MONITORING THE ENVIRONMENTAL AND ECOLOGICAL IMPACTS OF CLIMATE CHANGE ON BYLOT ISLAND, SIRMILIK NATIONAL PARK

2005-2006 ANNUAL PROGRESS REPORT

by

Marie-Christine Cadieux
Gilles Gauthier
Département de biologie et Centre d'études nordiques
Université Laval

Catherine Gagnon
Département de biologie, chimie et sciences de la santé
Université du Québec à Rimouski

Dominique Berteaux
Département de biologie, chimie et sciences de la santé et Centre d'études nordiques
Université du Québec à Rimouski

Esther Lévesque
Département de chimie-biologie et Centre d'études nordiques
Université du Québec à Trois-Rivières

Joël Bêty
Département de biologie, chimie et sciences de la santé et Centre d'études nordiques
Université du Québec à Rimouski

29 March 2006

INTRODUCTION

Global climatic change caused in part by the greenhouse gases released due to human activities is a major challenge faced by the earth ecosystems in this century. However, nowhere else on earth are these effects more threatening than in the Arctic. Indeed, all models predict that warming trends will be strongest in the Polar Regions as Arctic temperatures should increase by as much as 4° to 7°C over the course of the XXIth century (ACIA 2004). Precipitation is also expected to increase from 10 to 20%, as well as daily and seasonal variability in both temperature and precipitation, leading to more frequent climatic extremes. Recent analyses indicate that temperatures in the Arctic have been increasing steadily for the last three decades, and the extent and thickness of sea ice has been reduced considerably (Moritz et al. 2002, ACIA 2004).

Several long-term studies in different parts of the globe have detected ecological changes due to climate warming, such as alterations in geographical and breeding ranges, flowering dates, breeding dates, and migration schedules (reviewed by McCarty 2001, ACIA 2004, Berteaux et al. 2004). Impacts of climatic changes on arctic ecosystems are expected to be particularly strong because community structure is increasingly dominated by abiotic factors as we move closer to the poles and the climate becomes harsher (Hansell et al. 1998). Disruption of close ecological linkages, such as trophic interactions among plants-herbivores and herbivores-predators, will affect a significant proportion of the species assemblages in these depauperate communities (Gauthier et al. 2004). Thus, the simple ecological communities of the arctic may be at great risk.

Yet, evidences of these changes and of their impacts on biological communities are still scarce in the Arctic, mainly because few sites have adequate long-term data sets to address these questions. Our ongoing, long-term ecological research program on Bylot Island, Sirmilik National Park, Nunavut has been running for 17 years and has become one of the longest, most comprehensive, and rigorous long-term biological monitoring program in Nunavut. We have been monitoring the abundance and reproduction of several key species of birds, mammals, and plants. In addition, we have been continuously recording the most significant climatic variables through a network of automated weather stations. Hence, this program offers an exceptional opportunity to fill important knowledge gaps on climate/ecosystem status and may help to improve future ecological monitoring programs at other sites in the Arctic.

OBJECTIVES

The overall aim of our project is to measure changes occurring in Arctic ecosystems, analyse temporal trends, and evaluate to what extent these changes are driven by climate warming. This is achieved by continuing and expanding for the period 2004-2008 the climatic and ecological monitoring already in place on Bylot Island, and involving local communities into our research activities. Our specific objectives are as follows:

1) Continue the climate monitoring of Bylot Island and examine temporal trends.
2) Continue the monitoring of breeding activities of key bird species and expand it to shorebirds and avian predators.
3) Continue the monitoring of lemming populations.
4) Continue the monitoring of the breeding activities of Arctic and Red Foxes.
5) Continue the monitoring of plant production in wetland communities and expand it to plant phenology and goose grazing impact.
6) Expand the monitoring of goose grazing impact to mesic communities.
7) Develop an Inuit Knowledge Component to our monitoring program in order to get a more complete understanding of the ecosystem and of the ecological impacts of climate change.
8) Hold an annual community workshop in Pond Inlet to discuss the project findings and future work.
9) Present study results to high school students in Pond Inlet.
10) Maintain the project English-French-Inuktitut web site.
11) Hire and train individuals from local communities.

METHODS

STUDY AREA

All field work is conducted on the south plain of Bylot Island at the northern tip of Baffin Island (Fig. 1). The island is a Migratory Bird Sanctuary and is also included in the Sirmillik National Park. Our activities are conducted primarily at 2 sites on the island, the Qarlikturvik Valley (73° 08’ N; 80° 00’ W) and the main goose nesting colony (72° 53’ N, 79° 55’ W; Fig. 1). At both sites, lowlands are covered by a mixture of wetlands and mesic tundra, and uplands are largely dominated by mesic tundra (Gagnon et al. 2004).

CLIMATIC DATA

We have 7 automated environmental monitoring stations at our study site. Our network includes 3 full climatic stations that record data on an hourly basis, year-round. One is in operation since 1994 (elevation: 20 m ASL), another one since 2001 (340m ASL) and the most recent one since 2004 (21 m ASL). The 2 oldest stations are 3-m high towers that record air temperature and humidity (at 2 m), soil temperature (at 2, 5 and 10 cm), wind speed and direction (at 3 m), direct solar radiation, and snow depth. The newest one is a 10-m meteorological tower that hosts more recording instruments and over a greater height range above the ground. In compliance with recognized standards, we record air temperature (at 5 m), wind speed and direction (at 10 m), full solar radiation (i.e. far infrared, photosynthetic active radiation, albedo, net solar radiation, and UV-B radiation, which was added in 2005), barometric pressure, soil temperature (at 5 and 10 cm; 2 sites each), snow depth and air humidity. A fourth station monitors ground surface temperature (at 2 cm) at 5 paired sites (each pair has a site protected from goose grazing by an exclosure and a nearby site exposed to grazing). Finally, 3 additional stations record permafrost temperature at various depths down to 3 m (2 sites) or 11 m (1 site). All automated stations were visited during the summer 2005 to download data and were found to be operating normally. A few damaged sensors (especially those recording ground temperatures) were replaced.

Daily precipitation is recorded manually during the summer (1 June to 20 August) using a pluviometer. Snowmelt is monitored from 1 June until snow disappearance using 2 methods: 1) by measuring snow depth at 50 stations along two 250-m transects at 2-day intervals, and 2) by visually estimating the proportion of snow cover on the study area every 2-3 days.

BIOLOGICAL DATA

Birds

Greater Snow Geese.— We monitor the reproduction of Greater Snow Geese (*Chen caerulescens atlantica*) annually on Bylot Island since 1989. Goose nests are searched extensively in the Qarlikturvik Valley and at the main goose nesting colony where several thousands geese nest every year. All nests monitored are positioned with a GPS receiver. Each nest, are visited several times during the nesting period. On every visit we determine the number of eggs and/or goslings (dead or alive) and from these data we are able to determine the following parameters: total clutch laid (total number of egg laid by the female during nesting), clutch size at hatch, number of goslings leaving nest, laying and hatching dates, and nesting success.

Avian predators. — We systematically monitor the reproduction of the Snowy Owl (*Nyctea scandiaca*) since 1993, and of jaegers (*Stercorarius* spp.) and Glaucous Gull (*Larus hyperboreus*) since 2004 (before then, data on gulls and jaegers were taken opportunistically). Every year, we search systematically for nests of these species in our two study areas (Qarlikturvik Valley and the main goose nesting colony). The position of all nests found is recorded with a GPS receiver and nests are revisited periodically to determine laying and hatching dates, total clutch laid, and nesting success.

Other bird species. — We have been monitoring the reproductive activity of Lapland Longspurs (*Calcarius lapponicus*) since 1995. Longspur nests are found in the Qarlikturvik Valley only while walking throughout the study area for other activities, often when females are flushed from their nest. Starting in 2005, systematic searches of shorebirds nests have also been conducted in the Qarlikturvik Valley. Species include White-rumped Sandpiper (*Calidris fuscicollis*), Baird's Sandpiper (*Calidris bairdii*), American Golden Plover (*Pluvialis dominica*), Black-bellied Plover (*Pluvialis squatarola*), Common Ringed Plover (Charadrius hiaticula), Red Phalarope (*Phalaropus fulicarius*), Purple Sandpiper (*Caladris maritime*) and Ruddy Turnstone (*Arenaria interpres*). The position of all nests found is recorded with a GPS receiver and nests are revisited periodically to determine laying and hatching dates, total clutch laid, and nesting success. Since 1996, information on the reproductive activity of other bird species is also collected opportunistically, mostly for Sandhill Crane (*Grus canadensis*), King Eiders (*Somateria spectabilis*) and Long-tailed Ducks (*Clangula hyemalis*).

Mammals

Lemmings.— We monitor the populations of Collared (*Dicrostonyx groenlandicus*) and Brown Lemmings (*Lemmus sibiricus*) using 2 techniques: deadly trapping, which has been conducted at two sites since 1994, and live trapping, a new sampling program that we developed in 2004. The deadly trapping monitoring takes place in July and follows the protocol of the small-mammal survey coordinated across the Northwest Territories and Nunavut by the Northwest Territories Renewable Resources office in Yellowknife (Shank 1993). This trapping is carried out in two study plots of the Qarlikturvik Valley (one in wetlands, one in mesic tundra) since 1994, and at a third study plot in mixed wetland/mesic tundra at the main goose nesting colony since 1997. We use Museum Special® traps baited with peanut butter and rolled oats. At each site, we use 50 traps set at 10-m intervals along two parallel transect lines 100 m apart (25 traps/transect) and left open for a period of 10 or 11 days for a total of ~500 trap-nights (50 traps × 10 nights) per plot. Traps are checked daily; all lemmings caught are identified at the species and sprung traps are reset.

Our sampling program based on live-trapping of lemmings uses 2 grids (300 × 300 m) laid out in the Qarlikturvik Valley (one in wetlands and one in mesic tundra), each with 100 Longworth® traps baited with apples and set at each grid intersection every 30-m. In 2005, we trapped during 4 consecutive days every 15 days on each grid from early July to mid-August. All trapped animals were identified, sexed, weighed and marked with electronic PIT tags (or checked for the presence of such tags).

Arctic and Red Foxes.— We monitor the breeding activity of Arctic (*Alopex lagopus*) and Red Foxes (*Vulpes vulpes*) at dens annually since 1993. Until 2002, den monitoring only occurred in the Qarlikturvik Valley and the vicinity of the main goose nesting colony (about 100 km^2). Dens were found opportunistically and their position recorded with a GPS receiver. The number of dens found thus gradually increased from 1993 to 2002. In 2003, we expanded the covered area to about 600 km^2 by conducting a systematic survey of fox dens, which considerably increased the number of known dens. All dens are visited at least once or more in June or early July and any signs of fox activity is noted (e.g. fresh digging, new hairs, fresh prey). Dens showing signs of activity are re-visited later in the summer to determine the presence of a litter and the number of pups in each litter. Litter size data are the minimum number of pups observed at dens, which may sometimes be lower than the true number of pups present. All observations of adults near dens are also noted, and the species of fox identified.

Plant monitoring

Plant production and goose grazing impact in wetland communities.— We monitor the annual plant production in wetlands and the impact of goose grazing at 3 sites on Bylot Island (see Fig. 1): the Qarlikturvik Valley (monitored since 1990), the main goose nesting colony (monitored since 1998), and north of Pointe Dufour (monitored since 1998). At each site, 12 exclosures (1 × 1 m fenced areas built with chicken wire to keep geese off the plots) are installed in late June. At the end of the plant-growing season (i.e. mid-August), we sample the vegetation inside and outside the exclosures (i.e. ungrazed and grazed areas, respectively). All live above-ground plant biomass is cut, sorted out into sedges (*Eriophorum scheuchzeri* or *Carex aquatilis*), grasses (mostly *Dupontia fisheri*), and forbs, dried, and weighed. Above-ground biomass of vascular plants includes all green material and white basal stems buried in mosses. Live above-ground biomass in mid-August is a good measure of annual graminoid production (Gauthier et al. 1995).

Plant phenology in wetland communities. — In 2005, we expanded our monitoring to the plant phenology of *C. aquatilis*, *E. scheuchzeri* and *D. fisheri* in the Qarlikturvik Valley. Inside each exclosure, a permanent quadrat of 25 × 25 cm was delimited and every 2 weeks the number of shoots of each species was determined as well as their phenological stages, i.e. green leaves only, buds emergence, stigmas visible (*C. aquatilis* only), anthers visible, yellowing leaves (*C. aquatilis* only), fruits formed (*E. scheuchzeri* and *D. Fisheri* only), seed dispersal.

Grazing impact in mesic communities.— In 2002 we established an experimental set-up of long-term exclosures in two dominant mesic habitats used by geese (mesic meadows on the hills and mesic polygons in the lowlands; see Fig. 1). This experiment includes, in each community, three treatments: goose exclosure (3 × 2 m surrounded by chicken wire 0.45 m high, 2.5-cm mesh), goose+lemming exclosure (3 × 2 m surrounded by welded wire 0.45 m high inserted 0.15 m into the ground, 1.25-cm mesh) and control (unfenced plots receiving normal grazing pressure) in 4 replicated blocks (each with 3 groups of exclosures and a control) for a total of 24 groups of exclosures.

In 2003, 2004 and 2005, we monitored the grazing impact in mesic habitat using this experimental set up. To quantify the plants grazed by geese and lemmings, each treatment (see above) was sampled with two marked contiguous 70 × 70 cm quadrats early (prior to massive goose arrival in the valley) and late in season (mid-August). All inflorescences (and the phenological stage) and marks of grazing and/or grubbing (mostly on leaves and shoots) were counted. It was possible to distinguish and exclude grazing by invertebrates (mostly insects). To assess use by geese, permanent 1 × 20 m feces transects were marked and the number of feces were counted at each visit (early and late summer).

INUIT TRADITIONAL ECOLOGICAL KNOWLEDGE

In fall 2004, we initiated an Inuit Traditional Ecological Knowledge (TEK) study. The goal of the study is to integrate TEK and Western science to have a more complete understanding of arctic ecosystems as well as to document changes observed in the local environment. More specifically, the study aims at gathering Inuit Knowledge on (1) important components of the local terrestrial ecosystem, namely the Snow Geese and Arctic and Red Foxes and (2) changes observed in the environment. At a specific level, TEK will help us document long-term trends in abundance and distribution of geese and foxes, as well as better understand the importance of these species for the local community. At a more general level, TEK will also help understand changes that are occurring in the North Baffin area. Through the project, the investigators also aim at building a framework for increasing the integration of Inuit Knowledge in the management of the Sirmilik National Park of Canada.

The original plan for this study was to collect TEK in both the communities of Arctic Bay and Pond Inlet. However, due to logistical and monetary constraints, knowledge gathering has been restrained to the Pond Inlet community. On the other hand, working in a single community allowed researchers to spend more time in the community and build a meaningful relationship with local experts.

Following consultations in February 2005 (c.f. our 2004-2005 annual progress report), MSc student Catherine Gagnon resided in Pond Inlet from May to September 2005 and conducted an important part of knowledge gathering for this project. Over this period, local experts were interviewed using the informal semi-directive interview method. Semi-directed interviews are open and flexible, and allow avoiding the rigidity of questionnaires. We selected local experts to be interviewed based on recommendations from the Elders, members of the local

Hunters and Trappers Association, people from the Hamlet Office, and community members working for Parks Canada and the Nunavut Wildlife Management Board. During interviews, maps stimulated conversation and were used as a recording aid. With the consent of informants, a local student assistant recorded (audio and video) all interviews. All interviews were also simultaneously translated in Inuktitut and English with the assistance of a local translator. Most interviews were conducted at the Nattinak Visitor Centre of Pond Inlet, but one interview was also conducted at our Base-camp in the Qarlikturvik Valley on Bylot Island and another one was performed in Nadluat, a traditional camping site.

PRESENTATIONS AND COMMUNITY WORKSHOP

We organized a day and a half workshop on ecological monitoring on Bylot Island and TEK study with representatives from the community of Pond Inlet on 14 and 15 February 2006. Invited representatives were from the Joint Park Management Committee (JPMC Pond Inlet members), the Hamlet of Pond Inlet, the Mittimatalik Hunters and Trappers Organization (HTO), the Government of Nunavut, the Nattinak Center of Pond Inlet, the Elders of Pond Inlet, the Inuit Knowledge Working Group of Pond Inlet, the Parks Canada Office in Pond Inlet and the RCMP. The workshop was co-organized by Dominique Berteaux and Catherine Gagnon, with support from the local Parks Canada Office, and held in the conference room of the Nattinak Visitor Centre, Pond Inlet. One researcher (Dominique Berteaux) and one student (Catherine Gagnon) from a southern university (Université du Québec à Rimouski) attended the meeting. The workshop was followed by an evening public presentation (15 February) at the Nattinak Center, Pond Inlet. Everybody from the community was invited to attend the public meeting through announcements made on the local radio. Simultaneous Inuktitut/English translation was also available during the workshops. On the afternoon of 15 February, as well as on 16 and 17 February, Dominique Berteaux and Catherine Gagnon gave talks to the students of the Pond Inlet Ulaajuk Elementary School and Nassivik High School. In both cases, school principals organized the schedule of these talks.

RESULTS

CLIMATIC DATA

The data retrieved from our automated environmental stations in 2005 spanned the period from summer 2004 to summer 2005. All data were compiled, validated (e.g. missing or erroneous values were excluded), and archived. We present here an overview of the most important climatic variables during the last year, and an update of the long-term trends.

Air Temperature

The year 2004 (the last year for which we have a complete record) was the coldest year of the past 10 years on Bylot Island (mean annual temperature: -15.8°C, which is 1.3°C below the long-term average). However, there is no detectable trend yet in annual air temperature (Fig. 2). Fall 2004 and spring 2005 temperatures were above average but summer 2004 and winter 2004-2005 were below average. There was no trend observed in temperature for any of the seasons at Bylot Island (Fig. 3). The number of thawing degree-days (TDD) was below the long-term average during 2004, especially during the summer, but TDD was above average during fall 2004 and, near average during the spring 2005 (Fig. 4).

Snow cover and precipitations

The snow pack in spring 2005 was near normal with an average snow depth of 33.6 cm on 1 June compared to a long-term average of 31.5 cm. Snow depth varied greatly among years, but no trends were detected (Fig. 5). The percentage of snow cover recorded in the lowlands of the Qarlikturvik Valley on 5 June was 80%, above the long-term average. Snow cover varied similarly to snow depth, with no evidence of a temporal trend (Fig. 6). Despite the deeper snow pack in 2005 compared to 2004, snow-melt was relatively fast this year (Fig. 7). Again, there were large inter-annual differences in the speed of snowmelt, and no temporal trend was found.

The summer 2005 was the second wettest on record on Bylot Island, with 132 mm of rainfall compared to a long-term average of 97 mm. Although we found no evidence of a temporal trend in total summer rainfall, rainfall during the month of July showed a positive temporal trend, with an increase of 43.8 mm of rain over the last 10 years (Fig. 8).

Wind speed

Mean annual wind speed in 2004 was 2.0 m s^{-1} on Bylot Island, which is the long-term average (Fig. 9). Summer 2004 and spring 2005 wind speed were near average while fall 2004 was above average and winter 2004-2005 was below average (Fig. 10). We found no detectable trends in wind speed either on an annual or seasonal basis.

BIOLOGICAL DATA

Birds

Greater Snow Geese.— Overall, the median date that the first egg was laid in goose nests (i.e. egg-laying date) in 2005 was 12 June, which is also the long-term average (12 June). Mean egg-laying date showed relatively large inter-annual variations (from 6 to 20 June but analyses revealed no temporal trend in egg-laying dates; Fig. 11A). However, it should be noted that in the 4 years following the instauration of a spring hunt for geese in Québec (1999), egg-laying dates were all late or very late. The spring hunt disrupted the accumulation of fat by geese in spring, and this had a negative impact on subsequent reproduction (reduced reproductive effort and delayed phenology; Mainguy et al. 2002, Bêty et al. 2003, Féret et al. 2003, Reed et al. 2004).

Because incubation has a set time length in birds (23-24 days in snow geese), egg hatching dates followed annual trends similar to laying dates. In 2005, hatching date was 8 July (n = 197), which is the long-term average (8 July). There was no detectable long-term trend in hatching date (Fig. 11B).

The mean number of eggs per nest (i.e. total clutch laid) was 3.60 ± 0.08 eggs (n = 156) in 2005, very close to the long-term average (3.70; Fig. 12). We did not find any temporal trends in clutch size.

Nesting success (proportion of nests hatching at least one egg) in 2005 was good (66%, n = 226) and very close the long-term average (64%; Fig. 13). We did not find any temporal trends in nesting success.

***Avian predators*.—** Snowy Owls only nest in peak lemming years, which occur every 3-4 years on Bylot Island (see below). Owl nests were thus previously found in 1989, 1993, 1996, 2000 and 2004. In 2005, no Snowy Owls were found nesting in our study area.

In 2005, we found 11 nests of Glaucous Gulls in the Qarlikturvik Valley and 1 at the goose colony, and 9 nests of Long-tailed Jaegers at each study site (Table 1). Mean egg laying date of gull nests was 13 June and 16 June for jaegers; mean hatching date were 10 July and 11

July, respectively. Mean clutch size was 2.9 in gulls and 1.8 eggs in jaegers. Nesting success of gulls was 80% while most jaeger nests were predated and only 8% of them produced young.

***Shorebirds*.—** Our new monitoring of shorebird species was successful in 2005. Among the eight species monitored, five of them were found nesting, mostly in the Qarlikturvik Valley (Table 2). The most abundant shorebirds were the White-rumped Sandpiper (39 nests), the Baird's Sandpiper (20 nests) and the American Golden Plover (6 nests). Black-bellied Plover (1 nest), Red Phalarope (1 nest), Common Ringed Plover, Purple Sandpiper and Ruddy Turnstone were also observed on the island during the summer. Clutch size of all shorebird nests monitored was 4.0 eggs. Mean laying and hatching dates were between 10 and 18 June, and 4 and 18 July, respectively (Table 2). Overall, Baird's Sandpipers had the highest nesting success (25%) followed by American Golven Plovers (19%) and White-rumped Sandpipers (11%).

***Lapland Longspurs and other bird species*.—** In 2005, we found a record number of Lapland Longspur nests (68, Table 3). Large annual variations in number of nests found in part reflect variations in sampling effort among years. Egg-laying and hatching dates of longspurs in 2005 were 21 June (n = 32; long-term average: 17 June) and 3 July (n = 19; long-term average: 4 July), respectively. No temporal trends were detected for both laying and hatching dates. The clutch size was 5.1 ± 0.1 eggs (n = 57), slightly below the long-term average (5.3; Table 3) and no temporal trend was detected. Nesting success was very low (19%, n = 62) and below the long-term average (54%).

We also found 1 nest of Sandhill Cranes, 5 of King Eiders and 4 of Long-tailed Ducks in 2005 (Table 3).

Mammals

***Lemmings*.—** As commonly observed in the Arctic, lemming populations have been going through marked cycles of abundance on Bylot Island. Our longest record in the Qarlikturvik Valley indicated that cycles lasted 3 to 4 years, with peak abundance occurring in 1993, 1996, 2000 and 2004 (Fig. 14). Trapping conducted at the main goose colony suggested that the two sites generally fluctuated either in synchrony or possibly with a 1-year time lag in the main goose colony for the peak years of lemming abundance (Fig. 14).

The relative abundance of the two lemming species generally differed between the two sites (Fig. 15). In the Qarlikturvik Valley, the site with the highest density of wetlands, Brown Lemmings were typically more abundant than Collared, whereas at the main goose colony, where mesic tundra is most abundant, the reverse was true, except during the 2001 lemming peak. In 2005, abundance of Brown Lemmings was very low at both sites whereas the one of Collared Lemmings was low in the Qarlikturvik Valley and moderate at the main goose colony. The large annual fluctuations in lemming abundance precluded the examination of long-term trend in abundance.

For the second year of our live-trapping monitoring program for lemming populations, we captured a total of 55 lemming individuals, of which 24 were recaptured more than once (Table 4). We captured 12 Brown Lemmings and 13 Collared Lemmings in wetlands, and 16 Brown Lemmings and 14 Collared Lemmings in mesic tundra. Preliminary analyses based on capture-recapture models indicate that average densities of Brown Lemmings in 2004 was 2.2 lemmings ha^{-1} and 0.4 lemming ha^{-1} for Collared Lemmings, and in 2005, 0.3 and 0.2 lemming ha^{-1}, respectively

Arctic and Red Foxes.— In 2005, we visited 108 dens during the summer and we detected signs of activity (fresh digging and/or footprints) at 80 of them. The breeding activity of foxes was low as we found 7 litters (7% of known denning sites with a different litter) of Arctic Foxes and none of Red Foxes. This level of use is lower than last year (15%; Fig. 16) but typical of the proportion of fox dens used in years of relatively low lemming abundance (~5%). Minimum litter size varied between 3 and 9 pups (mean of 6.9 pups ± 0.8, n = 7). This value is higher than the long-term average litter size (Arctic Fox: 4.0 pups; Table 5). We found a weak increasing trend in the litter size of Arctic Foxes since 1996 ($R^2 = 0.072$, df = 51, $P = 0.031$; not enough data for a similar analysis in Red Fox). No temporal trend was detected in the percentage of dens used by Arctic Foxes since 1996 ($P = 0.210$, Fig. 16; number of dens monitored before this date too small for statistical analysis).

Plant monitoring

Plant production in wetlands.— Wetland communities on Bylot Island are largely dominated by graminoid plants (i.e. >90 % by sedges and grasses), and thus only these plants are considered here. Among the 3 sites where wetland plants are monitored on Bylot Island, the longest time series comes from the Qarlikturvik Valley, a major brood-rearing site for geese. Above-ground biomass of graminoid plants in the valley reached 57.1 ± 8.2 g m^{-2} in ungrazed areas in mid-August 2005 (long-term average 44.3 g m^{-2}; Fig. 17). *Dupontia fisheri* accounted for 68 % of the graminoid biomass, i.e. 38.8 ± 5.0 g m^{-2} in ungrazed areas (long-term average:

28.0 g m^{-2}) while *Eriophorum scheuchzeri* represented 24% with a production of 13.8 ± 3.9 g m^{-2} in ungrazed plots (long-term average: 13.9 g m^{-2}). Since 1990, the biomasses of all graminoids, *Eriophorum* and *Dupontia* have showed significant increasing trends in the Qarlikturvik Valley. Average production of all graminoid plants has increased by 1.9 g m^{-2} yr^{-1} (R^2 = 0.106, df = 178, $P < 0.001$), *Eriophorum* by 0.8 g m^{-2} yr^{-1} (R^2 = 0.048, df = 178, $P = 0.002$) and *Dupontia* by 0.9 g m^{-2} yr^{-1} (R^2 = 0.065, df = 178, $P < 0.001$) since 1990.

Wetland plant monitoring at the two other sites (main goose nesting colony and Pointe Dufour) has been conducted since 1998 only. The above-ground biomass of graminoids at the end of the summer was 25.1 ± 4.9 g m^{-2} in ungrazed areas of the main goose nesting colony, which is lower than the long-term average (31.2 g m^{-2}; Fig. 18). Graminoid biomass was also dominated by *Dupontia fisheri*, with an annual production of 15.5 ± 4.4 g m^{-2} (i.e. 62% of the total biomass) followed by *Eriophorum scheuchzeri* with 7.9 ± 2.5 g m^{-2} (i.e. 31% of the total biomass) both of which are lower than their long-term average (18.5 g m^{-2} and 11.0 g m^{-2}, respectively). Since 1998, average production of graminoids plants has decreased significantly at the main goose colony. We observed a decrease of 2.2 g m^{-2} $yr^{-1}$for all graminoids (R^2 = 0.067, df = 95, $P = 0.006$) and 1.3 g m^{-2} yr^{-1} for *Dupontia* (R^2 = 0.037, df = 95, $P = 0.034$). No significant trends were observed for *Eriophorum* ($P = 0.285$). Graminoid plants production at Pointe Dufour was similar to 2003 (42.3 ± 6.0 in 2005 vs. 46.0 ± 8.4 g m^{-2} in 2003; Fig. 19) and below the long-term average recorded since 1998 (49.2 g m^{-2}; Fig. 19). *Dupontia* represented 61% of the graminoid biomass, i.e. 25.7 ± 6.8 g m^{-2} (long-term average: 20.3 g m^{-2}) while *Eriophorum* accounted for 24%, i.e. 10.0 ± 4.7 g m^{-2} (long-term average: 13.7 g m^{-2}). No significant temporal trends were detected at Pointe Dufour ($0.116 < P < 0.778$). Over the period 1998-2005 when sampling was carried out at the 3 sites, we note that plant production was comparable in the Qarlikturvik Valley (56.4 g m^{-2}) and Pointe Dufour (49.2 g m^{-2}) but lower at the main goose colony (31.2 g m^{-2}).

Goose grazing impact in wetlands. — Goose grazing was relatively high in the wet meadows of the Qarlikturvik Valley where geese removed 46% of the above-ground biomass by mid-August 2005 (Fig. 17). Geese removed 51% of the total annual production of *Eriophorum* and 42% of *Dupontia*. We found a significant temporal trend in goose grazing impact in the Qarlikturvik Valley. Since 1990, grazing impact by geese on total graminoid plants decreased by

1.2% yr^{-1} (R^2 = 0.049, df = 178, *P* = 0.002), 1.3% yr^{-1} on *Eriophorum* (R^2 = 0.024, df = 176, *P* = 0.021) and 1.1% yr^{-1} on *Dupontia* (R^2 = 0.033, df = 178, *P* = 0.009).

At the main colony, the grazing impact was also relatively high with 41% of the graminoid biomass (61% of *Eriophorum* and 24 % of *Dupontia*) removed by geese (Fig. 18). Since 1998, goose impact on *Eriophorum* has increased by 5.4% yr^{-1} at the goose colony (R^2 = 0.119, df = 88, $P < 0.001$) but there was no temporal trends on total graminoids (*P* = 0.504) and *Dupontia* (*P* = 0.673).

Similarly, at Pointe Dufour geese removed 39% of the total biomass (76% of *Eriophorum* and 23% of *Dupontia*; Fig. 19). From 1998 to 2005, the proportion of total biomass removed by geese at Pointe Dufour increased by 4.0% yr^{-1} (R^2 = 0.151, df = 68, $P < 0.001$). This was mainly due to an increase of grazing impact on *Eriophorum* (R^2 = 0.167, df = 64, $P < 0.001$). No temporal trends were detected for *Dupontia* (*P* = 0.226).

Plant phenology in wetlands.— This year we tested and validated our new sampling method for the phenology of graminoid plants in wetlands. Our phenological data revealed the same pattern found with the biomass data, i.e. that *D. fisheri* and *E. scheuchzeri* are the most abundant graminoid species in the Qarlikturvik Valley wetlands with a total of 1827 ± 127 and 1404 ± 277 shoots m^{-2}, respectively, compared to only 139 ± 83 shoots m^{-2} for *C. aquatilis*. Sedge species (i.e. *C. aquatilis* and *E. scheuchzeri*) were the first to start their reproductive cycle with bud emergence well under way at the start of sampling on 5 July, whereas *D. fisheri* buds appeared only 2 weeks later in late July (Fig. 20). For *C. aquatilis*, female spikes (i.e. stigmas) appeared in late July while male spikes (i.e. anthers) emerged in August. Most anthers were visible in late July for *E. scheuchzeri* and fruits emerged in early August. In *D. fisheri*, shoots bearing anthers appeared only in early August and fruits also appeared at that time but were most abundant in mid-August. For all three species monitored, senescence (i.e. yellowing of leaves) and seed dispersion had not yet started in mid-August, when we left the study site. In 2006, we will initiate the monitoring of phenology earlier in June.

Goose grazing impact in mesic communities.— The sampling of grazing impact in the two mesic habitats was successful. Distinct grazing marks could be recognized on a number of plant species. Grazing of willows was mostly done by insects whereas grazing on graminoids and forbs could be associated with geese and lemming activity. The analyses of the data on frequency of occurrence and selection ratio are in progress.

Habitat use by geese, based on feces density, did not differ between the two mesic habitats ($F_{1,126}$ = 1.99, P = 0.172; Fig. 21). However, their intensity of use changed between years and sampling dates ($F_{2,126}$ = 26.29, P < 0.001). Habitat use during the fall 2002-spring 2003 and fall 2004-spring 2005 (based on feces count in early summer 2003 and 2005; Fig 21) were similar (P = 0.364) but much lower than during the fall 2003-spring 2004 (early summer count of 2004). While geese increased their habitat use of both mesic habitats during the summer of 2003, it decreased in 2004 and 2005 (0.001 < P < 0.038).

INUIT TRADITIONAL ECOLOGICAL KNOWLEDGE

During the spring and summer 2005, Catherine Gagnon was successful in collecting close to 40 hours of interviews with 21 local experts (6 women, 15 men; 14 Elders, 12 Hunters) from Pond Inlet. Subjects covered by the interviews included (1) the ecosystem, i.e. changes observed in the environment, areas considered particularly sensitive, activities that have affected the land; (2) foxes, i.e. cultural use and importance, location of trap-lines, changes in abundance and distribution, winter feeding habits, moult, and arrival of Red Foxes in the area; (3) geese, i.e. cultural use and importance, hunting areas, changes in abundance and distribution, migration routes, and timing of moult. During the interviews, areas considered important to local experts, either due to their cultural or ecological relevance, were recorded on 1:250 000 scale maps. These maps were later scanned and will eventually be made available in a digital format. While conducting data collection, Catherine Gagnon also provided updates to the community via shows held on the local radio.

Preliminary analysis of the interviews reveals that local experts observed different levels of changes in the local environment, ranging from no detected changes at all to changes observed in weather predictability, ice thickness, erosion patterns and garbage at traditional campsites. Informants also provided valuable information regarding areas and/or ecosystems components that they considered particularly sensitive. Concerning terrestrial ecosystems components, local experts provided detailed information about Greater Snow Geese ecology. Most informants identified changes in the numbers and distribution of nesting snow geese in the area. However, the cause of these changes varied according to informants. They also provided information regarding the feeding and breeding ecology of Arctic Foxes as well as temporal information concerning the recent arrival of Red Fox in the area.

Local elders and hunters participating in the study expressed the desire that the knowledge collected during the interviews be shared with the youth from the community. Considering this recommendation, Catherine Gagnon and Dominique Berteaux, have applied for funding and will organize an Elder-Youth Camp. During this camp, the knowledge shared during the interviews will be discussed, practiced and transmitted to the younger generation. Pending funding, this camp should be held on Bylot Island in June 2006.

Finally, preliminary results emerging from the interviews have been communicated via presentations at 3 conferences : the 30e Colloque annuel de la Société Québécoise pour l'Étude de la Biologie et du Comportement (Concordia University, Montreal, November 2005), the Second Annual ArcticNet Annual Meeting (Banff Centre, December 2005) and the 26e Colloque annuel du Centre d'études nordiques (Laval University, Québec, January 2006). Preliminary results have also been communicated to the local community via Christmas cards (Appendix 1) sent to the participants and during the workshops held in Pond Inlet in February 2006 (see below). During the latter workshop, the idea of the Elder-Youth Camp was presented to the elders and members of the Joint Park Management Committee. The idea was greatly appreciated and attendees provided insights on the best way to proceed with the camp. They also signed letters to support funding applications for the camp.

COMMUNITY WORKSHOP

The workshop was highly successful, with 14 participants (11 from northern communities) attending it on 14 February (the list of participants and their affiliation are given in Appendix 2). On 14 February, there was five presentations (three by Dominique Berteaux, one by Catherine Gagnon and one by Gary Mouland from Parks Canada; see schedule in Appendix 3) supported by visual material (Power Point presentations are available upon request). Following these presentations, considerable time was devoted to questions and discussions with participants. The purpose of the workshop was to 1) inform the community about the ecological monitoring activities performed on Bylot Island, with a special focus this year on studies related to Arctic Foxes, 2) present the proposed monitoring activities in the coming years, seeking suggestion and advices and 3) present the results and upcoming events related to the TEK study, such as the organization of an Elder-Youth Camp on Bylot Island in 2006.

During the workshop, a pamphlet that summarizes the fox studies performed in the area (including Western science and TEK) was distributed and used as a basis for discussion. The pamphlet is bilingual (Inuktitut-English) and copies were distributed to all participants (Appendix 4). During the afternoon, procedures and equipment for fox trapping on Bylot Island were presented, as well as archive pictures showing fox and goose harvesting activities. For the workshop, Cornelius Nutaraq, a respected elder from the community, had prepared 4 maps of the area with many drawings of the animals he had seen during his life. Drawings included Red Foxes in different parts of the Pond Inlet area. M. Nutaraq had made them for us in order to pass on his knowledge to younger generations and he has giving them to us. This was a much appreciated sign of trust and we were very grateful. This was also an expression of the two-way exchange of information that is taking place between scientists and community members. Catherine Gagnon had prepared a gift in advance for this exceptional Elder: a very large, laminated map of the area.

The morning of 15 February was dedicated to less formal discussion regarding the workshop of the previous day. Eleven participants (8 from northern communities) attended the morning session. Feedbacks received were very positive. Participants were pleased that southern researchers took time to visit them during the winter to inform them about their projects. Participants were also enthusiastic about the perspective of organizing the Elder-Youth Camp. A real exchange between scientists and northern community members took place during this meeting.

On 15 February, the evening consultation with the general public was also very successful with 12 local persons attending. The activity had been well publicised in the community (on the community radio). Talks were given by Dominique Berteaux and Catherine Gagnon, followed by presentations of posters, maps, archive pictures and fox trapping procedures. Pamphlets were also distributed during the consultation. It was followed by snacks and coffee, which allowed people to discuss in a more informal and comfortable way.

Talks given at the high school and elementary school were also successful. For the high school, Dominique Berteaux and Catherine Gagnon presented their research to one group. They had also prepared a 1-hour talk supported by visual material (Power Point) on environmental studies on Bylot Island. During the presentation, Dominique Berteaux advertised the possibility for students to get summer jobs with the researchers. Students and teachers enjoyed the talks and our presentation generated several questions from the students. A simplified version of the talk was later presented to a grade 4 class at the elementary school. For this group, the talk mainly focused on presenting pictures about the animals studied on Bylot Island. The teachers were so pleased about the enthusiasm that the presentation generated among students that the principal of the elementary school asked Dominique Berteaux and Catherine Gagnon to give other talks. Three other talks were therefore given to grade 1, 2 and 5 classes.

HIRING AND TRAINING OF INDIVIDUALS FROM LOCAL COMMUNITIES

We hired 3 persons from the Pond Inlet community to work with us for various lengths of time (1-2 weeks each) during the summer 2005: James Inootik, Patrick Enokooloo and Jimmy Pitseolak. All these people received valuable training in environmental studies while working with us. In addition, Adam Ferguson, patrol person from Parks Canada also joined our crew again this year for a few days to receive a similar training.

PRELIMINARY CONCLUSIONS

So far, few temporal trends were observed in the climatic data collected on Bylot Island over the last decade. Air temperatures has varied greatly from year to year and no trend were detected either on an annual or seasonal basis. The weak decreasing trend in the spring thawing degree-days (TDD) is entirely due to the extremely high TDD value recorded in 1994, a year with virtually no snow cover during the winter. The absence of temporal trends in air temperatures on Bylot Island is likely related to our short time series (i.e. 12 years) as Gagnon et al. (2004) were able to detect warming trends in the summer, spring and fall temperatures of Pond Inlet and Nanisivik over the past 3 decades. Interestingly, our data suggests some trends in summer precipitation with an increase in mid summer (July). The summer 2005 was very wet, especially the month of July with yet again record rainfall.

In 2005, Snow Geese nested at usual dates, and their reproductive effort was moderate (i.e. moderate nesting density). Even though no Snowy Owls have nested this year, geese still benefited from a relatively low predation pressure, due to low abundance of foxes and jaegers, which enabled them to have a relatively high nesting success.

Our long-term data on lemming abundance show that the population dynamics of the two lemming species found on Bylot Island differ. Indeed, the population of Brown Lemmings has been going through much deeper cycles than the one of Collared Lemmings at our two study sites. During peak years, abundance of Brown Lemmings was several times higher than Collared Lemmings, but in low years that species was equally scarce (in the Qarlikturvik Valley) or rarer (at the nesting colony) than Collared Lemmings. Although population cycles were much more obvious in Brown than Collared Lemmings, the abundance of both species tended to fluctuate synchronously. Even though our 2004 lemming index was much lower than in previous peak years, data from our 2005 dead-trapping survey, and from our 2004 and 2005 live-trapping survey further confirm that 2004 was indeed a peak in lemming abundance on Bylot Island, albeit a smaller one than usual.

In 2005, plant production in wetlands of the Qarlikturvik Valley was the highest since 2001. This is likely due to the very low grazing impact of geese in 2004. Even though we detected a long-term increasing trend in plant production, the most striking feature seemed to be a somewhat cyclic fluctuation since 1990, with a low in 1994 and a high in 2000. We do not know the cause of these fluctuations but in coming years we will examine more closely possible links with the climate and grazing pressure. In fact, the decreasing trend observed in goose grazing impact in the Qarlikturvik Valley could be partly explained by their reduced use of wet meadows in recent years (i.e. 2003-2004) as broods apparently moved earlier to upland areas due to heavy rainfall and extensive flooding in low-lying areas in late July and early August. However, this needs to be explored further. It is also noteworthy that plant production at the goose colony is half of that at the brood-rearing areas of Dufour Point and Qarlikturvik Valley. The high density of geese at the colony and the ensuing high grazing impact during nesting and early-brood rearing likely explain the low plant production there.

We are highly satisfied with the success of our TEK project this past summer. The participation and assistance received from the community was greatly appreciated. We are very hopeful that, with the support received from the Elders and the Joint Park Management Committee, the project will further benefit the community with the organization of the Elder-Youth Camp in 2006.

With the additional funding awarded to our project for the 2005 field season we were able to add new components to our monitoring program on Bylot Island (e.g. new recording instruments installed on our weather stations, monitoring of the breeding activities of shorebirds, expanding our monitoring in wetlands to plant phenology and goose grazing impact, and plant monitoring in mesic tundra). In 2006, these new monitoring activities will be continued in combination with those that were already in place.

ACKNOWLEDGEMENTS

The enormous amount of data collected over 17 years of field work on Bylot Island was possible thanks to the financial support received from numerous agencies. These include the Northern Ecosystem Initiative program of Environment Canada in Yellowknife, the Natural Sciences and Engineering Research Council of Canada, the Fonds Québécois de la Recherche sur la Nature et les Technologies, the Canada Research Chair program, the Canada Foundation for Innovation, the Arctic Goose Joint Venture (Canadian Wildlife Service), the Canadian Wildlife Service (Québec region), the Nunavut Wildlife Management Board, the Polar Continental Shelf Project (Natural Resources Canada), ArcticNet (Network of Centres of Excellence of Canada), Ducks Unlimited (Canada), the Department of Indian and Northern Affairs Canada, Université Laval, the Centre d'études nordiques, Parks Canada, and the US Fish and Wildlife Service. Above all, the success of this project rests on the hard and dedicated work of over 100 graduate students, summer students, technicians and other assistants that have painstakingly collected these data in the field over all these years. We are thankful to the Elders and hunters who participate in the TEK project. We also want to thank the Hunters and Trappers Organization of Pond Inlet, the Joint Park Management Committee, the Hamlet of Pond Inlet and the Pond Inlet Inuit Knowledge Working Group, for their assistance and support with this project.

REFERENCES

ACIA. 2004. Impacts of a Warming Climate: Arctic Climate Impact Assessment. Cambridge University Press, Cambridge, UK. http//www.acia.uaf.edu

Berteaux, D., D. Réale, A.G. McAdam & S. Boutin. 2004. Keeping pace with fast climate change: can arctic life count on evolution? Integrative and Comparative Biology 44:140-151.

Bêty, J., G. Gauthier, & J.-F. Giroux. 2003. Body condition, migration and timing of reproduction in snow geese: a test of the condition-dependent model of optimal clutch size. American Naturalist 162:110-121.

Féret, M., G. Gauthier, A. Béchet, J.-F. Giroux & K. Hobson. 2003. Effect of a spring hunt on nutrient storage by greater snow geese in southern Québec. Journal of Wildlife Management 67:796-807.

Gagnon, C., M.-C. Cadieux, G. Gauthier, E. Lévesque, A. Reed, and D. Berteaux. 2004. Analyses and reporting on 15 years of biological monitoring data from Bylot Island, Sirmilik National Park of Canada. Unpublished report, Centre d'études nordiques, Université Laval, 115 pp.

Gauthier, G., J. Bêty, J.-F. Giroux, & L. Rochefort. 2004. Trophic interactions in a High Arctic Snow Goose colony. Integrative and Comparative Biology 44:119-129.

Gauthier, G., R.J. Hughes, A. Reed, J. Beaulieu & L. Rochefort. 1995. Effect of grazing by greater snow geese on the production of graminoids at an arctic site (Bylot Island, NWT, Canada). Journal of Ecology 83:653-664.

Hansell, R.I.C., J.R. Malcolm, H. Welch, R.L. Jefferies & P.A. Scott. 1998. Atmospheric change and biodiversity in the Arctic. Environmental Monitoring and Assessment 49:303-325.

Mainguy, J., J. Bêty, G. Gauthier & J.-F. Giroux. 2002. Are body condition and reproductive effort of laying greater snow geese affected by the spring hunt? Condor 104:156-162.

McCarty, J.P. 2001. Ecological consequences of recent climate changes. Conservation Biology 15:320-331.

Moritz, R. E., C. M. Bitz & E. J. Steig. 2002. Dynamics of recent climate change in the Arctic. Science 297:1497-1502.

Reed, E.T., G. Gauthier & J.-F. Giroux. 2004. Effects of spring conditions on breeding propensity of greater snow goose females. Animal Biodiversity Conservation 27:35-46.

Shank, C.C. 1993. The Northwest Territories small mammal survey: 1990-1992. Manuscript Report No 72. Department of Renewable Resources, Government of the Northwest Territories, Yellowknife, NWT.

Table 1. Data on the reproduction of Snowy Owls, Jaegers (mostly Long-tailed) and Glaucous Gulls on Bylot Island, from 1993 to 2005.

Species		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Snowy Owl	N of nests [a]	12 / 0	0 / 0	0 / 0	7 / 3	0 / 0	0 / 0	0 / 0	12 / 1	0 / 0	0 / 0	0 / 0	13 / 9	0 / 0
	Laying date	21 May	- [b]	-	16 May	-	-	-	29 May	-	-	-	18 May	-
	Hatching date	22 June	-	-	17 June	-	-	-	30 June	-	-	-	19 June	-
	Clutch size	7.6	-	-	7.9	-	-	-	6.4	-	-	-	7.1	-
	Nesting success	-	-	-	-	-	-	-	85%	-	-	-	95%	-
Long-tailed Jaeger	N of nests	-	-	-	-	6	3	-	9	9	-	-	17 / 6	9 / 9
	Laying date	-	-	-	-	-	-	-	-	-	-	-	15 June	16 June
	Hatching date	-	-	-	-	-	-	-	-	-	-	-	10 July	11 July
	Clutch size	-	-	-	-	-	-	-	-	-	-	-	1.8	1.8
	Nesting success	-	-	-	-	-	-	-	-	-	-	-	86%	8%
Glaucous Gull	N of nests	-	-	-	-	3	5	7	5	4	1	-	5 / 5	11 / 1
	Laying date	-	-	-	-	-	-	-	-	-	-	-	-	13 June
	Hatching date	-	-	-	-	-	-	-	-	-	-	-	-	10 July
	Clutch size	-	-	-	-	-	-	-	-	-	-	-	2.3	2.9
	Nesting success	-	-	-	-	-	-	-	-	-	-	-	-	80%

[a] Qarlikturvik Valley / main goose nesting colony; otherwise, number of nests combines both sites.
[b] No data available.

Table 2. Data on the reproduction of shorebirds species on Bylot Island, in 2004 and 2005.

Species		2004	2005
White-rumped Sandpiper	N of nests [a]	- [b]	36 / 3
	Laying date	-	13 June
	Hatching date	-	8 July
	Clutch size	-	4.0
	Nesting success	-	11%
Baird's Sandpiper	N of nests	5 / 0	20 / 0
	Laying date	-	10 June
	Hatching date	-	4 July
	Clutch size	4.0	4.0
	Nesting success	-	25%
American Golden Plover	N of nests	-	6 / 0
	Laying date	-	17 June
	Hatching date	-	13 July
	Clutch size	-	4.0
	Nesting success	-	19%
Black-bellied Plover	N of nests	-	1 / 0
	Laying date	-	18 June
	Hatching date	-	18 July
	Clutch size	-	4.0
	Nesting success	-	-
Red Phalarope	N of nests	-	1 / 0
	Laying date	-	-
	Hatching date	-	-
	Clutch size	-	4.0
	Nesting success	-	-

[a] Qarlikturvik Valley / main goose nesting colony.
[b] No data available.

Table 3. Data on the reproduction of Lapland Longspurs, Sandhill Cranes, King Eiders and Long-tailed Ducks on Bylot Island, from 1995 to 2005.

Species		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Lapland Longspur	N of nests [a]	23	5	13	18	7	22	18	13	18	27	68
	Laying date	16 June	13 June	23 June	13 June	22 June	19 June	16 June	16 June	7 June	24 June	21 June
	Hatching date	1 July	29 June	9 July	30 June	8 July	4 July	2 July	1 July	23 June	9 July	3 July
	Clutch size	5.7	5.2	4.7	5.6	5.3	5.6	5.1	5.8	5.5	5.2	5.1
	Nesting success	75%	- [b]	40%	38%	50%	82%	-	50%	-	75%	19%
Sandhill Crane	N of nests	-	2	1	1	2	3	1	-	1	2 / 0	1 / 0
	Clutch size	-	-	-	-	-	-	-	-	-	2.0	2.0
King Eider	N of nests	-	-	-	2	2	7	3	1	2	2 / 2	5 / 0
	Clutch size	-	-	-	-	-	-	-	-	-	-	5.0
Long-tailed Duck	N of nests	-	-	-	1	-	5	1	-	-	1 / 1	4 / 0
	Clutch size	-	-	-	-	-	-	-	-	-	-	4.8

[a] Qarlikturvik Valley / main goose nesting colony; otherwise, number of nests combines both sites (except for Lapland Longspurs, Qarlikturvik Valley only).
[b] No data available.

Table 4. Number of Brown and Collared Lemmings captured and recaptured during the live-trapping program on Bylot Island in 2004 and 2005.

Year		Wetlands		Mesic tundra		Total
		Brown Lemming	Collared Lemming	Brown Lemming	Collared Lemming	
2004	Number captured	83	0	53	23	159
	Number recaptured[1]	56	0	31	9	96
2005	Number captured	12	13	16	14	55
	Number recaptured	7	4	8	5	24

[1] Number of individual recaptured more than once.

Table 5. Average litter size of Arctic and Red Foxes on Bylot Island from 1993 to 2005.

Year	Average litter size	
	Arctic Fox	Red Fox
1993	2.0	-[a]
1994	-	-
1995	-	-
1996	5.6	6.0
1997	5.0	-
1998	2.9	2.0
1999	2.0	4.0
2000	3.2	5.0
2001	3.3	5.0
2002	-	-
2003	4.3	-
2004	5.1	6.0
2005	6.9	-
Long-term average	4.0	4.7

[a] No data available.

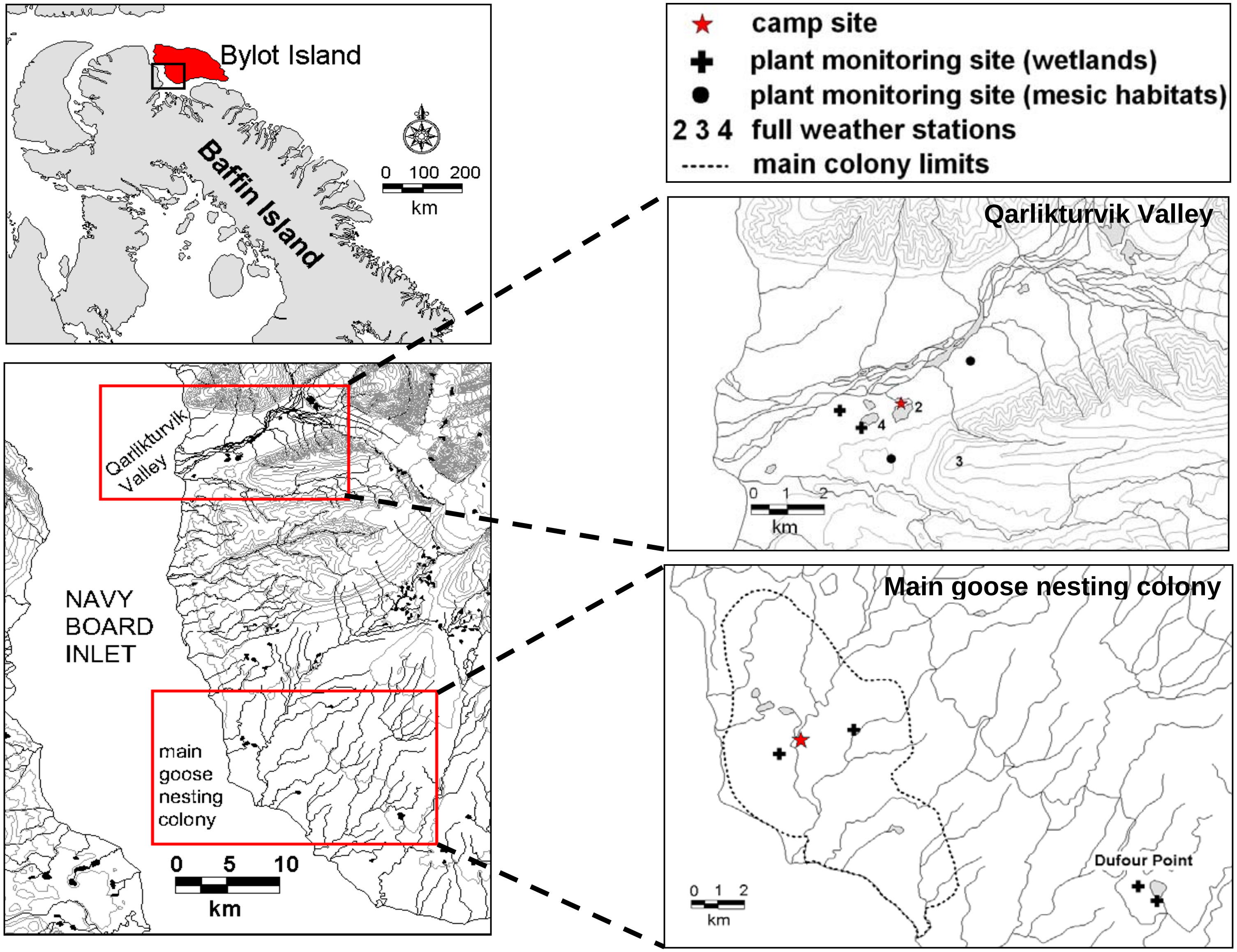

Figure 1. General location of the study area, Bylot Island, Nunavut, and of the two main study sites (Qarlikturvik Valley and the main goose nesting colony) on the South plain of the island. Enlarged maps on the right present these study sites in more details, including camp locations, sampling sites and our three full weather stations.

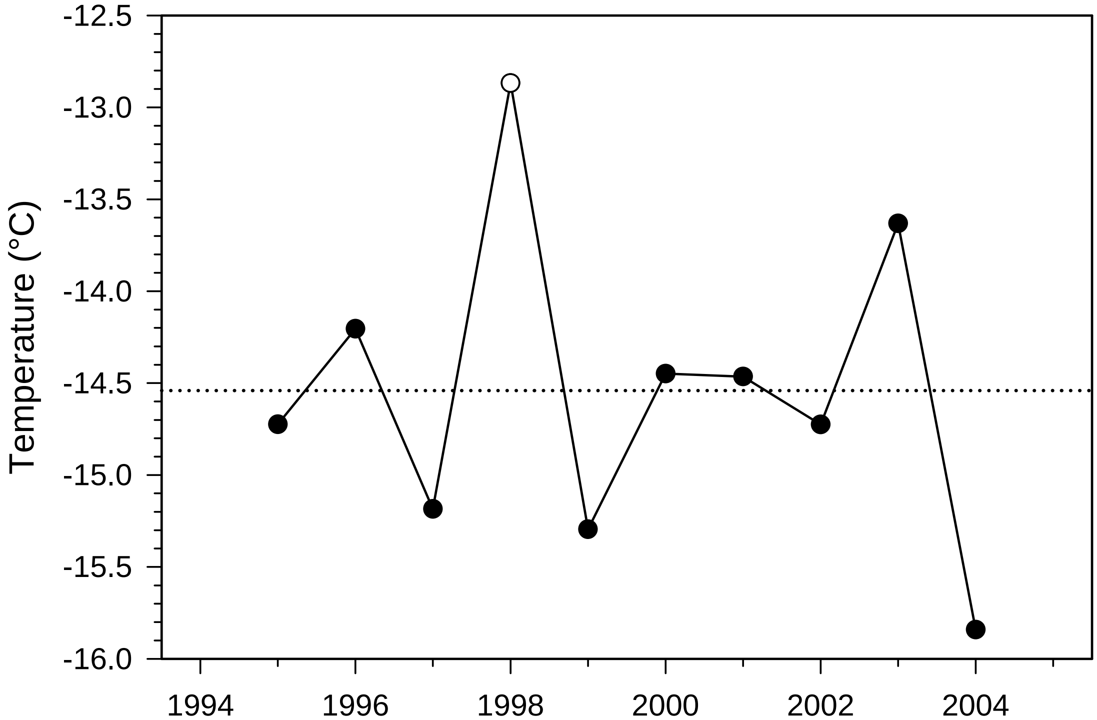

Figure 2. Average annual air temperature in the Qarlikturvik Valley lowlands of Bylot Island from 1995 to 2004. The dotted line shows the mean for the whole period. Air temperature for 1998 is represented by a white circle as it was extrapolated for part of the year from the relation between the air temperatures at Bylot Island and Pond Inlet due to missing values.

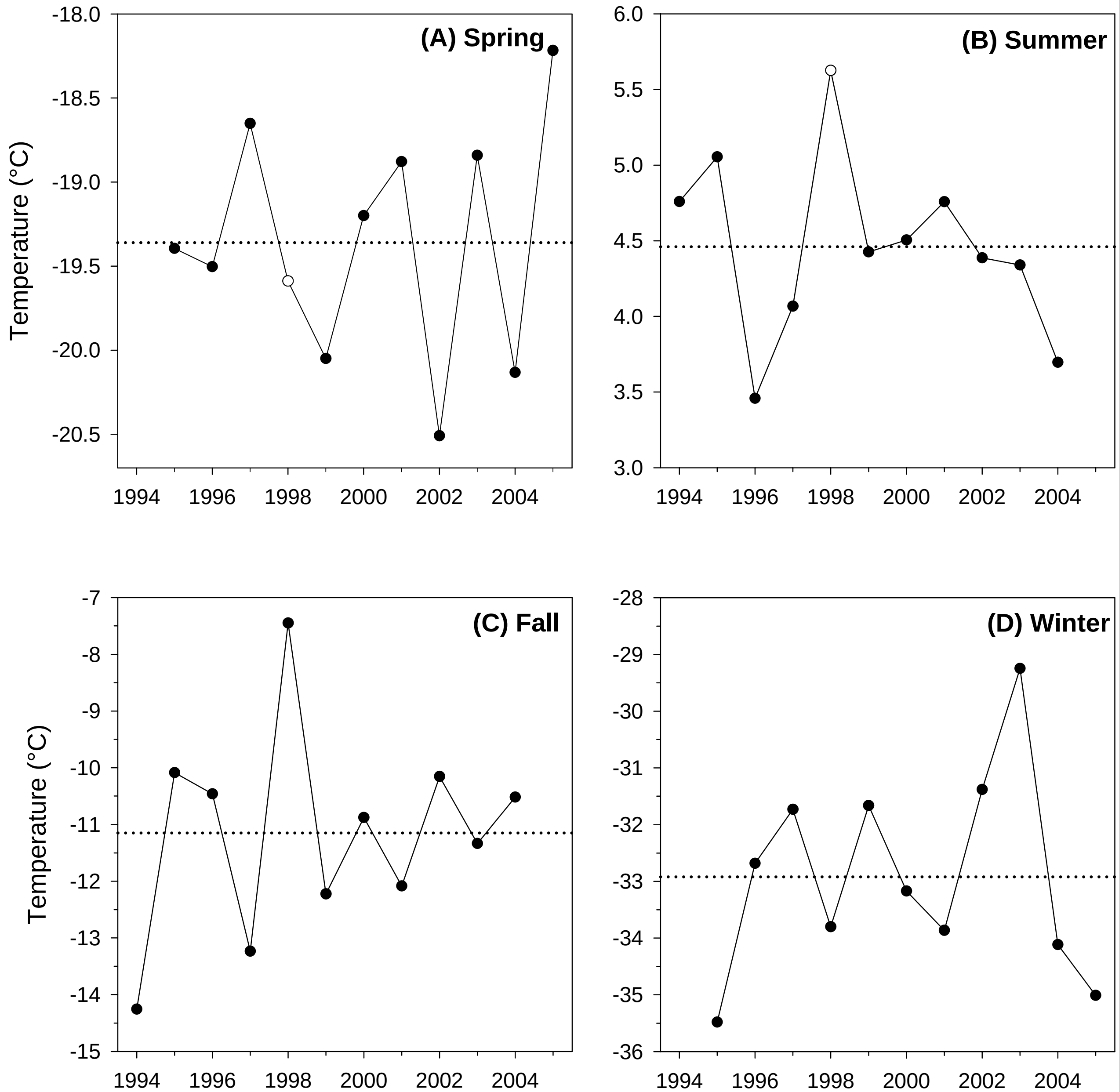

Figure 3. Average air temperature in the Qarlikturvik Valley lowlands of Bylot Island from 1994 to 2005 for (A) spring (March to May), (B) summer (June to August), (C) fall (September to November) and (D) winter (December to February). The dotted line shows the mean for the whole period. Air temperature for the spring and summer 1998 is represented by a white circle as it was extrapolated from the relation between the air temperatures at Bylot Island and Pond Inlet.

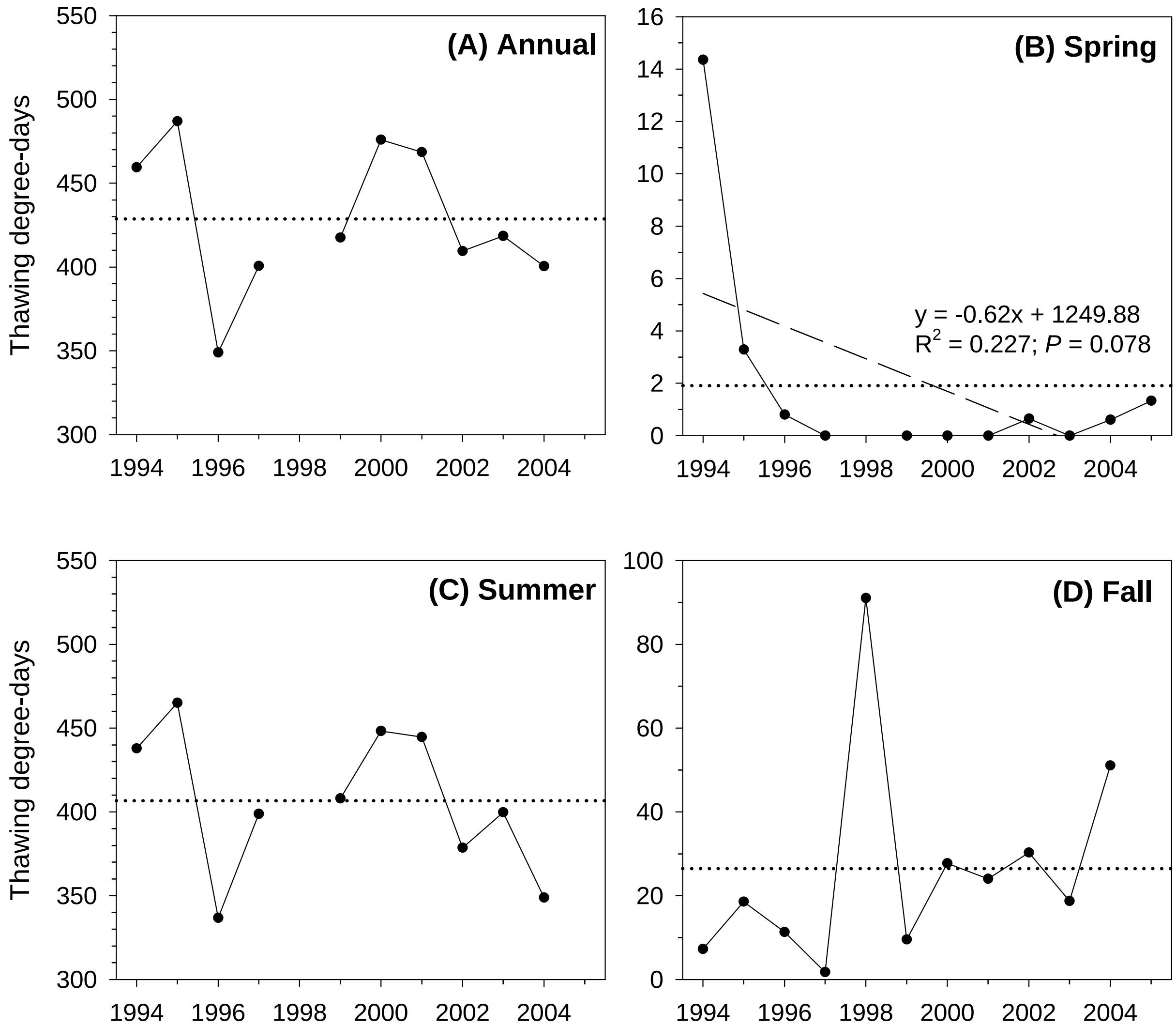

Figure 4. Number of thawing degree-days in the Qarlikturvik Valley lowlands of Bylot Island from 1994 to 2005 for (A) entire year, (B) spring (March to May), (C), summer (June to August) and (D) fall (September to November). Temporal trends are represented by a dashed line when approaching significance (0.05 < *P* < 0.15). The dotted line shows the mean for the whole period.

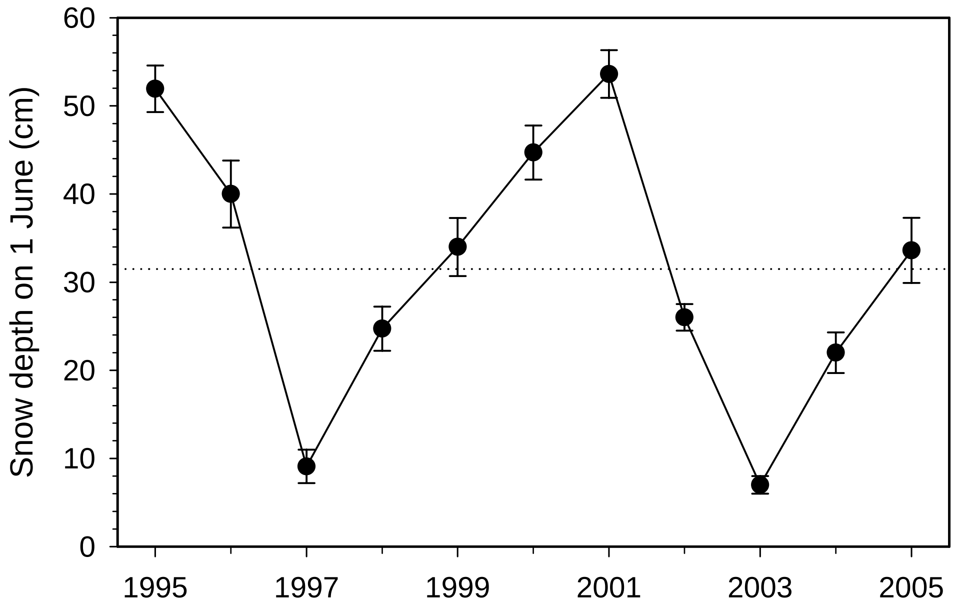

Figure 5. Average snow depth (mean ± SE) on the ground on 1 June in the Qarlikturvik Valley lowlands of Bylot Island from 1995 to 2005. The dotted line shows the mean for the whole period.

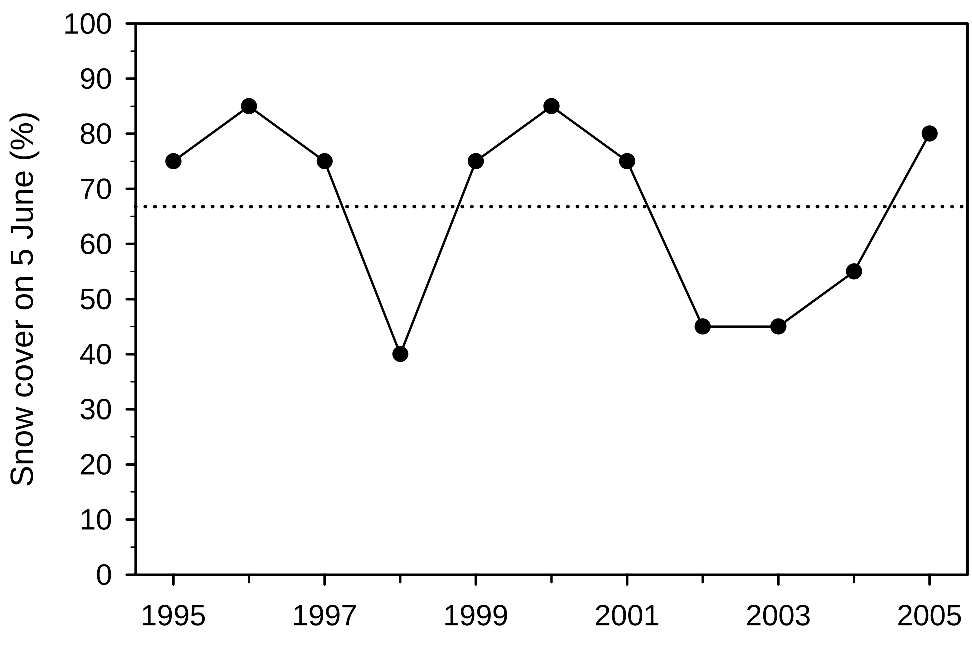

Figure 6. Average percentage of snow cover on the ground on 5 June in the Qarlikturvik Valley lowlands of Bylot Island from 1995 to 2005. The dotted line shows the mean for the whole period.

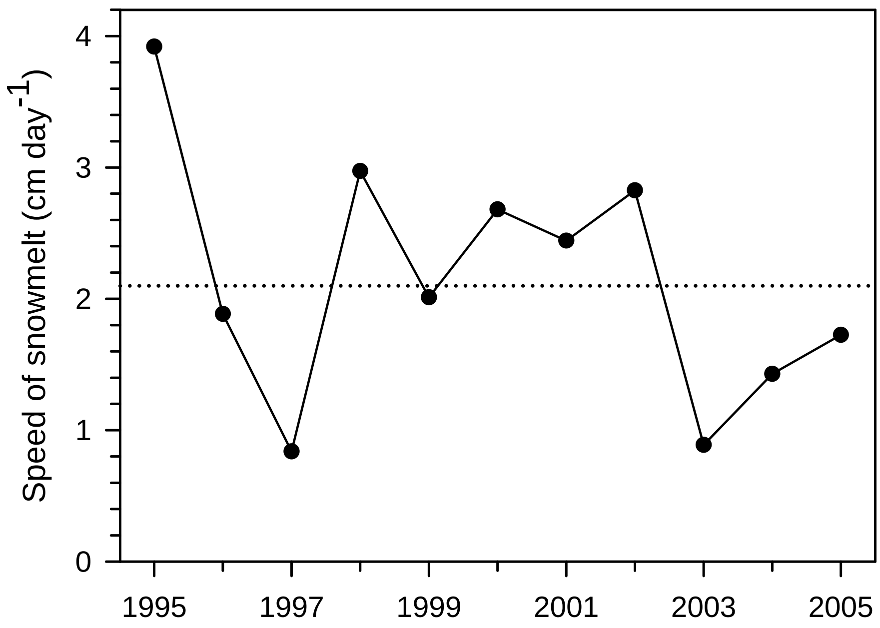

Figure 7. Average speed of snowmelt during the month of June in the Qarlikturvik Valley lowlands of Bylot Island from 1995 to 2005. The dotted line shows the mean for the whole period.

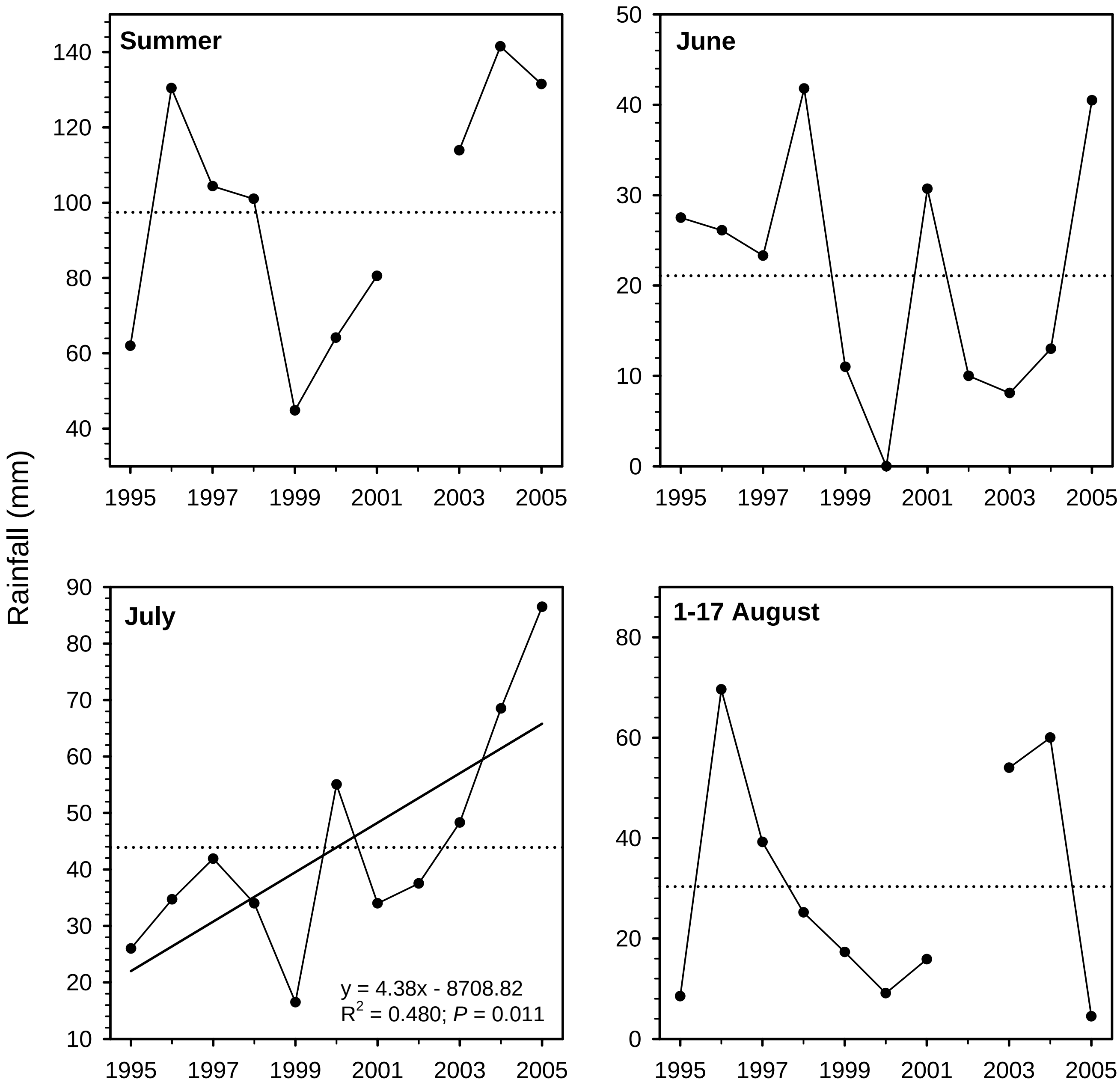

Figure 8. Average summer and monthly rainfall in the Qarlikturvik Valley lowlands of Bylot Island from 1995 to 2005. Temporal trends are represented by a solid line when significant ($P < 0.05$). The dotted line shows the mean for the whole period.

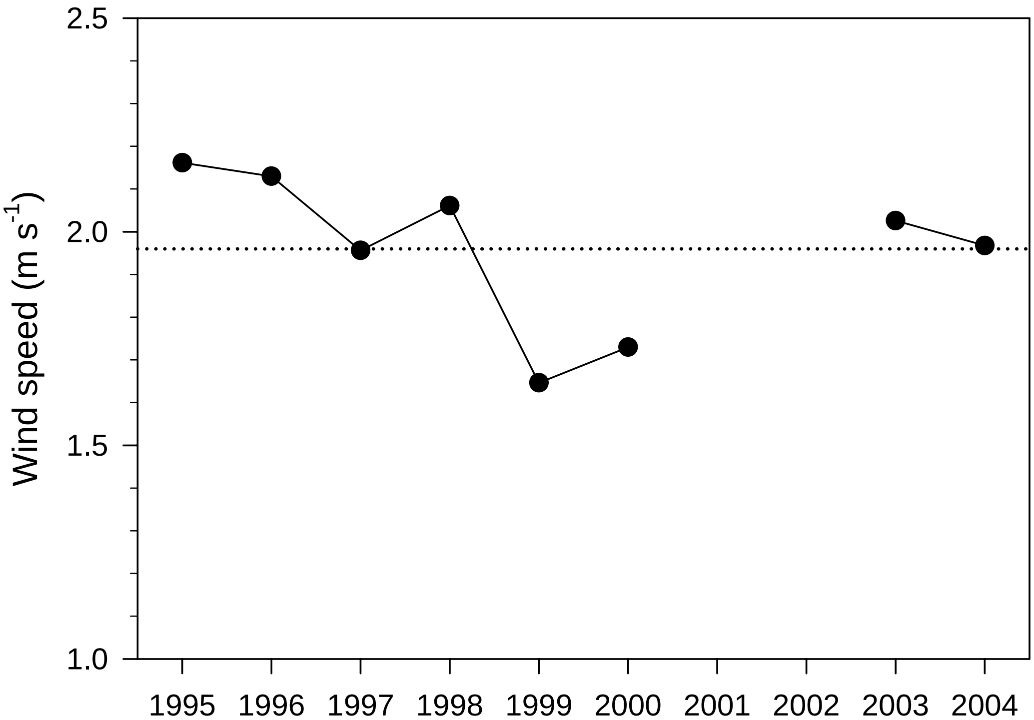

Figure 9. Average annual wind speed in the Qarlikturvik Valley lowlands of Bylot Island from 1995 to 2004. The dotted line shows the mean for the whole period.

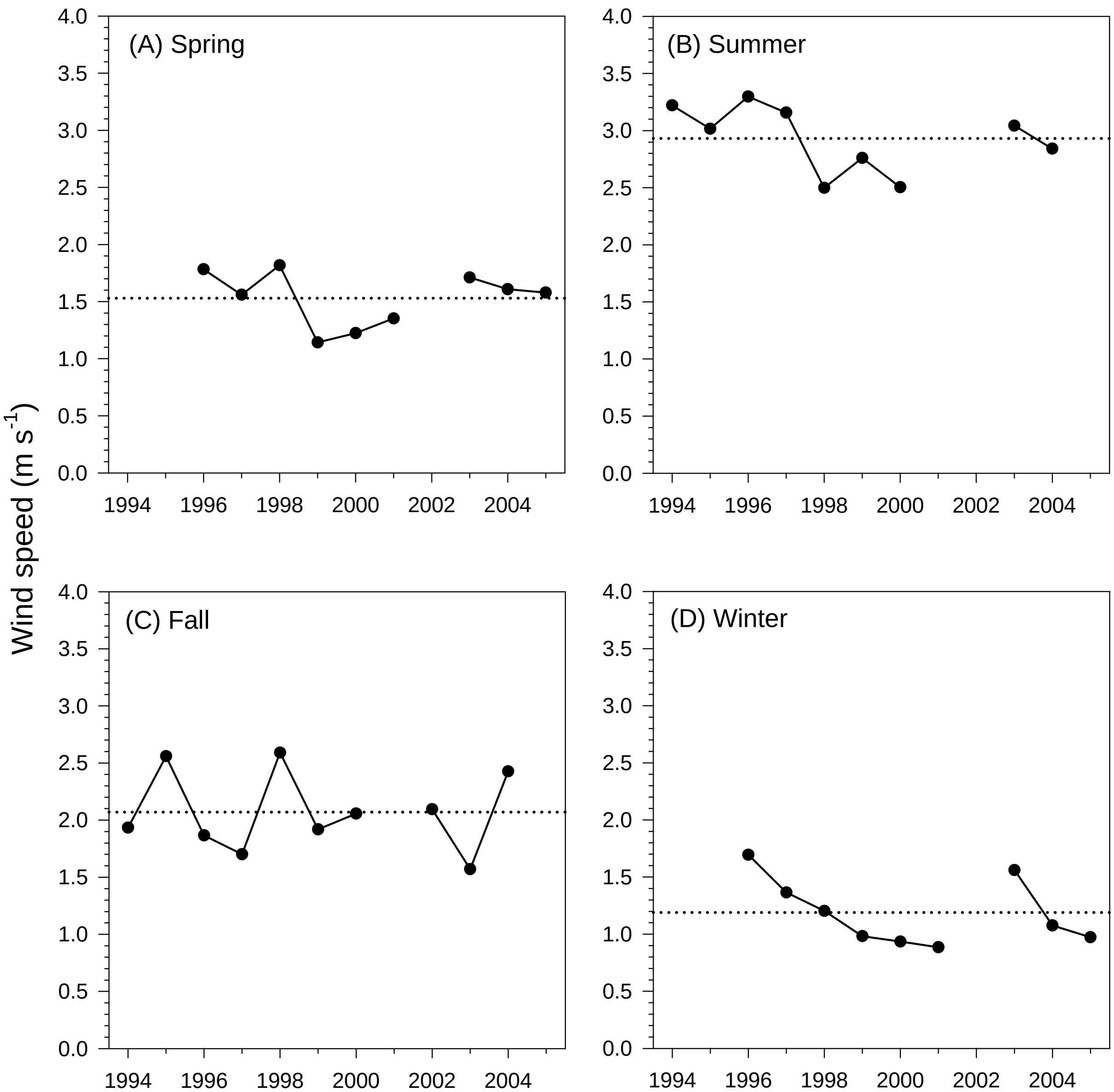

Figure 10. Average wind speed in the Qarlikturvik Valley lowlands of Bylot Island, from 1994 to 2005 for (A) spring (March to May), (B) summer (June to August), (C) fall (September to November) and (D) winter (December to February). The dotted line shows the mean for the whole period.

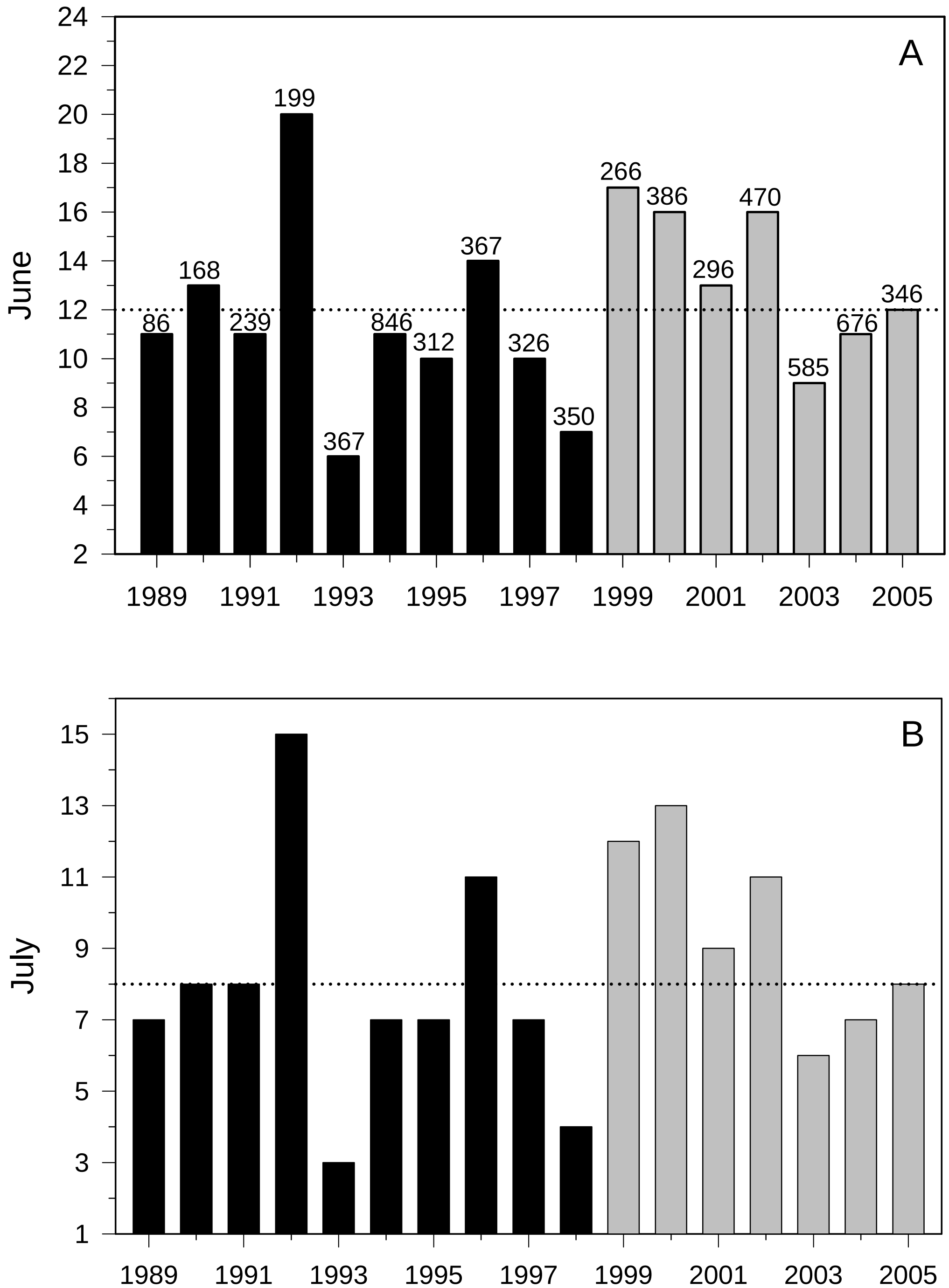

Figure 11. Median annual (A) egg-laying dates and (B) egg-hatching dates of Greater Snow Geese on Bylot Island from 1989 to 2005. Grey columns represents years during which a spring hunt occurred in Quebec. The dotted line shows the mean for the whole period. Numbers on top of bars in panel A indicate the number of nests monitored each year.

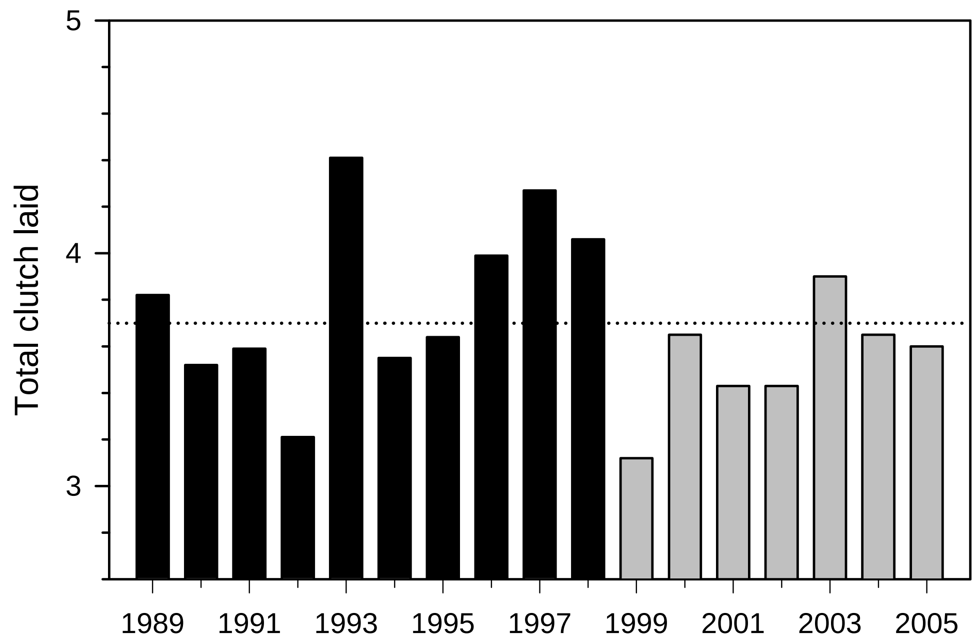

Figure 12. Annual total clutch laid of Greater Snow Geese on Bylot Island from 1989 to 2005. Grey columns represents years during which a spring hunt occurred in Quebec. The dotted line shows the mean for the whole period.

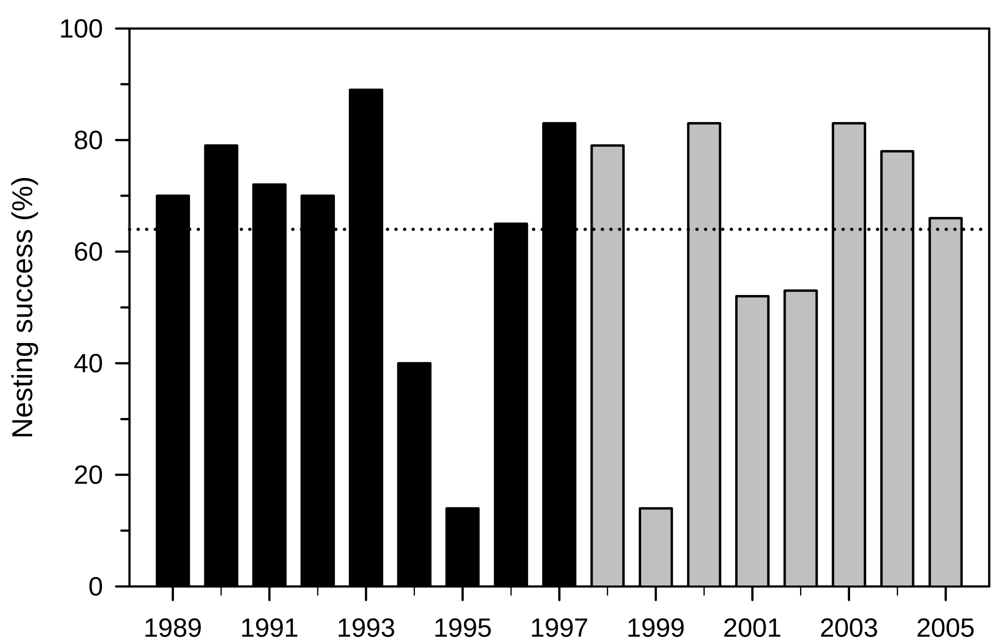

Figure 13. Annual nesting success (percentage of nests where at least one egg hatched) of Greater Snow Geese on Bylot Island from 1989 to 2005. Grey columns represents years during which a spring hunt occurred in Quebec. The dotted line shows the mean for the whole period.

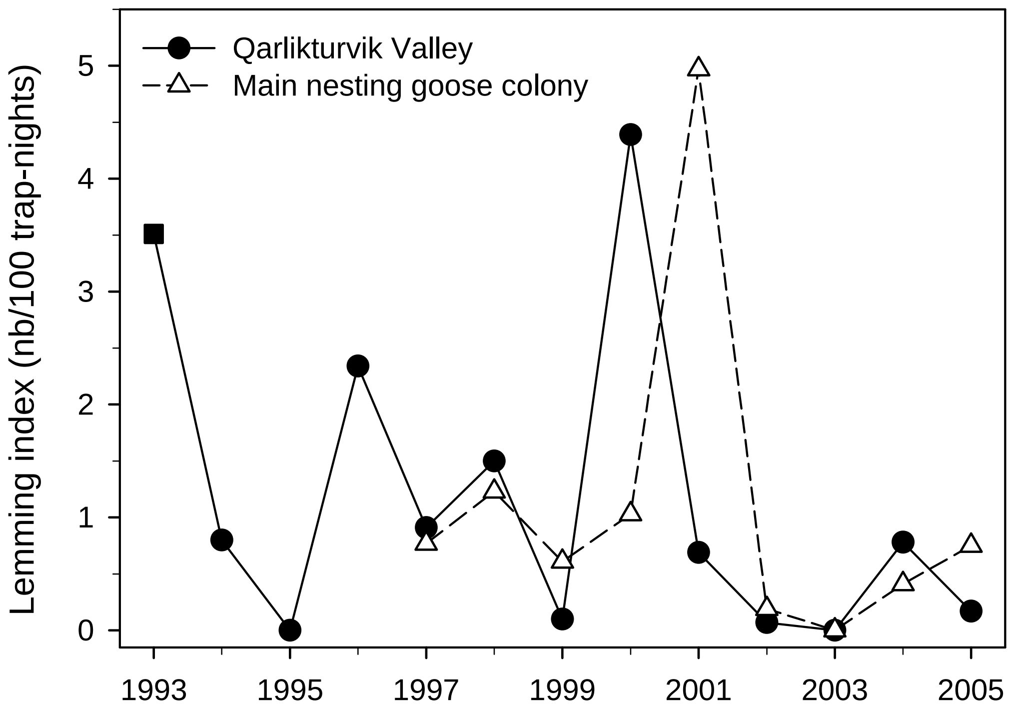

Figure 14. Index of lemming abundance (number caught per 100 trap-nights) in the Qarlikturvik Valley and the main goose nesting colony of Bylot Island from 1993 to 2005. Although no lemmings were trapped in 1993, an estimate was derived based on a winter nest survey.

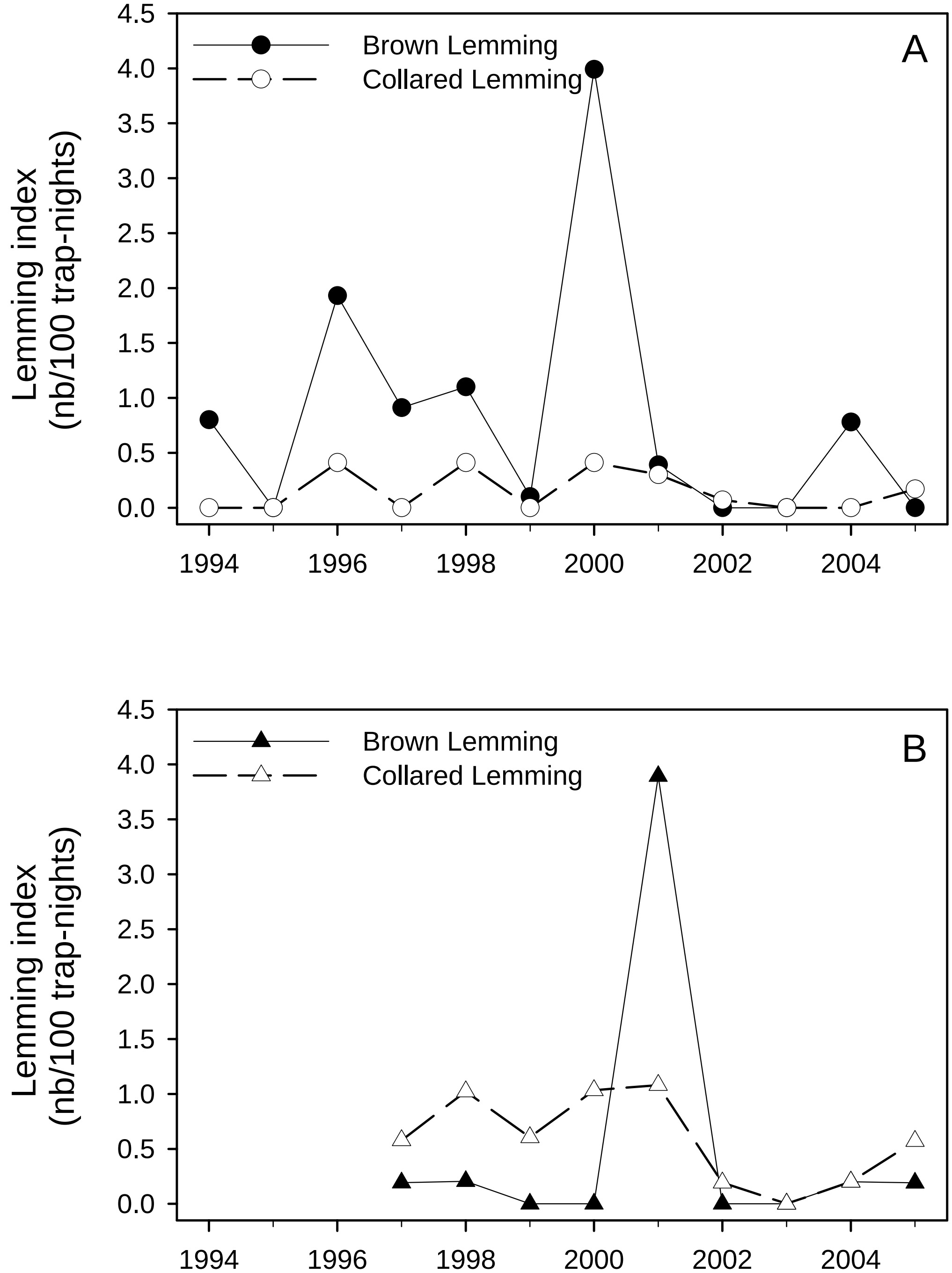

Figure 15. Index of Brown and Collared Lemmings abundance (number caught per 100 trap-nights) in (A) the Qarlikturvik Valley and (B) the main goose nesting colony of Bylot Island from 1994 to 2005.

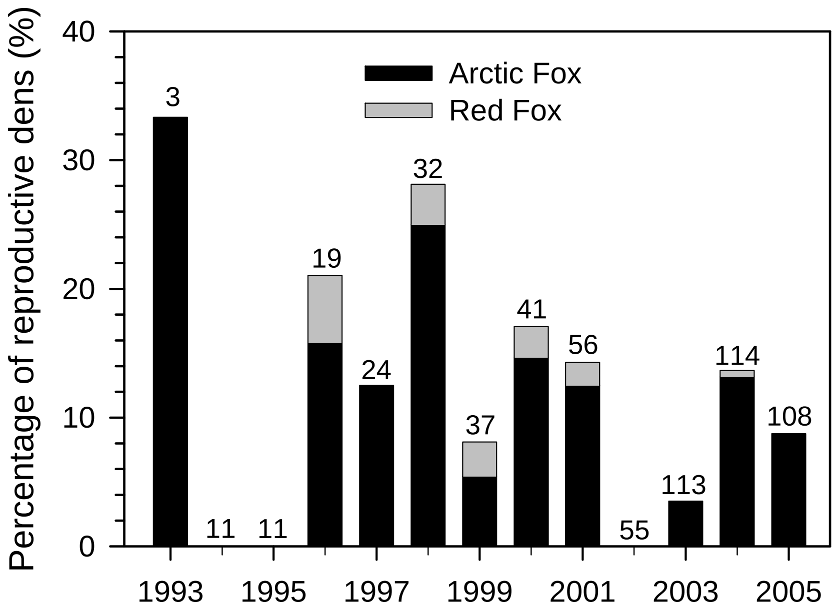

Figure 16. Annual percentage of Arctic and Red Fox dens with presence of pups on Bylot Island from 1993 to 2005. Numbers on top of bars indicate the number of dens monitored each year.

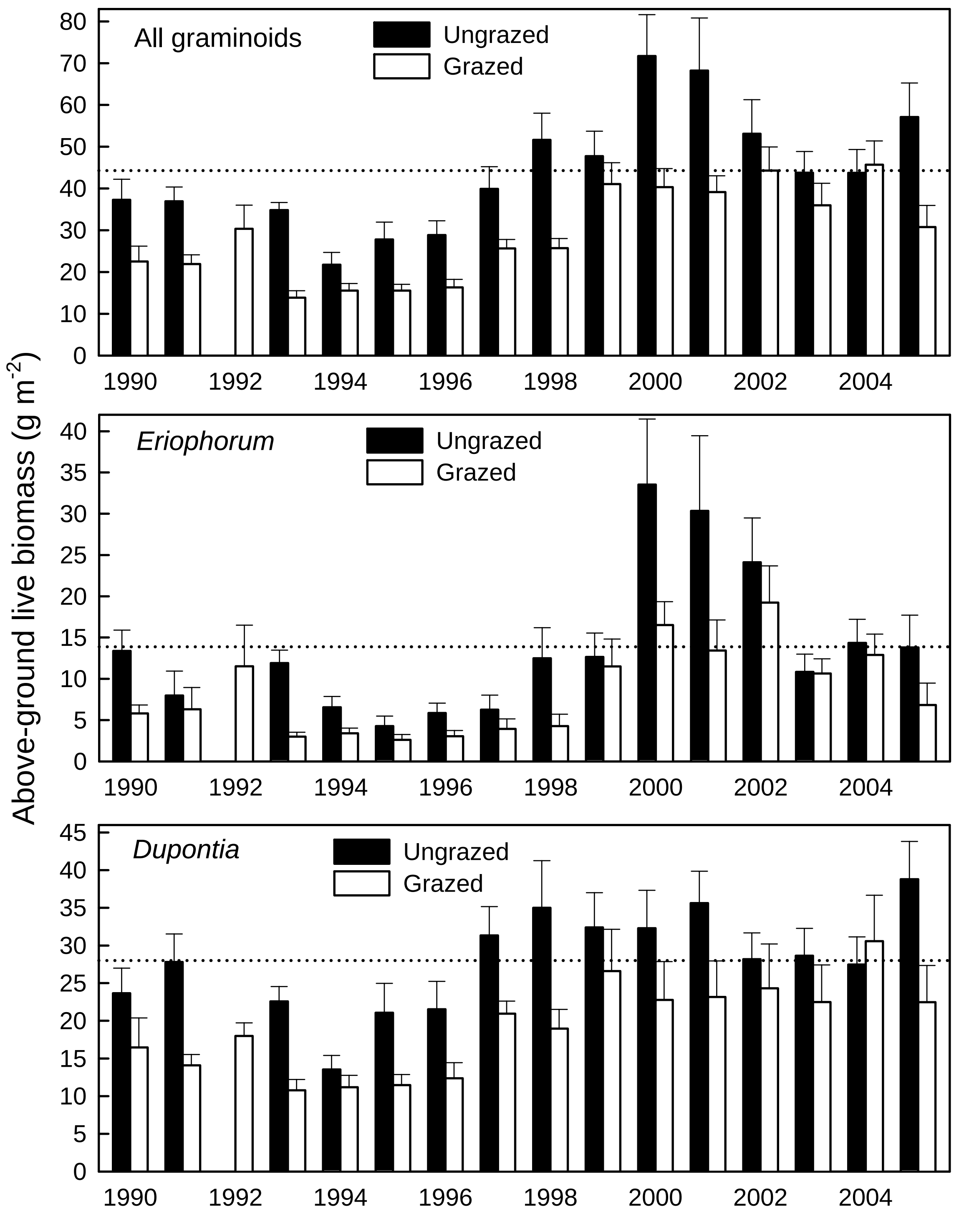

Figure 17. Live above-ground biomass (mean ± SE, dry mass) of (A) all graminoids, (B) *Eriophorum scheuchzeri* and (C) *Dupontia fisheri* around 16 August in grazed and ungrazed wet meadows of the Qarlikturvik Valley, Bylot Island, from 1990 to 2005 (*n* = 12 each year). There is no data from ungrazed area in 1992. The dotted line shows the mean plant production for the whole period.

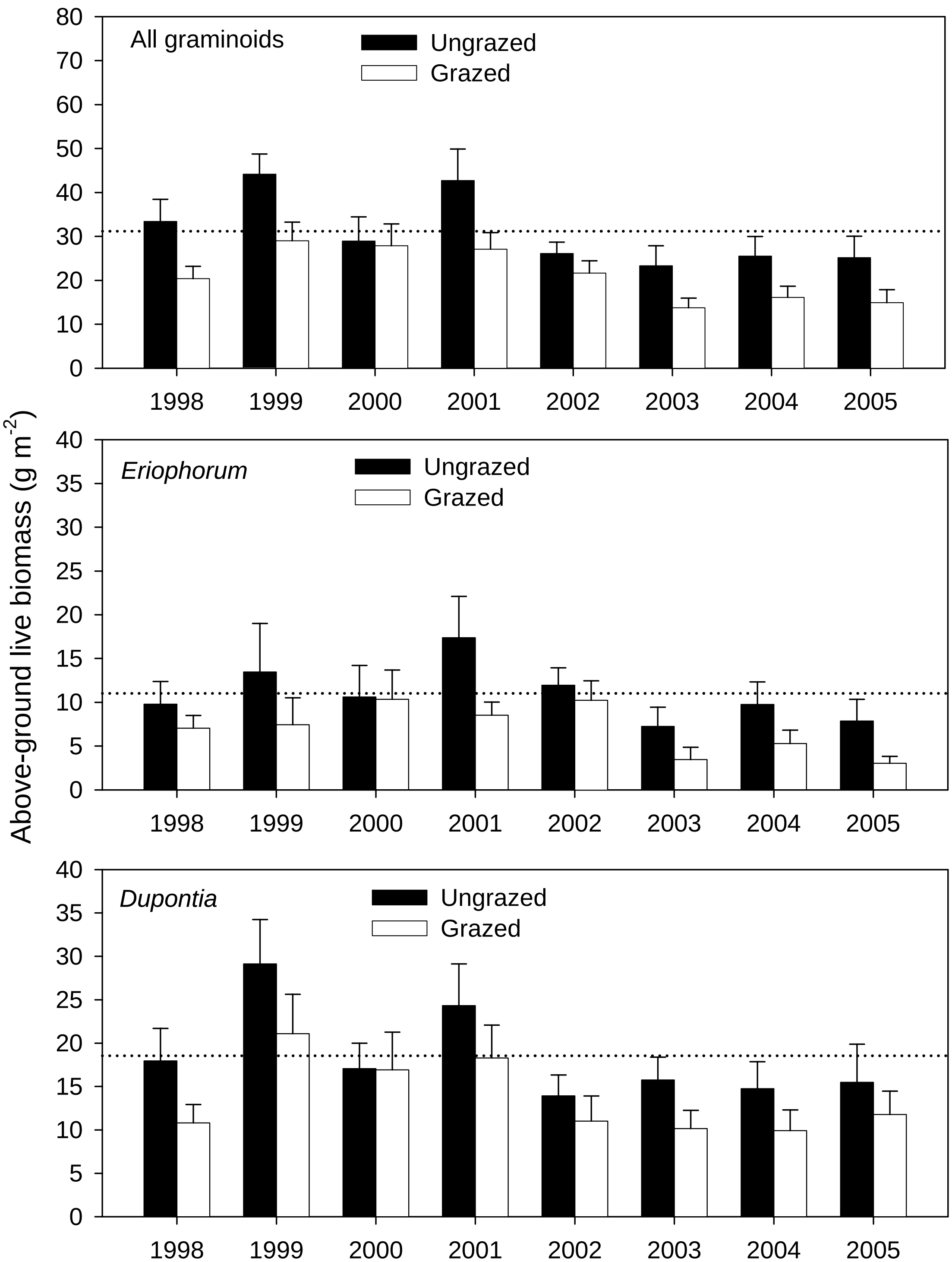

Figure 18. Live above-ground biomass (mean ± SE, dry mass) of (A) all graminoids (B) *Eriophorum scheuchzeri* and (C) *Dupontia fisheri* around 17 August in grazed and ungrazed wet meadows of the main nesting goose colony, Bylot Island, from 1998 to 2005 (*n* = 12 each year). The dotted line shows the mean plant production for the whole period.

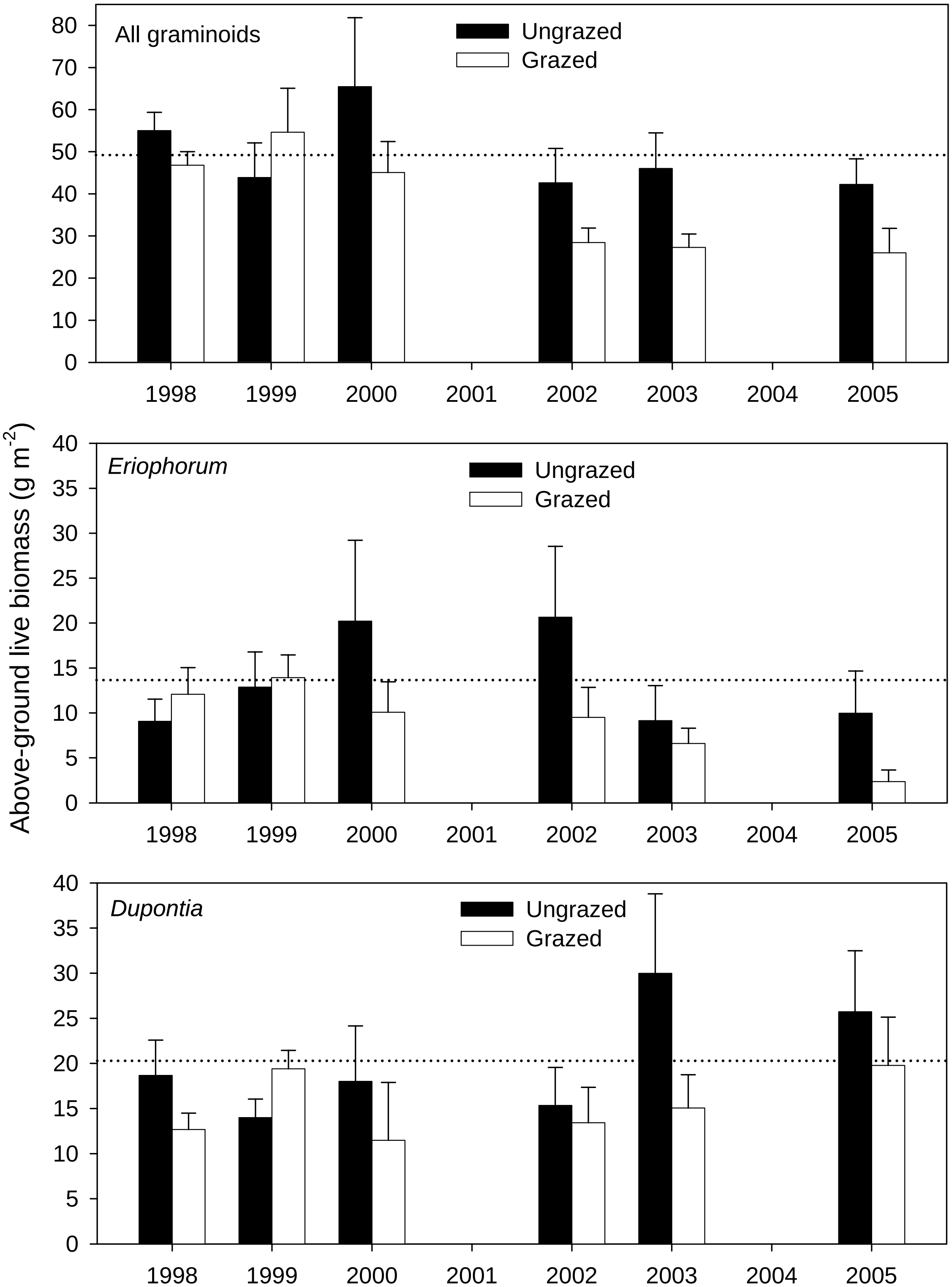

Figure 19. Live above-ground biomass (mean ± SE, dry mass) of (A) all graminoids (B) *Eriophorum scheuchzeri* and (C) *Dupontia fisheri* around 17 August in grazed and ungrazed wet meadows of Pointe Dufour, Bylot Island, from 1998 to 2005 (n = 12 each year). No sampling took place in 2001 and 2004. The dotted line shows the mean plant production for the whole period.

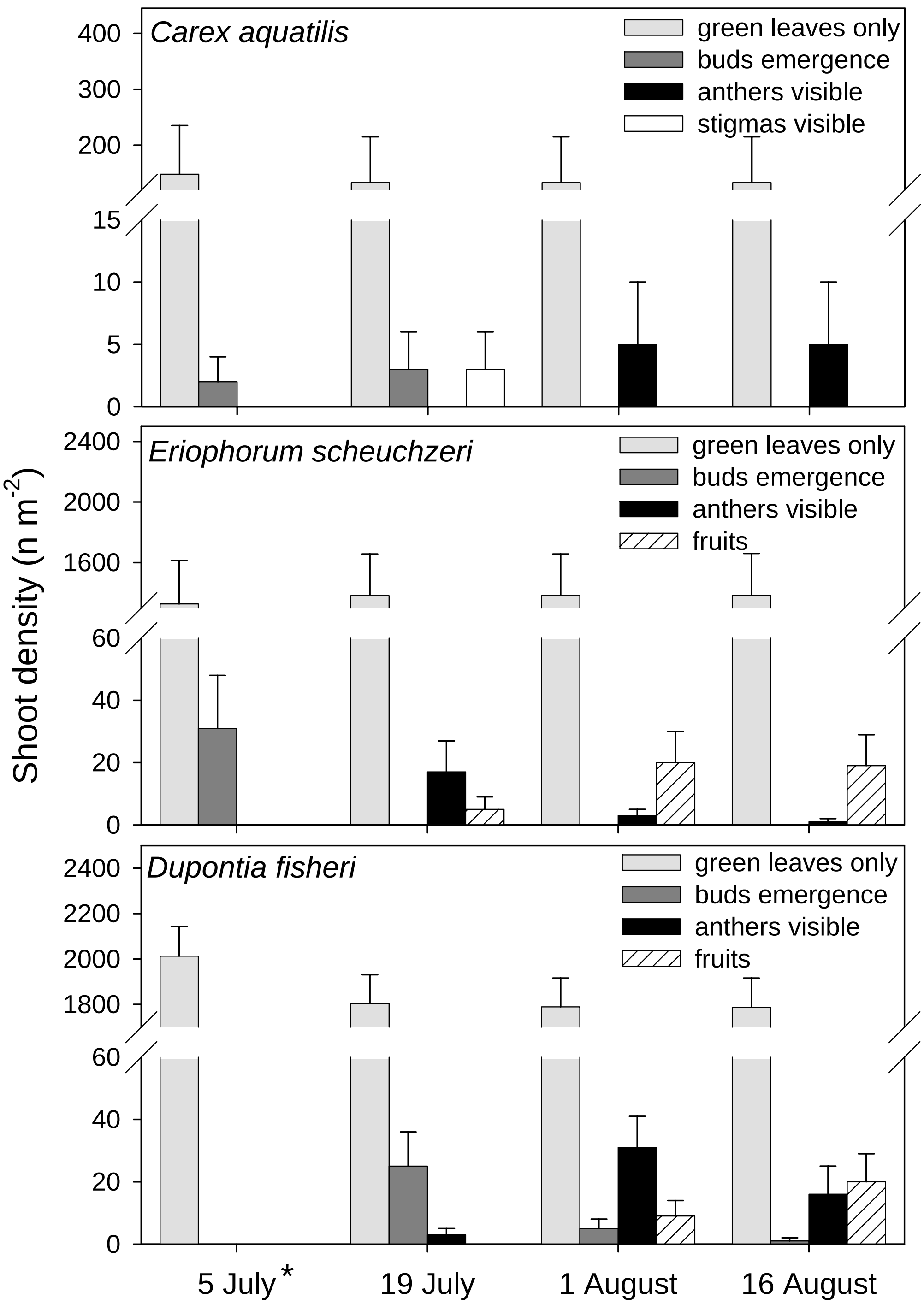

Figure 20. Plant phenology of (A) *Carex aquatilis*, (B) *Eriophorum scheuchzeri* and (C) *Dupontia fisheri* in ungrazed wet meadows of the Qarlikturvik Valley, Bylot Island, in 2005 (n = 12 each phenological stage). *Sampling was done using a 25 × 25 cm quadrat except on 5 July when a 20 × 20 cm quadrat was used.

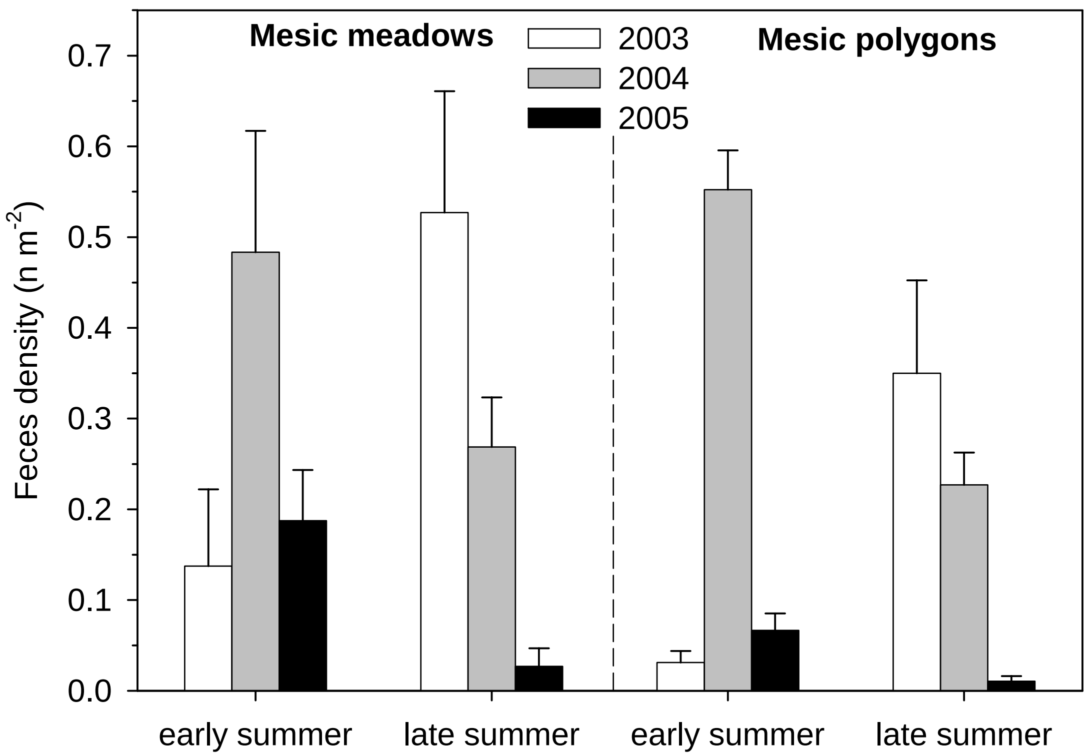

Figure 21. Feces density showing the use of mesic meadows and mesic polygons by Greater Snow Geese (n = 4 blocks of 3 transects of 1 × 20 m) on Bylot Island in early (July) and late summer (August) from 2003 to 2005.

APPENDIX 1. English and Inuktitut text sent in the Christmas card to the participants of the TEK study.

Merry Christmas and Happy New Year!

I wanted to thank you very much for participating in the project about geese and foxes last summer. It was greatly appreciated! I am now working on the interviews and planning to visit Pond Inlet again in February to provide the latest news on the project. I hope to see you around then.

My best wishes,

Catherine

Little update on the project:

- 21 persons from Pond Inlet were interviewed last summer, and all were recorded. Thank you everyone for your participation. You provided plenty of interesting stories and information.

- Last fall, I spent much time writing the translated part of the interview down on paper, so that there is a paper copy of the English translation. Unfortunately, my Inuktitut is not good enough to put on paper the non-translated versions.

- Eventually, the interviews, both in video and audio format, will be made accessible to the community via an archive created by Parks Canada. I also hope to put some of the information and stories into a shorter format easily accessible to the youth. The best format still needs to be determined, but it could be a video, for example.

- I am also working on the maps on which we took notes, trying to put them into a computer. I try to put them in a computer so that they can eventually be accessible to more people and put in the archives.

- Some of you mentioned it would be good to communicate the knowledge to the younger generation. I therefore apply for funding to pay for transportation so that Elders and youth could go out on the land to live and discuss the subject we talked about in the interviews. This is only an idea for the moment and I would be happy to receive your comments about this idea.

The Arctic is experiencing social as well as ecological changes. Arctic indigenous people are prime observers of these changes. Their local ecological knowledge is thus a valuable mean to direct and develop locally sensitive ecosystem-based management strategies. This project aims at collecting Inuit Local Ecological Knowledge in the Pond Inlet area to 1) document local knowledge about changes observed in the local environment and 2) broaden baseline data on the local terrestrial ecosystems, with special emphasis on the ecology of the greater snow geese and the arctic and red foxes and the value of those species to the local population. On a broader level, this project is a first step towards integration of Local Ecological Knowledge in managing the ecological integrity of the changing social-ecological systems of Sirmilik National Park.

APPENDIX 1 (continued).

ᖁᕕᐊᓱᒋᑦᑎ ᖁᕕᐊᓱᒻᕕᖕᒥ ᐊᕿᒍᒥᓗ ᓄᑖᒥ

ᐊᐅᔭᖅ ᐃᓚᐅᖃᑕᐅᓂᕆᓚᐅᖅᑕᕐᓄᑦ ᑲᖑᓕᕆᑎᓪᓗᑕ ᑎᕆᒐᓂᐊᓕᕆᑎᓪᓗᑕᓗ ᖁᔭᓐᓇᒦᕈᒪᑦᑎᐊᕋᒃᑭᑦ. ᐊᓕᐊᓇᐃᒋᑦᑎᐊᓚᐅᕋᑦᑎᒍᑦ ᐱᖃᑕᐅᓂᕆᔭᐃᕐ! ᒫᓐᓇ ᑕᐃᒪ ᐱᓕᕆᐊᕆᐸᓪᓕᐊᒐᒃᑭᑦ ᐊᐱᖅᓱᖅᑕᐅᖃᑦᑕᓚᐅᖅᑐᑦ ᐊᒻᒪᓗ ᒥᑦᑎᒪᑕᓕᖕᒎᑦ ᐸᕐᓇᒃᐸᓪᓕᐊᓕᓇᓪᓗᖕᒐ ᕖᕝᕗᐊᓇᐅᓕᖅᐸᑦ ᑐᓴᖅᑎᑦᑎᔭᖅᑐᕐᓗᖕᒐ ᐱᓕᕆᐊᕆᔭᕗᑦ ᖃᓄᐃᓕᖕᒐᓕᕐᒪᖕᒐᑦ. ᑕᐃᓯᒪᓂᐅᓕᖅᐸᑦ ᑕᑯᒃᑲᓐᓂᓛᕈᒪᒪᒐᓗᐊᓇᕙᕆᑦ.

ᖃᓄᐃᖏᑦᑎᐊᖁᔨᕗᖓ,

ᑳᑐᕐᓐ

ᑐᓴᒃᓵᕐᔪᒃ ᐱᓕᕆᐊᑦᑕ ᒥᒃᓵᓄᑦ:

- 21 ᒥᑦᑎᒪᑕᓕᖕᒥᐅᑕᐃᑦ ᐊᐱᖅᓱᖅᑕᐅᓚᐅᖅᑐᑦ ᐊᐅᔭᖅ, ᓂᐱᓕᐅᖅᑕᐅᔪᐃᓐᓇᐃᓪᓗᑎᒃ. ᖁᔭᓐᓇᒦᒻᒪᕆᒃ ᑕᐃᒃᑯᐊᓕᓛᖅ ᐃᓚᐅᕕᖃᓚᐅᖅᑐᑦ. ᐊᒃᓱᐊᓗᒃ ᑐᓴᕈᒥᓇᖅᑐᓂᒃ ᐅᓂᒃᑳᒃᓴᖃᓚᐅᕋᔅᓯ ᐊᒻᒪᓗ ᖃᐅᔨᕚᓪᓕᕈᑎᒃᓴᑦᑎᐊᕙᖕᓂᑦ.

- ᐅᑭᐊᒃᓵᖑᓚᐅᖅᑐᖅ, ᑕᐃᒃᑯᐊ ᖃᓪᓗᓈᑎᑑᓕᖅᑎᑕᐅᓯᒪᔪᑦ ᑎᑎᕋᖅᐸᓪᓕᐊᓱᕆᐊᓕᓚᐅᕋᒃᑭᑦ, ᐊᓱᐃᓛᒃ ᖃᓪᓗᓈᑎᑑᖓᔪᓂᒃ ᐅᖃᓕᒫᒐᒃᓴᖅᑕᖃᓕᖅᑐᖅ. ᐊᐅᑦᑖᖑᒐᓗᐊᖅᐸᕐᓕ, ᐃᓄᒃᑎᑐᑦᑎᐊᕈᓐᓇᖏᑦᑐᕈᓘᒐᒪ ᐃᓄᒃᑐᑦ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ ᓴᖅᑭᑦᑎᔪᓐᓇᖏᓚᖓ.

- ᖃᖓᐅᒍᓗᐊᕿᐊᖅ, ᑕᐃᒃᑯᐊ ᐊᔾᔨᓕᐅᖅᑕᐅᓚᐅᖅᑐᑦ ᓂᐱᓕᐅᖅᑕᐅᓯᒪᔪᓪᓗ, ᐊᑐᐃᓐᓇᕈᖅᑎᓛᖅᑕᕗᑦ ᒥᑦᑎᒪᑕᓕᖕᒥᐅᓄᑦ ᒥᕐᖑᐃᖅᓯᕝᕕᓕᓇᔾᑯᓐᓄᑦ ᑲᓇᑕᒥ ᐹᐸᑦᑕᒃᓴᐃᑦ ᐊᖅᑭᒃᓱᖅᑕᐅᓯᒪᔪᖕᒋᑎᒍᑦ. ᓂᓇᐅᒃᑲᓗᐊᓇᕗᖓ ᑕᐃᒃᑯᐊ ᐃᓚᖏᑦ ᖃᐅᔨᒪᒋᐊᕈᑎᒃᓴᐃᑦ ᐅᓂᒃᑳᖅᑐᐊᓪᓗ ᓇᐃᓪᓕᒋᐊᖅᓯᓖᕐᔫᓪᓗᒋᑦ ᒪᒃᑯᒃᑐᓄᑦ ᐊᑐᐃᓐᓇᐅᓂᖕᓴᐅᓂᐊᕐᒪᑕ. ᓇᓕᐊᒃ ᖃᓄᐃᑦᑐᓪᓗ, ᐱᐅᓂᖅᐸᐅᓂᐊᕐᒪᖖᖏᑦᑕ ᓱᓕ ᓇᓗᓇᐃᓪᓕᓈᖕᖏᑦᑕᕗᑦ, ᑭᓯᐊᓂ ᑕᕐᓇᔭᒃᓴᒃᓴᑎᒎᔪᓐᓇᕋᔭᖅᑐᑦ ᓱᕐᓗ.

- ᓄᓇᖑᐊᑦᑕᐅᖅ ᐱᓕᕆᐊᕆᐸᓪᓕᐊᕗᒃ ᑎᑎᖅᓯᕕᐅᖃᑦᑕᐅᖅᑐᑦ, ᖃᕋᓴᐅᔭᒨᖅᐸᓪᓕᐊᓇᓱᒃᓗᒋᑦ. ᖃᕋᓴᐅᔭᕐᓅᕋᓱᒍᑎᒋᕗᒃ ᐃᓄᖕᓄᑦ ᑕᖅᑲᒃᑯᓄᖕ ᓇᐅᑦᑎᐅᒪᒋᔭᐅᓂᖅᓴᐅᓂᐊᕐᒪᑕ ᐊᒻᒪ ᐸᐸᑐᖅᑕᐅᓯᒪᔪᓄᑦ ᐃᓚᓕᐅᔾᔭᐅᓯᒪᓂᐊᕐᒪᑕ.

- ᐃᓛᓯᒍᑦ ᐅᖃᐅᕋᔅᓯ ᒪᒃᑯᒃᑐᖁᑎᔅᓯᓐᓄᑦ ᑕᒪᒃᑯᐊ ᖃᐅᔨᒪᔭᐅᑎᑕᐅᔭᕆᐊᖃᕐᓂᖏᓐᓂᑦ. ᑕᐃᒪᐃᒻᒪᑦ ᓅᔾᔪᑎᒃᓴᓄᑦ ᐃᓐᓇᐃᑦ ᒪᒃᑯᒃᑐᓪᓗ ᐊᐅᓪᓛᖅᓯᓗᑎᒃ ᐃᓅᖃᑎᒌᓚᐅᑲᒍᑎᒃᓴᖏᓐᓄᑦ ᑕᐃᒃᑯᐊᓗ ᐊᐱᖅᓱᕐᓂᖅᖃᖅᑎᓪᓗᑕ ᐅᖃᐅᓯᐅᖃᑦᑕᓚᐅᖅᑐᑦ ᐊᑐᓕᖅᑎᓐᓇᓱᒍᑎᒃᓴᖏᓐᓄᑦ ᑐᒃᓯᕋᖅᓯᒪᕗᖓ. ᒫᓐᓇᐅᓂᖓ ᐃᓱᒪᒋᑐᐃᓐᓇᖅᑕᕋᓗᐊᕋ ᑭᓯᐊᓂ ᑕᒪᓐᓇ ᐃᓱᒪᖃᕐᕕᒋᑐᐊᕈᓯᐅᒃ ᑐᓴᕈᒪᑐᐃᓐᓇᓇᕗᖓ.

ᐅᑭᐅᖅᑕᖅᑐᒥ ᐃᓅᓯᖏᑦ ᐊᕙᑎᖓᑎᒍᓪᓗ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖅᑕᖃᓪᓚᑦᑖᕐᒪᑦ. ᐅᑭᐅᖅᑕᖅᑐᒥᐅᑕᓪᓚᓈᑦ ᑕᒪᒃᑯᓂᐊ ᐅᔾᔨᕈᓱᒃᑐᒻᒪᓇᐊᓘᖕᒪᑕ. ᓄᓇᒥᓂ ᓯᓚᑎᒥᓂᓪᓗ ᖃᐅᔨᒪᓂᖓ ᑕᕙ ᐊᑑᑎᓂᖃᓪᓚᓇᒃᐳᖅ ᐱᑦᖃᓇᐊᖃᕐᓂᖓᓂᒃ ᑐᑭᒧᐊᒍᑎᒃᓴᒥ ᓄᓇᖓᑕ ᓂᑲᓇᓇᔭᖏᓐᓂᒃ ᐊᕙᑎᓕᓇᓂᕐᒧᑦ ᑲᒪᒋᔭᐅᔾᔪᑎᒃᓴᖏᓐᓂᒃ. ᑕᒪᓐᓇ ᐱᓕᕆᐊᒃᓴᖅ ᑐᕿᓚᖃᕿᓱᒃᐳᖅ ᐊᕗᐃᓂᕐᒥᒃ ᐃᓄᐃᑦ ᑐᓄᓂᕐᒥᐅᑦ ᐊᕙᑎᖓᓂᒃ ᖃᐅᔨᒪᓂᓇᔭᐅᔪᖁᑎᖏᓐᓂᓗ ᐃᒪᐃᓕᐅᕐᓗᑎᒃ 1) ᑎᑎᕋᕐᓗᒋᑦ ᓄᓇᖓᓂ ᖃᐅᔨᒪᔭᐅᔪᑦ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᐅᔪᑦ ᐊᒻᒪ 2) ᓯᕕᑦᑎᓇᐊᓚᓛᓪᓗᒍ ᖃᐅᔨᒪᔭᐅᓂᓇᔭᖓ ᓄᓇᖁᑎᖓᑕ ᐃᓕᖅᑯᓯᖏᓐᓂᒃ ᐱᐅᓯᖃᕈᓯᖏᓪᓗ, ᐱᓗᐊᖅᑐᒥᒃ ᑲᖑᐃᑦ ᓄᓇᖁᑎᒋᓂᓇᔭᖏᑦ ᐊᒻᒪᓗ ᑎᓇᒐᓂᐊᕐᔪᑦᑎᐊᑦ ᐊᒻᒪᓗ ᑲᔪᐃᑦ ᑎᓇᒐᓂᐊᑦ ᐊᒻᒪ ᖃᓄᖅ ᑖᒃᑯᐊ ᐱᑕᖃᕐᓂᖏᑦ ᐊᑑᑎᖃᖅᑎᒋᒪᖓᑕ ᑐᓄᓂᕐᒥᐅᑦ ᓄᓇᖓᖁᑎᖓᓄᑦ. ᐊᖏᓂᖅᓴᒃᑯᑦ, ᑕᒪᓐᓇ ᐱᓕᕆᐊᒃᓴᖅ ᓱᕐᓗ ᐊᕗᖓᓪᓗᐊᑲᓪᓚᒃ ᐊᓪᓗᕈᑎᐅᒐᔭᖅᐳᖅ ᓄᓇᓕᐅᔪᑦ ᐊᕙᑎᒥᖕᓂᑦ ᖃᐅᔨᒪᓂᖁᑎᖏᓐᓂᒃ ᐊᑐᖅᑎᑦᑎᓂᕐᒧᑦ ᑲᒪᒋᔭᐅᓇᓱᒃᑎᓪᓗᒍ ᐊᕙᑎᓕᓇᓂᒃᑯᑦ ᑕᒪᒃᑭᑦ ᐃᓅᓯᐅᔪᑦ ᐊᕙᑎᖓᓂᓪᓗ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖅᑕᖅᑎᓪᓗᒍ ᓯᕐᒥᓕᒃ ᒥᕐᖑᐃᖅᓯᕝᕕᖃᕝᕕᒋᔭᖓᓂ.

APPENDIX 2. List of attendees to the Bylot Island Research and Monitoring Workshop and public consultation on 14-15 February 2006 at the conference room of the Nattinak Visitor Center, Pond Inlet.

Name	Affiliation	Workshop		Public consult.
		14 Feb.	15 Feb.	15 Feb.
Gary Mouland	Parks Canada – Iqaluit	X	X	
David Qamaniq	Mayor, Chairmand, Inuit Qikiktani Association, JPMC – Pond Inlet	X	X	X
Qavavauq Issuqangituk	JPMC – Pond Inlet	X	X	
Geesoonie Killiktee	JPMC – Pond Inlet	X	X	
Joshua Idlaout	Hamlet – Pond Inlet	X		
Phillip Panneak	Inuit Qikiktani Association, translator – Pond Inlet	X	X	
Joseph Koonoo	Elder – Pond Inlet	X	X	X
Jayko Peterloosie	Elder – Pond Inlet	X	X	
Cornelius Nutaraq	Elder – Pond Inlet	X		
Paniloo Sangoya	Elder – Pond Inlet	X		
Dominique Berteaux	Université du Québec à Rimouski – Rimouski, QC	X	X	X
Catherine Gagnon	Université du Québec à Rimouski – Rimouski, QC	X	X	X
Isidore Quasa	TEK research assistant – Pond Inlet	X	X	
Jimmy Pitseolak	Field Assistant – Pond Inlet	X		
Israel Mablick *(with wife and kids at the public consultation)*	Parks Canada – Pond Inlet		X	X
Rhoda Koonoo	Elder – Pond Inlet			X
Gamalial Kilukishak	Elder – Pond Inlet			X
Mary Kilukishak	Elder – Pond Inlet			X
Johana Pewatoalook	Elder – Pond Inlet			X
Leslie Pewatoalook	Youth – Pond Inlet			X
Jennifer Pewatoalook	Youth – Pond Inlet			X
Elisha Pewatoalook	Research assistant, translator – Pond Inlet			X
Phillipa Ootoova	Archives - Pond Inlet library			X

APPENDIX 3. Schedule of the workshop on ecological monitoring on Bylot Island, Sirmilik National Park, Pond Inlet, 14-15 February 2006 and different meetings attended between 13 and 24 February 2006.

MONDAY, 13 February

12:00	**Radio communication in Pond Inlet announcing the workshop and public talk**
16:25	**Dominique Berteaux & Catherine Gagnon** Arrive in Pond Inlet

TUESDAY, 14 February

9:00-9:30	**Dominique Berteaux** Welcome word – Why doing some ecological research on Bylot Island
9:30-10:00	**Dominique Berteaux** Research on Arctic Foxes on Bylot Island
10:00-10:20	Coffee Break
10:20-10:50	**Catherine Gagnon** Traditional Ecological Knowledge studies on fox and geese
10:50-11:20	**Dominique Berteaux** New research projects on Bylot Island
11:20-11:50	**Gary Mouland** Ecological Integrity in National Parks of Canada
12:00-13:30	LUNCH TIME **Radio communication in Pond Inlet announcing the workshop and public talk**
13:30-15:30	**Dominique Berteaux & Catherine Gagnon** Presentation of procedures and equipment for fox trapping on Bylot Presentation of posters and pictures relating traditional ecological knowledge study on fox and geese Presentation of archive pictures showing fox trapping in the area Poster distribution

APPENDIX 3 (continued).

WEDNESDAY, 15 February

9:00-12:00	Meeting between researchers, Joint Park Management Committee members, Parks Canada people, and Inuit Knowledge Working Group to discuss specific issues related to the Park and our research
12:00-13:00	LUNCH TIME
15:15-17:00	**Dominique Berteaux** & **Catherine Gagnon** Lectures to the Nassivik High School
17:00-19:00	DINNER TIME
19:00-21:00	**Presentation of research performed on Bylot Island** Talk on fox research performed at Bylot and on TEK research done in Pond Inlet Presentation of scientific trapping methods and equipment Presentation of archive pictures

THURSDAY, 16 February

10:45-12:00	**Dominique Berteaux** & **Catherine Gagnon** Lectures to the Ulaajuk Elementary School
14:00-15:00	**Dominique Berteaux** Meeting with Mayor of Pond Inlet David Qamaniq to discuss International Polar Year and get written support from Pond Inlet community

FRIDAY, 17 February

10:45-12:00	**Dominique Berteaux** & **Catherine Gagnon** Lectures to the Ulaajuk Elementary School
13:15-14:30	**Dominique Berteaux** & **Catherine Gagnon** Lectures to the Ulaajuk Elementary School

SATURDAY, 18 February

Dominique Berteaux leaves from Pond Inlet

SATURDAY, 18 February – MONDAY 20 February

Catherine Gagnon at the Nunatsiaq outpost camp with three hunters to share their experience with the land in winter

APPENDIX 3 (continued).

TUESAY, 21 February

Catherine Gagnon scheduled to work with translator Elisha Pewatoalook to fine tune translation of some of the 2005 summer interviews – cancelled due to youth suicide in the community

WEDNESDAY, 22 February

Catherine Gagnon leaves from Pond Inlet

THURSADY-FRIDAY, 23-24 February

Catherine Gagnon in Iqaluit to meet with Parks Canada staff and Joint Park Management Committee members; completion of the park permit update for 2006 field season

APPENDIX 4

Pamphlet on fox studies on Bylot Island, Sirmilik National Park
distributed to the participants at the workshop

ᓯᕗᓂᑦᑎᓐᓂ ᖃᐅᔨᓴᕐᓂᐅᖃᔭᖅᑐᑦ

FUTURE STUDIES

There are still many unknowns about the ecology of Arctic foxes. For example, we know that they can move large distances over the tundra or the sea ice. But how far do foxes move from their natal den before settling in a new area? Does a given fox use the same den every year? How separate are their summer and winter ranges? How far from their den do foxes hunt when they are feeding cubs? In the next years, scientists and their Mittimatalik collaborators will try to answer some of these questions. Ecological knowledge is critical to the management and protection of tundra ecosystems. Sustained interest in animal and plant life is also one way to bridge generations and help Youth to remember their important cultural heritage.

ᐊᒥᓱᓂᑦ ᓱᓕ ᑐᑭᓯᐅᒪᙱᑦᑐᑦ ᓂᕿᒋᖃᑦᑕᖅᑕᙱᓐᓂ ᑎᕆᒐᓂᐊᑦ. ᓲᕐᓗ, ᖃᐅᔨᒪᒐᑦᑕ ᐅᖓᓯᑦᑐᐊᓘᒃᑰᖃᑦᑕᓲᖑᒪᑕ ᓄᓇᒥᑦ ᓯᑯᒧᑦ. ᑭᓯᐊᓂᓕ ᖃᓄᑎᒃ ᐅᖓᓯᑦᑐᓕᐊᓲᖑᕙᑦ ᑎᓯᑐᖃᕐᒥᓂᑦ ᐊᓯᐊᓅᓐᓂᐊᓕᖅᑎᓪᓗᒍ? ᐊᕐᕌᒍᑕᒫᖅ ᑖᔅᓱᒥᙵᓭᐃᓐᓇᖅ ᑎᓯᖃᓲᖑᕙᑦ? ᖃᓅᓕᕆᒃ ᐱᓲᖑᕙᑦ ᐅᐱᕐᙳᒃᑯᑦ ᐅᑭᐅᒃᑯᓪᓗ? ᑎᕆᒐᓂᐊᕋᓛᖅᖢᑎᓪᓗᒋᑦ ᖃᓄᑎᒃ ᐅᖓᓯᑦᑑᓲᖑᕙᑦ ᓂᕿᔅᓴᖅᓯᐅᕆᐊᖅᑐᑎᒃ? ᐅᑭᐅᓂᒃ ᐊᒡᒋᖅᑐᓂᒃ, ᖃᐅᔨᓴᖅᑏᑦ ᒥᑦᑎᒪᑕᓕᒻᒥᓪᓗ ᐃᑲᔪᖅᑎᖏᑦ ᑕᒪᒃᑯᓂᖓ ᐊᐱᖅᑯᓯᐅᔪᓂᒃ ᓴᖅᑮᔪᒫᖅᑐᖅ. ᓄᓇᓕᕆᓂᕐᒥᑦ ᖃᐅᔨᒪᓂᖅ ᐱᒻᒪᕆᐅᒻᒪᑦ ᐊᐅᓚᑦᑎᔾᔪᑕᐅᔪᓐᓇᕐᒐᑦ ᐸᖅᑭᔾᔪᑕᐅᓗᑎᓪᓗ ᓄᓇᒦᓐᖏᖅᑐᓂᒃ. ᐃᑲᔫᑎᐅᔪᓐᓇᕆᓗᑎᒃ ᓘᖃᖅᑎᓄᑦ ᐃᖅᑲᐅᒪᓂᐊᕐᒐᑦ ᖃᓄᑎᒋᐱ ᐱᒪᕆᐅᑎᒋᒻᒪᖔᖅ ᐱᖁᓯᑐᖃᖏᑦ.

Acknowledgements ᐃᓚᔅᓇᔾᐅᔪᑦ

ᖁᔭᓐᓇᒦᕈᒪᔪᑦ ᐃᓐᓇᐃᑦ ᐊᓯᕙᖅᑖᓪᓗ ᐅᓂᒃᑳᕐᓇᓚᐅᕐᖓᑕ ᐃᓄᐃᑦ ᖃᐅᔨᒪᓂᖏᓐᓂ: ᒫᑎᐅ ᐊᑯᒪᓕᒃ, ᑎᒧᑎ ᐊᒃᓵᕐᔪᒃ, Hᐊᒻ ᑲᓪᓗᒃ, ᐊᖑᑕᐃᓐᓇᒃ ᔭᐃᑭᐱ ᑲᑦᓴᒃ, ᐋᔅᒥᐅ ᑲᑦᓴᒃ, ᑲᒪᓕᐊ ᕿᓗᖅᑭᔅᓴᖅ, ᒨᓯᔅ ᑯᓄᒃ, ᐳᕋᐃᔭᓐ ᑯᓄᒃ, ᔫᓯᑉ ᑯᓄᒃ, ᕉᑕ ᑯᓄᒃ, ᐋᓚᓐ ᒪᒃᑖᖅ, ᑐᕇᓴ ᒪᒃᑖᖅ, ᑯᐊᓂᓕᐊᔅ ᓄᑕᕋᖅ, ᑖᒪᔅ ᓄᑕᕋᕆᐊᖅ, ᐃᓚᓯᐱ ᐆᑐᕙ, ᐃᓚᐃᔾ ᐸᓂᐸᑯᑦᓱ, ᔮᐃᑯ ᐲᑐᓗᓯ, ᐸᐃᖕᑐᐊ ᐋᓂ ᐲᑐᓗᓯ, ᒫᑎᐊᔅ ᖃᐅᓈᖅ, ᐸᓂᓗ ᓴᖑᔭ, ᕈᑦ ᓴᖑᔭ. ᖁᔭᓐᓇᒦᕐᒥᔪᒍᑦ ᕿᓚᔅ ᕝᕙᑎᐊ ᖃᐅᔨᓴᓇᐊᓐᖓᓚᐅᖅᓯᒪᔪᖅ ᓴᓐᓂᕈᓯᒥ ᒥᑦᑎᒪᑕᓕᒫᑉ ᕿᑭᖅᑕᖓᓐᓂ 1993−ᖑᑎᓪᓗᒍ, ᐊᓪᓚᓗ ᐃᐅᕋᓐ ᐱᑦᓯᐊᓛᖅ, ᐄᓇᔅ ᒥᖅᑯᓵᖅ ᐊᓪᓚᓗ ᔨᒥ ᐱᑦᓯᐅᓛᖅ ᐃᑲᔪᖃᑦᑕᓚᐅᕐᓂᖏᓐᓂ ᓴᓐᓂᕈᓯᒥ. ᖁᔭᓐᓇᒦᕐᒥᔪᒍᑦ ᐃᓚᐃᓴ ᐱᐅᒋᑦᑐᐊᓗᒃ, ᐃᓯᑐᐊ ᖁᐊᓴ, ᓘᓯ ᖁᐊᓴ, ᓭᓕ ᐃᕗᕋᒻ ᐊᓪᓚᓗ ᓗᐊᓇ ᐆᑐᕙ ᑐᓵᐅᑎᑦᑕᓚᐅᕐᓂᖏᓐᓂ ᐃᑲᔪᖃᑦᑕᓚᐅᕐᒪᑕ. ᑭᐅᕆ ᐊᕗᕈᒻ ᐊᓪᓚᓗ ᓯᕐᒥᓕᒃᑯᑦ ᒥᕐᖑᐃᓯᕆᔨᖏᑦᑕ ᐃᖅᑲᓇᐃᔭᖅᑎᖏᑦ ᐊᔾᔨᐊᓗᒃ ᖁᔭᒋᐹᑦ ᑕᒪᔾᓱᒥᖓ ᐱᓕᕆᖃᑦᑕᐅᕐᓂᖏᓐᓂ.
ᖃᐅᔨᓴᕐᓂᐅᔪᑦ ᐃᑲᔪᖅᑐᖅᑕᐅᔾᔪᑦ ᐅᑯᓄᖓ (ᖃᓪᓗᓈᑎᑐᑦ ᑎᑎᕋᐅᓯᖏᑦ ᒪᓕᒡᓗᒋᑦ): ᑲᓇᑕᒥ ᑲᑐᔾᔭᖃᑎᒌᑦ ᐋᖅᑭᓱᐃᔨᓄᑦ, ᑲᓇᑕᒥ ᖃᐅᔨᓴᖅᑏᑦ ᐃᔅᓯᕙᐅᑕᖓ, ᑲᓇᑕᒥ ᐆᒪᔪᓕᕆᔨᒃᑯᑦ, (/ᓕᓴᖁᐅ ᖏᒥéᑕéᖃᓕᓂᐅ ᖁᕿ ᓗᖕᒍ ᑭᕿᖃᓱᕿᑭᖃᓱᕿ ᐅᒥᑭ ᓗᖕᒍ ᓴᖕᒍᑎᒥᑭᕿ ᕿᑎ ᓗᕿᐅ ᑎᕿᖃᓱᓴᓕᓗᓕᑐᓂᕿᐅ0 ᐅᐃᕕᒃᑯᑦ ᑲᑐᔾᔭᖃᑎᒌᖏᑦ, ᒥᑦᑎᒪᑕᓕᒥ ᐆᒪᔪᕐᓕᐊᖅᑎᒃᑯᖏᑦ, ᑲᓇᑕᒥ ᖃᐅᔨᓴᖅᑎᓪᓚᕈᑦ ᑲᑎᒪᔨᖏᑦ ᑲᓇᑕᒥ, ᑲᓇᑕᒥ ᖃᕋᓴᐅᔭᓕᕆᔨᒃᑯᑦ, ᐅᑭᐅᖅᑕᖅᑐᒥ ᐆᒪᔪᓂᑦ ᐱᕈᖅᑐᓕᒫᓗ ᑲᒪᔨᖏᑦ (ᐊᐱᑎᓕᕆᔨᒃᑯᑦ ᑲᓇᑕᒥ), ᐅᑭᐅᖅᑕᖅᑐᒥ ᖃᐅᔨᓴᕐᓂᑯᑦ ᐃᓕᓐᓂᐊᕐᑎᑦᑎᓂᖏᑦ (ᐃᓄᓕᕆᔨᒃᑯᑦ ᑲᓇᑕᒥ), ᓄᓇᕗᑦ ᐆᒪᔪᓕᕆᔨᒃᑯᖏᑦᑕ ᑲᑎᒪᔨᖏᑦ, ᑲᓇᑕᒥ ᒥᕐᖑᐃᓯᕆᐊᒃᑯᖏᑦ, ᓯᓚᕐᔪᐊᒥ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑲᒪᔨᖏᑦ, 9!ᓴᓂᑲᕿᑭᑭᐅᓂᑎé ᖁᒥ ᑭᒥéᑕᕿᖃ à $ᓂᒪᓕᒥᐅᓄᓂ, ᖑᓴᖁ !ᓴᓂᑲᕿᑭᑭᐅᓂᑎé ᓗᖕᑲᖕᒍᓗ0 ᓚᕙᐅ ᐃᓕᓐᓂᐊᕕᐊᔾᔪᐊᖓ.

We thank the Elders and Hunters who participated in the Inuit Knowledge project: Matthew Akomalik, Timothy Aksarjuq, Ham Kadloo, Angootainook Jokepee Katsak, Ishmael Katsak, Gamalial Kilukishak, Moses Koonark, Brian Koonoo, Joseph Koonoo, Rhoda Koonoo, Alan Mucktar, Theresa Mucktar, Cornelius Nutarak, Thomas Nutarariaq, Elisapee Ootoova, Elijah Panipakoocho, Jayko Peterlossie, Paingut Annie Peterlossie, Mathias Qaunaq, Paniloo Sangoya, Ruth Sangoya. We thank Gilles Gauthier for initiating fox studies on Bylot Island in 1993, and Aaron Pitseolak, Ernest Merkosak, and Jimmy Pitseolak for help with fieldwork on Bylot. Thanks to Elisha Pewatoalook, Isidore Quasa, Lucy Quasa, Shelly Elverum and Lorna Ootova for translation and/or assistance. Carey Elverum and the Sirmilik NPC staff deserve warm thanks for facilitating this project.
Studies are supported by (alphabetical order): Canada Foundation for Innovation, Canada Research Chairs, Canadian Wildlife Service, Fonds québécois de la recherche sur la nature et les technologies, Mittimatalik Hunters and Trappers Organization, Natural Sciences and Engineering Research Council of Canada, Network of Centres of Excellence of Canada ArcticNet, Northern Ecosystem Initiative (Environment Canada), Northern Scientific Training Program (Indian and Northern Affairs Canada), Nunavut Wildlife Management Board, Parks Canada, Polar Continental Shelf Project, Université du Québec à Rimouski, and Université Laval.

FOR MORE INFORMATION
ᑐᑭᓯᕆᐊᒃᑲᓐᓂᕈᒪᓐᓂᕈᕕᑦ

Contact ᑐᑭᓯᕆᐊᕐᕕᒋᔪᓐᓇᖅᑕᐃᑦ Dominique Berteaux ᑖᒪᓂᒃ ᐴᑐᕈ (dominique_berteaux@uqar.qc.ca) or Catherine Gagnon ᐅᑦᕙᓘᓐᓃᑦ ᑳᑦᑖᓐ ᒐᖕᔭ (Catherine-Alexandra.Gagnon@uqar.qc.ca), ᑲᓇᑕᒥ ᖃᐅᔨᓴᖅᑎᒻᒪᕆᒃ ᐸᖅᑭᑦᑎᓂᕐᒧᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐱᕈᖅᑐᓂᒃ Canada research chair in conservation of northern ecosystems and Centre d’études nordiques, Université du Québec à Rimouski, 300 allée des Ursulines, Rimouski (Québec) G5L 3A1 Canada (http://www.uqar.qc.ca/chairedb/)
Visit ᖃᐅᔨᒋᐊᕈᓐᓇᖅᑐᑎᑦ http://www.cen.ulaval.ca/bylot/

ᑎᕆᒐᓂᐊᕐᓂᑦ ᖃᐅᔨᓴᕐᓂᐅᓂᐊᖅᑐᖅ ᓯᕐᒥᓂᒃ ᑲᓇᑕᒥ ᒥᕐᖑᐃᓯᕐᕕᖓ

FOX STUDIES
SIRMILIK NATIONAL PARK
OF CANADA

Arctic fox are studied for several reasons.

They are the main predator of the tundra and an essential component of the health of this ecosystem. Changes in climate, wildlife exploitation, rate of visitation by humans, or the arrival of new species to the North can all potentially disturb the tundra ecosystem and affect its health. Monitoring fox populations at Sirmilik National Park is one way to ensure that any drastic change to this ecosystem would be quickly detected.

Arctic foxes feed on goose eggs and goslings in summer. Managing goose populations requires a good understanding of goose reproduction, which in part depends on arctic fox predation. Thus arctic fox studies also contribute to the management of goose populations.

Arctic foxes in other countries such as Norway or Sweden used to be abundant, as in Nunavut, but have now nearly disappeared. Some suggest that the spread of red foxes to Northern latitudes during the twentieth century may have contributed to this decline. Red foxes also arrived recently to Sirmilik and this is an additional reason to closely study arctic fox populations and their relations with red foxes.

Finally, arctic fox used to be vital to the economy of northern communities, and still play an important role in Inuit culture and memories. This also is an important reason to study arctic fox, so that younger generations do not forget this important cultural heritage, and continue to learn about this arctic species.

ᓱᒻᒪᑦ ᖃᐅᔨᓴᖅᑕᐅᓯᐊᖃᖅᑲᑦ ᑎᕆᒐᓂᐊᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ?

WHY STUDYING ARCTIC FOX?

ᐅᑭᐅᖅᑕᖅᑐᒥ ᑎᕆᒐᓂᐊᑦ ᖃᐅᔨᓴᖅᑕᐅᖃᑦᑕᖅᑐᑦ ᐊᒥᓱᑲᓪᓚᖓᓂᒃ ᐱᔾᔪᑎᖃᖅᑐᑎᒃ.

ᐅᒪᔪᖅᑕᐅᒐᔪᓐᓂᖅᐹᖑᔪᑦ ᓄᓇᒥ ᐊᓪᓚᓗ ᓂᕿᑎᐊᕙᕆᔭᐅᓪᓗᑎᒃ ᐊᓯᖏᓐᓄᑦ ᐆᒪᔪᓄᑦ. ᐊᓯᔾᔨᕐᓂᖏᑦ ᓯᓚᐅᑉ, ᓂᕐᔪᑏᓪᓗ ᐊᑐᖅᑕᐅᑎᐊᓐᖏᓐᓂᖏᑦ, ᐃᓄᓐᓄᓪᓗ ᐅᐸᑦᑕᐅᖃᑦᑕᕐᓂᖏᑦ, ᐅᐸᕗᓐᓂᓐᓃᑦ ᓄᑦᑖᓂᑦ ᐆᒪᔪᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᒧᖅᑐᖅᑎᓪᓗᒍ ᐅᓗᕆᐊᓇᖅᓯᒍᓐᓇᖅᑐᖅ ᓄᓇᒥᐅᑦᑕᕐᓄᑦ ᐊᑐᐃᓂᖃᕐᓗᑎᓪᓗ ᓂᕆᖃᑦᑕᕐᓂᖏᓐᓂᒃ. ᖃᐅᔨᓴᖃᑦᑕᕐᓗᑎᑦ ᓯᕐᒥᓕᒥ ᒥᕐᖑᐃᓯᕐᕕᖓᓐᓂ ᖃᐅᔨᒪᓇᑦᑎᐊᕐᔪᕐᖓᑦ ᖃᓄᑎᒃ ᐊᓯᔾᔨᐸᓪᓕᐊᔪᒦᓪᒪᖓᑕ ᓄᓇᐃᑦ ᐱᕈᖅᑐᐃᑦ ᖃᐅᔨᔭᐅᓴᕋᐃᓐᓂᖅᓴᐅᓚᔭᖅᑐᑎᓪᓗ.

ᐅᑭᐅᖅᑕᖅᑐᒥ ᑎᕆᒐᓂᐊ ᓂᕆᔪᑦ ᑲᖑᐃ ᒪᓐᓂᖏᓐᓂ ᐊᓪᓚᓗ ᐊᐅᔭᒃᑯᓪᓗ ᑲᖑᐊᕋᖅᑐᖃᑦᑕᖅᑐᑎᒃ. ᐊᒥᖑᓂᖏᓐᓂ ᐊᐅᓚᑦᑎᑦᑎᐊᕋᓱᐊᕐᓂᐊᕐᓗᓂ ᑲᖑᕐᓂᒃ ᑐᑭᓯᓗᑎᒃ ᑭᓯᐊᓂ ᖃᑦᑏᓐᓇᕈᖅᐸᓪᓕᐊᓂᖏᑦ, ᑕᐱᒪᐃᓐᓂᖓᓄᑦ ᐊᑦᑐᐊᓂᖅᓯᖓᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑎᕆᒐᓂᐊᕐᓂᑦ ᓂᕆᖃᑦᑕᖅᑐᓂᒃ. ᑎᕆᒐᓂᐊᕐᓂᑦ ᖃᐅᔨᓴᕐᓗᓂ ᐃᑲᔫᑎᖃᕐᕕᒃ ᐊᐅᓚᑦᑎᓂᕐᒥᑦ ᑲᖑᐃᑦ ᐊᒥᓲᓂᖓᓂ.

ᑎᕆᒐᓂᐊᑦ ᐊᓯᖏᓐᓂᑦ ᓲᕐᓗ ᓄᐊᕙᐃᒥ ᓱᕚᑕᒥᓪᓗᓃᑦ ᐊᒥᓱᐊᓗᓚᐅᖅᓯᒪᔪᕚᓪᓗᐊᑦ, ᑕᐃᒫᑦᑕᐅ ᓄᓇᕗᒥ, ᑭᓯᐊᓂᓕ ᓄᖑᑉᐸᓪᓕᐊᓪᓚᑖᓚᕆᑦᑐᑦ. ᐃᓚᖏᑦ ᑲᔪᐃᑦ ᐅᑭᐅᖅᑕᖅᑐᒦᕈᖅᑐᑦ 1900−ᖏᓐᓂ ᖃᑦᑏᓐᓇᕈᖅᐹᓪᓕᖅᓯᒪᓕᖅᑐᑦ. ᑲᔪᑦ ᓯᕐᒥᓕᒻᒥᖅᐸᓪᓕᐊᓯᒪᒻᒪᑕ ᐊᓪᓚᓗ ᐱᔾᔪᑎᕐᓗᒍᑦᑕᐅ ᑕᒪᓐᓇ ᖃᐅᔨᓴᕈᒪᓚᕿᕙᔭᑦ ᑎᕆᒐᓂᐊᖅᑕᖃᕐᓂᖓᓐᓂ ᐊᓪᓚᓗ ᖃᓄᖅ ᑲᔪᕐᓄᑦ ᐊᑦᑐᐊᓂᖃᖅᑎᕆᒪᖕᒐᑦ ᖃᐅᔨᒍᒪᓗᑎᑦ.

ᑕᐃᒪᓕ, ᑲᔪᐃᑦ ᒪᑭᒪᔾᔪᑕᐅᖃᑦᑕᓚᐅᖅᓯᒪᒪᑕ ᐅᑭᐅᖅᑕᖅᑐᒥ, ᐃᓄᓐᓂᑦ ᓱᓕ ᐊᑐᖅᑕᐅᕙᑐᖅ ᐃᖅᑲᐅᒪᔭᐅᑦᑎᐊᖅᑐᑎᑦ. ᑕᒪᓐᓇ ᐱᒪᕆᐅᓂᖓᓄᑦ ᖃᐅᔨᓴᕆᐊᕐᕙᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑎᕆᒐᓂᐊᑦ, ᐃᓅᓱᓐᓂᖅᓴᐃᑦ ᐃᓄᐃᑦ ᐃᖅᑲᐅᒪᖃᑦᑕᕐᓂᐊᕐᒪᑕ ᐱᖅᑯᓯᐅᓯᒪᔪᓂᒃ, ᐃᓕᑦᑕᐅᑲᓐᓂᕐᓗᑎᓪᓗ ᐅᑭᐅᖅᑕᖅᑐᒥ ᓂᕐᔪᑎᐅᖃᑕᐅᒪᑕ.

ᖃᐅᔨᓴᖃᑦᑕᖅᓯᒪᒐᑦᑕ ᑎᕆᒐᓂᐊᕐᓂᑦ ᐅᑲᐅᖅᑕᖅᑐᒥ ᐊᒻᒪᓗ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖃᖏᓐᓂ ᐊᑐᖅᑕ. ᖃᐅᔨᓴᕐᓂᒃᑯᑦ ᖃᐅᔨᓴᓛᐅᖅᓯᒪᔪᑦ ᓵᓂᕈᒻᒥ ᒥᑦᑎᒪᑕᓕᐅᑉ ᕿᑭᖅᑖᓗᐊᓂ, ᐃᓄᓐᓂᓪᓗ ᖃᐅᔨᒪᔪᓂᒃ ᑐᓴᖅᑕ ᒥᑦᑎᒪᑕᓕᒻᒥ.
2005-ᒥ ᐊᐱᖅᓱᓚᐅᖅᓯᒪᔪᒍᑦ ᐃᑲᕐᕿᐅᓗᐊᖅᑐᓂᒃ 40-ᓂᒃ 23-ᓂᒃ ᐃᓐᓇᕐᓂᑦ ᐊᓯᕙᖅᑎᓂᓪᓗ ᖃᐅᔨᒪᓂᖏᓐᓂ ᑐᓴᖅᑕ ᑎᕆᒐᓂᐊᑉ ᒥᔅᓵᓄᑦ ᓄᓇᐃᓪᓗ ᒥᔅᓵᓄᑦ.

We study arctic fox through scientific research and Inuit traditional knowledge. We conduct scientific studies on Bylot Island, and collect Inuit traditional knowledge mostly at Mittimatalik (Pond Inlet). In 2005 we performed over 40 hours of interviews with 23 Elders and/or hunters to collect traditional knowledge on fox history and ecology.

Field Work ᐱᓕᕆᐊᕆᖃᑦᑕᖅᓯᒪᔭᖏᑦ

ᓴᓐᓂᕈᒻᒥ ᒥᑦᑎᒪᑕᓕᐅᑉ ᕿᑭᖅᑖᓗᐊᓂ ᕿᑭᖅᑖᓘᑉ ᓄᕗᐊᓃᑦᑐᖅ, ᓄᓇᕗᒻᒥ, ᑲᓇᑕᒥ. ᐊᐅᔭᑕᒫᑦ, ᐱᙳᓱᓂᒃ ᑕᓪᓕᒪᓂᓪᓘᓐᓃᑦ ᖃᐅᔨᓴᖅᑎᓂᒃ, ᐃᓕᓐᓂᐊᖅᑎᓂᒃ ᐃᑲᔪᖅᑎᓂᓪᓗ ᒥᑦᑎᒪᑕᓕᒻᒥ ᓈᓴᐃᓚᐅᖅᓯᒪᔪᑦ ᑎᓯᖏᓐᓂ ᑎᕆᒐᓂᐊᑉ, ᐱᓪᓗᒋᑦ ᓇᓗᓇᐃᒃᑯᓯᖅᓱᖅᑐᒋᑦ ᓂᐅᖓᒍᑦ, ᖃᓄᐃᓐᓂᖏᓐᓂᓪᓗ ᑎᑎᕋᖅᐸᑦᑐᑕ. ᖃᐅᔨᓴᕆᐊᓯᓚᐅᖅᓯᒪᔪᑦ 1993-ᖑᑎᓪᓗᒍ ᑲᖑᕐᓂᑦ ᖃᐅᔨᓴᖅᑎ ᖃᐅᔨᒍᒪᓕᓚᐅᖅᓯᒪᒻᒪᑦ ᑎᕆᒐᓂᐊᑦ ᐊᖑᖅᑕᓕᒫᖃᑦᑕᕐᓂᖏᓐᓂ. ᖃᐅᔨᓴᕐᓂᖏᓐᓂ 2003-ᒥ ᐃᓚᒌᔭᐅᖃᑕᐅᓚᐅᖅᓯᒪᔪᑦ ᑭᓯᐊᓂᓕ ᒫᓐᓇ ᑎᕆᒐᓂᐊᑦ ᐃᒻᒥᒃᑯᑦ ᖃᐅᔨᓴᖅᑕᐅᕙᖃᑦᑕᓕᕐᔪᑦ. ᐅᖓᑖᓂ 100 ᑎᓯᑕᖃᓚᐅᖅᓯᒪᔪᖅ 600-ᑭᑕᓂᒃ ᐅᖓᓯᓐᓂᓕᓐᓂᑦ ᐊᐅᔭᑕᒫᑦ ᑕᐃᒪᐃᖃᑦᑕᖅᑐᑎᒃ ᐊᒥᓲᓂᖏᓐᓂ ᑎᑎᕋᖅᑐᑕ, ᕿᑐᕐᖏᐅᕐᓂᖏᓐᓂ ᖃᓄᐃᖃᑦᑕᕐᓂᖏᓐᓂᓪᓗ, ᐃᓄᒋᐊᓐᓂᖏᓐᓂ ᐊᕐᕌᒍᑕᒫᑦ ᐊᓯᔾᔨᕆᖃᑦᑕᖏᑦᑐᑦ, ᐊᕕᙵᖅᑕᖃᕐᓂᖏᓐᓂᓪᓗ ᒪᓕᒧᑦ. 2004-ᖑᑎᓪᓗᒍ ᐊᕕᙵᓕᖓᓕᕆᐊᓘᓚᐅᖅᓯᒪᔪᖅ, 15-ᓂᒃ ᐃᓐᓇᓯᐊᓚᐅᖅᓯᒪᔪᒍᑦ ᑎᕆᒐᓂᐊᕐᓂᑦ. ᐱᓪᓗᑕ 7-ᓂᒃ ᐃᓐᓇᕐᓂᑦ 42-ᓂ ᑎᕆᒐᓂᐊᕐᓂᑦ ᐃᓐᓇᐅᖏᑦᑐᓂᒃ. ᐃᓚᖏᑦ ᑕᑯᔭᐅᒃᑲᓐᓂᓚᐅᖅᓯᒪᔪᑦ 2005-ᖑᑎᓪᓗᒍ ᓴᓐᓂᕈᒻᒥ ᒥᑦᑎᒪᑕᓕᐅᑉ ᕿᑭᖅᑖᓗᐊᓂ, ᐃᓚᖏᑦ ᒥᑭᒋᐊᖅᑕᐅᓪᓗᑎᒃ, ᐊᓯᖏᓪᓕ ᑕᑯᔭᐅᒃᑲᓐᓂᓚᐅᖅᓯᒪᓐᖏᑦᑐᑦ.

Bylot Island is located off the northern tip of Baffin Island, Nunavut, Canada. Each summer, teams of 3-5 scientists, students, and collaborators from Mittimatalik observe and count foxes at dens, capture them using cage traps and leg hold traps, and record patiently their behaviour. Studies started in 1993 when goose biologists became interested in predation by foxes in goose colonies. Studies have intensified in 2003 and foxes are now studied on their own. More than 100 dens spread over a 600-km2 area are visited every summer to record fox abundance, reproduction, and behaviour. Fox numbers vary widely from year to year, following cycles in lemming abundance. In 2004, a high lemming year, we found 15 litters of arctic fox. We captured and tagged 7 adult and 42 juvenile arctic foxes. Some of these foxes were seen again in 2005 on Bylot, some were caught by trappers, and others were not re-observed.

Arctic fox and red fox ᐅᑲᐅᖅᑕᖅᑐᒥ ᑎᕆᒐᓂᐊᑦ ᑲᔪᐃᓪᓗ

ᑲᔪᐃᕐᓂᑦᑕᐅ ᓯᒥᓕᒻᒦᑦᑐᖃᖅᐸᒃᑐᑦ ᒥᕐᖑᐃᓯᕐᕕᖕᖓᓂ. ᑕᒪᒃᑯᐊ ᑎᕆᒐᓂᐊᕐᓯᔭᓐᓂ ᓂᐅᕕᖅᑎᒃᑯᑦ ᓂᐅᕕᖃᑦᑕᐅᖅᓯᒪᒻᒪᑕ ᑭᓯᐊᓂᓕ ᓄᕙᒍᑕᐅᕙᓕᓐᓂᓇᓚᐅᖅᓯᒪᔪᑦ ᓂᒋᖅᐸᓯᐊᓃᑦᑐᑦ ᕿᑭᖅᑖᓗᒥ 1918-ᖑᑎᓪᓗᒍ ᐊᒻᒪᓗ ᑎᑭᑦᑐᒍ ᐱᖓᓐᓇᖅᐸᓯᖓᓐᓄ ᕿᑭᖅᑖᓗᒥ ᑕᕝᕙ 1900 ᕿᑎᕐᕋᐊᓄᑦ. ᐊᕐᕌᒍᑕᒫᑦ ᐅᐊᑦᑎᖃᑦᑕᕐᓂᑦ ᐊᒥᓲᓗᐊᙱᑦᑐᓂᒃ ᑲᔪᕐᓂᑦ ᓴᓐᓂᕈᒻᒥ ᒥᑦᑎᒪᑕᓕᐅᑉ ᕿᑭᖅᑖᓗᐊᓂ. ᐊᑕᐅᓯᖅᑐᐊᖃᕐᓕᒥ ᑎᓯᓯᐊᖅᐸᑦᑐᑦ ᐊᕐᕌᒍᑕᒫᑦ ᓴᓐᓂᕈᒻᒥ ᒥᑦᑎᒪᑕᓕᐅᑉ ᕿᑭᖅᑖᓗᐊᓂ.

Red foxes are also present at Sirmilik National Park. Pelt records of the Hudson’s Bay Company suggest that they colonized Southern Baffin around 1918 and reached Northern Baffin in the middle of the 20th century. Every year we observe a few red foxes on Bylot Island. We have never found more than one breeding den per year on Bylot.

Feeding habits ᓂᕆᖃᑦᑕᕐᓂᖏᑦ

ᐅᑲᐅᖅᑕᖅᑐᒥ ᑎᕆᒐᓂᐊᑦ ᐊᔾᔨᒌᖏᑦᑐᕈᓘᔭᓪᓗᓐᓂ ᓂᕿᖃᓲᑦ. ᐊᕕᙵᕐᓂᑦ ᓂᕿᖃᕈᑎᑦ ᐊᐅᔭᒃᑯᑦ, ᑭᓯᐊᓂᓕ ᒪᓐᓂᑐᐊᕐᔪᒥᔪᑦ ᐃᓅᕋᓂᓪᓗ ᐊᑐᐃᓐᓇᐅᒐᐃᒻᒪᑕ. ᐅᑭᐅᒃᑯᑦ ᐅᐱᕐᖓᓴᒃᑯᓪᓗᓂᓪᓗ, ᑎᕆᒐᓂᐊᑦ ᓂᕆᖃᑦᑕᖅᑐᑦ ᓇᑦᑎᒥᓂᑐᖃᕐᓂᑦ ᑕᐃᒪᐃᓐᓇᓐᖓᓄᑦ, ᓂᕆᔭᐅᖃᑦᑕᖅᑐᑦ ᑎᕆᒐᓂᐊᕐᓄᑦ ᓂᕆᖃᑦᑕᖅᑐᑦ ᓄᓇᒥᑦ (ᐊᕕᙵᕐᓂᑦ), ᓄᓇᒥᑦ ᐊᒻᒪᓗ ᓂᒋᖅᐸᓯᐊᓂ ᓂᕿᑦ (ᐊᑦᑐᖅᑲᑦᑕᖅᑐᑦ ᑎᒻᒥᐊᑦ) ᐃᒪᕐᒥᓪᓗᓐᓃᑦ (ᓇᑦᑎᕐᓂᑦ). ᐊᔾᔨᒌᖏᑦᑐᓂᒃ ᓂᕆᖃᑦᑕᖅᑐᑦ ᓇᑭᑐᐃᓐᓇᖅ. ᖃᐅᔨᓴᕐᓂᑎᓂ, ᖃᐅᔨᖃᑦᑕᖅᓯᒪᔪᒍᑦ, ᒥᖅᑯᓛᓐᓂᒃ, ᓂᕆᔭᒥᓂᖏᓐᓂ ᑎᕆᒐᓂᐊᑦ.

Arctic foxes use a great variety of food sources. Lemmings constitute the main component of their summer diet, but bird eggs and chicks are also used when available. In winter or spring, foxes can feed from seal carcasses or seal pups. As a result, foods eaten by arctic foxes are produced in the tundra (lemmings), in the tundra and in Southern ecosystems (migratory birds), or in the sea (seals). This shows the complexity of the relations between ecosystems. Using a technique called "stable isotopes", we can detect, from the analysis of just a few hairs, what food has been eaten by a fox.

History of exploitation ᑎᕆᒐᓂᐊᖅᑕᐅᖃᑦᑕᕐᓂᖏᑦ

ᐅᑲᐅᖅᑕᖅᑐᒥ ᑎᕆᒐᓂᐊᑦ ᒥᑭᒋᐊᖅᑕᐅᖃᑦᑕᖅᓯᒪᔪᑦ ᒥᑦᑎᒪᑕᓕᒻᒥ ᐅᑭᐅᒐᓴᓪᓗᐊᓂᒃ. ᐅᐊᑦᑎᐊᕈᓕ, ᑎᕆᒐᓂᐊᖃᑦᑕᓚᐅᖅᓯᒪᔪᑦ ᖃᓄᐃᑦᑐᑐᐃᓐᓇᖅᑎᒍ ᒥᑭᒋᐊᕐᓂᑦ ᐅᔭᕋᖕᓂᑦ ᐊᑯᓐᓂᖏᓐᓂ, ᑭᓯᐊᓂᓕ ᒫᓐᓇᕈᓗᒃ, ᒥᑭᒋᐊᖅᓯᖃᑦᑕᖅᓯᒪᔪᑦ ᓂᐅᕐᒋᑎᒍᑦ ᓇᔪᒥᔾᔪᐊᑎᓕᖓᓂᒃ. ᐃᓐᓇᕐᓂᑦ ᐊᓯᕙᖅᑎᓪᓗ ᐊᐱᖅᓱᖅᑐᑦ ᑐᑭᓯᓚᐅᖅᓯᒪᔪᑦ ᑎᕆᒐᓂᐊᑦ ᑮᓇᐅᔭᓕᐅᕈᑎᐅᖃᑦᑕᓚᐅᖅᓯᒪᔪᑦ ᐃᓄᓐᓄᑦ ᐃᓚᒌᓐᓄᑦ 1920-ᖏᓐᓂ ᑎᑭᑦᑐᒍ 1970-ᒍᑦ, ᑎᕆᒐᓂᐊᓯᔭᐃᑦ ᓂᐅᕈᑕᐅᖃᑦᑕᖅᓯᒪᔪᑦ ᓂᐅᕕᖅᑎᒃᑯᓄᑦ. ᒥᑭᒋᐊᖅᓯᖃᑦᑕᐃᓐᓇᑎᓪᓗᒋᑦ, ᐃᓚᖏᑦ ᐃᓄᐃᑦ ᐅᖃᓪᓚᖅᑐᖅ ᑕᒪᒃᑯᐊ ᑎᕆᒐᓂᐊᑦ ᐱᒻᒪᕆᐅᓂᕋᖅᑐᓂᑦ ᑮᓇᐅᔭᓕᐅᕈᑎᒍᓐᓇᕋᔭᖕᖓᑕ ᐃᓅᓯᓐᓂᖅᓴᓄᑦ.

Arctic foxes have been trapped in the area of Pond Inlet for thousands of years. In the past, foxes were captured using various kinds of stone traps, but in recent history, trappers used mainly leg hold traps. Interviews with Elders and Hunters also revealed the great importance of arctic foxes as the main source of income for Inuit families from the 1920’s to the 1970’s, as pelts were sold to the local Hudson’s Bay Company trading post. If the era of intensive fox trapping is past, some local experts believe the arctic fox is still important to younger generation as a potential complementary source of income.

Artctic fox and red fox ᐅᑲᐅᖅᑕᖅᑐᒥ ᑎᕆᒐᓂᐊᑦ ᑲᔪᐃᓪᓗ

ᐱᖓᓐᓇᖓᓂ ᕿᑭᖅᑖᓗᐊᕐ, ᐅᓂᒃᑳᓚᐅᖅᓯᒪᔪᑐᐊᑦ ᑲᔪᐃᑦ ᑎᕆᒐᓂᐊᑦ ᑎᕆᒐᓂᐊᕐᒐᔭᕐᓂᑦ ᐱᔭᐅᓯᒪᔪᒥᓃᑦ ᓂᐅᕕᖅᑎᒃᑯᓂ ᑕᕝᕗᖕᔪᐊᑕᐅᕙᑦᑐᒥᓃᑦ ᒥᑦᑎᒪᑕᓕᒻᒥᑦ. ᐃᓐᓇᐃᑦ ᐊᓯᕙᖅᑏᓪᓗ ᑎᕆᒐᓂᐊᔭᑦ ᒥᔅᓵᓄᑦ ᑐᓴᖅᑎᑦᑎᓚᐅᖅᑐᒥᔪᑦ ᖃᖓᒃᑯᑦ ᐱᔭᐅᕙᑦᑕᕐᓂᖏᓐᓂ. ᐃᓚᖏᑦ ᐃᓐᓇᐃᑦ ᐃᖅᑲᐅᒪᔪᑦ ᑲᔪᐃᑦ ᓯᕗᓪᓕᖅᐹᒥ ᒥᑭᒋᐊᖅᑕᐅᖃᑦᑕᖅᑐᒥᓃᑦ 1948-ᖑᑎᓪᓗᒍ. ᐃᓚᖏᑦ ᐃᓐᓇᐃᑦ ᐅᖃᓚᐅᖅᑐᑦ ᐊᒥᓱᓪᓗᓂᒃ ᖃᑏᓐᓇᕈᖅᐹᓪᓕᖅᓯᒪᒐᒪᒪᑕ ᑕᐃᒪᙵᓂ 1950-ᖏᓐᓂ ᑲᔪᐃᑦ ᑎᑭᑕᐅᖅᑎᓪᓗᒋᑦ.

In the North Baffin area, the only available information on the red fox invasion was coming from the pelt records of the Hudson’s Bay Company trading post in Mittimatalik. Elders and Hunters provided new evidence as to the timing and consequences of invasion of the area by red foxes. Some Elders remembered that a red fox was first caught in one of their traps in 1948. Some Elders indicated that abundance of arctic fox may have decreased in the 1950’s when red fox arrived in the region.

Feeding behaviour ᓂᕆᖃᑦᑕᕐᓂᖏᑦ

ᐃᓐᓇᐃᑦ ᐊᓯᕙᖅᑏᓪᓗ ᑐᓴᖅᑎᑦᑎᓚᐅᖅᑐᒥᔪᑦ ᖃᐅᔨᓴᖅᑏᑦ ᑐᓴᓚᐅᖅᓯᒪᙱᑦᑕᖏᓐᓂ ᑲᒪᔪᓂᒃ ᓴᓐᓂᕈᒻᒥ ᒥᑦᑎᒪᑕᓕᐅᑉ ᕿᑭᖅᑕᖓᓐᓂ. ᐅᓂᒃᑳᓚᐅᖅᑐᖅ, ᐅᑲᐅᖅᑕᖅᑐᒥ ᑎᕆᒐᓂᐊᑦ ᒪᕿᓕᖅᑲᖓᔫᑦ ᓂᕆᖃᑦᑕᕐᓂᖏᓐᓂ ᐅᑭᐅᒃᑯᑦ. ᐃᓚᖏᑦ ᓄᓇᒦᑦᑐᑎᒃ ᐅᑭᐅᓕᒫᐸᒃ, ᐊᕕᙵᖅᑐᖃᑦᑕᖅᑐᑎᒃ. ᑕᒪᒃᑯᐊ ᑐᕿᓂᔅᓴᓂᒃ ᒥᖅᑯᖃᖅᑐᑎᒃ. ᐃᓚᖏᑦ ᓯᑯᒦᖃᑦᑕᐃᓇᕈᔪᑦᑐᑎᒃ ᐅᑭᐅᓕᒫᐸᒃ, ᓂᕆᖃᑦᑕᖅᑐᑎᒃ ᓇᑦᑎᒥᓂᑐᖃᕐᓂᑦ. ᖁᖓᓯᖏᑦ ᐃᑦᑕᓯᒪᓂᖃᖅᑐᑎᒃ ᓇᑦᑎᒥᓂᕐᓂᑦ ᓂᕆᖃᑦᑕᖅᓯᒪᔭᖏᓐᓂ. ᒫᔾᔨᐅᑎᓪᓗᒍ ᐊᐃᐳᓗᒥᓗ, ᑎᕆᒐᓂᐊᑦ ᓯᑯᓕᐊᖃᑦᑕᓱᑦ ᓇᑦᑎᐊᖅᓯᐅᕆᐊᖅᑐᑎᒃ.

Elders and Hunters provided information unknown to scientists working on Bylot. According to them, arctic foxes have two types of feeding strategies during winter. Some foxes remain inland most of winter, feeding on lemmings. These foxes have thick white fur. Other foxes live on the ice for most of the winter, feeding on carcasses of sea mammals. The neck of these foxes is stained by the fat of the sea mammals that they eat. In March and April, arctic foxes migrate to the ice to hunt newborn ringed seals.