



ANNUAL REPORT OF RESEARCH AND MONITORING IN NATIONAL PARKS OF THE WESTERN ARCTIC 2003



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Many people contributed to this report. We wish to acknowledge them for their commitment to the project, and their timely and enthusiastic response to our requests.

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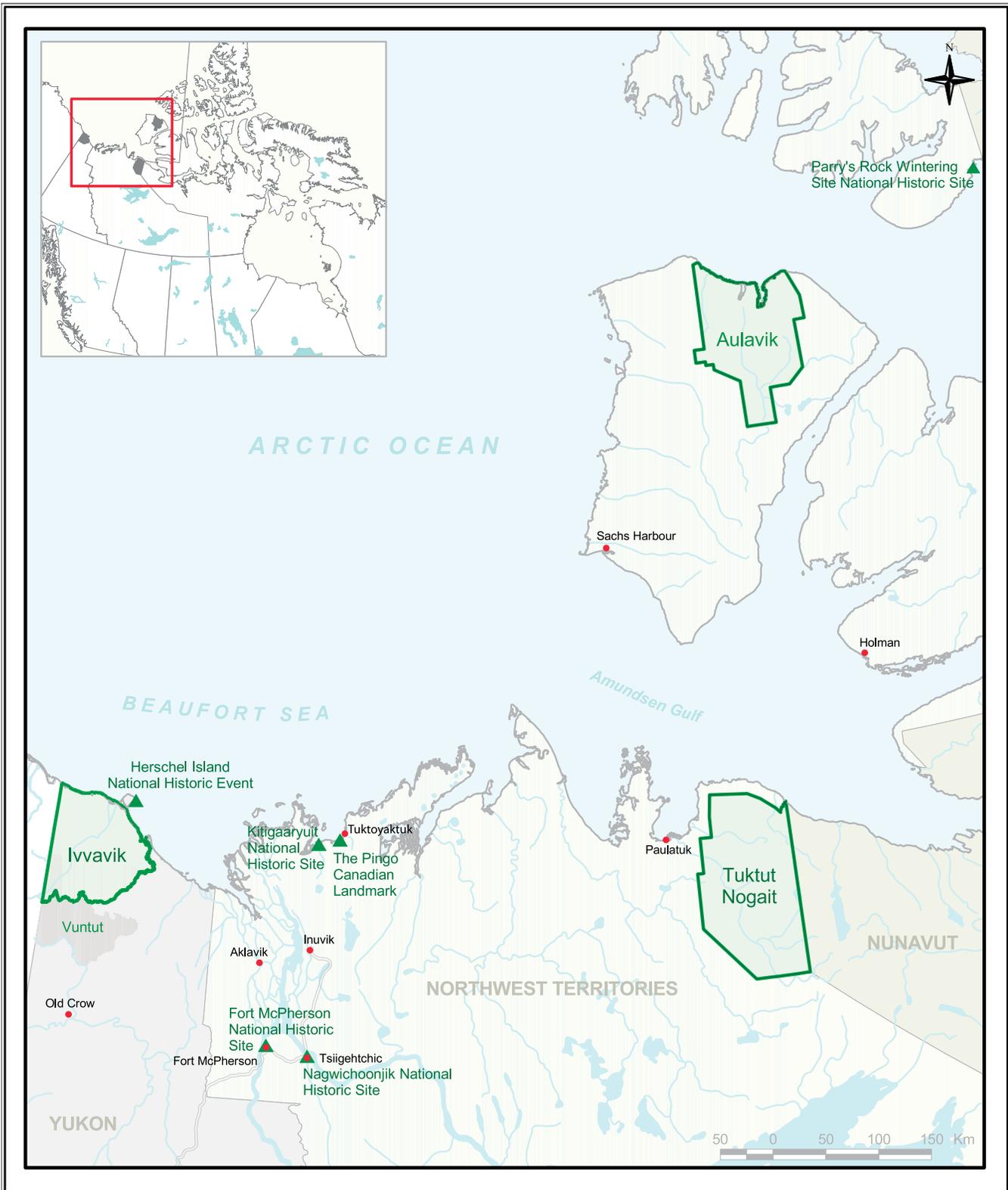
INTRODUCTION

Research and monitoring are essential for managing protected heritage areas, such as Canadian national parks, historic sites and landmarks. 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. Research is conducted to improve our knowledge of ecological and cultural resources. Monitoring is conducted to determine how systems and resources change over time. The Western Arctic Field Unit (WAFU) 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 co-management organizations, government agencies and the public. All research and monitoring projects conducted in 2003, 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 (see map, page 8). 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 remote northern wilderness. The Pingo Canadian Landmark, the only landmark in Canada, represents the permafrost and pingo terrain of the Tuktoyaktuk Peninsula.





Parks Canada Western Arctic Field Unit

The Need for Research and Monitoring

Direction for establishing a research and monitoring program in Canada's protected heritage areas comes from a number of sources.

At the national level, the Canada National Parks Act establishes the maintenance of ecological integrity as the first priority for all aspects of park management. Research and monitoring activities are conducted in order to assess the ecological condition of national parks and to address this priority.

At the regional level, Community Conservation Plans for Aklavik, Holman, Inuvik, Paulatuk, Sachs Harbour and Tuktoyaktuk outline conservation and management objectives for renewable resources and lands within the Inuvialuit Settlement Region (ISR). These plans include priorities for research and monitoring. The Yukon North Slope Wildlife Conservation and Management Plan and the Yukon North Slope Long-Term Research and Monitoring Plan identify priorities for research and monitoring on the Yukon North Slope, including Ivvavik National Park. Co-management plans have been developed for grizzly bears throughout the ISR, for arctic char around the community of Paulatuk, and for the Porcupine Caribou Herd. Additional research and monitoring priorities have been developed for Aulavik and Tukut Nogait national parks through consultation with Inuvialuit, co-management and government organizations. Research and monitoring priorities from all of these sources are summarized in the park management plans for Aulavik, Ivvavik and Tukut Nogait national parks.

In the ISR, planning, management, monitoring and research conducted by Parks Canada are subject to the provisions of the Inuvialuit Final Agreement (IFA). One goal of the IFA is the protection and preservation of Arctic wildlife, environment and biological productivity through the application of conservation principles and practices. Information about ecological and cultural resources in protected heritage areas, and how they are changing, is required to meet these goals.

There are a number of Inuvialuit and co-management organizations with resource management responsibilities in the ISR. These organizations need information from research and monitoring activities to be effective. These organizations are the Inuvialuit Game Council, Hunters and Trappers Committees, the Wildlife Management Advisory Council (North Slope), the Wildlife Management Advisory Council (Northwest Territories), the Fisheries Joint Management Committee, the Porcupine Caribou Management Board, the Tukut Nogait National Park Management Board, the Environmental Impact Screening Committee and the Environmental Impact Review Board.

Structure of the Report

This report is divided into two sections. Section 1 summarizes research projects that were conducted in 2003. 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 is being conducted and why it is important.

Objectives

A description of the main objectives of the project.

Methods and Information Collected

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

Results

A summary of the results, if they are available.

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 provide funding for the project.

Data Location

A list of where the hard copy and digital data for the project are stored.

Contacts

Contact information.

Research and Monitoring Report on the Internet

The Research and Monitoring Report can be found at two locations on the Internet. These are:

1. The Parks Canada web site at www.pc.gc.ca. Select one of Aulavik, Ivvavik or Tukturnogait national parks.
2. The EMAN North web site at www.emannorth.ca/reports.cfm. Look for the report under the “EMAN-North Partners’ Reports” section of the web site.

Research and Monitoring Activities in National Parks of the Western Arctic

	Ivvavik National Park	Aulavik National Park	Tuktut Nogait National Park
RESEARCH			
Clarence Lagoon Archaeological Salvage Operation	X		
Clarence River Breeding Bird Survey	X		
Fishery Survey of the Brock River Headwater Lake			X
Fossil Coral Reefs of Banks Island		X	
Frost Boil Ecosystem of Banks Island		X	
Grizzly Bear Population Study			X
Sport Angler Survey	X	X	X
MONITORING			
<i>Wildlife</i>			
Wildlife Cards	X	X	X
NWT-Nunavut Bird Checklist Survey	X	X	X
Raptor Survey	X	X	X
Breeding Bird Survey	X		
Lemming Monitoring		X	
Babbage River Moose Survey	X		
Yukon North Slope Muskoxen Population Monitoring	X		
Tuktut Nogait Muskoxen Population Monitoring			X
Banks Island Peary Caribou Monitoring		X	
Banks Island Muskoxen Monitoring		X	
Cape Bathurst and Bluenose-West Caribou Monitoring			X
Porcupine Caribou Herd Monitoring	X		
<i>Habitat</i>			
Satellite Monitoring of Plant Productivity	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
Beaufort Sea Coastal Monitoring	X		
<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>			
Firth River Cultural Resources Monitoring	X		
Ivvavik Coast Cultural Resources Monitoring	X		
Aulavik Cultural Resources Monitoring		X	

TIMELINE FOR MONITORING PROJECTS IN NATIONAL PARKS OF THE WESTERN ARCTIC

MONITORING PROJECTS

Wildlife

- Wildlife Cards
- NWT Nunavut Bird Checklist Survey
- Raptor Survey
- Breeding Bird Survey
- Lemming Monitoring
- Babbage River Moose Survey
- Yukon North Slope Muskoxen Population Monitoring
- Tuktut Nogait Muskoxen Population Monitoring
- Banks Island Peary Caribou Monitoring
- Banks Island Muskoxen Monitoring
- Cape Bathurst and Bluenose-West Caribou Monitoring
- Porcupine Caribou Herd Monitoring

Habitat

- Satellite Monitoring of Plant Productivity
- Pingo Monitoring

Human Use

- Firth River Campsite Monitoring
- Human Use Monitoring

Climate Change

- Weather and Permafrost Monitoring
- River Water Flow Monitoring
- Beaufort Sea Coastal Monitoring

Solid Waste

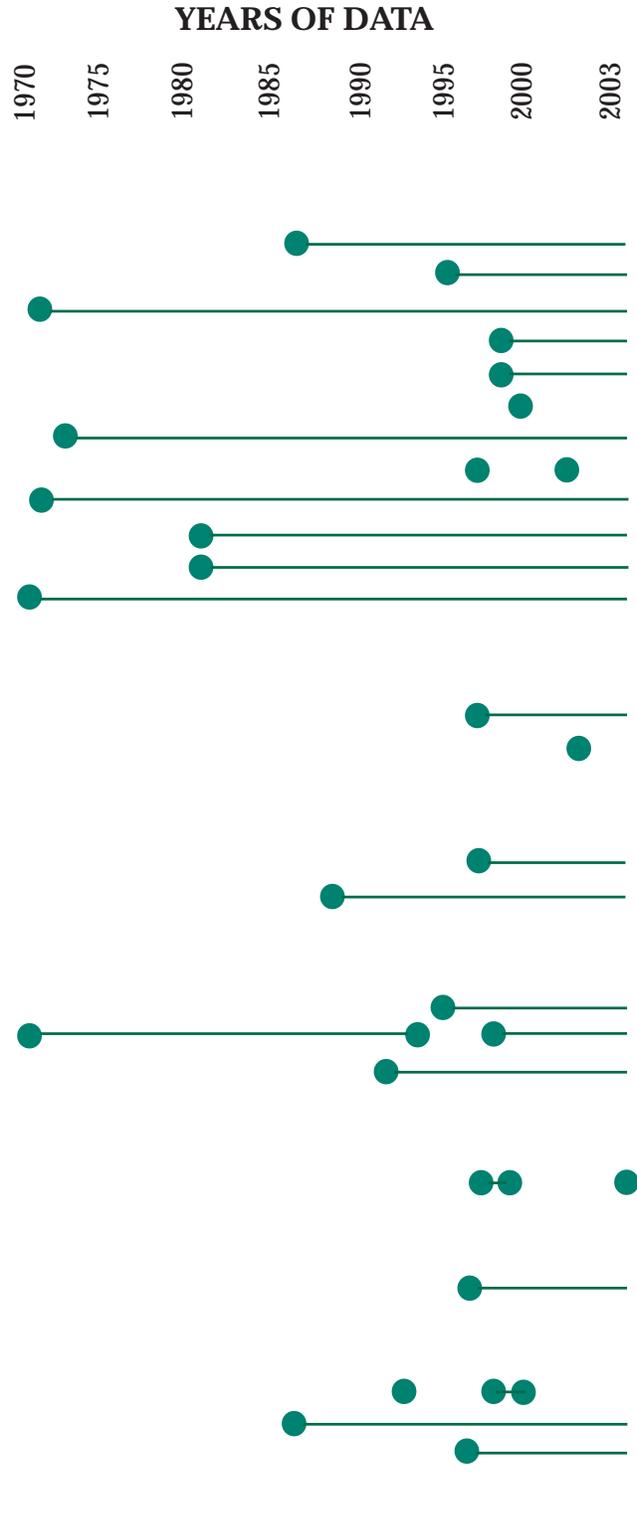
- Komakuk Beach Clean-up Monitoring

Long Range Transport of Pesticides

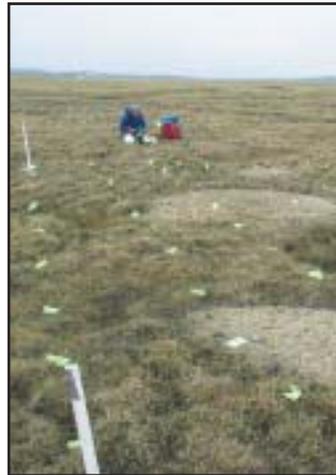
- Water Quality Monitoring

Cultural Resources

- Firth River Cultural Resources Monitoring
- Ivvavik Coastal Cultural Resources Monitoring
- Aulavik Cultural Resources Monitoring



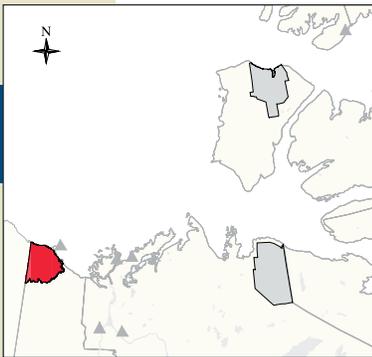
Research





Rationale

Inventory and monitoring activities in 1996 and 2000 at Clarence Lagoon (Qainniurvik), in Ivvavik National Park, have identified cultural resources and potential impacts to them. A storm surge in 2002 caused unprecedented alteration to the shoreline at Clarence Lagoon and exposed cultural resources at a site at the southern extent of the lagoon. This site contains remains of at least two sod and wood houses and a range of other cultural features. Parks Canada undertook salvage excavations of the two houses at Clarence Lagoon during the summer of 2003 in order to prevent the loss of these cultural resources to continued coastal erosion.



Research

CLARENCE LAGOON ARCHAEOLOGICAL SALVAGE OPERATION

Natasha Lyons and Sandra Jezik, Parks Canada

Objectives

- To collect cultural information from two sod and wood houses, and associated features, at the southern edge of Clarence Lagoon.

Methods and Information Collected

- Salvage excavations of the two house features were undertaken using standard archaeological techniques. Threatened features were located, overlaid with a 2x2 m grid, mapped, and excavated. Artifacts, fauna, and sediment samples were collected during the course of the excavations. Photographs, field notes and video recordings were used to document the excavation.
- The house features were excavated to basal layers, then backfilled to the original approximate grade. The sod was replaced as well as possible.
- The surface around the structures was surveyed for threatened resources, such as additional features and artifacts.
- Two local elders, Ida Joe and Nellie Arey, visited the site midway through the excavations. The history of the site, and their experiences and travels on the Yukon North Slope was documented. This information is currently being transcribed for inclusion in the final report.



Leslie Burns taking a photo of the excavations.

Results

- Artifacts collected from the sod houses at Clarence Lagoon include both traditional and European material. Significant artifacts recovered from the house closest to the lagoon's edge include a stone oil lamp, a complete shotgun (identified as a Marlin, 1895, 32-40 calibre), fragments of beaded cloth, book pages, a possible sewing box, and antler door handles. Artifacts found in the house located further from the shore include porthole glass, a toy wood boat, a rifle butt, and a complete antler.

Results (continued)

- A preliminary assessment indicates that the houses at the site were probably inhabited prior to the occupation of the nearby Hudson's Bay post in the 1920s. Ongoing analysis of the artifacts, house architecture, and oral history collected during the course of the project should aid in determining when the site was occupied and by whom, in addition to shedding light on the broader picture of Inuvialuit life on the Yukon North Slope in the early 20th century.

Funding

- Parks Canada

Data Location

- Western Canada Service Centre, Parks Canada, Winnipeg
- Parks Canada, Inuvik



Ida Joe and Nellie Arey enjoy looking at a qullit (traditional stone lamp).



Jimmy Doug Meyook points to a shotgun he is about to excavate.

Contacts

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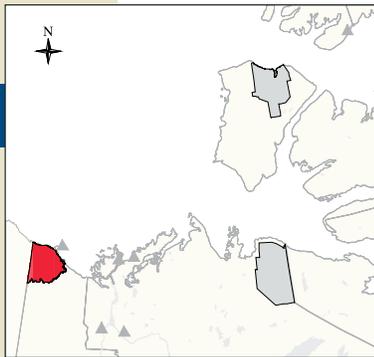
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Rationale

A number of bird species nesting on the Yukon North slope have very small ranges in the Yukon Territory, and for some this is their only nesting area in Canada. The population status and local habitat requirements of some species, including the bluethroat, yellow wagtail, ruddy turnstone, stilt sandpiper, buff-breasted sandpiper and red phalarope, are not well known. Most Canadian records of bluethroat have been in Ivvavik National Park. The Canadian range for this species is very limited, with records only from the Yukon North Slope, where birds have been recorded along the tributaries of Clarence Lagoon, at the Babbage River, the Running River, and near the upper Blow River. The highest concentration of birds discovered to date is in the vicinity of Clarence Lagoon.



Research

CLARENCE RIVER BREEDING BIRD SURVEY

Pamela Sinclair, Canadian Wildlife Service

Objectives

- To record evidence of nesting for the following bird species in the Clarence River area: bluethroat, yellow wagtail, ruddy turnstone, stilt sandpiper, buff-breasted sandpiper and red phalarope. The bluethroat is the main species of interest in this study.
- To document nesting chronology, productivity and habitat use and to further delineate the bluethroat's Canadian range.
- To document habitats used by these birds.
- To generate current population estimates and nesting densities.
- The research was conducted from a base camp located along Craig Creek, 6 km south of Clarence Lagoon in Ivvavik National Park.
- Surveys were conducted from June 15 to July 4, 2003.
- Line transects recorded most species that occur in the area. As well, the line transects identified specific locations for focal observations of priority species.
- Focal observations allowed observers to conduct intensive observations of individual birds on their nesting territories. This survey method provided detailed information on habitat use and maximized opportunities for monitoring the breeding activity of priority species. When nests were found they were observed, photographed and notes were taken with regards to the contents of the nest, its location, construction and associated habitat.
- Observations of other wildlife species (e.g. tundra vole, grizzly bear, caribou) were noted.

Methods and Information Collected



A male bluethroat defends its nesting territory.

Results



Bruce MacTavish and Brian Bell watch a male bluethroat on its nesting territory.

- A total of 80 bird species were observed in the area, with confirmed breeding records established for 32 species.
- A total of 8-10 male and 2 female bluethroats were observed. Canada's first Bluethroat nest was discovered. All bluethroats were observed in willows along Craig Creek and tributaries of Clarence Lagoon.
- Nests were also recorded for ruddy turnstone, wandering tattler, peregrine falcon, baird's sandpiper, yellow wagtail, and Smith's longspur.
- Observations of avian vagrants in the area included Canada's second arctic warbler, the Yukon's second dusky thrush, and the Yukon's third common grackle.
- Other noteworthy observations suggesting local breeding included pairs of pomarine jaegers (not yet recorded breeding in the Yukon), king eiders at Clarence Lagoon, red phalaropes at Clarence Lagoon, and yellow-billed loons at Clarence Lagoon.

Preliminary conclusions include:

- Ivvavik National Park is an exceptionally rich area for breeding birds.
- Ivvavik National Park contains key habitat for rare Yukon and Canadian breeders, especially bluethroat and yellow wagtail.
- The bird communities of Ivvavik National Park should be prioritized for further study with emphasis on habitat relationships for all species, and the breeding status of poorly known and potential breeders such as pomarine jaeger, yellow-billed loon, king eider, and ruddy turnstone.
- Species near the edge of their ranges such as bluethroat, and yellow wagtail, which may respond to global climate change should be prioritized for monitoring within Ivvavik National Park.
- The Canadian Wildlife Service, with logistic and technical support from NatureServe Yukon.
- Data collected for this project will be added to the Birds of the Yukon database. Data on priority species (e.g. bluethroat, yellow wagtail, ruddy turnstone) will be tracked by NatureServe Yukon.

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Funding

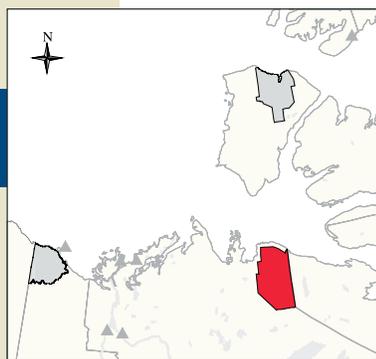
Data Location



Brian Bell records habitat details at a yellow wagtail nest.

Rationale

Residents of Paulatuk are interested in finding new fishing sites for Arctic char. The Hornaday River was, and continues to be, an important source of char for the community of Paulatuk. However, the size of the Hornaday River char stock has declined and volunteer restrictions on subsistence fishing for char have been put in place through the Paulatuk Char Management Plan, 2003-2005. The Brock River headwater lake, in Tuktut Nogait 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 (DFO) on behalf of the Fisheries Joint Management Committee. These projects include counting and sampling char caught from the Hornaday River, monitoring water quality and flow in the Hornaday River, and implementing the Paulatuk Char Management Plan, 2003-2005.



Research

FISHERY SURVEY OF THE BROCK RIVER HEADWATER LAKE

Lois Harwood, Department of Fisheries and Oceans

Objectives

- To determine the relationship of Arctic char from the Brock River headwater lake with Arctic char of the Hornaday River.
- To evaluate the lake as a possible alternative source of char for the people of Paulatuk.
- To provide a basic inventory of fish and fish habitat in the Brock River headwater lake.
- To provide information to support the Paulatuk Char Management Plan 2003-2005.
- Index netting using gill nets (fall) and standard gang test nets (summer) were used to determine species composition of fish in the Brock River headwater lake.
- Captured fish were sampled for length, weight, sex, maturity, stomach contents, muscle for genetic work, and otoliths for strontium profiles and aging. After sampling the fish were distributed to the community members in Paulatuk.
- Arctic char from the Brock River headwater lake were tagged to determine if they move to areas near Paulatuk, including the Hornaday River.

Methods and Information Collected

Results

- A community based exploratory fishery was conducted from November 13-19, 2003.
- During this fishery, nets were set in the Brock River headwater lake for a total of 10 sets, most of which were 24-hour sets. Two sets caught nothing, 2 sets caught both lake trout and char, 3 sets caught lake trout only and 3 sets caught char only. A total of 15 char and 7 lake trout were captured.
- The trout and char otoliths were sent to DFO Winnipeg to initiate the strontium work.



Paulatuk community fisherman holding an Arctic char.

Partners

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

Funding

- Fisheries Joint Management Committee
- Parks Canada

Data Location

- Department of Fisheries and Oceans
- Parks Canada, Paulatuk



Netting for fish species composition in the Brock River headwater lake.

Contacts**Lois Harwood**

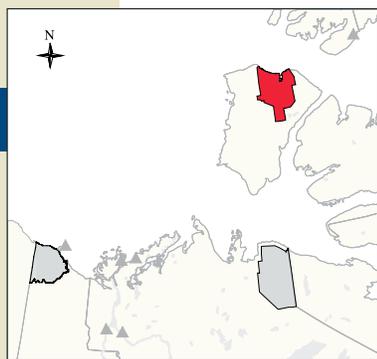
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Arctic char.

Rationale

The fossil coral reefs of Mercy Bay, in the northeast corner of Aulavik National Park, may provide insight into the nature of ancient coral reef ecosystems. The Mercy Bay reefs are extraordinarily well preserved and have undergone almost no structural change. Their detailed stratification may provide clues to help understand their growth and decline. The structure and composition of the Banks Island reefs will be compared with those of modern reefs on siliclastic shelves and with Frasnian reefs of southern Canada, western Europe, Australia and China.



Research

FOSSIL CORAL REEFS OF BANKS ISLAND

Paul Copper, Laurentian University and Evan Edinger,
Memorial University of Newfoundland

Objectives

- To document the stratigraphy and paleoecology of the Mercy Bay reefs which are exposed in Aulavik National Park.
- To describe the stratigraphic relationships between fossil reefs and intervening siliclastic sediments, and the influence of sea level change on these relationships.
- To document the corals, stromatoporoids and other fossils preserved in the reefs and intervening sediments, including epibionts on fossil wood.

Methods and Information Collected

- Fieldwork for this project was conducted in 2000 and 2003.
- A number of the larger and more prominent reefs were mapped in 2000.
- Fieldwork in 2003 focused on the more promising sights found in 2000. These areas were plotted and divided into 7 regions, which were then systematically searched.

Results

- The reef platform in northeastern Banks Island was developed in 4 successive time stages, over a period of probably 3 to 4 million years or less.
- The oldest reefs are exposed in the lower Mercy River area, around Mercy Falls and north of that, and along the lower Manning and Vesey rivers. These A-level reefs are generally patch reef types up to about 150 m diameter and 15-20 m thick, but many were smaller and thinner. A typical reef for this level is exposed right at Mercy Falls, where the river cascades over about a 10 m thick section. Sandstones further to the north may bury some reefs.



B-level reefs on the North Mercy tributary, consisting of a series of coral-sponge patch reefs forming a reef complex.

Results (continued)



Evan Edinger standing by a C-level reef on the south side of the East Mercy River.

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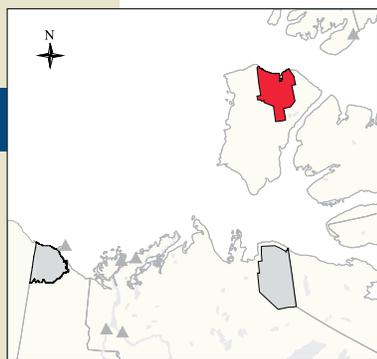
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Data Location

- The B-level reefs developed about 15-25 m higher and consist of an isolated reef as well as clustered reef complexes with a massive core and usually sharp flank facies. Such reefs are exposed at an un-named river north of the lower Mercy River, along the upper stretches of the lower Mercy River and at the mouth of the Gyrfalcon River, as well as along riverbeds south of the Gyrfalcon Bluffs.
 - The C-level reefs are the growth of the most widespread reef platforms and the primary reef development. These make up a considerable area of mesa and buttes along the Kamik (Tiber) River, upper Manning River, and East and Middle Mercy Rivers, and parts of the platforms south of Gyrfalcon River, including Gyrfalcon Bluff itself. Gyrfalcon Bluff is actually made up of two reefs, one to the north and one to the south, separated by dark sandstones that breach a gap between the double reefs.
 - The final reef phase is exposed only on the eastern sides of the East and Middle Mercy Rivers, and probably includes the isolated reef mounds exposed along the M'Clure River to the northeast and the nearby coastline. This is reduced from the C-level reefs in aerial extent and thickness, and marks the closing stage of reef development in the Canadian arctic as a whole. The total thickness is estimated to be about 250 m.
 - As the only coral and sponge reef complex of the Canadian arctic in Late Devonian time (380-355 million years ago), this location is unique, and represents one of the most complete geologic sections and the most spectacular reef outcrops of this age in the world. The region of the Mercy Platform is also the only known area for which, in Palaeozoic time, reef corals are known to have grown attached to fossil tree trunks, and is located on the margins of a giant paleo-delta stretching southwest from Ellesmere Island and Greenland.
 - The area is of great geologic interest because shortly after these reefs were deposited, coral-sponge reefs completely disappeared from the oceans worldwide. Thus, the reefs of Banks Island give us not only a glimpse into the distant past, at a time of global mass extinction, but also a view of the second most devastating mass extinction of the last half billion years.
-
- Laurentian University
 - Memorial University of Newfoundland
-
- National Science and Research Council of Canada
 - Polar Continental Shelf Project
-
- Samples are presently archived at Laurentian University, Sudbury, Ontario. After the study is complete, specimens will be transferred to the Geological Survey of Canada in Ottawa.
 - Data will be archived at the Department of Earth Sciences, Laurentian University, and at the Department of Geography at Memorial University.
 - Microfossil age determinations and stratigraphic data will be stored on spreadsheets, which, upon completion, will be sent in digital form to Parks Canada, Inuvik.

Rationale

Frost boils, and other patterned ground, were studied in Aulavik National Park to improve our understanding of the complex processes that drive Arctic ecosystems, and how these systems may respond to climate change. There are complex links between biogeochemical cycles, vegetation, disturbance, and climate in the Arctic. One way of looking at these links is by studying frost boils and other types of patterned ground, as the processes that create these landforms also drive biogeochemical cycling and vegetation succession in the Arctic. Little work has been done to date to study the complexity of these systems. It is likely that these relationships can be understood and modelled by examining the relative strength of feedbacks from components of the system at several sites in the Arctic with different temperatures. The work conducted in Aulavik National Park was part of this larger research effort.



Research FROST BOIL ECOSYSTEMS OF BANKS ISLAND

Donald Walker and Martha Reynolds, Institute of Arctic Biology, University of Alaska

Objectives

- To study the interaction between vegetation, soil and climate in frost boil ecosystems.

Methods and Information Collected

- Three sites, representative of vegetation in the area, were chosen. Vegetation was characterized by identifying species, plant communities and cover. A small soil plug at each vegetation site was removed for analysis. Small samples of plants were collected for identification.
- At each site, a 10x10 m grid was marked. Climate stations were set up at each 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 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.
- 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 characteristics. Small samples of the different types of soils were taken for physical and chemical analysis.
- Data that will be used to characterize frost boil ecosystems for vegetation modeling was collected. LAI (Leaf Area Index), NDVI (Normalized Difference Vegetation Index and a measure of greenness), and plant biomass were measured on frost boil areas and between frost boils so that values could be compared. These data will be summarized to determine the biomass of plant groups, and the carbon and nitrogen content of the plant tissue.



Hill slope with turf hummocks.

Methods and Information Collected (continued)

Results



Charles Tarnocai in a frost pit which cuts across a frost boil.

- 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.

The following are preliminary results from the first year of a multi-year study:

- On well-drained and imperfectly drained upland soils, the frost boils are very active and soil types do not always correspond to vegetation cover. The frost boil process is a controlling factor for cycling the surface formed organic matter into the lower parts of the soil.
- In the poorly drained lowland sites, the soil types can be better predicted according to landforms and most of the organic matter is accumulated in the surface organic layer. There is more organic carbon stored in these soils than predicted.
- Initial results indicate that distinct differences in plant community biomass, LAI, NDVI, and nitrogen cycling do exist between the well-drained, imperfectly drained and poorly drained sites. These differences are especially obvious between the poorly drained and the well and imperfectly drained sites.
- Additional results show that thaw depth was greatest in the frost boils when compared to the inter-boil areas. This can be attributed to the insulation provided by plant cover in the inter-boil areas. The greatest difference in thaw between frost boils and inter-boil areas existed in the poorly drained sites.

Partners

- University of Virginia
- United States District of Agriculture Forest Service
- VECO Polar Resources
- University of Alaska
- University of Cincinnati
- Agriculture and Agri-Food Canada

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Funding

- U.S. National Science Foundation

Data Location

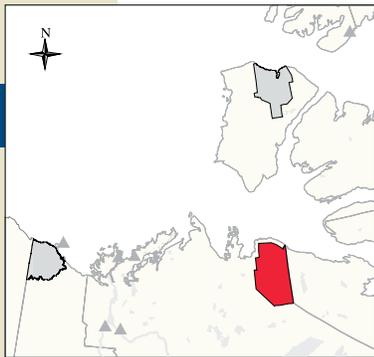
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- Results from the studies will be published in journals for the next several years and posted on the Alaska Geobotany Center web site (www.geobotany.uaf.edu).
- Two PhD students are part of the project, and their work will result in theses with the University of Virginia and the University of Alaska Fairbanks.
- Data from Aulavik National Park, and reports from the project will be sent to Parks Canada, Inuvik.

Rationale

Population estimates of grizzly bears are used to set quotas for the subsistence and sport harvests of grizzly bears in the Inuvialuit Settlement Region (ISR). Communities in the ISR feel that the number of grizzly bears in the region has increased since the last population estimates were conducted. Current population estimates are required to review and establish new quotas for grizzly bears. This project is being conducted in the Northwest Territories in the eastern portion of the ISR. A similar project will be conducted in the Yukon in the western portion of the ISR. This project is being conducted by the Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development (DRWED). Parks Canada is a partner in the project, contributing funds and other resources.



Research

GRIZZLY BEAR POPULATION STUDY

John Nagy and Marsha Branigan, Government of the Northwest Territories,
Department of Resources, Wildlife and Economic Development

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

- Grizzly bears were captured in the spring of 2003.
- The following information or samples were taken from each bear that was captured:
 - Weight
 - Body measurements (length, girth, etc.)
 - Lower left premolar extracted to determine age
 - A blood sample to determine condition and to test for exposure to rabies
 - Fecal samples to determine diet
 - Hair samples for DNA and diet analyses
 - A small, approximately 0.5 cm, disc of skin for DNA analysis
 - A fat sample to determine diet
 - A shaving of the outer edge of one claw to determine diet (used in combination with milk, hair, and fat samples)



Lyle Lambert ear tagging a grizzly bear.

Methods and Information Collected (continued)

- Each bear was tattooed with a unique number on the lower lip. Bears were ear tagged to ensure their identification in subsequent years if the bears remove their collars.
- A maximum of 40 bears were equipped with ARGOS ST14 satellite collars that are programmed to provide one location every 2 days. Each collar is equipped with a VHF transmitter so that the collar/bear can be located from an aircraft or on the ground. These collars are equipped with a “break away” feature so that the collars automatically fall off the animals before the end of the study, if the bears cannot be recaptured for some reason.
- Traditional knowledge about grizzly bears will be collected during meetings and workshops with Hunters and Trappers Committee’s and co-management boards in the region.

Results

- Fifty-four bears were captured during the spring capture program.
- Thirty bears were equipped with satellite collars and ten bears in the development zone (another related project) were equipped with GPS collars.

Partners

- Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development (project lead)

Funding

- Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development - IFA Implementation Funds
- Parks Canada

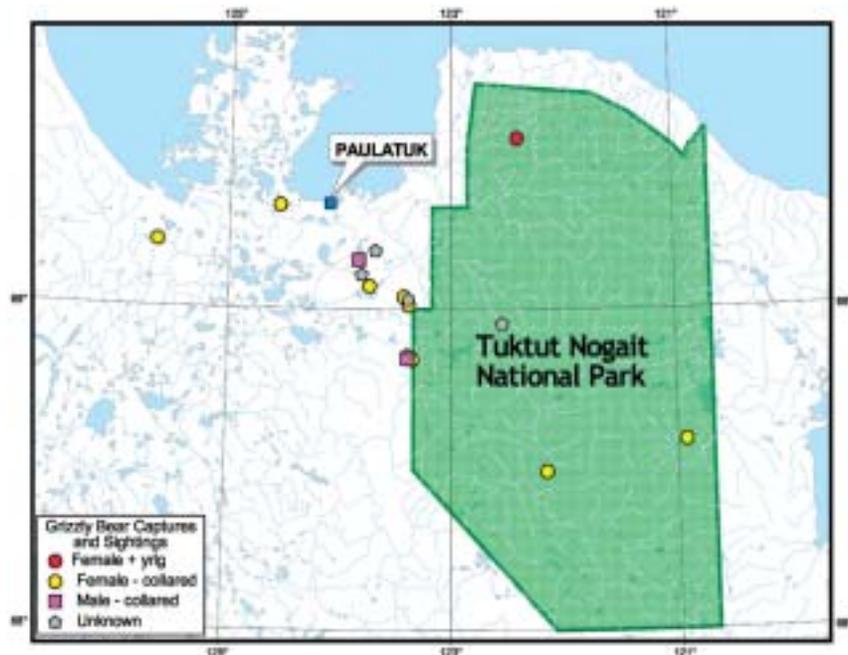
Data Location

- Department of Resources, Wildlife and Economic Development, Inuvik

Contacts

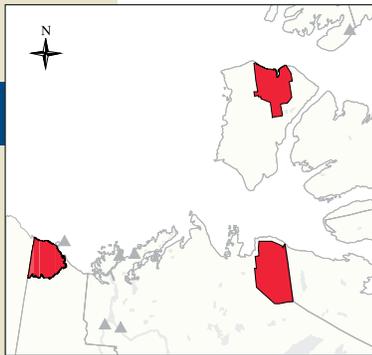
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Rationale

For over a decade the Inuvialuit provided subsistence fish catch information to the Inuvialuit Harvest Study. However, during this period there had been no comprehensive survey of recreational anglers fishing in the Inuvialuit Settlement Region (ISR). The annual sport angler survey provides resource co-managers with a more complete body of information to better manage our fish stocks for the Inuvialuit who depend on the fish as an important food source, and for the continued enjoyment of recreational anglers from the north and around the world.



Research

SPORT ANGLER SURVEY

Fisheries Joint Management Committee

Objectives

- To determine the number, species and location of fish caught by sport anglers within the ISR during the spring and summer fishing season.
- To develop more effective promotional and educational programs to inform the public about the ISR private lands fishing registry.
- To promote awareness of the Fisheries Joint Management Committee and their mandate to recreational anglers.

Methods and Information Collected

- The sport angler survey is conducted with recreational anglers purchasing a licence, or registered to fish, in the ISR between April and September each year.
- Anglers surveyed include those issued with:
 - a) Northwest Territories sport fishing licenses by vendors within the Inuvik region,
 - b) Northwest Territories sport fishing licenses with an “ISR validation” by vendors from outside the Inuvik region,
 - c) Parks Canada fishing permits to fish within National Parks in the ISR.
- Information is gathered from recreational anglers using a mail-out questionnaire that is self-completed and returned by mail.
- The information that is collected includes: total number of fish caught, number of fish retained, location, month, gear type used, angler preference for fish species, intent to ice fish in the ISR during the winter and use of fishing guides and outfitter serves.
- To increase angler participation, a reminder letter and a second questionnaire mail-out is sent to non-responders. A prize draw incentive for participants is offered.



Fly fishing at Crooked Creek, Ivvavik National Park.

Results

- Seventy percent of Parks Canada fishing permit holders returned a completed questionnaire for the 2001 survey.
- Most sport fish catches were reported from along the Firth River corridor in Ivvavik National Park.
- Grayling was the most common fish caught. Arctic char was the most preferred sport species.

Sport fish species caught in ISR National Parks between Apr 1-Sept 30, 2001	% of anglers fishing in ISR national Parks who caught given species (keep and/or release) (N=45)	Total # of fish kept (mean # of fish per angler)	Total # of fish released (mean # of fish per angler)
Grayling	69% (31)	41 (1)	207 (7)
D. Varden Char	27% (12)	42 (4)	32 (3)
Lake Trout	9% (4)	10	6
Arctic Char	9% (4)	8	2

Source: McLean, E.B., (in prep). Inuvialuit Settlement Region (ISR) 2001 spring-summer sport angler survey. Canada/Inuvialuit Fisheries Joint Management Committee Technical Report, Inuvik, NT

Partners

- Fisheries Joint Management Committee (project lead)
- Fisheries and Oceans Canada
- Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development

Funding

- Fisheries Joint Management Committee
- Department of Fisheries and Oceans

Data Location

- Fisheries Joint Management Committee
- Department of Fisheries and Oceans
- Parks Canada, Inuvik

Contacts

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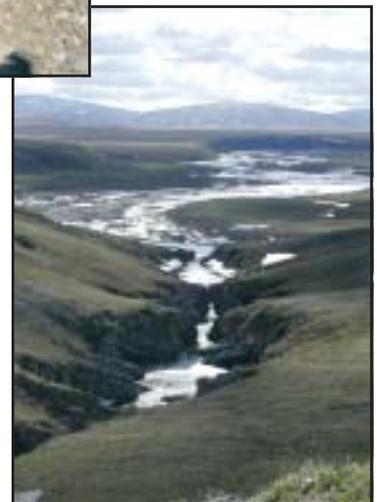
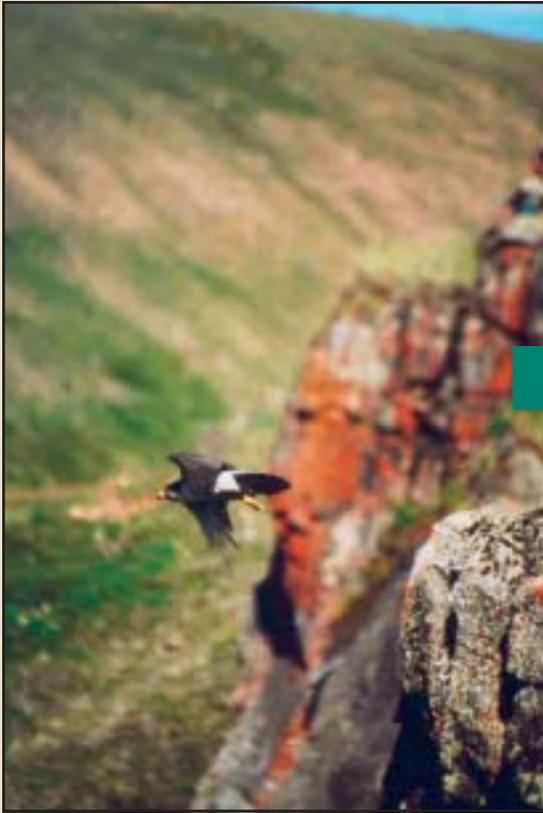
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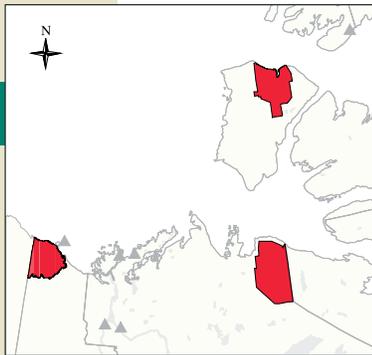
Monitoring





Rationale

Recording incidental wildlife observations is an inexpensive method of collecting information about wildlife populations. Observations made in Aulavik, Ivvavik and Tuktoyaktuk national parks, and surrounding areas, are recorded on wildlife cards and the information is stored in a computer database. Special attention is paid to observations of bears and wolves, as there are long records of observations for both species and because they are good indicators of environmental health.



Wildlife WILDLIFE CARDS

Objectives

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

Methods and Information Collected

- Parks Canada staff 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.



Young Arctic hare.



Short-tailed weasel.

Results

- There are currently 1694 observations in the wildlife cards database.
- Summaries and maps of wildlife observations can be produced as required.

Years of Data

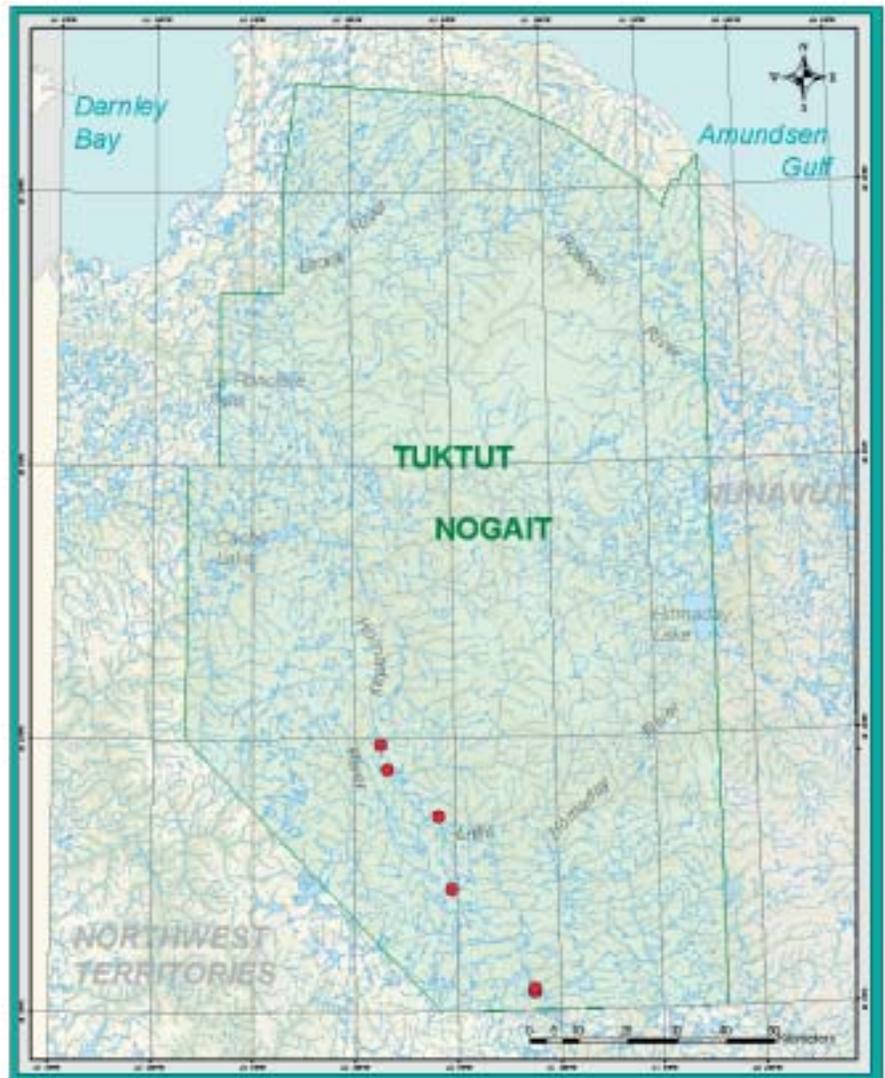
- 1986-ongoing

Funding

- Parks Canada

Data Location

- Parks Canada, Inuvik



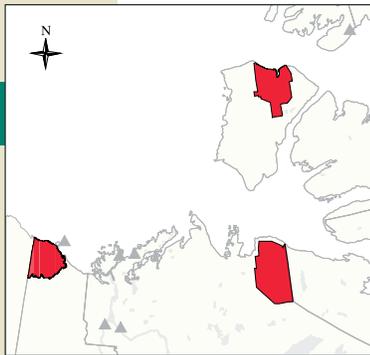
Observations of wolverine in Tuktut Nogait National Park.

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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 data can provide useful information about birds that is difficult to collect in large, remote areas. Potential uses include baseline information for further studies, environmental assessments, mapping bird distributions more accurately 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).



Baird's sandpiper.



King eider.

Results

- The NWT-Nunavut Bird Checklist Survey database is now located on the internet at www.pnr-rpn.ec.gc.ca/checklist. Features of this web site include maps of all the bird data as well as park-specific data and other features.
- Some of the more unusual reports from the survey are: harlequin ducks spotted on the Horton River, white-crowned sparrow reported in Sachs Harbour, an american robin sighting March 30th on the Dempster Highway and a Say's phoebe seen on the Horton River.

Years of Data

- 1995 - ongoing

Partners

- Canadian Wildlife Service (project lead)

Funding

- Canadian Wildlife Service

Data Location

- Canadian Wildlife Service, Yellowknife, NT
- Internet: www.pnr-rpn.ec.gc.ca/checklist

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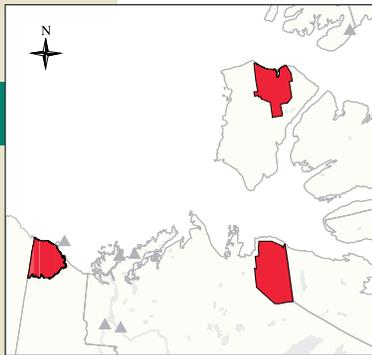
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Young snowy owl.

Rationale

Raptors, especially peregrine falcons, can be used as indicators of ecosystem health. Surveying raptors when they are in Aulavik, Ivvavik and Tukturnogait national parks to breed provides an indicator of the health of their populations and the condition of the ecosystem throughout their range. These surveys coincide with the Canadian Peregrine Falcon Survey, a national effort to monitor the status of peregrine falcon populations in North America every five years.



Wildlife RAPTOR SURVEY

Objectives

- To document the number of peregrine falcons and other species of raptors breeding in Aulavik, Ivvavik and Tukturnogait national parks.
- To provide information about peregrine falcon populations in Aulavik, Ivvavik and Tukturnogait national parks to the Canadian Peregrine Falcon Survey.

Methods and Information Collected

- The raptor survey is conducted every 5 years. The next survey will be conducted in 2005. Incidental observations of raptors are recorded annually.

2000 Raptor Survey

Aulavik National Park

- Two surveys were conducted along the Thomsen River from Green Cabin to the Muskox River. One hiking patrol surveyed 30 km of the Muskox River. Two hiking patrols surveyed areas east and south of Mercy Bay. A helicopter survey was conducted south and east of Nangmagvik Lake.

Ivvavik National Park

- The survey was conducted by helicopter on the Yukon North Slope. The survey area included the lower reaches of the Firth, Malcolm and Babbage rivers, and Herschel Island.

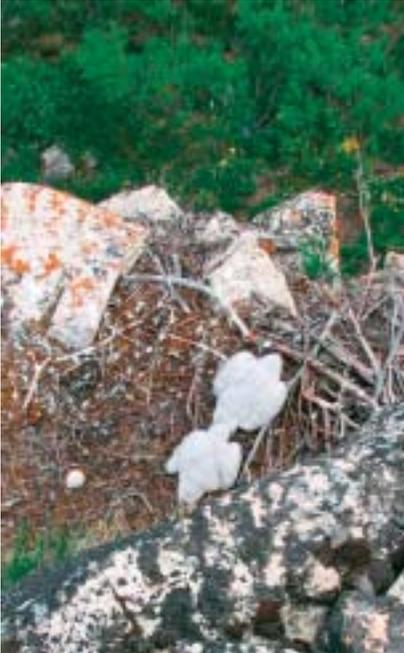
Tukturnogait National Park

- The Hornaday River was surveyed on foot and by boat. The canyon section was hiked and the upper Hornaday River was surveyed by canoe. The Roscoe River was surveyed on foot.



Golden eagle nest at Cache Lake.

Results



Peregrine falcon nest at Cache Lake.

Years of Data

Funding

Data Location

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2000 Raptor Survey

Aulavik National Park

- A total of 91 active raptor nests were located in the park: 10 peregrine falcon, 63 rough-legged hawk, 16 snowy owl and two short-eared owl.
- The two short-eared owl nests were the first recorded for Banks Island.

Ivvavik National Park

- Sixteen known peregrine falcon territories on the Yukon North Slope were visited and four new territories were found. In total, nine occupied territories were found in 2000. Seven of these were productive.

These results indicate an increase in the number of peregrine falcons on the Yukon North Slope since 1995. However, a larger area was surveyed in 2000 than in the past.

- The 2000 survey found 13 productive territories, 1 territorial pair and 1 territorial adult male in 15 of 19 known peregrine falcon territories along the Hornaday River. Four new territories with productive pairs were also found.

- The size of the peregrine falcon population on the Hornaday River has, at least, been stable from 1988 to 2000. The four new peregrine falcon territories found in 2000 indicate a positive, but unconfirmed, trend.

2003 Raptor Survey

- A raptor survey was conducted around Cache Lake in Tuktut Nogait National Park July 25-28, 2003. Two peregrine falcon nests, 1 rough-legged hawk nest and 1 golden eagle nest were found.

- Parks Canada raptor survey 2000.

Ivvavik National Park

- Peregrine falcon surveys on the Yukon North Slope since 1972.
- Parks Canada raptor survey 2000.

Tuktut Nogait National Park

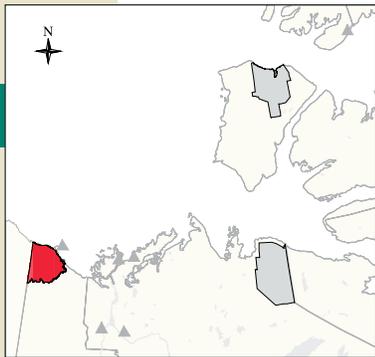
- Raptor surveys along the Brock and Hornaday Rivers - 1988, 1990, 1991.
- Parks Canada raptor survey 2000 and 2003 (Cache Lake survey only).

- Parks Canada
- Government of Yukon
- Polar Continental Shelf Project

- Parks Canada, Inuvik

Rationale

Environmental problems in wintering areas, breeding areas and along migration routes used by birds can affect the health of their populations. Breeding bird surveys are used to detect changes in the abundance 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 used by the Canadian Wildlife Service and for the Alaska Offroad Bird Survey.



Wildlife

BREEDING BIRD SURVEY

Objectives

- To monitor the 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. Two new transects were created at Margaret Lake this year to replace the existing transects.
- 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.
- Only selected bird species are recorded for the survey. Additional species can be noted if the observer is certain of their identification.
- Birds are identified within a 50 m radius by sight and sound at each station. Observations at each station are made for 5 minutes.
- Wind and weather conditions are also recorded for each route.



Snow bunting.

Results

- Breeding bird surveys were conducted at Margaret Lake on June 13-14, 2003 and at Sheep Creek on June 18-19, 2003.
- Northern pintail, spotted sandpiper and semipalmated sandpiper were observed during the survey for the first time in 2002. All of these species are known to occur in the Margaret Lake and Sheep Creek areas.
- Northern shrike and sharp-shinned hawk were some of the more unusual sightings in 2003.

Years of Data	• 1999 - ongoing
Funding	• Parks Canada
Data Location	• Parks Canada, Inuvik



Ian McDonald making notes at the Sheep Creek south observation site.



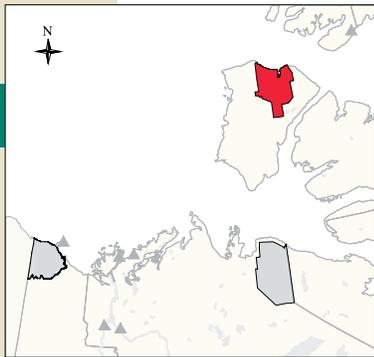
Red phalarope.

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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.



Objectives

- To track 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, along the Thomsen River.
- Lemming winter nests are counted using the plot and line transect survey methods.
- The species and number of lemming predators observed during the survey are counted.

Plot Survey Method

- 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.

Line Transect Survey Method

- 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.



Lemming nest.

Results

- The plot survey method was conducted on July 1 and 13 in 2003. The line transect survey was conducted on July 1 and 2 in 2003.
- Five lemming nests were counted and 1 lemming was seen during the plot survey. One ermine nest was also recorded. Eleven lemming nests were observed during the line transect survey.
- There is not enough information collected yet to analyse the data. The increase in the number of nests counted in 2000 and 2001 corresponds with an increase in lemming sightings made during that time period. Similarly, the lower number of lemming nests counted in 2003 seems to correspond with the lower number of lemming sightings that year.

Years of Data

- 1999 - ongoing

Funding

- Parks Canada

Data Location

- Parks Canada, Inuvik and Sachs Harbour

Plot	1999	2000	2001	2002	2003
1	0	3	3	4	0
2	3	1	4	0	1
3	6	18	9	4	0
4	11	6	9	1	2
5	0	5	6	0	2
Total	20	33	31	9	5



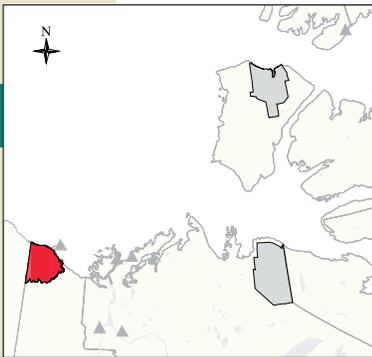
Year-old lemming nest.

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Rationale

Little is known about the abundance, seasonal movements and habitat use of moose in Ivvavik National Park. The survey is conducted to determine abundance, sex and age composition, and distribution of moose in the Babbage River watershed. This information provides a baseline for future surveys that will allow Parks Canada to track changes in moose populations.



Wildlife

BABBAGE RIVER MOOSE SURVEY

Objectives

- To collect information about moose abundance, population characteristics and distribution in the Babbage River watershed on the Yukon North Slope.

Methods and Information Collected

- Age and sex of moose, location and habitat type where moose were observed were recorded.
- The survey area includes the Babbage River and all of its tributaries, from the coast of the Beaufort Sea to the headwaters of the Babbage River.
- The 2000 survey was conducted on April 16, with a Bell 206B Jet Ranger helicopter, by 3 observers and a pilot.
- The moose survey is conducted every 5 years. The next survey will be conducted in 2005.
- Moose surveys in the Babbage River watershed are timed to coincide with the moose surveys in the Richardson Mountains that are conducted by the Government of Yukon. This provides information on the status of moose populations over a large area of the Yukon North Slope.



Moose in Ivvavik National Park.

Results

- A total of 51 moose were counted in 2000.
- Changes in moose populations in the Babbage River area will be determined as future surveys are conducted.

Years of Data

- 2000

Partners

- Government of Yukon

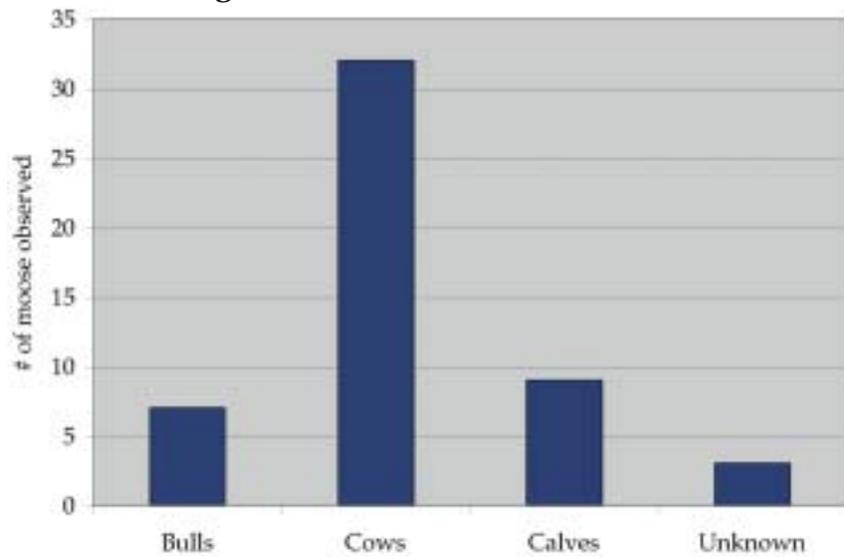
Funding

- Parks Canada

Data Location

- Parks Canada, Inuvik

Age and Sex Composition of Moose in the Babbage River Area, Ivvavik National Park, 2000

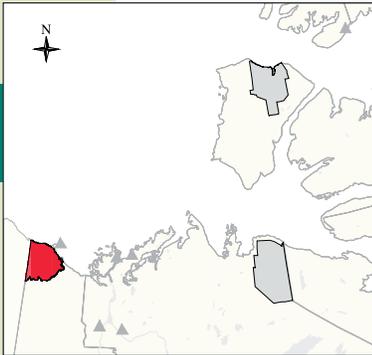


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Rationale

Muskoxen were re-introduced to Alaska 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 Mountain 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. Research and monitoring of North Slope muskoxen is directed by the draft Canadian North Slope Muskoxen Co-management Plan, 2002-2007, developed by the Wildlife Management Advisory Council (North Slope).



Wildlife

YUKON NORTH SLOPE MUSKOXEN POPULATION MONITORING

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



Dorothy Cooley using telemetry equipment to locate muskoxen.

- 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. Satellite-radio collars were placed on 10 muskoxen (8 cows and 2 bulls) in 1999. These collars were either removed or replaced in 2002. There are now 5 muskoxen (4 cows and 1 bull) on the Yukon North Slope with satellite-radio collars.
- Parasite research has been conducted for muskoxen on the Yukon North Slope and from the Richardson Mountains in the Northwest Territories.

Results

- A population and composition survey was conducted from April 8 to 11, 2003 on the Yukon Coastal Plain between the Alaska border and Shingle Point. A total of 85 muskoxen were recorded in the study area during the survey flights. 10 muskoxen were seen outside of the survey area.

Results (continued)

- A yearling:cow (females 3 years and older) ratio of 16:100 was recorded, which is down slightly from previous late winter surveys. The number of bulls recorded was comparable with other surveys.
- Productivity (the number of calves born in a year) was estimated to be 54 calves:100 adult females (females 3 years and older) in July, 2003. Productivity was higher in 2003 than in 2001 and 2002.

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 to determine the size and distribution of the North Slope muskoxen population have been conducted since 1986.
- A 4-year study of muskoxen distribution and movement was initiated in 1999.
- Parasite research was conducted in 2000 and 2002.

Partners

- Government of Yukon

Funding

- Government of Yukon
- Parks Canada

Data Location

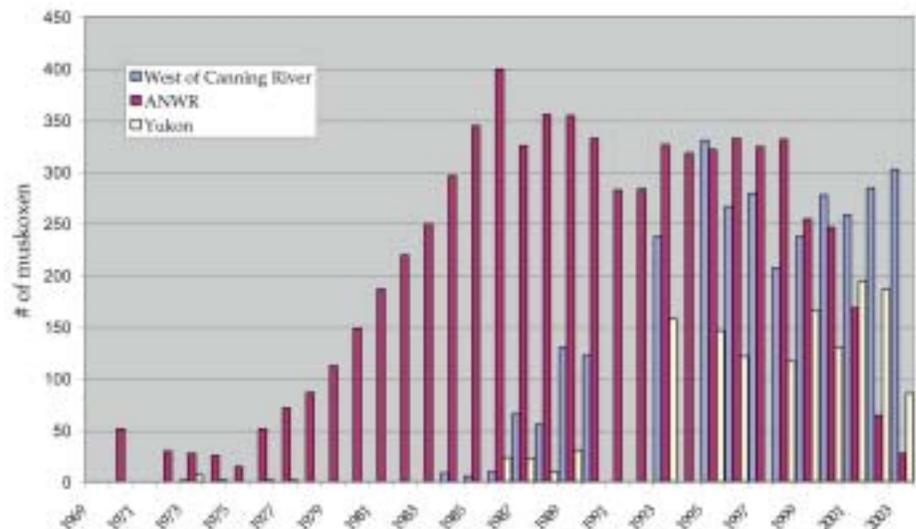
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- Parks Canada, Inuvik

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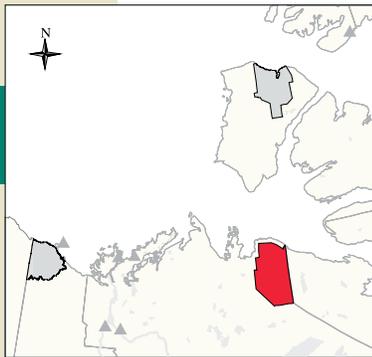
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North Slope Muskoxen Population Estimates



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 the land within the boundary of Tuktut Nogait National Park. In 1998 a research needs workshop for Tuktut Nogait National Park identified the need for current information about muskoxen in and around the park. As a result, Parks Canada started this survey in conjunction with a long-term monitoring program conducted by the Government of the Northwest Territories. Information from this survey will be used to resolve issues related to harvest quotas and muskoxen and caribou interactions.



Wildlife

TUKTUT NOGAIT MUSKOXEN POPULATION MONITORING

Objectives

- To estimate the number and distribution of muskoxen within the boundaries of 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.

Results

- The first muskoxen 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.

Years of Data

- 1997, 2002

Partners

- Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development



Muskox.

Funding

- Parks Canada
- Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development

Data Location

- Parks Canada, Inuvik
- Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development, Inuvik

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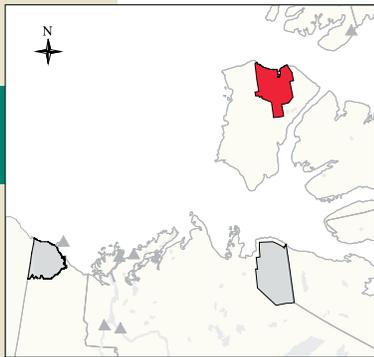
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Map of muskoxen locations in Tuktut Nogait National Park, March 2002. Numbers on map indicate the number of muskoxen found at each location.

Rationale

Peary caribou on Banks Island are classified as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The highest population estimate for the herd 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 factors for the population decline include harvest, 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 has taken place. This project is led by the Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development and is carried out under the direction of the draft Co-management Plan for Caribou, Muskox, Arctic Wolves, Snow Geese, and Small Herbivores on Banks Island, 1998/99 to 2002/2003. Parks Canada is a partner in this project, contributing funds and other resources.



Wildlife

BANKS ISLAND PEARY CARIBOU MONITORING

Department of Resources, Wildlife and Economic Development

Objectives

- To estimate the number of Banks Island Peary caribou.
- To determine caribou productivity and recruitment of calves.
- To determine caribou body condition.
- To assess late winter snow conditions in wintering range for Banks Island Peary caribou.
- To determine the movement of caribou between Banks and Victoria Islands.
- To determine the presence and abundance of parasites and diseases in caribou.

Methods and Information Collected

- The survey area covers all of Banks Island, including Aulavik National Park.
- Caribou are counted from a fixed-wing aircraft.
- Classification surveys are conducted by using a helicopter to position surveyors near groups of caribou. Caribou are observed with spotting scopes or binoculars and classified by age and sex.
- Incidental observations of wolves are recorded during the survey.
- 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.
- Urine and fecal samples from caribou are collected and analysed to determine animal body condition.
- Satellite collars were placed on 10 Banks Island Peary caribou in 1999, and on 10 Low Arctic Peary caribou on Victoria Island in 2003, to track their distribution and movement.



Releasing satellite collared caribou on Victoria Island.

Methods and Information Collected (continued)

Results

- Fecal and fourth stomach samples are collected to determine the infection of caribou with parasites.
- The last population survey, conducted in 2001, estimated the population of Banks Island Peary caribou to be 1,196 non-calf caribou. The next population survey is scheduled to be conducted in 2004 or 2005.
- Estimates of productivity range from 24 to 75.6 calves:100 adult female from 1982 to 2001.
- Over winter survival of calves ranges from 23 to 86% survival from 1991 to 1999.

Years of Data

- Population estimates have been conducted since 1972.
- Classification surveys have been conducted since 1982.
- Winter range conditions have been monitored since 1994.
- Caribou late winter body condition has been assessed since 1993.
- Parasite levels have been assessed since 2000.
- Information on summer caribou ranges has been collected since 1982.

Partners

- Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development (DRWED) (project lead)

Funding

- Government of the Northwest Territories
- Parks Canada

Data Location

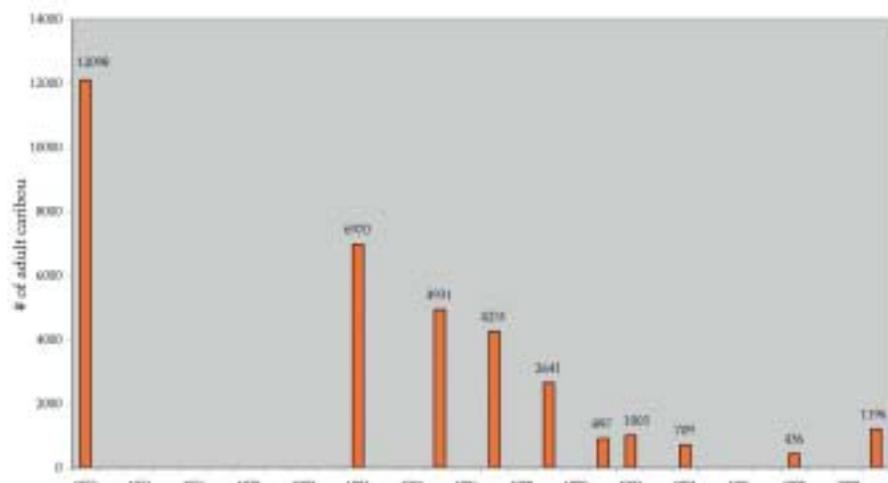
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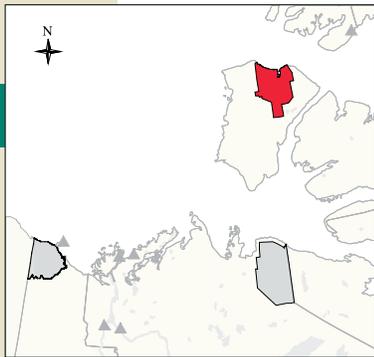
Banks Island Peary Caribou Population Estimates 1972-2001



Population estimates for adult caribou on Banks Island, 1972-2001. Source: Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development.

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 most recent population estimate, conducted in 2001, put the population at 68,788 non-calf muskoxen. Information about the size, characteristics, habitat use, movements and health of the muskoxen population is important for managing muskoxen on Banks Island and 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, Department of Resources, Wildlife and Economic Development and is carried out under the direction of the draft Co-management Plan for Caribou, Muskox, Arctic Wolves, Snow Geese, and Small Herbivores on Banks Island. Parks Canada is a partner in this project, contributing funds and other resources.



Wildlife

BANKS ISLAND MUSKOXEN MONITORING

Department of Resources, Wildlife and Economic Development

Objectives

- To estimate the number of non-calf and calf muskoxen on Banks Island.
- To determine the recruitment of muskoxen calves and the productivity of muskoxen in the Egg, Masik and Thomsen river areas.
- To assess late winter snow conditions in high-density muskoxen areas.
- To determine body condition of muskoxen.
- To determine the presence and abundance of parasites and diseases in muskoxen.

Methods and Information Collected

- All areas of Banks Island are surveyed, including Aulavik National Park.
- Muskoxen are counted from a fixed-wing aircraft.
- Age and sex classification of muskoxen is conducted in their high-density summer ranges. These ranges are in the vicinity of the Egg, Masik, Thomsen and Muskox rivers.
- Classification surveys are conducted by using a helicopter to position surveyors near groups of muskoxen. Muskoxen are then observed with spotting scopes or binoculars and are classified by age and sex. Attempts are made to classify a minimum of 500 muskoxen, or 30 groups of muskoxen, in each area that is surveyed.
- Productivity is estimated by counting the number of calves present per 100 2-year-old or older females.
- Recruitment of calves is determined by counting the number of yearlings present per 100 3-year-old or older females.
- Urine, snow urine and fecal samples from muskoxen are collected in low and high muskoxen density areas and analysed to determine animal body condition.



A herd of muskoxen on Banks Island.

Methods and Information Collected (continued)

- Incidental observations of wolves are recorded.
- Fecal and fourth stomach samples are collected to determine infection of muskoxen by parasites.
- Data collected during commercial muskoxen harvests is being analysed to look at the change in pregnancy rates, body condition and size.

Results

- Banks Island was surveyed from July 7 to 15, 2001 using a strip transect survey flown at 20% coverage. The population is estimated at 68,788 non-calf adults.
- A composition survey was completed on July 22 to 23, 2001. The results show 41 calves per 100 2-year-old or older cows.

Years of Data

- The first whole-island population survey of muskoxen took place in 1972, and has been conducted every 3-4 years since 1982.
- Classification surveys were conducted in the Thomsen River area during the 1980s and from 1999 to 2000.
- Winter range conditions were monitored on Banks Island from 1993 to 1999.
- Muskoxen late winter body condition was assessed from 1993 to 2001.
- Levels of different parasite species have been assessed since 1999.

Partners

- Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development (project lead)

Funding

- Government of the Northwest Territories
- Parks Canada

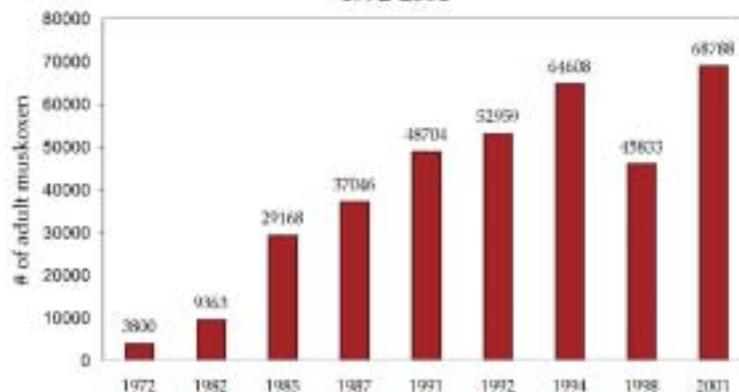
Data Location

- Department of Resources, Wildlife and Economic Development, Inuvik

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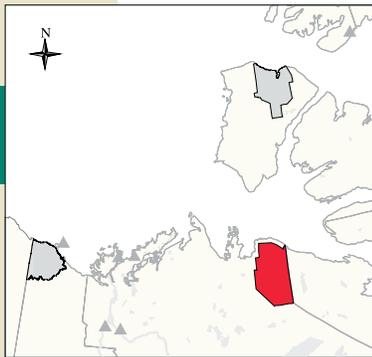
Banks Island Muskoxen Population Estimates, 1972-2001



Population estimates of muskoxen on Banks Island, 1972-2001. Source: Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development.

Rationale

The Cape Bathurst and Bluenose-West caribou herds are two barren-ground caribou herds in the Northwest Territories and Nunavut. In 2000 the number of adult caribou in these herds was estimated to be 15,000 and 75,000 respectively. Information about the biology of the two herds is required to understand their current status and how their populations change over time. The draft Co-management Plan for the Cape Bathurst, Bluenose-West and Bluenose-East Caribou Herds, created in consultation with the Gwich'in, Sahtu, Inuvialuit and Inuit, indicates the need to conduct a variety of activities to monitor both caribou herds. The Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development leads this project. Parks Canada is a partner in this project, contributing funds and conducting parts of the research.



Wildlife

CAPE BATHURST AND BLUENOSE-WEST CARIBOU MONITORING

Department of Resources, Wildlife and Economic Development

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 Cape Bathurst and Bluenose-West caribou herds.

Methods and Information Collected

- Surveys of the Cape Bathurst and Bluenose-West caribou herds are conducted in the Cape Bathurst and Melville Hills regions in the Northwest Territories. Part of this area includes Tukturnogait National Park.
- Surveys to determine recruitment of calves and productivity are conducted in March and June. Age and sex composition surveys are conducted in October.
- Productivity, recruitment of calves and age and sex composition surveys are conducted with radio telemetry equipped fixed-wing aircraft and a helicopter. The fixed wing aircraft is flown over suspected calving ranges for each herd to locate radio-collared caribou. A helicopter is then used to classify caribou that were observed by the fixed-winged aircraft. Classifications are conducted by landing near groups of caribou and observing them with a spotting scope. For small groups of caribou, classifications are also conducted from the air.
- Forty-five caribou (35 adult females and 10 adult males) from the Bluenose-West herd and 14 caribou from the Cape Bathurst herd (11 adult females and 3 adult males) were equipped with radio collars in 1999 and 2000. Satellite-radio collars were placed on 13 adult caribou from the Bluenose-West herd in 1996, 1997 and 1999 and on 2 adult caribou from the Cape Bathurst herd in 1996 and 1999. 6 additional satellite radio collars were placed on Cape Bathurst adults in March of 2002.



Caribou.

Methods and Information Collected (continued)

- Female mortality rates are estimated from death rates of female caribou with satellite radio collars.
- Fecal samples were collected in 2001 and 2002 to determine infection levels of gastro-intestinal parasites. They were also collected in 2003 to determine infection levels in the Bluenose-West herd.
- Fall body condition was assessed in 2002 using various caribou body parts collected from hunters.
- Fourth stomach samples were collected from harvested animals during 2001 to determine the number and species of parasites present.

Results

- A survey to determine productivity was conducted in the Bluenose-West calving area from June 20-24, 2003 and in the Cape Bathurst calving area from June 25-26, 2003. Results show a ratio of 53 calves per 100 2-year old or older cows for the Bluenose-West herd and 47 calves per 100 2-year old or older cows for the Cape Bathurst herd.
- Satellite tracking data collected since 1996 was animated and distributed on a CD-ROM.

Years of Data

- Productivity and age and sex compositions surveys have been conducted since 2000.
- Population estimates of the Cape Bathurst and Bluenose-West caribou herds on calving and post calving ranges were conducted in 1986, 1987, 1992, 2000 and 2002.
- A productivity survey was conducted in 1981, and has since been conducted yearly since 2000. Eight surveys have been conducted between 1983 and 1994 to determine recruitment of caribou calves. One age and sex composition survey was conducted in 1978.
- The presence and abundance of parasites was assessed in 2001.

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Partners

- Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development (project lead).

Funding

- Government of the Northwest Territories
- Parks Canada

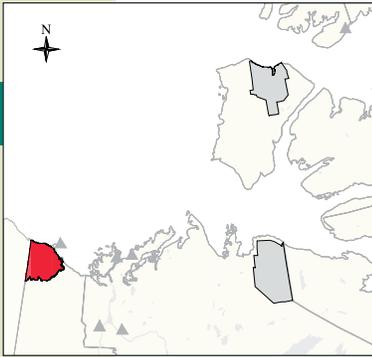
Data Location

- Department of Resources, Wildlife and Economic Development, Inuvik
- Parks Canada, Inuvik



Rationale

The Porcupine caribou herd is a large population of barren-ground caribou that migrates throughout the northern Yukon, Alaska and the Northwest Territories. In 2001 the size of the herd was estimated at 123,000 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 (e.g. oil and gas development) and changes in the arctic environment may affect the size and condition of the herd. This project is conducted by the Government of 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 Herd Management Plan. Parks Canada is a partner in this project, contributing funds and other resources towards the project.



Wildlife

PORCUPINE CARIBOU HERD MONITORING

Government of Yukon, Canadian Wildlife Service,
Alaska Department of Fish and Game and the U.S. Fish and Wildlife Service

Objectives

- To estimate the size, age and sex composition, body condition, productivity, over winter survival of caribou calves, adult female mortality, distribution and movements 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 3 years while the herd is congregated on their post-calving grounds.
- Composition counts are conducted every year in March to determine the calf:cow ratio.
- 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 1 week to document perinatal calf mortality. Another survey is done in late June or early July to calculate calf survival rates to 1 month of age. Calf survival to 9 months of age is documented during the March composition count.
- Adult female mortality rates are estimated from death rates of satellite radio collared female caribou. The U.S. Fish and Wildlife Service started a new adult female mortality study in October 2003. This mortality study was conducted throughout the winter of 2003-04.
- Satellite collars are used to determine the seasonal distribution and movements of the herd.



Female caribou, just released after being fitted with a satellite collar.

Results

- The last photocensus was conducted in 2001. This photocensus estimated 123,000 caribou in the herd.
- The March composition count for 2003 showed about 38 calves for every 100 cows. This is slightly higher than in recent years and higher than the 10-year average. However, because the calf:cow ratio was lower from 1994 to 1999, it is feared that the current levels of reproduction are not enough to stop the decline in herd size that has occurred since 1989.
- The 2003 calving survey showed that the birth rate for the herd this year was 87%, determined from the 61 of 70 radio-collared adult cows that were observed to be pregnant or accompanied by a calf in early June. At the end of June, post calving survival was found to be 85%, which represents a calf:cow ratio of 69%. Birth rate and post-calving survival of calves in 2003 were identical to rates from 2002. The late June calf:cow ratio was the highest since 1999.

Years of Data

- Population estimates have been conducted since 1972.
- Calf mortality, calf:cow ratios and birth rate have been collected since 1983.
- Seasonal range use has been documented since 1970.

Partners

- Alaska Department of Fish and Game (project lead)
- U.S. Fish and Wildlife Service (project lead)
- Government of Yukon (project lead)
- Canadian Wildlife Service (project lead)
- 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

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Data Location

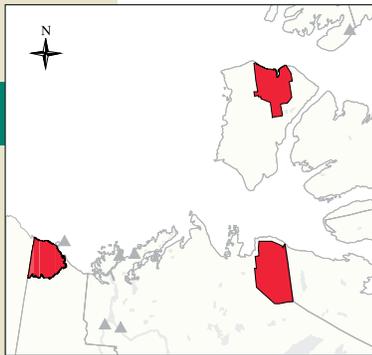
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- Government of Yukon
- Canadian Wildlife Service

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Rationale

Some environmental changes are best understood by looking at entire landscapes. A “big picture” approach provides information about how entire ecosystems function and change. This can provide information that complements smaller scale monitoring activities. Parks Canada uses Advanced Very High Resolution Radiometer (AVHRR) satellite images to monitor landscapes. Of special interest is the Normalized Difference Vegetation Index (NDVI), which is recorded by the AVHRR satellite. NDVI measures the productivity or growth of vegetation. AVHRR satellite images make it possible to monitor ecosystems within parks, and their surrounding regions, and across the north.



Habitat

SATELLITE MONITORING OF PLANT PRODUCTIVITY

Objectives

- To monitor possible changes of plant productivity in Aulavik, Ivvavik and Tuktoyaktuk national parks.

Methods and Information Collected

- Satellite monitoring of plant productivity is conducted for the Western Arctic Field Unit in Aulavik, Ivvavik and Tuktoyaktuk national parks. This is part of a larger program that is conducted in 11 northern national parks.
- Satellite images are taken daily from April 1 to October 21 each year. The images are created by combining the best images taken over a 10-day period.
- Analysis of satellite images is conducted by the Parks Canada Western Canada Service Centre in Winnipeg.
- Sampling units changed in 2002 from 3x3 km sites to ecodistrict boundaries 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 also introduced 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.

Years of Data

- 1997-ongoing

Partners

- Parks Canada - Western Canada Service Centre (Winnipeg)

Funding

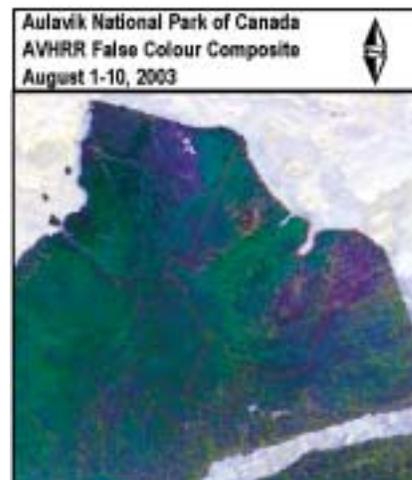
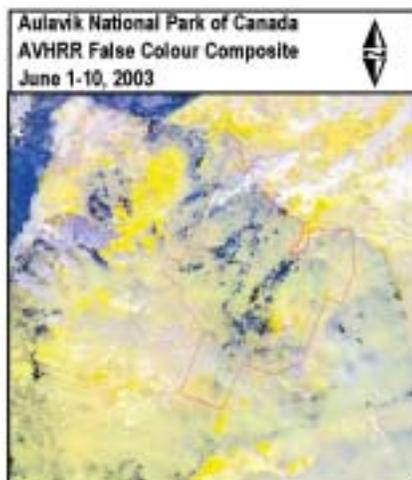
- Parks Canada

Data Location

- Parks Canada, Winnipeg



Woolly lousewort.



AVHRR satellite images for Aulavik National Park.

Results

- Data from 1997 to 2003 for Aulavik, Ivvavik and Tukturnogait national parks were analysed to determine changes in the NDVI.
- Seven years of data were analysed to show that there is an overall declining trend in NDVI, beginning in 1998. Late growing season onset is suspected to be the cause.
- The table below summarizes the results of statistical fragmentation analysis of data for Aulavik, Ivvavik, and Tukturnogait national parks.

CHANGE OVER TIME WITHIN ECODISTRICTS

	PPU (relative size of NDVI patches)	E (diversity of NDVI patch types)	SqP (relative complexity of shapes of NDVI patches in the park)
Aulavik National Park	Increased slightly over time and varied among ecodistricts	Increased with time amongst all ecodistricts	Stable over time but differed significantly among ecodistricts
Ivvavik National Park	Increased significantly over time but not across ecosystems	Increased with time amongst all ecodistricts	Stable over time but differed greatly among ecodistricts
Tukturnogait National Park	Did not increase significantly over time and differed only marginally amongst ecodistricts	Increased slightly with time amongst all ecodistricts	Stable over time but differed significantly among ecodistricts

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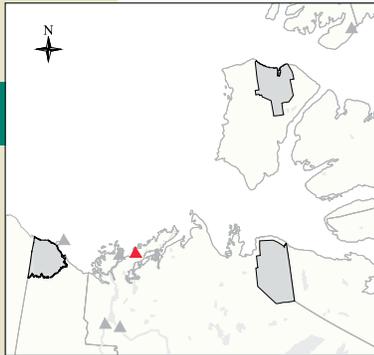
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Rationale

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 also developing the Landmark as an attraction for visitors. There is concern that recreational activities and natural processes are causing the pingos to deteriorate. Damage to the vegetation covering the pingos exposes their ice core and causes them to melt. Damage to the pingos 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, co-manage the Landmark.



Habitat

PINGO MONITORING

Objectives

- To develop a program, through the Pingo Working Group, to monitor the condition of the Pingo Canadian Landmark.

Methods and Information Collected

- Parks Canada is developing a monitoring program for the Pingo Canadian Landmark in cooperation with the Pingo Working Group.
- Four PlantWatch plots and 5 photopoints were established close to Ibyuk and Split Pingos as a pilot project to monitor ecological change. Plot locations and vegetative composition were determined. Photos were taken from each photopoint.

Results

- A monitoring options paper was written for the Pingo Working Group. This paper provides a synthesis of the various applicable monitoring methods. It will be used to assist with deciding on appropriate monitoring programs to be carried out within the Landmark.
- Data for the Plant Watch plots and photopoints can be recorded in subsequent years, should a decision be made to continue with this program.



Top of Ibyuk Pingo.

Years of Data

- 2002

Partners

- Hamlet of Tuktoyaktuk
- Inuvialuit Land Administration
- Tuktoyaktuk Hunters and Trappers Committee
- Tuktoyaktuk Community Corporation



Panoramic view of the Pingo Canadian Landmark.

Funding

- Parks Canada

Data Location

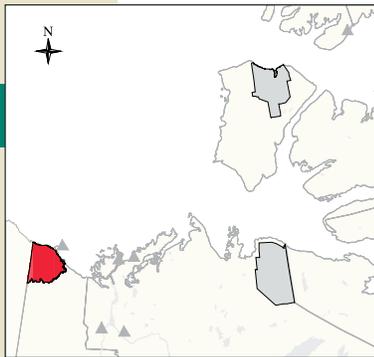
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Rationale

Approximately 80 percent of park visitors use some of the 35 campsites along the Firth River in Ivvavik National Park every year. 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 provide park managers with information necessary to make decisions about campsite closures and restoration.

Methods and Information Collected

- Thirty-five campsites 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 seasonal 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. 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 removing any waste or garbage left by people.



Wolf Tors campsite.

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 for measuring plant cover that have been impacted the most.
- A campsite reporting program began in 2000, asking park visitors which campsites they used. This information is used by Parks Canada to identify which campsites are likely to be most impacted by human use.

Results

- Campsites were monitored in the spring from June 12 - 23, 2003 and in the fall from August 21 to September 12, 2003.
- Cut firewood was found at the Crooked Creek campsite and 2 campsites were found to have distinct trails starting to form above the high water level.

Years of Data

- 1997- ongoing

Funding

- Parks Canada

Data Location

- Parks Canada, Inuvik

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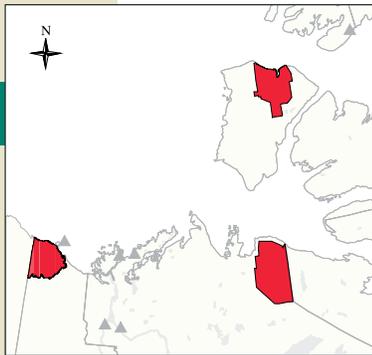
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Camping at Eagle Nest campsite on the Firth River, Ivvavik National Park.

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 visitors and Parks Canada staff who use the park, when and where they visit and the types of activities they conduct. 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 on visitor, Parks Canada staff, researcher and student numbers for 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.
- This information is summarized every year.

Years of Data

- Aulavik: since 1994
- Ivvavik: since 1989
- Tuktoyaktuk: since 1998

Results

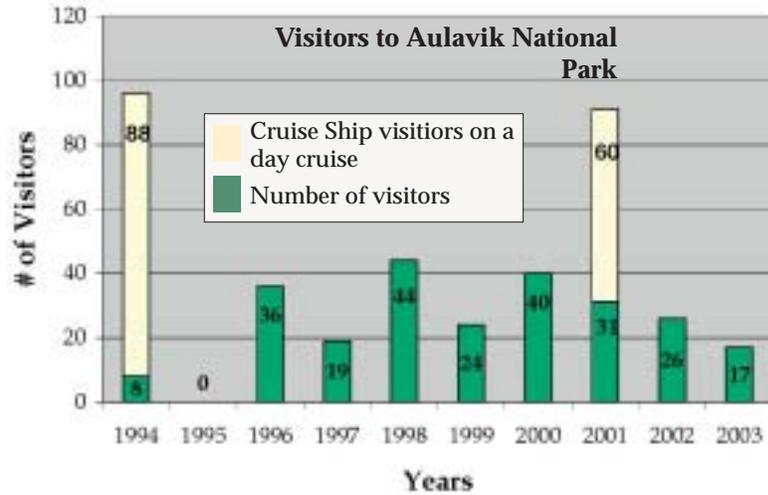
Aulavik National Park

- The number of visitors to Aulavik National Park has remained relatively constant in the last 8 years.
- In 1994 and 2001, 88 and 60 visitors from a cruise ship visited the park on a day excursion.



Viewing muskoxen in Aulavik National Park.

Results (continued)

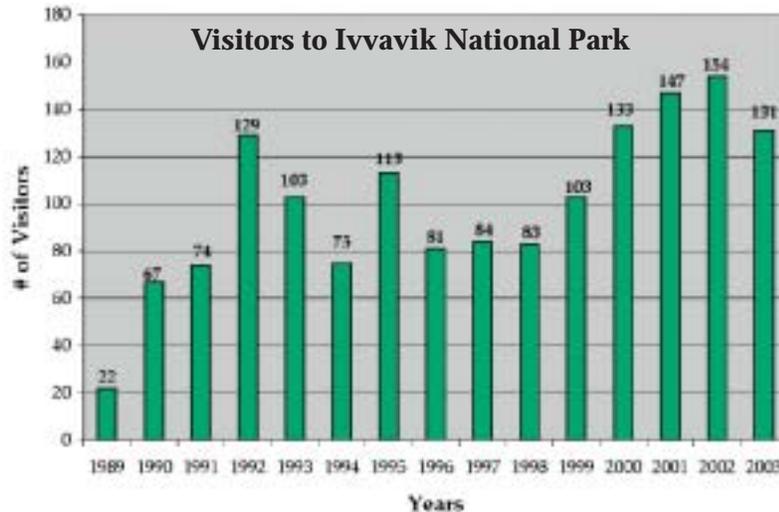


Ivvavik National Park

- The number of visitors to Ivvavik National Park decreased slightly in 2003.
- Since 1988, the number of commercial rafting trips has decreased and the number of private trips has increased.
- The number of hiking trips in the park has increased in recent years.



Rafting the Firth River, Ivvavik National Park.

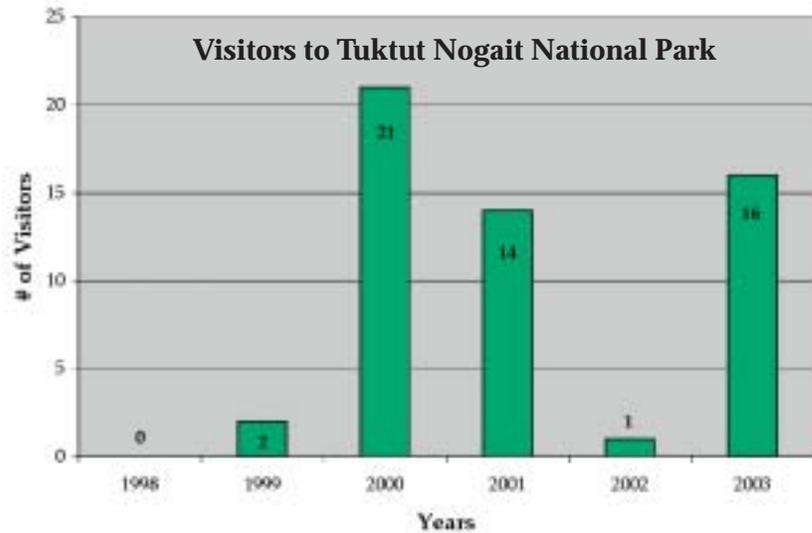




Camping along the Hornaday River, Tuklut Nogait National Park.

Tuklut Nogait National Park

- The number of visitors to Tuklut Nogait National Park increased in 2003.



Staff and Researchers

- Parks Canada staff and researchers made a total of 799 person-day visits of varying duration to Aulavik, Ivvavik and Tuklut Nogait national parks in 2003. A variety of resource management, public safety, law enforcement and education and interpretation activities were conducted during these visits.

Funding

- Parks Canada

Data Location

- Parks Canada, Inuvik

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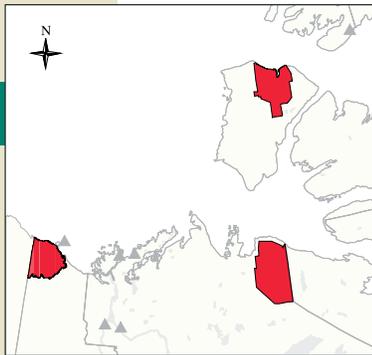
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	Aulavik National Park			Ivvavik National Park			Tuklut Nogait National Park		
	# of groups	# of visitors	visitor days	# of groups	# of visitors	visitor days	# of groups	# of visitors	visitor days
Canoe Trips	1	7	77						
Commercial Canoe Trips	1	10	140						
Raft Trips				9	67	624			
Commercial Raft Trips				4	56	590			
Kayak Trips				1	3	42			
Hiking Trips				3	5	48	4	7	110
Commercial Hiking Trips							1	9	89
Day Use Trips									
Total	2	17	217	17	131	1504	5	16	200



Rationale

Information about climate change indicates that the temperature of the earth has increased over the past 100 years. This increase is likely caused by human activities, especially burning fossil fuels and deforestation. 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

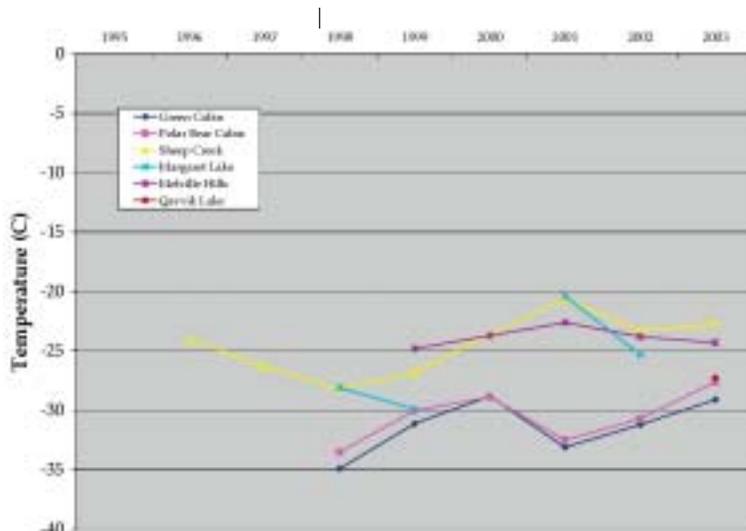
- To monitor weather, permafrost temperature and active layer temperature in Aulavik, Ivvavik and Tuktoyaktuk national parks.

Methods and Information Collected

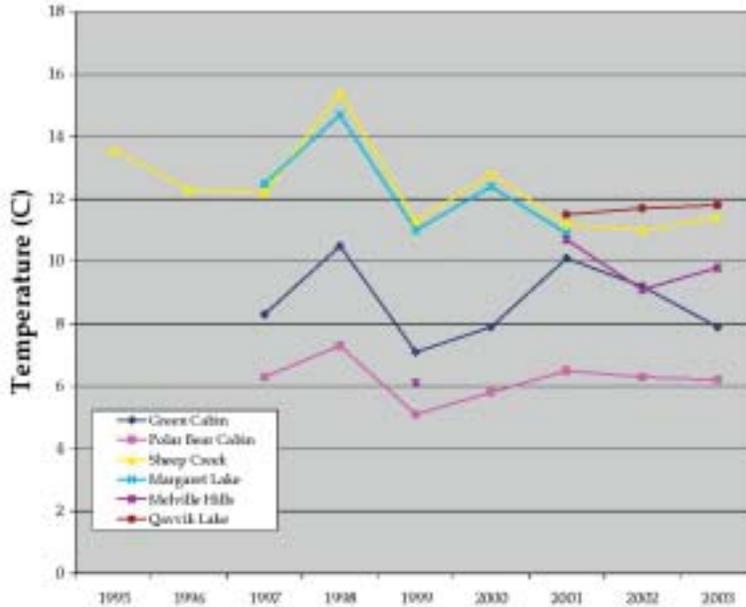
- Aulavik, Ivvavik and Tuktoyaktuk national parks each have two weather stations.
- All of the weather stations record the following:
 - precipitation
 - wind speed and direction
 - air temperature
 - incoming short wave radiation
 - relative humidity
 - dew point
 - snowfall and snow depth
 - barometric 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. Permafrost probes are not installed in Tuktoyaktuk National Park due to the nature of the substrate (bedrock) at the weather stations.
- All measurements, except for snow depth, barometric pressure, permafrost and active layer temperature, are taken 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.



Weather station at Sheep Creek.



Mean January temperature at weather stations in Aulavik, Ivvavik and Tukturnogait national parks, 1995-2003.



Mean July temperature at weather stations in Aulavik, Ivvavik and Tukturnogait national parks, 1995-2003.

Years of Data

- The weather stations operated by the Western Arctic Field Unit were installed between 1995 and 1999.
- Permafrost probes were installed in Aulavik National Park in 2000, and in Ivvavik National Park in 2001 and 2002. Permafrost probes will not be installed in Tukturnogait National Park due to the nature of the substrate (bedrock) at the weather stations.

Partners

- Environment Canada, Atmospheric Environment Service

Funding

- Parks Canada

Data Location

- Parks Canada, Inuvik
- Environment Canada, Yellowknife

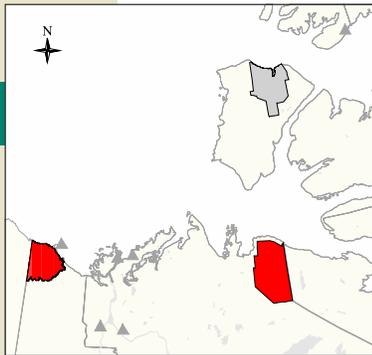
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Rationale

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 in 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 in 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 and crossings.

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 Firth River is located at 69° 19' 37" N; 139° 34' 8" W.
- The station on the Hornaday River is located outside of the park at 69° 10' 41" N; 123° 15' 01" W. The station is approximately 5 km downstream of the west park boundary.

Years of Data

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

Partners

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



August water levels at La Ronciere Falls, Hornaday River.

Funding

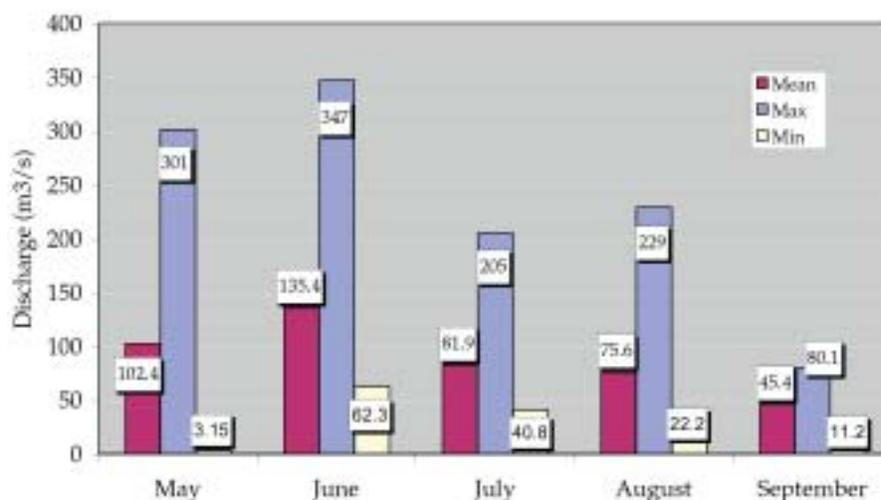
- Parks Canada
- Environment Canada, Water Survey Branch
- Fisheries and Oceans Canada
- Fisheries Joint Management Committee
- Polar Continental Shelf Project

Data Location

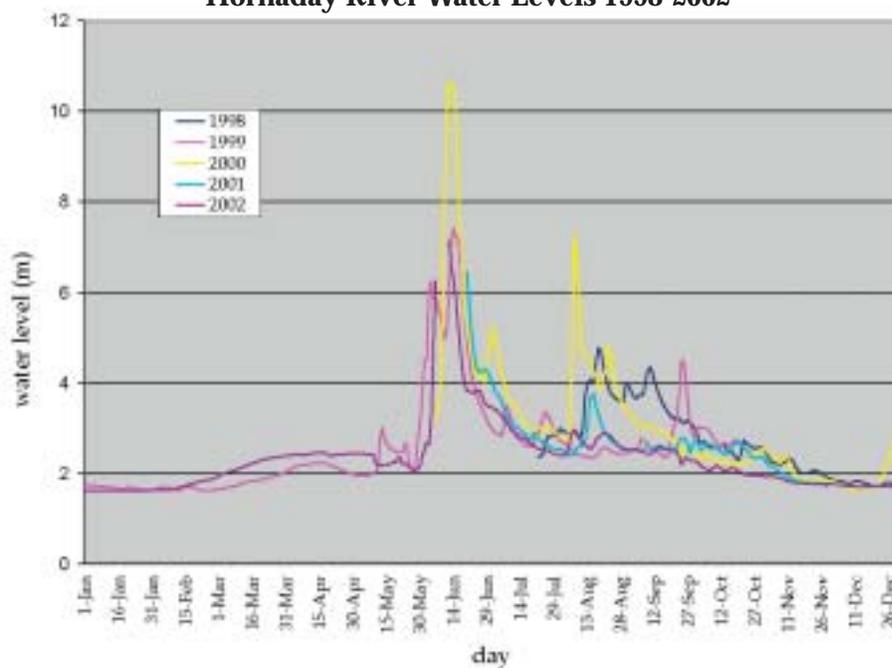
- Parks Canada, Inuvik
- Environment Canada, Water Survey Branch, Yellowknife

Results

Mean monthly discharge for the Firth River, YK
1972-2002



Hornaday River Water Levels 1998-2002



Contacts

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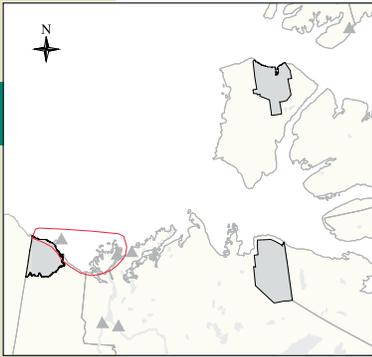
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Rationale

The Beaufort Sea coast is one of the most rapidly changing coasts of Canada. Coastal erosion (as much as 20 m in a single storm in some low-lying areas) threatens historical sites, archaeological sites and the coastal environment. Predicted climate-induced changes in sea ice and temperature, and possible changes in storm frequency and intensity, will likely result in an increase in coastal instability. This research program was originally initiated to examine historical and archaeological sites at risk from coastal erosion. In recent years, oil and gas exploration, pipeline-related activities and proposed marine protected areas have raised issues in relation to coastal stability and oil spill sensitivity.



Climate change

BEAUFORT SEA COASTAL MONITORING

Geological Survey of Canada, Natural Resources Canada

Objectives

- To improve our understanding of Beaufort Sea coastal stability.
- To monitor changes along the Beaufort Sea coast at sites that represent specific coastal environments or are cultural or historical sites.
- To investigate changes in water levels and temperature during storms along the southeastern Beaufort Sea coast.

Methods and Information Collected

- Videos, air photos, satellite imagery and ground photos are taken of coastal areas.
- Cliff and beach topography, near shore bathymetry, sediment samples and water levels are measured.
- Sediment grain size is measured using settling tubes and sedigraph or coulter counters.
- Sea temperature and storm surge monitoring is conducted at various locations along the Beaufort Sea coast. Probes are located at Shingle Point, Stokes Point and Nuneluk Spit along the coast of Ivvavik National Park. There are also probes at locations in Alaska, and at Kendall Island and Tuktoyaktuk.
- Probes are used to measure sea temperature and storm surges. The probes are cylinder shaped and are approximately 10 cm long and 3 cm in diameter. The probes are attached to a weight and placed in 1-3 m of water.
- Parks Canada is responsible for setting out and retrieving probes along the coast of Ivvavik National Park. The probes are set out in July and retrieved in July of the following year when the new probes are set.



Steve Solomon measuring coastal erosion at Komakuk Beach.

Results



Log cabin and eroding cliff edge at Nunaluk Spit.

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Years of Data

Partners

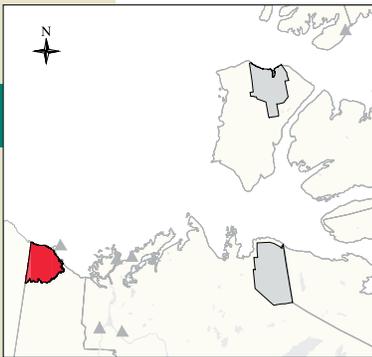
Funding

Data Location

- In the absence of permanent tide gauges, storm surge probes have proven to be a suitable tool for monitoring summer and early fall water levels along the Beaufort Sea shoreline.
- The probes recorded a water surge associated with a storm on August 10-14, 2000. This storm showed the differences in timing and height of water surges at different locations. Surges were later, higher and longer in the west.
- A dramatic change in wind speed and direction around Prudhoe Bay was noted from August 18-27, 2001. This coincided with a decrease in water levels throughout the region.
- Coastal sites were ranked according to their relative vulnerability to erosion. Coastal mapping at 1:50 000 scale was completed in 1999 using aerial videography. Monitoring for this phase of the project was completed in 2000-01. Analysis and reporting is expected to be completed by the end of 2001-2003.
- Several reports have also been produced - *Draft Report to Department of National Defence and Ivvavik National Park on Erosion at the Komakuk DEW Line Site* (1998, Steve Solomon). *Kitigaaryuit Archaeological Inventory and Mapping Project - 1997* and *Kitigaaryuit Archaeological Inventory and Oral Traditions project - 2001* have also been produced in conjunction with Elisa Hart.
- A digital coastal information system has been developed and used to rank the erosion hazard along the Beaufort coastline
- Data from 2003 illustrate that rapid retreat is continuing at most sites. The very low-lying site at Niaqulik and the Nunaluk Spit tundra island are changing particularly rapidly. The log house on Nunaluk Spit will likely be at the cliff edge within the next 5-10 years at the present rate.
- Fieldwork for this project was carried out in 1994, 1995, 1996, 1997, 1999, 2000 and 2003. In 2001, fieldwork was conducted in Kitigaaryuit National Historic Site in order to assess the stability of, and hazards to, cultural sites in the area.
- Geological Survey of Canada, Natural Resources Canada (project lead)
- Fisheries and Oceans Canada
- Parks Canada
- U.S. Fish and Wildlife Service
- Environment Canada
- Panel on Energy Research and Development
- Geological Survey of Canada, Natural Resources Canada
- Polar Continental Shelf Project
- Geological Survey of Canada (Atlantic), Dartmouth

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 after a clean-up was completed in 2000. The clean-up involved demolishing buildings, excavating contaminated soil, remediating an area where fuel was spilled, collecting debris, excavating three landfills and closing a fourth. A landfill and fuel spill monitoring program to monitor conditions at the site after the clean-up has been developed and implemented by Inuvialuit Environmental and Geotechnical Inc. (IEG) in cooperation with the Department of National Defence (DND), the Inuvialuit Regional Corporation (IRC) and Parks Canada.



Solid waste

KOMAKUK BEACH CLEAN-UP MONITORING

Objectives

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

Methods and Information Collected

- Komakuk Beach is located on the Yukon North Slope at 69° 35'53" N; 140° 11'00" W.
- The monitoring program has two phases, both conducted by IEG. Phase One started with a site visit on September 5 and 6, 2004 and will end in the summer of 2005. Phase Two will start in 2007 and take place for a total of 20 years, with summer visits to Komakuk on the second, third, fifth, tenth and twentieth year.
- Samples are taken from the fuel spill monitoring wells.
- The landfill sites are monitored for vegetation growth, settlement, erosion, discoloration and odours.

Results

- Monitoring will begin in September 2004 and results will be available in the summer of 2005.

Years of Data

- Clean-up conducted in 1999 and 2000
- Monitoring began in September 2004

Partner

- Department of National Defence – Defence Construction Canada
- Inuvialuit Regional Corporation

Funding

- Department of National Defence



Fuel spill monitoring well at Komakuk Beach.

Data Location

- Department of National Defence, Ottawa



Komakuk Beach fuel spill site.

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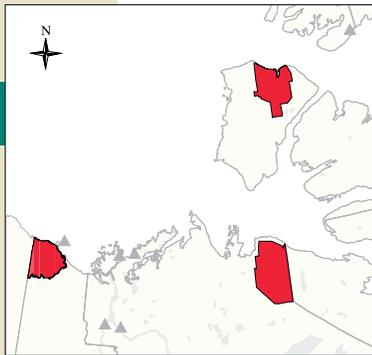
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Clean-up efforts at
Komakuk Beach.



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 2 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.
- Water quality samples are analysed for physicals, nutrients, major cations, major anions, trace metals and organics.



Christian Bucher drilling a hole in the Hornaday River ice to take a water sample.

Results

- The Firth River was sampled in May, June and August in 2003.
- The Thomsen River was sampled in July 2003.
- The Hornaday River was sampled in June, July and September in 2003.
- Results from the Thomsen, Firth and Hornaday rivers indicate that all three rivers have excellent water quality.
- Traces of lindane, a pesticide used in other regions of Canada and around the world, has 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 Tukut Nogait: since 1999
- Ivvavik: since 2000

Partners

- Environment Canada

Funding

- Parks Canada

Data Location

- Parks Canada, Inuvik
- Environment Canada, Yellowknife

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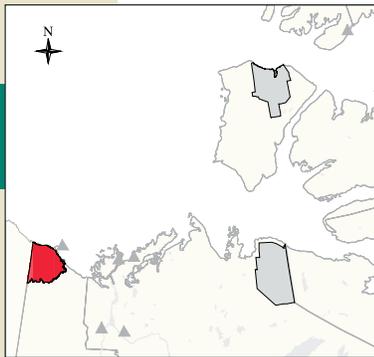
The Hornaday River.



The Thomsen River.

Rationale

The Firth River corridor has over 100 identified cultural sites. These range from early occupation sites of 8000-10,000 years ago to gold mining sites from the mid to late 20th century. Today, humans, wildlife and natural processes such as erosion may impact some of these sites. Parks Canada monitors these sites to determine their condition, the rate at which they are changing and the cause of these changes. This information helps with determining if action needs to be taken to protect the site, and which actions would be the most effective.



Cultural resources

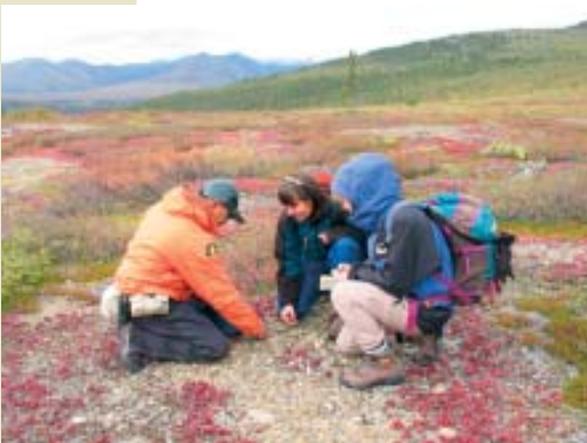
FIRTH RIVER CULTURAL RESOURCES MONITORING

Objectives

- To identify threats to cultural sites along the Firth River in Ivvavik National Park.
- To measure the rate and extent of change to cultural sites along the Firth River.
- To determine thresholds of change that indicate when actions need to be taken to protect cultural sites.
- To take action, when required, to protect these cultural sites and the artifacts contained within them.

Methods and Information Collected

- Monitoring is conducted for 7 cultural sites downstream of Sheep Creek.
- The cultural sites that are monitored were previously identified and described. The sites were photographed, and threats were identified, in 1999.
- Photographs and measurements of soil erosion are used to determine if the sites have changed.
- The cultural sites along the Firth River are monitored every 5 years. The next site assessment will be conducted in 2005.



Mervin Joe, Roberta Hartman and Jacquie Bastick examining stone chips at the Caribou Drive cultural site.

Results

- The main threats to cultural sites along the Firth River are natural erosion, trampling and burrowing by animals, and human disturbance.
- Erosion may affect sandy sites that are on the river bed. The sand is eroded by the wind, which reduces the size of the site and uncovers artifacts.
- Sites found on the raised cobble riverbed are very stable and unlikely to change much over the next few decades.
- The disturbance of sites by wildlife is a concern at sites near the river bank and on soft ground. Sites may be trampled by migrating caribou or damaged by burrowing ground squirrels.

Years of Data

- 1995 - original site surveys
- 1999 and 2000

Funding

- Parks Canada

Data Location

- Parks Canada, Inuvik
- Parks Canada, Western Canada Service Centre, Winnipeg



Artifacts found along the Firth River corridor.

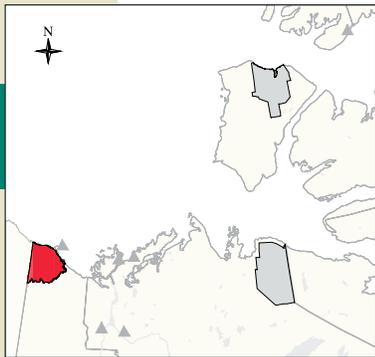


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Rationale

There are concerns that erosion is damaging and completely washing away cultural sites along the coast of Ivvavik National Park. The impact of coastal erosion on these sites may increase in the future if climate change increases the size and frequency of storms in the Beaufort Sea. Monitoring of cultural sites along the coast of Ivvavik National Park is conducted to assess and monitor the impact of erosion on coastal sites, and to recommend actions to protect these sites and their artifacts.



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 develop a monitoring strategy for sites at risk to erosion and visitor disturbance.
- To recommend actions to protect cultural sites and artifacts at sites that are at risk.

Methods and Information Collected

- Cultural resources along the coast of Ivvavik National Park are monitored every 2 years. The next site assessment will be conducted in 2004.
- Initial surveys of cultural sites in Ivvavik National Park were conducted in 1987 and in 1997. Twelve of these sites were visited in 2000 to determine their condition and to develop methods for monitoring them.
- Photographs taken from established photopoints are used to determine changes.

Years of Data

- 1987, 1997, 2000 and 2002
- 12 sites were monitored in 2002

Funding

- Parks Canada

Data Location

- Parks Canada, Inuvik
- Parks Canada, Western Canada Service Center, Winnipeg



Monitoring stakes along the Ivvavik coast.

Methods and Information Collected (continued)

Site Number	Traditional Name/Location
30Y48 (82Y)	Niaqulik
30Y61 (85Y)	Qargialuk
30Y64 (83Y)	(Paul Kayotuk's place)
30Y64 (84Y)	(Wilson Suplu, Charlie Gordon/Daniel Kapuk's place)
30Y90 (69Y)	Nunaaluk Spit
30Y78 (68Y)	Nunaaluk village, Shinikruaq
30Y96	Clarence Lagoon
30Y97 (74Y)	Hudson Bay post, Clarence Lagoon
30Y113 (76Y)	Clarence Lagoon
30Y59	Roland Bay
30Y57 (36Y)	Umiak Site
30Y56 (91Y)	Near Stokes Point DEW Line station

The name and location of the cultural sites monitored along the coast of Ivvavik National Park.



Erosion under an icehouse.



Log house located along the coast.

Results

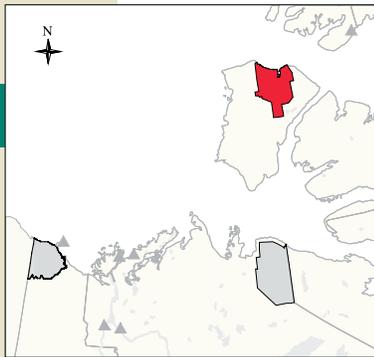
- Many of the 12 sites are increasingly threatened by coastal erosion.
- House foundations and gravesites at many sites are being threatened by the encroachment of banks, and, in some cases, storms have already washed them away.
- Evidence of recent human activity, such as new windshelters, can be found at some sites. Artifacts appear to have been untouched by visitors.
- A decision was made to monitor the sites every 2 years in order to provide frequent updates about their condition.
- Decisions about preventing the sites from eroding or allowing them to be destroyed will have to be made. These decisions will be made in consultation with the Inuvialuit.
- A salvage project was completed in 2001 at Niaqulik to document and recover artifacts from this site. This site had 2 remaining sod houses that were likely to be destroyed by erosion.

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Rationale

Monitoring cultural sites helps to ensure that the sites are protected and the important artifacts they may contain are not damaged or lost. Nasogaluak, M'Clure's Cache and Head Hill are three large cultural sites in Aulavik National Park. Nasogaluak cultural site consists of approximately 100 stone structures including tent rings, caches, akatut (areas paved with large, flat slabs of stone) and wind breaks. The M'Clure's Cache site has the remains of a cache built by Robert M'Clure and his crew when they wintered in Mercy Bay from 1851 to 1853. The Head Hill site consists of at least 43 identifiable features, including tent rings and hearths, and the remains of an estimated 800-1000 muskoxen. These sites are monitored to identify threats to the sites, to determine if the sites have changed, and to recommend measures for protecting the sites.



Cultural resources

AULAVIK CULTURAL RESOURCES MONITORING

Objectives

- To identify impacts to the cultural resources at Nasogaluak, M'Clure's Cache and Head Hill cultural sites.
- To monitor changes to these cultural sites.
- To recommend measures to protect these cultural sites.

Methods and Information Collected

Nasogaluak Cultural Site:

- The Nasogaluak cultural site is located on the east bank of the Thomsen River approximately 8 km south of Green Cabin. The site is monitored every year.
- Seven photographs are taken of specific features from designated photopoints.
- Measurements are taken to determine if items at the site have been moved.
- Fragments of grey quartz sandstone are counted.

M'Clure's Cache Cultural Site:

- M'Clure's Cache cultural site is located along the western shore of Mercy Bay. The site is monitored every 2-3 years.
- Photographs are taken at 9 photopoints. These photos are compared with existing photos of the site to determine if there are any major changes to the artifacts and to the overall site.
- Barrel parts are counted in 3 areas.
- The condition of 3 selected artifacts is described.



A topsail yard at M'Clure's Cache.

Methods and Information Collected (continued)

Results



Christine Aikens and Ian McDonald examining artefacts at Head Hill.

Head Hill Cultural Site:

- The Head Hill cultural site is located at the junction of the Muskox and Thomsen rivers. The site is monitored every year.
- Photographs are taken from 5 photopoints to determine if the site has changed.
- The distance from reference points to artifacts is measured to determine if the artifacts have been moved.
- Muskox skulls are counted in 5 circular plots.

Nasogaluak Cultural Site:

- The site was visited on July 3, 2003.
- Two skulls beside a cache had been moved and a rib added to the same cache. The skulls were returned to their original position.
- Photographs indicate that there have not been any significant changes to the site since 1997.

M'Clure's Cache Cultural Site:

- The site was visited on July 20, 2003.
- Counts of barrel parts have been inconsistent between years. Methods used to count barrel parts are being reviewed.
- Disturbances to the coal mound and one boot sole were noted.
- Disturbance to artifacts identified during monitoring appear to be caused by environmental factors (e.g. weather, erosion) and wildlife.

Head Hill Cultural Site:

- The site was visited on July 8, 2003.
- One muskoxen skull had been moved. The skull was also moved in 2002. The skull was returned to its original location.
- Photographs indicate that there have not been any significant changes to the site since 1997.

Years of Data

- Nasogaluak: 1997, 1999, 2000, 2001 and 2002
- M'Clure's Cache: 1997, 2000
- Head Hill: 1997, 1999, 2000, 2001 and 2002

Funding

- Parks Canada

Data Location

- Parks Canada, Inuvik

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