik and Tuktut Nogait national parks are occupied and productive.
- To estimate the reproductive success of these territories during the nesting period.
- To collect incidental observations of other species of raptors in Aulavik, Ivvavik and Tuktut Nogait national parks.

#### Methods and Information Collected

- The peregrine falcon survey is conducted every 5 years. The next survey will be conducted in 2010.
- Known peregrine falcon territories along the Thomsen River in Aulavik National Park, the Firth River and the coastal plain in Ivvavik National Park, and along the Hornaday River in Tuktut Nogait National Park are visited.

#### Update/Results

- Peregrine falcon surveys were planned for Aulavik, Ivvavik and Tuktut Nogait National Parks in 2005. The survey was conducted in Ivvavik, but not in Aulavik or Tuktut Nogait because of logistical problems and poor weather.
- Surveys will be attempted in Aulavik and Tuktut Nogait in 2006.
- Eleven known peregrine falcon territories in Ivvavik National Park were surveyed in July. Territories along the Firth River were surveyed on foot and those along the

**Update/Results  
(continued)**

coastal plain were surveyed from a helicopter. Eight of these territories were found to be occupied. Of these eight sites, three territorial pairs produced five young for a mean of 1.7 young per pair. An additional three pairs were observed, but numbers of young were not determined. Lone adults were observed at two sites that were assumed to be unproductive.

- Information about site occupancy and productivity of peregrine falcons in Ivvavik National Park in 2005 will be combined with similar information collected in areas of the Yukon North Slope that are outside of the park. This will allow for the presentation and analysis of this information for the entire Yukon North Slope, which is the typical reporting unit for this region of the Yukon.
- Golden eagle, gyrfalcon and rough-legged hawks were also observed during the survey. These sightings have been archived through the Western Arctic Field Unit wildlife cards program.

**Years of Data**

- Aulavik National Park: 2000 - present
- Ivvavik National Park: 1972 - present
- Tuktut Nogait National Park: 1988 - present

**Funding**

- Parks Canada

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## Rationale

Environmental problems, or changes in wintering habitats, breeding habitats and habitats along migration routes can affect the health and distribution of bird populations. The purpose of this survey is to create a long-term record of breeding bird observations in Ivvavik National Park. This survey is based on the breeding bird surveys conducted by the Canadian Wildlife Service and for the Alaska Offroad Bird Survey.



## Wildlife

### BREEDING BIRD SURVEY

#### Objectives

- To monitor the relative abundance and distribution of breeding birds at two locations in Ivvavik National Park.

#### Methods and Information Collected

- Surveys are conducted at Sheep Creek and Margaret Lake in the Firth River watershed.
- Four transects, each with 12 stations, are surveyed. There are 2 transects at Margaret Lake and 2 transects at Sheep Creek.
- Surveys are conducted in early to mid-June. Survey dates are kept relatively consistent from year to year.
- All surveys start at 5:00 am and conclude by 11:00 am.
- Birds are identified by sight and sound at each station. Observations at each station are made for 10 minutes.
- Wind and weather conditions are recorded for each route.

#### Update/Results

- The breeding bird survey was conducted in 2005 from June 17-18 at Margaret Lake and from June 19-20 at Sheep Creek.
- Species observed during the survey were: American pipit, American robin, American tree sparrow, boreal chickadee, common and hoary redpoll, dark-eyed junco, golden eagle, gray jay, horned lark, lesser yellowlegs, merlin, mew gull, red-throated loon, rock ptarmigan, savannah sparrow, tree swallow, upland sandpiper, white-crowned sparrow, Wilson's snipe, yellow warbler and yellow-rumped warbler.
- There were no unusual bird sightings in 2005.



Ian McDonald conducting the Ivvavik breeding bird survey.  
PHOTO: JAMES MCCORMICK/PARKS CANADA.

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**Years of Data**

- 1999 - ongoing

**Funding**

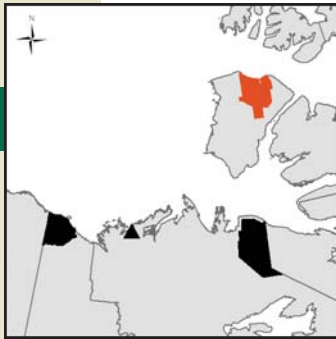
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## Rationale

Lemmings are an important part of many Arctic ecosystems. They are a source of food for predators such as Arctic fox, wolves, ermine and raptors, and can affect soil and vegetation. Lemming populations typically grow and decline cyclically, affecting the rest of the ecosystem as their abundance changes. Monitoring lemming abundance in Aulavik National Park is important for understanding how these lemming populations change, and for interpreting some of the changes observed in the rest of the park ecosystem.



## Wildlife

### LEMMING MONITORING

#### Objectives

- To monitor the relative changes in the abundance of collared and brown lemmings in one area of Aulavik National Park.

#### Methods and Information Collected

- Lemming monitoring is conducted annually in Aulavik National Park near Green Cabin, in the Thomsen River watershed.
- Lemming winter nests are counted using the plot and line transect survey methods.
- Five, one-hectare plots were created. The plots are located in areas that are typical habitat for brown and collared lemmings, such as depressions or drainages in the tundra that tend to hold snow until early summer.
- In the early summer, preferably just after all of the snow has melted, the plots are systematically searched for lemming nests. The total number of nests in each plot is recorded.
- Eleven parallel transects of varying lengths were created. The transects cross a variety of habitats, many of which are suitable for brown or collared lemmings.
- In early summer, preferably just after all of the snow has melted, observers walk the transects looking for lemming nests. When a nest is sighted, the observer measures its perpendicular distance from the line of travel. The density of lemming nests is calculated using the total distance the observer walks, and the perpendicular distance measurements.
- The species, and number, of lemming predators observed during the line transect survey are also counted.

## Update/Results

- The plot survey method and line transect method were conducted in 2005 in June.
- Thirty-two lemming nests were counted during the plot survey, and twenty-seven lemming nests were counted during the transect survey.
- There is not enough data collected yet for a comprehensive analysis. The increase in the number of nests counted during the plot surveys in 2000, 2001 and 2005 corresponds with an increase in lemming sightings made during those years. Similarly, the lower number of lemming nests counted during the plot surveys in 2002, 2003 and 2004 seems to correspond with the lower number of lemming sightings during those years.

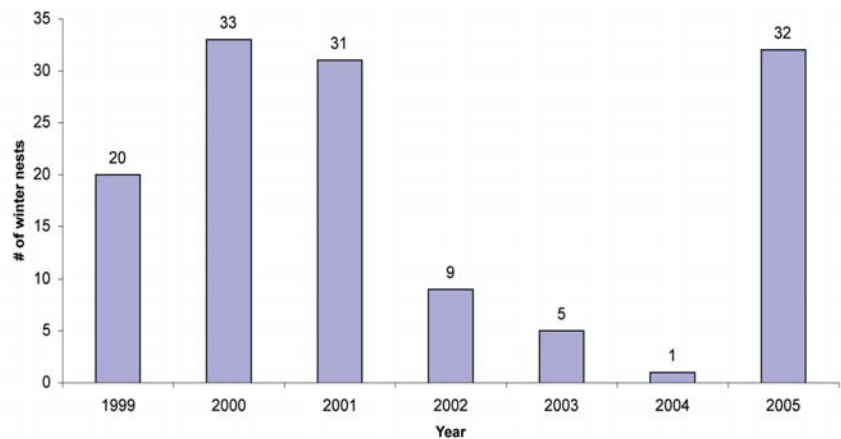
## Years of Data

- 1999 - ongoing

## Funding

- Parks Canada

**Lemming Winter Nests Counted At Five Plots  
in Aulavik National Park, Banks Island**



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## Rationale

Little is known about the abundance, seasonal movements and habitat use of moose in Ivvavik National Park. Aerial surveys of moose were recently initiated in eastern Ivvavik National Park to determine the abundance, sex and age composition, and distribution of moose in this region of the park. This information provides a baseline that will allow Parks Canada to track changes in moose populations.



## Wildlife

### EASTERN IVVAVIK NATIONAL PARK MOOSE SURVEY

#### Objectives

- To collect information about moose abundance, population characteristics and distribution in eastern Ivvavik National Park.

#### Methods and Information Collected

- The age and sex of moose, and the location and habitat type where moose were observed, are recorded.
- The survey area includes the Babbage, Trail and Tulugag River valleys, from the coast of the Beaufort Sea to the headwaters of these rivers.
- The 2000 survey was conducted on April 16 by helicopter.
- The moose survey is conducted approximately every five years. The next survey will be conducted in 2006.
- The survey in 2006 is being timed to coincide with the moose surveys conducted by the Government of Yukon in the northern Richardson Mountains.
- Conducting these surveys concurrently will provide information on the status of moose populations over an area larger than the eastern portion of Ivvavik National Park.

#### Update/Results

- A total of 51 moose were counted in 2000. Of these moose, 7 were adult bulls, 32 were adult cows, 9 were calves and 2 were adults of unknown sex.
- The bulls to 100 adult cows ratio was 22: 100 and the calves to 100 adult cows ration was 28: 100.
- Seven of the adult cows had calves, and two adult cows had twin calves. The twinning rate was therefore 29%.
- Changes in moose populations in eastern Ivvavik National Park will be determined as future surveys are conducted.

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**Years of Data**

- 2000

**Partners**

- Government of Yukon

**Funding**

- Parks Canada

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## Rationale

Muskoxen were re-introduced to the Alaskan North Slope in the late 1960s and early 1970s. The population eventually expanded its range to the northern Yukon, and now ranges across the Yukon North Slope, south of the Yukon North Slope towards Old Crow, and in the Richardson Mountains in the Northwest Territories. Surveys of muskoxen have been conducted in the Yukon since 1986 to determine the size, and age and sex composition, of the population. Research has also been conducted to determine the movement and distribution of muskoxen, their behaviour and the presence of parasites.



Wildlife

## YUKON NORTH SLOPE MUSKOXEN POPULATION MONITORING

Government of Yukon

### Objectives

- To monitor the size and sex and age composition, of the muskoxen population on the Yukon North Slope.
- To monitor the distribution and movement of muskoxen.
- To determine the presence of parasites in muskoxen on the Yukon North Slope.

### Methods and Information Collected

- Muskoxen population sizes, and sex and age composition, are determined through aerial surveys conducted in the spring and summer.
- Surveys are conducted on the Yukon North Slope, from the Alaska/Yukon border to the Blow River, including Ivvavik National Park. The survey area includes the coastal plain and parts of the British and Barn Mountains.
- Muskoxen distribution and movements are determined by tracking muskoxen with satellite-radio collars and through aerial surveys.
- Parasite research has been conducted for muskoxen on the Yukon North Slope and from the Richardson Mountains in the Northwest Territories.

### Update/Results

- A population and composition survey was conducted from April 5-7, 2005 on the Yukon coastal plain between the Alaska/Yukon border and Shingle Point. A total of 86 muskoxen were recorded in the study area during the survey flights. 20% of the animals that were classified during this survey were yearlings.
- A productivity survey was conducted from July 23-26, 2005. A total of 110 muskoxen were recorded in these areas during the flight. Based on information from this survey, productivity was estimated to be 29 calves: 100 adult

**Update/Results  
(continued)**

females (females 3 years and older) and recruitment was estimated to be 24 yearlings: 100 adult females.

- One remaining muskox with a satellite-radio collar was captured in July. The collar was removed and the muskox was released uncollared.

**Years of Data**

- Population information for muskoxen west of the Canning River in Alaska has been collected since 1973.
- Incidental observations of muskoxen on the Yukon North Slope have been reported since 1973. Systematic surveys of muskoxen on the Yukon North Slope have been conducted since 1986.
- A study of the population size, distribution and movements of the Yukon North Slope muskoxen population was initiated in 1999 and was completed in 2005.

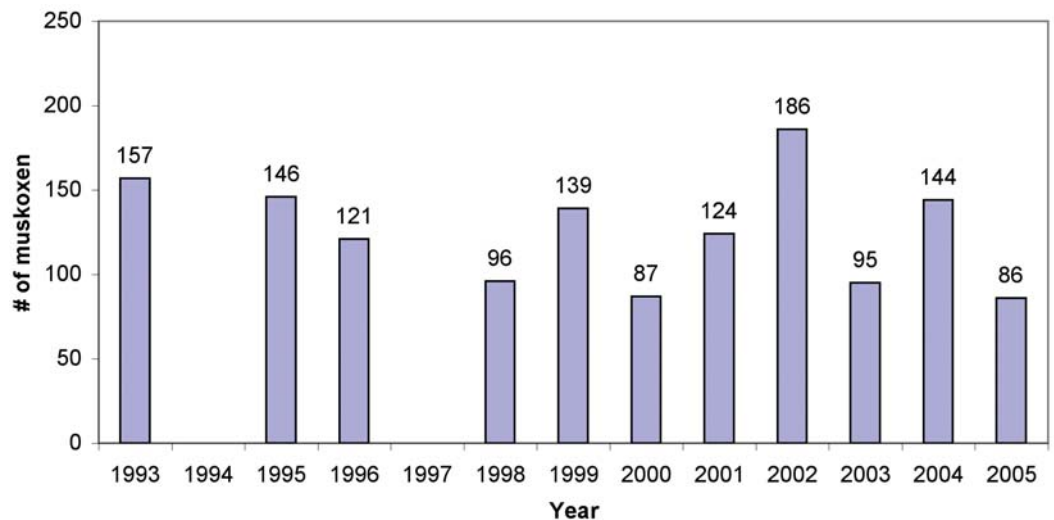
**Partners**

- Government of Yukon (project lead)
- Parks Canada

**Funding**

- Government of Yukon
- Parks Canada

**Number of muskoxen counted on the  
Yukon North Slope in late winter, 1993-2005.**



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## Rationale

There have been a limited number of surveys specifically for muskoxen in the Northwest Territories north of Great Bear Lake to the Beaufort Sea coast. While two surveys were conducted in this area in 1987 and 1997, neither of these systematically covered what is now Tuktut Nogait National Park. Parks Canada initiated periodic muskoxen surveys in Tuktut Nogait National Park in response to a research needs workshop for the park that was conducted in 1998. This survey is conducted in conjunction with periodic muskoxen surveys conducted by the Government of the Northwest Territories in the region surrounding Tuktut Nogait National Park.



Wildlife

## TUKTUT NOGAIT MUSKOXEN SURVEY

### Objectives

- To estimate the number of muskoxen in Tuktut Nogait National Park.

### Methods and Information Collected

- Muskoxen are surveyed from a fixed-wing aircraft.
- The survey is conducted in Tuktut Nogait National Park and surrounding areas. The survey area is bounded by the Beaufort Sea to the north, the Northwest Territories / Nunavut border to the east, the Inuvialuit Settlement Region boundary to the south, and by longitude 123° 20' to the west.
- The survey is conducted as a strip transect survey. Twenty transects are flown in an east-west direction over the entire study area.
- Observations of other species of wildlife are also recorded during the survey.
- These surveys are conducted every five years.

### Update/Results

- The survey in Tuktut Nogait National Park was conducted from March 27 to 29, 2002.
- Four groups of muskoxen were observed. A total of 32 adults and 2 calves were counted.
- The next Tuktut Nogait muskoxen survey is planned for 2007.

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**Years of Data**

- 1997, 2002

**Partners**

- Government of the Northwest Territories

**Funding**

- Parks Canada
- Government of the Northwest Territories

## Contacts

**Ian McDonald**

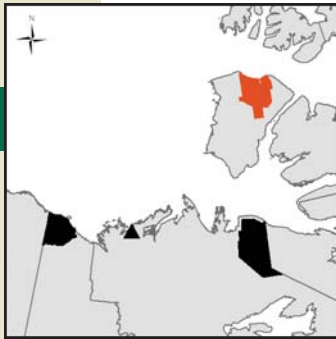
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## Rationale

Peary caribou are classified as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The highest population estimate for Peary caribou on Banks Island was 12,098 caribou in 1972. The size of the population declined to 436 non-calf caribou in 1998, but increased to 1,196 non-calf caribou in 2001. Possible reasons for the population decline include severe climate events, harvest, predation, competition with other wildlife and the movement of caribou to other Arctic islands. Information about the caribou population, seasonal habitat use, range conditions and predation is required to monitor the number of Peary caribou on Banks Island and to understand why the population decline took place. This project is led by the Government of the Northwest Territories. Parks Canada is a partner in this project, contributing funds and other resources.



Wildlife

## BANKS ISLAND PEARY CARIBOU MONITORING

### Objectives

- To estimate the number Peary caribou on Banks Island.
- To determine caribou productivity and over-winter survival.
- To determine the movement of caribou between Banks and Victoria Islands.

### Methods and Information Collected

- The population survey is conducted on Banks Island, including Aulavik National Park, every three to five years. This survey is conducted by fixed-wing aircraft, and is conducted in conjunction with the Banks Island muskoxen survey.
- Productivity and over-winter survival surveys are conducted by helicopter. Caribou are observed with spotting scopes or binoculars and classified by age and sex.
- Productivity is estimated by counting the number of calves present per 100 two-year-old or older females.
- Over-winter survival of calves is determined by counting the number of yearlings per 100 two-year-old or older females.
- Satellite collars were placed on 10 Banks Island Peary caribou in 1999 to track their distribution and movement.
- Incidental observations of wolves are recorded during the survey.

### Update/Results

- A population survey for Peary caribou was conducted on Banks and Victoria Islands in August, 2005. Preliminary results indicate that there has not been a significant change in the number of caribou on Banks

**Update/Results  
(continued)**

Island (approximately 1,000 non-calf animals) or Victoria Island (approximately 150 to 200 non-calf animals) since 2001.

- The number of wolves on Banks and Victoria Islands was also similar to numbers observed during previous surveys.

**Years of Data**

- Population estimates have been conducted since 1972.
- Productivity and over-winter survival surveys have been conducted since 1982.

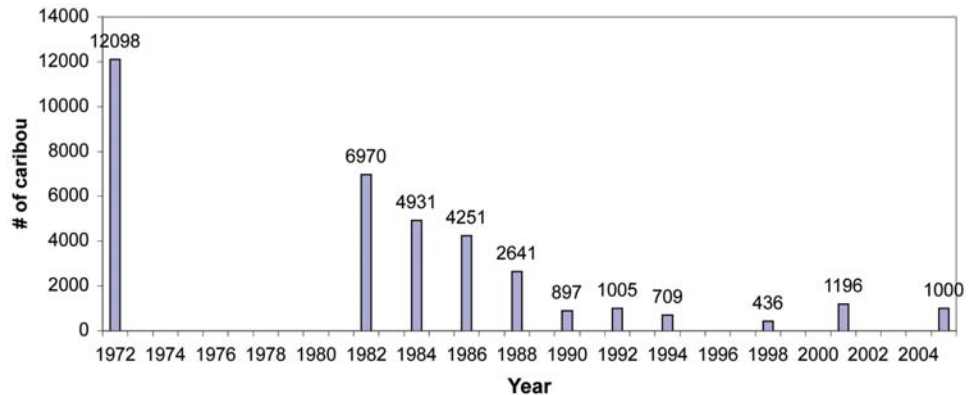
**Partners**

- Government of the Northwest Territories (project lead)

**Funding**

- Government of the Northwest Territories
- Parks Canada

**Population Estimates of Peary Caribou  
on Bank Island, 1972-2005**



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## Rationale

The number of muskoxen on Banks Island has changed dramatically from the 1950s to the present. The population grew from hundreds of muskoxen in the 1950s to 3,800 in 1972, and then to 64,608 by 1994. The highest population estimate to date, made in 2001, estimated the population at 68,788 non-calf muskoxen. Information about the population size, characteristics, habitat use, movements and health of the Banks Island muskoxen population is important for managing this muskoxen population, and for understanding the Banks Island ecosystem. The information is also important to ensure that the commercial harvest of muskoxen on Banks Island is sustainable. This project is led by the Government of the Northwest Territories. Parks Canada is a partner in this project, contributing funds and other resources.



Wildlife

## BANKS ISLAND MUSKOXEN MONITORING

Government of the Northwest Territories

### Objectives

- To estimate the number of muskoxen on Banks Island.
- To determine the recruitment of muskoxen calves and the productivity of muskoxen in the Egg, Masik and Thomsen River areas.

### Methods and Information Collected

- All areas of Banks Island are surveyed, including Aulavik National Park.
- Muskoxen are counted from a fixed-wing aircraft. This survey is conducted in conjunction with the Banks Island Peary caribou survey.
- Helicopters are used to conduct the productivity and recruitment surveys.
- Age and sex classification of muskoxen occurs in their high-density summer ranges around the Egg, Masik, Thomsen and Muskox Rivers. Surveyors positioned near groups of muskoxen use spotting scopes or binoculars to classify muskoxen by age and sex.
- Attempts are made to classify a minimum of 500 muskoxen, or 30 groups of muskoxen, in each area.
- Productivity is estimated by counting the number of calves present per 100 2-year-old or older females. Recruitment is determined by counting the number of yearlings present per 100 3-year-old or older females.

### Update/Results

- A population survey for muskoxen was conducted on Banks Island in August, 2005. Preliminary results estimated the number of muskoxen on Banks Island to be approximately 47,000 non-calf animals.

## Years of Data

- Population estimates have been conducted since 1972.
- Classification surveys were conducted in the Thomsen River area during the 1980s and from 1999 to 2000.
- Muskoxen late winter body condition was assessed from 1993 to 2001.

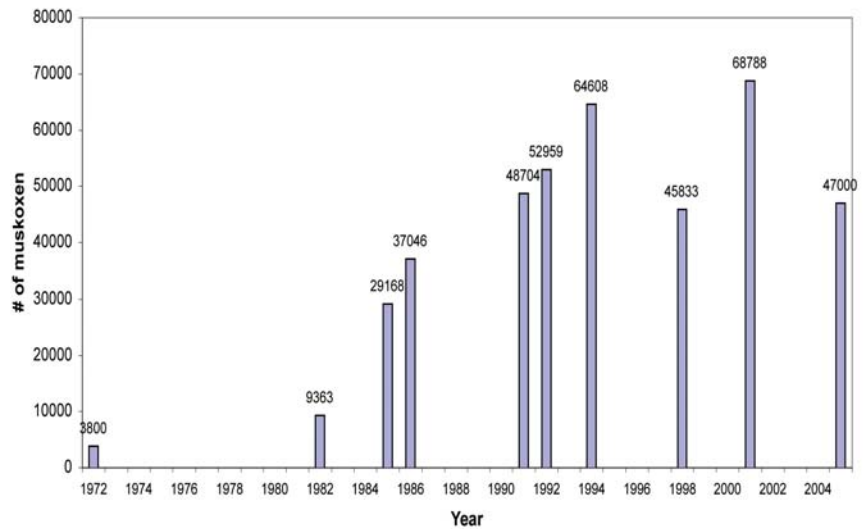
## Partners

- Government of the Northwest Territories (project lead)

## Funding

- Government of the Northwest Territories
- Parks Canada

### Population Estimates of Muskoxen on Banks Island, 1972-2005



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## Rationale

The Bluenose-West caribou herd is a population of barren ground caribou in the Northwest Territories. The calving grounds of this herd is located in Tuktoyaktuk National Park, and the winter range of the herd extends from Eskimo Lakes and the Anderson River to the northwest to Colville and Great Bear Lakes, and Fort Good Hope, to the southeast. In 1987, the number of adult caribou in this herd was estimated to be 98,874. The size of the herd has declined to approximately 20,800 adult caribou in 2005. Information about the biology of the herd is required to understand its current status and how it changes over time. The Government of the Northwest Territories leads this project. Parks Canada is a partner in this project, contributing funds and conducting parts of the research.



## BLUENOSE-WEST CARIBOU HERD MONITORING

Government of the Northwest Territories

### Objectives

- To determine the population size, productivity, recruitment of caribou calves, age and sex composition, mortality of females, parasite infection levels, distribution and movements of the Bluenose-West caribou herd.

### Methods and Information Collected

- Surveys to determine recruitment of calves and productivity are typically conducted in March and June.
- Age and sex composition surveys are typically conducted in the fall or winter.

### Update/Results

- A photo-census of the Bluenose-West caribou herd was conducted in July, 2005. The size of the population was estimated to be 20,800 adult caribou. This is a considerable decline from the year 1987, 1992 and 2000 population estimates of approximately 98,874, 64,705 and 74,273 adult caribou respectively.
- A late winter recruitment survey was conducted in April, 2005.
- Recruitment was estimated to be 25 calves: 100 cows.
- A calving ground survey of the Bluenose-West herd was conducted in June, 2005. Productivity was estimated to be 61 calves: 100 cows.

### Years of Data

- Surveys to obtain population estimates on the calving and post calving ranges have been conducted in 1987, 1992, 2000 and 2005.
- A productivity survey was conducted in 1981, and one age and sex composition survey was conducted in 1978.

**Years of Data  
(continued)**

- Productivity and age and sex composition surveys have been conducted annually since 2000.
- Eight recruitment surveys were conducted between 1983 and 1994.
- The presence and abundance of parasites was assessed in 2001.

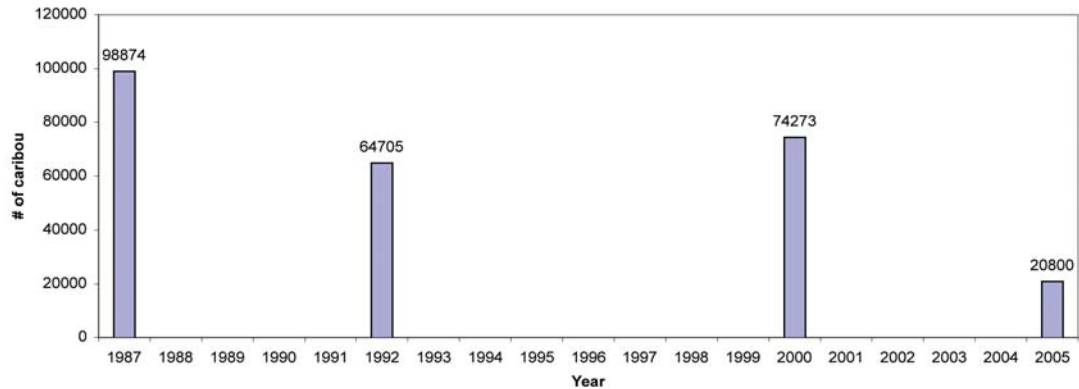
**Partners**

- Government of the Northwest Territories (project lead)

**Funding**

- Government of the Northwest Territories
- Parks Canada

**Population Estimates of the  
Bluenose-West Caribou Herd, 1987-2005**



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## Rationale

The Porcupine caribou herd is a population of Grant's caribou whose range includes the northern Yukon, Alaska and the Northwest Territories. In 2001 the size of the herd was estimated to be 123,000 caribou. The size of the herd has declined steadily since 1989, when the size of the herd was estimated to be 178,000 caribou. Information about the Porcupine caribou herd is required for understanding the current status of the herd and how it is changing. Current monitoring is important because existing and planned developments in the range of the herd, and because of current and forecasted changes in the Arctic environment. This work is conducted by the Government of the Yukon, the Canadian Wildlife Service, the Alaska Department of Fish and Game and the U.S. Fish and Wildlife Service. Parts of this work are conducted under the direction of the Porcupine Caribou Management Board and the Porcupine Caribou Herd Management Plan. Parks Canada is a partner in this project, contributing funds and other resources towards the project.



Wildlife

## PORCUPINE CARIBOU HERD MONITORING

Alaska Department of Fish and Game, U.S. Fish and Wildlife Service

### Objectives

- To estimate the population size, age and sex composition, body condition, productivity, over winter survival of caribou calves, adult female mortality, distribution and movements, and over-winter mortality of the Porcupine caribou herd.

### Methods and Information Collected

- Surveys are conducted throughout the range of the herd in northern Alaska, Yukon and the Northwest Territories.
- A photocensus of the Porcupine caribou herd is attempted every two to three years. This survey is conducted while the herd is congregated on their post-calving grounds.
- A calving survey is conducted by locating satellite and radio-collared caribou starting in late May. Cows are located daily until they give birth and then located again in approximately one week to document perinatal calf mortality. Another survey is done in late June or early July to calculate calf survival rates to one month of age. Calf survival to nine months of age is documented during the March composition count.
- An adult overwinter mortality study will be conducted from 2003 to 2006.
- This study involves locating radio-collared caribou in Alaska and the Yukon throughout the winter to estimate adult mortality rates during this time period.
- A yearling survival study was initiated in 2004. Ten female short-yearlings (nine months old) will be collared each year for a five year period. These caribou will be

**Methods and Information Collected (continued)**

monitored during regularly scheduled collar re-location flights. Survival from nine months to three years of age will be estimated in 2009 based on information from this study.

- Satellite and radio collars are used to determine the seasonal distribution and movements of the herd.

**Update/Results**

- Calving surveys were conducted in June, 2005.
- These surveys documented a parturition rate of 0.64, June calf survival rate of 0.77, post-calving survival of 0.88, and a July calf:cow ratio of 0.49. The parturition and calf:cow ratios in 2005 were among the lowest ever documented for the herd.
- Five flights were conducted in the winter to determine over-winter mortality in 2004 and 2005. Over-winter survival (maximum) was estimated to be 85%.
- The last photocensus was conducted in 2001. This photocensus estimated 123,000 caribou in the herd.
- The next photocensus is planned for 2006.
- Information about the movements and distribution of the Porcupine Caribou Herd can be found at [www.taiga.net/satellite/index.html](http://www.taiga.net/satellite/index.html).

**Years of Data**

- Population estimates have been conducted since 1972.
- Parturition rates, calf survival, and calf:cow ratios have been documented since 1983.
- Seasonal range use has been documented since 1970.

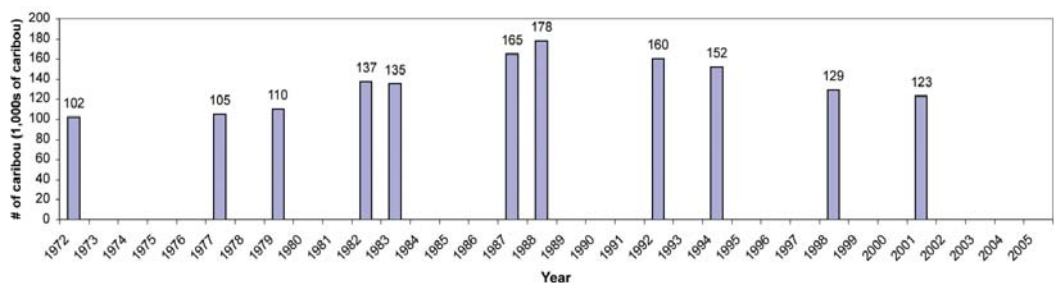
**Partners**

- Alaska Department of Fish and Game
- U.S. Fish and Wildlife Service
- Government of Yukon
- Canadian Wildlife Service
- Government of the Northwest Territories

**Funding**

- Alaska Department of Fish and Game
- U.S. Fish and Wildlife Service
- Government of Yukon
- Canadian Wildlife Service
- Government of the Northwest Territories
- Parks Canada

**Population Estimates of the Porcupine Caribou Herd, 1972-2001**



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## Rationale

Some environmental changes are best understood by looking at entire landscapes. Parks Canada monitors changes in vegetation productivity using normalized difference vegetation index (NDVI), which is acquired from Advanced Very High Resolution Radiometer (AVHRR) satellite data. The Satellite Monitoring of Northern Ecosystems project includes nine national parks in the Canadian north, including Aulavik, Ivvavik and Tuktoyaktuk National Parks, and the Pingo Canadian Landmark.



## Habitat

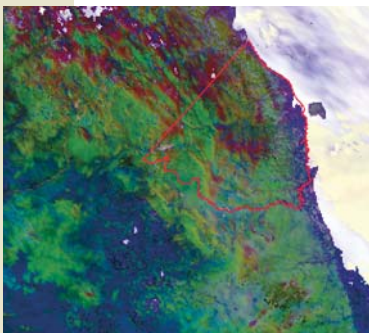
### SATELLITE MONITORING OF NORTHERN ECOSYSTEMS

#### Objectives

- To monitor large-scale variation in vegetation productivity in Aulavik, Ivvavik and Tuktoyaktuk National Parks and around the Pingo Canadian Landmark.

#### Methods and Information Collected

- Satellite monitoring of northern ecosystems is conducted for the Western Arctic Field Unit in Aulavik, Ivvavik and Tuktoyaktuk National Parks, and the Pingo Canadian Landmark. This is part of a larger program that is conducted in 9 northern national parks.
- Satellite images are taken daily from April 1 to October 31 each year.
- In order to reduce cloud effects composites are created by combining the images taken over a ten-day period.
- Analysis of satellite composites images is conducted by the Parks Canada Western and Northern Canada Service Centre in Winnipeg.
- Ecodistricts are used as sampling units in order to best integrate the satellite data with available landscape and biological information.
- A new statistical analysis method for the satellite images, fragmentation analysis, was adopted in 2002. Fragmentation analysis is a method of measuring the ecological integrity of an area and will allow for the detection of change within each park.
- In 2004, AVHRR-NDVI, air temperature and precipitation data was analysed throughout northern Canada for an eleven-year period (1993-2003).



An AVHRR image of Ivvavik National Park, and the surrounding region, taken on June 21, 2005.

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**Update/Results**

- Analysis of NDVI and green-up conditions for 1993-2005 will be conducted in the upcoming year.
- The Canadian Centre for Remote Sensing (CCRS) is opening its archive of AVHRR images, and thus it may be possible to extend analysis of NDVI and green-up conditions back to 1983.

**Years of Data**

- 1993-present

**Partners**

- Parks Canada - Western and Northern Canada Service Centre (Winnipeg)

**Funding**

- Parks Canada

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## Rationale

Pingos are a permafrost feature represented in the Pingo Canadian Landmark, near Tuktoyaktuk. The community of Tuktoyaktuk is interested in protecting the pingos in the Landmark and in developing the Landmark as an attraction for visitors. There is concern that recreational activities and environmental changes are causing the pingos to deteriorate at an accelerated rate, which may decrease the value of the Landmark as an area that represents permafrost landforms and as a visitor attraction. The Pingo Working Group, comprised of the Inuvialuit Land Administration, Hamlet of Tuktoyaktuk, Tuktoyaktuk Hunters and Trappers Committee, Tuktoyaktuk Community Corporation and Parks Canada, is a management advisory body for the Landmark.



## Habitat

### PINGO MONITORING

#### Objectives

- To monitor changes in the height and shape of Ibyuk and Split pingos.
- To monitor damage caused by recreational vehicles to the vegetation of Ibyuk and Split pingos.

#### Methods and Information Collected

- In cooperation with the Pingo Working Group, Parks Canada is developing a monitoring program for the Pingo Canadian Landmark.
- LiDAR and centimetre accuracy GPS were used to determine the summit heights and side profiles of Ibyuk and Split pingos.
- Pictures were taken at designated photopoints around Ibyuk and Split pingos in order to monitor changes in vegetation cover and pingo shape.

#### Update/Results

- A monitoring options paper and various monitoring protocols were written for the Pingo Working Group. The paper provides a synthesis of the various applicable monitoring methods, and the protocols provide direction for carrying out the monitoring program.
- Recently acquired LiDAR imagery and locations recorded with a GPS will be used to assist with the monitoring programs that will be carried out within the Landmark.
- LiDAR imagery collected in the Pingo Canadian Landmark is being processed to determine the precise height of Ibyuk Pingo, and to form a baseline for monitoring its change. Measurements were taken with a GPS to validate the LiDAR image, and indicate the pingo is 49.09 m tall from the lakebed to its highest point.



Split Pingo in the Pingo Canadian Landmark.  
PHOTO: GAVIN MANSON.

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**Years of Data**

- 2002-present

**Partners**

- Geological Survey of Canada (Atlantic)
- Hamlet of Tuktoyaktuk
- Inuvialuit Land Administration
- Tuktoyaktuk Hunters and Trappers Committee
- Tuktoyaktuk Community Corporation

**Funding**

- Parks Canada

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## Rationale

Approximately 80 percent of the visitors to Ivvavik National Park use some of the 35 campsites along the Firth River. A number of these sites are used repeatedly each summer by large groups of people. Potential impacts to these campsites from human use include damage to vegetation, soil erosion and improper disposal of human waste and garbage. All of these impacts can affect the park environment and the quality of the wilderness experience for park visitors. Campsites along the Firth River are monitored annually to identify impacts from human use, and to determine if sites should be closed and restored.



## Human Use

### FIRTH RIVER CAMPSITE MONITORING

#### Objectives

- To identify and track human caused impacts to campsites along the Firth River.
- To identify potential conflicts between wildlife and park visitors at campsites along the Firth River.
- To provide managers with information necessary to make decisions about campsite closures and restoration.

#### Methods and Information Collected

- 35 campsites, at maximum, are monitored along the Firth River between Margaret Lake and Nunaluk Spit.
- Campsite monitoring is conducted in the spring and in the fall every year.
- The monitoring focuses on campsites that are not affected by spring flooding.
- These campsites are generally located upstream and downstream of the canyon section of the river. Campsites in the canyon section of the river that receive frequent use by large groups are also monitored.
- Spring monitoring occurs before the first visitor trip on the Firth River.
- This monitoring is conducted to identify wildlife threats or concerns, such as wildlife carcasses near the site and active nest or den sites in the area.
- Fall monitoring is conducted to identify impacts resulting from human use of campsites during the summer. This involves comparing the composition and density of the vegetation at the campsite with the surrounding area, determining the presence and extent of bare soil, bank erosion, trails and root exposure caused by human use of the site, identifying damage to vegetation in the surrounding area and identifying any waste or garbage left by people.

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**Methods and Information Collected (continued)**

- Photo monitoring points were established and photos taken at every campsite.
- These photos help with monitoring vegetation cover, and other changes to the campsite. Daubermire squares are used to measure plant cover and are used to record data in areas with the largest impact.
- A campsite monitoring program asking park visitors to report which campsites they used was initiated in 2000. This information is used by Parks Canada to identify which campsites are likely to be most impacted by human use.

**Update/Results**

- Campsite monitoring was not conducted in the spring of 2005. Campsites were monitored in the fall from August 23-31. A total of 23 sites were monitored during the fall trip. Of these sites, 19 showed no visible impacts, 2 showed improvements from the previous year and 2 showed increased impacts.

**Funding**

- Parks Canada

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## Rationale

Understanding the human use of national parks in the western Arctic is required for effective park management. Human use monitoring involves recording the number of visits made to each park, the number of Parks Canada staff who are in the park, when and where these visits are made, and the types of activities that are conducted. This information is used by Parks Canada to develop and refine its public safety, law enforcement, resource management, and interpretation and education activities. It is also used to reduce conflicts between people involved in different activities in the parks, and conflicts between people and wildlife.



## Human Use

### HUMAN USE MONITORING

#### Objectives

- To document the extent and nature of human use of Aulavik, Ivvavik and Tuktoyaktuk national parks.

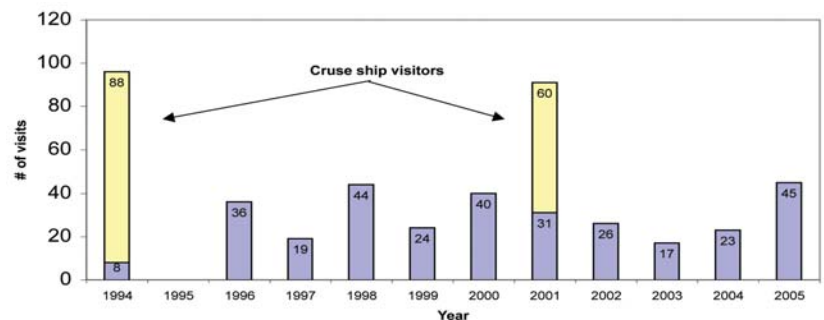
#### Methods and Information Collected

- Information is collected annually on visitor, Parks Canada staff, researcher and student visits to Aulavik, Ivvavik and Tuktoyaktuk national parks.
- The number of people in the park, the dates of their visit and the activities they conduct are recorded.

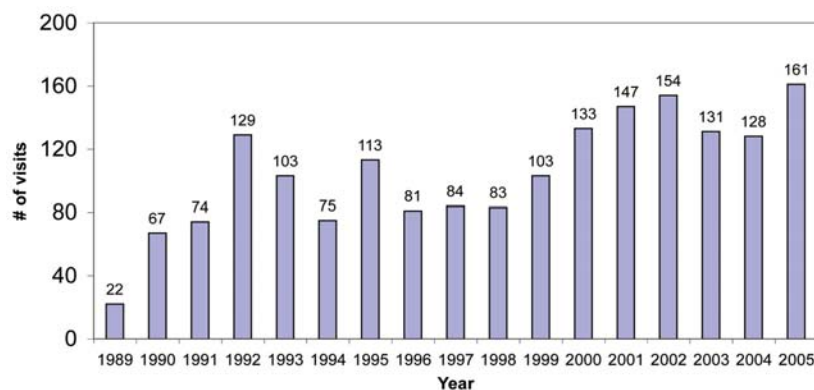
#### Update/Results

- The number of visits to Aulavik National Park has remained relatively constant in the last 10 years. The number of visits to Ivvavik and Tuktoyaktuk national parks was relatively high in 2005.
- Visitors used different means to travel through different parks, including canoeing, rafting and hiking.

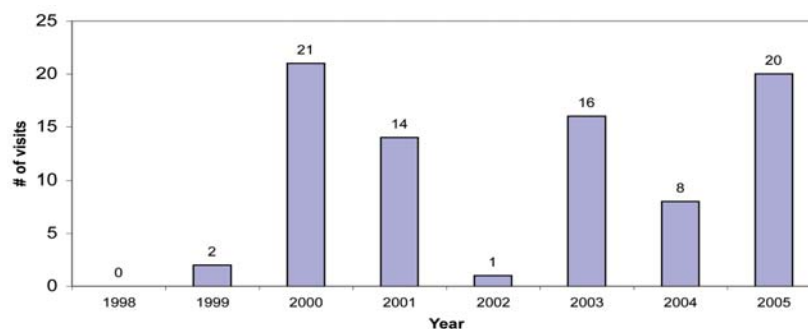
#### Visits to Aulavik National Park, 1994-2005



### Visits to Ivvavik National Park, 1989-2005



### Visits to Tuktut Nogait National Park, 1998-2005



### Visitor Activities in Aulavik, Ivvavik and Tuktut Nogait National Parks in 2005

Activity	Aulavik	Ivvavik	Tuktut Nogait
Commercial Canoe	20	0	0
Private Canoe	19	0	0
Commercial Raft	0	85	0
Private Raft	0	76	0
Private Hiking	6	0	20
<b>Total</b>	<b>45</b>	<b>161</b>	<b>20</b>

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## Rationale

Information about climate change indicates that the temperature of the earth has increased over the past 100 years. Human activities, especially emissions of carbon dioxide and other greenhouse gasses, are thought to have contributed to this increase. It is widely accepted that the greatest increases in temperature will take place in polar regions such as the Canadian Arctic. Long term monitoring of weather and permafrost temperature is required to track changes in the climate of national parks in the western Arctic, and to understand how these changes will affect the environment of the western Arctic.



## Climate Change

### WEATHER AND PERMAFROST MONITORING

#### Objectives

- To monitor weather, and permafrost and active layer temperature, in Aulavik, Ivvavik and Tuktoyaktuk national parks.

#### Methods and Information Collected

- Aulavik, Ivvavik and Tuktoyaktuk national parks each have two weather stations.
- All of the weather stations record the following:
  - precipitation
  - wind speed and direction
  - air temperature
  - incoming short wave radiation
  - relative humidity
  - dew point
  - snow fall and snow depth
  - barometric and vapour pressure
- UV-B radiation is recorded at one station in each park.
- Active layer temperature is measured at a depth of 10 cm in Tuktoyaktuk National Park.
- Permafrost probes, which measure soil temperature at 2.5, 10, 20, 50, 100 and 150 cm below the ground, have replaced the active layer probes in Aulavik and Ivvavik national parks.
- A permafrost probe was installed in 2003 in Paulatuk through a partnership between Carleton University and Parks Canada. The probe measures permafrost temperatures at nine depths: 0.7 m; 1.7 m; 2.7 m; 4.7 m; 7.2 m; 9.7 m; 12.2 m; 14.7 m; and 16.7 m. Measurements are recorded every two weeks by Parks Canada staff based in Paulatuk. Permafrost probes were not installed in association with the weather stations in Tuktoyaktuk National Park as these stations are on bedrock.

**Methods and Information Collected (continued)**

- All measurements, except for snow depth, barometric pressure, permafrost and active layer temperature, are recorded automatically by the weather stations every 5 seconds. Snow depth, barometric pressure, permafrost and active layer temperature are measured every 5 seconds during the last 10 minutes of the hour.

**Update/Results**

- Information collected from the weather stations is available from the Environment Canada web site at [http://www.climate.weatheroffice.ec.gc.ca/climateData/canada\\_e.html](http://www.climate.weatheroffice.ec.gc.ca/climateData/canada_e.html). To find the appropriate weather station, select “Customized Search”, and then use the station names listed under “Web search name” in the table below in the “Search by Station Name” feature of the web site.

**Years of Data**

- The weather stations operated by the Western Arctic Field Unit were installed between 1995 and 1999.
- Permafrost probes were installed at weather stations in Aulavik National Park in 2000, and in Ivvavik National Park in 2001 and 2002.

**Partners**

- Environment Canada, Meteorological Service of Canada

**Funding**

- Parks Canada

### Weather Stations in Aulavik, Ivvavik and Tuktut Nogait National Parks

HQID	Station Name	Web search name	Location	Elev. ASL (m)	Date Installed
<b>Aulavik National Park</b>					
2503886	Green Cabin	Thomsen River	73.2303 °N; 119.5367 °W	37.0	6/27/96
2500440	Polar Bear Cabin	Aulavik National Park	74.1417 °N; 119.9833 °W	32.0	6/26/96
<b>Ivvavik National Park</b>					
2100660	Sheep Creek	Ivvavik Nat.Park	69.1667 °N; 140.1500 °W	301.8	6/11/95
2100697	Margaret Lake	Margaret Lake	68.8006 °N; 140.8333 °W	524.5	6/9/97
<b>Tuktut Nogait National Park</b>					
2203918	Melville Hills	Tuktut Nogait	69.1928 °N; 122.3539 °W	551.6	7/25/98
2203341	Qavvik Lake	Qavvik Lake	68.2256 °N; 122.0206 °W	530.0	7/7/99

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## Rationale

Changes in the amount of water flowing in Arctic rivers, and the timing of peak and low water levels, may be affected by climate change. River water flow monitoring is conducted in the Firth River in Ivvavik National Park and the Hornaday River near Tukturnogait National Park to determine current water cycles and to identify long-term changes to these cycles. On the Hornaday River, river flow information is also used to look at relationships between river water flow, fish habitat and fish productivity. River water flow information is also useful for people who are planning to canoe, raft or kayak the Hornaday or Firth rivers.



# Climate Change

## RIVER WATER FLOW MONITORING

### Objectives

- To document and monitor water flow and discharge in the Firth River in Ivvavik National Park and the Hornaday River near Tukturnogait National Park.
- To examine the relationship between river water flow, fish habitat and fish productivity in the Hornaday River.
- To provide park visitors with information about river navigability.

### Methods and Information Collected

- Stations that measure water flow are located on the Firth River in Ivvavik National Park and on the Hornaday River near Tukturnogait National Park. The station on the Hornaday River is approximately 5 km downstream of the west park boundary.

### Update/Results

- Regular maintenance was conducted at both stations in 2005.
- An additional trip to the Firth River water gauge is planned for July, 2006 in order to take river bed measurements when the water levels are high.



The water gauge on the Hornaday River.  
PHOTO: IAN MCDONALD/PARKS CANADA.

### Years of Data

- Firth River station from 1972-1994 and since 1997
- Hornaday River station since 1998

### Partners

- Environment Canada, Meteorological Service of Canada
- Department of Fisheries and Oceans
- Fisheries Joint Management Committee
- Polar Continental Shelf Project

### Funding

- Parks Canada
- Environment Canada, Water Survey Branch
- Fisheries and Oceans Canada
- Fisheries Joint Management Committee
- Polar Continental Shelf Project

### Water Gauges in Ivvavik and Tukturn Nogait National Parks

Park	Station Name	Location
Ivvavik	Firth River	69.3269 °N; 139.5689 °W
Tukturn Nogait	Hornaday River	69.1781 °N; 123.2503 °W

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## Rationale

Relative sea level is currently rising in the western Canadian Arctic due to a combination of crustal subsidence and global sea-level rise. This drives retreat of shorelines at rates that vary in the short-term due to the influence of wind storms, which bring high waves and storm surges. Erosion and flooding threaten communities and infrastructure, coastal landforms and habitats within and outside national parks and the Pingo Canadian Landmark, and sites of historical and cultural significance. In the Arctic, potential climate change impacts include accelerated sea-level rise, reduced sea ice extent, increased temperatures and increased frequency of the most severe storms. Overall, increased rates of coastal change and increased frequency and severity of flooding may be expected. Coastal landform changes are monitored and hazard extents are mapped in selected locations in order to better understand these processes and to identify erosion and flooding hazards.



## Climate Change

### COASTAL MAPPING, CHANGE MONITORING AND HAZARD ASSESSMENT

Geological Survey of Canada, Natural Resources Canada

#### Objectives

- To monitor changes of coastal areas at selected sites (e.g., communities, industrial development sites, sites of cultural, historical and ecological significance, and coastal landforms of scientific or socio-economic significance) in the western Canadian Arctic.
- To improve understanding of western Arctic coastal processes and hazards.
- To provide information to northern residents, industries, community organisations and governments on coastal hazards and the coastal impacts of climate change.

#### Methods and Information Collected

- Oblique airborne video is collected of the shoreline and interpreted into a geospatial database.
- Satellite imagery is acquired and shoreline positions are mapped and compared to those from historical aerial photography to calculate rates of change.
- Cliff and beach topography, shoreline and cliff edge positions and other coastal features are surveyed using high resolution GPS.
- Nearshore bathymetry is measured using echosounders linked to differential GPS receivers, and morphology is mapped using sidescan sonar and bottom sampling.
- Airborne LiDAR is acquired and used to develop digital elevation models for flooding analysis, and to map coastal landforms and monitor how they change.
- GPS receivers are installed permanently or temporarily to measure rates of vertical motion (i.e., subsidence and uplift) of coastal areas.
- Coastal water levels are monitored using submerged pressure sensors to measure flooding elevations.
- Satellite imagery is acquired to map nearshore and lake ice in winter, and flood extents in summer.



Surveying a shoreline at Tuktoyaktuk using a global positioning system (GPS). PHOTO: GAVIN MANSON.

## Methods and Information Collected (continued)

## Update/Results

- Shallow cores are collected by auger and analysed for stratigraphy, ice content and grain size. Deeper boreholes are drilled and thermistor cables installed to determine if permafrost is aggrading seasonally.
- Ground-penetrating radar is collected to analyse stratigraphy and permafrost distributions. Interpretations are controlled by borehole data.
- Oblique aerial video was completed for Banks Island and is being interpreted into the geospatial database.
- New sites in the vicinity of Sachs Harbour and De Sallis Bay were established and surveyed. Preexisting sites revisited include those at Sachs Harbour, western Banks Island, Tuktoyaktuk, Mackenzie Delta, Shingle Point and the Pingo Canadian Landmark. Data are processed, archived in a database and are undergoing analysis.
- New QuickBird imagery was acquired to nearly complete coverage of southwestern Banks Island, and IKONOS imagery of the Mackenzie Delta was purchased. Both sets of images are currently being analysed. Image products have been distributed to community organisations.
- LiDAR processing was completed for areas of the Mackenzie Delta, Aklavik, Shingle Point and Tuktoyaktuk. Flooding analyses were performed and imagery products were delivered to the Tuktoyaktuk Community Council and the Tuktoyaktuk RCMP detachment.
- Temporary GPS sites in the Mackenzie Delta for monitoring vertical motion were revisited in the winter and again in the fall. The continuous site at Sachs Harbour has been dismantled due to conflicting use of its foundation.
- Synthetic Aperture Radar satellite imagery was acquired in the Mackenzie Delta, and nearshore ice and ice on lakes in the coastal zone was mapped. Image products were delivered to industry. Ice interpretations were groundtruthed by augering and sampling.
- Boreholes were drilled at several locations in the Mackenzie Delta and thermistor cables were installed. These will be downloaded in March, 2006 and reinstalled.

- 1994 to present. Not all years in most locations.

- Geomatics Canada, Natural Resources Canada (project lead)
- Fisheries and Oceans Canada
- Parks Canada
- Environment Canada
- McGill University
- Memorial University
- University of Calgary

- Earth Science Sector, Natural Resources Canada
- Panel on Energy Research and Development
- Polar Continental Shelf Project
- Canadian Space Agency
- Indian and Northern Affairs Canada

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### Years of Data

### Partners

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## Rationale

The BAR-1 Distant Early Warning (DEW) line station at Komakuk Beach was closed in 1993 as part of a general closure of the DEW line. The site became part of Ivvavik National Park when the clean up was completed in 2000. The clean-up involved demolishing buildings, excavating contaminated soil, remediating a fuel spill, collecting debris, excavating three landfills and closing a fourth. A landfill and fuel spill monitoring program has been developed for Komakuk Beach by Inuvialuit Environmental and Geotechnical Inc., in cooperation with the Department of National Defence, the Inuvialuit Regional Corporation and Parks Canada.



## Solid Waste

### KOMAKUK BEACH CLEAN-UP MONITORING

Department of National Defence

#### Objectives

- To monitor the condition of the remediated fuel spill and landfills at Komakuk Beach.

#### Methods and Information Collected

- The Komakuk Beach monitoring program has two phases. Phase one started with a site visit in 2001 and will end in the summer of 2005. Phase two will start in 2007 and take place for a total of 20 years, with visits to Komakuk Beach during the summer on the 5th, 7th, 10th, 15th, and 20th year.
- Samples are taken from the fuel spill monitoring wells.
- The landfill sites are monitored for vegetation growth, settlement, erosion, discoloration and odours.

#### Update/Results

- The BAR-1 Landfill Monitoring report, 2003 was submitted to Parks Canada by the Department of National Defence in 2005.
- A report on phase one of the monitoring program will be produced by the Department of National Defence and submitted to Parks Canada now that this component of the monitoring program has been completed.



The site of the BAR-1 Distant Early Warning (DEW) Line station at Komakuk Beach after the clean-up in 1999 and 2000.  
PHOTO: IAN MCDONALD/PARKS CANADA.

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**Years of Data**

- The initial clean-up was conducted in 1999 and 2000
- Phase One of the monitoring program began in 2001

**Partners**

- Department of National Defence - Defence
- Construction Canada (project lead)

**Funding**

- Department of National Defence

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## Rationale

Contaminants from sources within and outside of the north are found in Arctic ecosystems, including rivers and lakes. The presence of contaminants such as persistent organic pollutants (POPs), heavy metals and radionuclides are a concern because they can have negative effects on Arctic ecosystems and human health. Water quality monitoring is conducted on the Thomsen River in Aulavik National Park, the Firth River in Ivvavik National Park and the Hornaday River in Tukturnogait National Park. Water quality information for these rivers is used to determine current water quality conditions and to monitor changes in water quality over time.



# Long Range Transport of Pesticides

## WATER QUALITY MONITORING

### Objectives

- To determine the current water quality of the Thomsen River in Aulavik National Park, the Firth River in Ivvavik National Park and the Hornaday River in Tukturnogait National Park.
- To determine if water quality in these rivers changes over time.

### Methods and Information Collected

- Water quality samples are taken from the Thomsen River at Green Cabin, from the Firth River at the water survey site and at two sites in the upper Hornaday River.
- Three sets of water samples are taken at each site on the Firth and Hornaday rivers each summer. The first set of samples is typically taken in May or June, just after the ice breaks up on the river. The second set of samples is usually taken in late June or July and the third set of samples is taken in September.
- One or two sets of water samples are taken from the Thomsen River each summer. Samples are typically taken in June and July. Fewer sets of samples are taken from the Thomsen than the Firth or Hornaday rivers because of the expense of travelling to Aulavik National Park.
- Quality assurance and quality control samples are taken at some sites to test the quality of the samples and the accuracy of the laboratory analysis.
- Water temperature, conductivity and pH are measured at the site.

**Methods and Information Collected (continued)**

- Water quality samples are analysed for physicals, nutrients, major cations, major anions, trace metals and organics.
- Sediment samples are taken once at both sites on the Hornaday River and analysed for nutrients, metals, pesticides and hydrocarbons.

**Update/Results**

- The following samples were taken in 2005: the Thomsen River was sampled in August; the Firth River was sampled in May, July and October; and the Hornaday River was sampled in June and September. An additional set of samples were supposed to be taken from the Hornaday River in May, but were not collected because of logistical problems.
- Results from the Thomsen, Firth and Hornaday rivers indicate that all three rivers have excellent water quality.
- Minute traces of lindane, a pesticide used in other regions of Canada and around the world, have been found in the Thomsen and Hornaday rivers. This is an example of the long-range transport of pollutants to the Arctic.

**Years of Data**

- Aulavik and Tuktut Nogait: since 1999
- Ivvavik: since 2000

**Partners**

- Environment Canada

**Funding**

- Parks Canada

**Water Quality Sites in Aulavik, Ivvavik and Tuktut Nogait National Parks**

Park	Site Name	Site ID	Location
Aulavik	Thomsen River at Green Cabin	NW10TB0001	73.2270 °N, 119.5418 °W
Ivvavik	Firth River at Mouth	YT10MD0001	69.3268 °N, 139.5721 °W
Tuktut Nogait	Hornaday River below unnamed eastern tributary	NW10OB0003	68.7540 °N, 122.4022 °W
Tuktut Nogait	Hornaday River above Little Hornaday River	NW10OB0006	68.3310 °N, 121.9633 °W

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## Rationale

Cultural resources along the coast of Ivvavik National Park are monitored to assess the integrity of these resources, and to implement measures to protect these resources if changes in their condition are discovered. It is evident that some of the cultural resources along the coast of Ivvavik have been damaged or destroyed by erosion and storms, and that additional resources may be lost if nothing is done to protect or remove them.



## Cultural Resources

### IVVAVIK COAST CULTURAL RESOURCES MONITORING

#### Objectives

- To assess the impact of erosion and visitor disturbance on cultural resources along the coast of Ivvavik National Park.
- To recommend actions to protect or salvage the cultural resources at risk.

#### Methods and Information Collected

- Methods include taking photographs from established photo-points, measuring the distance of the cultural resources from the edge of the shoreline and recording any changes to the cultural resources.

#### Update/Results

- In 2002 and 2004, 19 and 11 sites, respectively, were monitored. Recorded artifacts at these sites were inventoried.
- Since 1997, many sites have been affected by erosion, storms and build up of logs along the shore.
- Evidence of recent human activity such as new or altered wind shelters can be found at some sites. Artifacts appear to have been untouched by visitors.
- A decision was made to monitor the coastal sites every two years to provide more frequent updates on their condition.
- Salvage projects were completed in 2001 at Niaqulik and 2003 at Clarence Lagoon. These sites have sod houses that were at imminent risk of destruction by erosion and encroachment of the logs.

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**Years of Data**

- Initial surveys: 1987
- Additional surveys: 1996-1997
- Monitoring of sites: 2000, 2002 and 2004

**Funding**

- Parks Canada
- Parks Canada, Western and Northern Canada Service Center (Winnipeg)

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