POPULATION STUDY OF GREATER SNOW GEESE ON BYLOT AND ELLESMERE ISLANDS (NUNAVUT) IN 2007: A PROGRESS REPORT

Gilles Gauthier Département de biologie & Centre d'études nordiques
Université Laval, Québec

Marie-Christine Cadieux Département de biologie & Centre d'études nordiques
Université Laval, Québec

Josée Lefebvre Canadian Wildlife Service, Environment Canada, Québec

Joël Bêty Département de biologie & Centre d'études nordiques
Université du Québec à Rimouski

Dominique Berteaux Département de biologie & Centre d'études nordiques
Université du Québec à Rimouski

Austin Reed Canadian Wildlife Service, Environment Canada, Québec

21 December 2007

INTRODUCTION

In 2007, we continued our long-term study of the population dynamics of Greater Snow Geese (*Chen caerulescens atlantica*) and of the interactions between geese, plants and their predators on Bylot Island. Like many other goose populations worldwide, Greater Snow Geese have increased considerably during the late XXth century. The exploding population has imposed considerable stress on its breeding habitat, while extensive use of agriculture lands provides an unlimited source of food during winter and migratory stopovers for them. Remedial management during autumn, winter and spring has been undertaken since 1999 to curb the growth of this population. A synthesis report produced in 2007 evaluated the initial success of these special conservation measures. However, the recent Action Plan released in 2006 by the Canadian Wildlife Service called for a continued monitoring of the dynamic of this population and of its habitats. In response to those needs, the long-term objectives of this project are to (1) study changes in the demographic parameters of the Greater Snow Goose population, and especially the effects of the spring conservation harvest, (2) determine the role of food availability and predation in limiting annual production of geese, and (3) monitor the impact of grazing on the Arctic vegetation.

OBJECTIVES

Specific goals for 2007 were as follows:

1) Monitor productivity (egg laying date, clutch size and nesting success) of Greater Snow Geese on Bylot Island.

2) Mark goslings in the nest to provide a sample of known-age individuals to be used to assess the growth of goslings by their recapture in late summer.

3) Band goslings and adults, and neck-collar adult females at the end of the summer to continue the long-term study of demographic parameters such as survival and breeding propensity.

4) Mark adult females with satellite radio-transmitters to monitor their behaviour, migration, and subsequent reproduction on Bylot Island.

5) Monitor the level of intestinal parasite infestations in goslings.

6) Participate in the Canadian Inter-Agency Wild Bird Influenza Survey by collecting cloacal and throat swab samples during banding.

7) Monitor the abundance of lemmings and study their demography.

8) Monitor the breeding activity of other bird species and in particular avian predators (Snowy Owls, jaegers and Glaucous Gulls).

9) Monitor the breeding activity of foxes at dens.

10) Capture and mark adults Arctic Foxes and their pups with ear-tags to study their movements and demography.

11) Sample plants in exclosures to assess annual production and the impact of goose grazing on plant abundance in wet meadows.

12) Maintain and upgrade our automated environmental and weather monitoring system.

13) Monitor the goose breeding activity, their grazing impact, and band geese at another arctic colony on Ellesmere Island and surrounding areas.

FIELD ACTIVITIES

Field camps. — In 2007, we operated two field camps on Bylot Island: the main camp, located at 6 km from the coast in the largest glacial valley on the island (“Base-camp Valley”, 73^{o} 08' N, 80^{o} 00' W), was occupied from 17 May to 21 August. A secondary camp, located in a narrow valley 30 km south of the Base-camp and 5 km from the coast (“Camp-2 area”, 72^{o} 53' N, 79^{o} 54' W) was occupied from 20 May to 21 July (Fig. 1). Both of these camps are protected by semi-permanent bear-deterring fences. Finally, ten fly camps were also established for 2-11 days at various times throughout the island, west of Pointe Dufour.

Field parties. — The total number of people in both camps ranged from 2 to 17 depending on the period. Members of our field party included project leaders Gilles Gauthier, Dominique Berteaux and Joël Bêty. There was several graduate students whose thesis projects addressed many of the objectives mentioned above, including: Cédric Juillet (PhD, objectives 1 and 2), Arnaud Tarroux (PhD, objective 10), Jean-François Therrien (PhD, objective 8), Madeleine Doiron (PhD student, objectives 2 and 3), Marc-André Valiquette (MSc, objective 8), David Duchesne (MSc, objective 7), Cassandra Cameron (MSc, objectives 9). Several other students assisted them in the field, including: Daniel Gallant, Antoine Richard, Julie Tremblay, Mélanie Veilleux-Nolin, Éliane Valiquette, François Racine, François Rousseu, Aurélie Bourbeau-Lemieux and Manon Morrissette. Other people in the field included Gérald Picard, a technician in charge of the banding operation (objectives 3 and 5); Marie-Christine Cadieux, a research professional in charge of plant sampling (objective 11); Denis Sarrazin, a research professional responsible of the maintenance of the weather stations (objective 12); Louise Laurin from the Ottawa Banding Office and François Fournier, a biologist from the Canadian Wildlife Service (CWS) responsible for collecting samples to test for avian influenza (objective 6); and Marten Stoffel, a technician from the University of Saskatchewan who collaborated with us on the Snowy Owl project. Finally, we hired 5 persons from Pond Inlet to work with us: Joassie Otoovak (marking goslings in the nests), Samuel Arreak (goose banding), Daniel Ootoova (shorebirds nest monitoring) and, Bernie Kilukishak and Terry Killiktee (nest monitoring and banding of Snowy Owl).

Other people shared our camp for part of the summer. They were the field party of Esther Lévesque (UQTR) and Line Rochefort (Université Laval), which included Mylène Marchand-Roy (MSc student) and Jean-Bastien Lambert who studied plant ecology; Laura McKinnon (PhD student) and Ludovic Jolicoeur who studied shorebirds under the supervision of Joël Bêty; and the party lead by Isabelle Laurion (INRS), which included Leira Retamal and Christiane Dupont who studied the carbon cycle in thermokarst ponds. Several persons from Parks Canada also visited our camp at different moment of the summer. They include Carey Elverum (chief warden of *Sirmilik National Park*), Andrew Maher (Park warden) and Andrew Arreak (Park patrol person). Finally, a film crew of 4 people from the Société Radio-Canada spent 9 days at our camps to prepare a film documentary on our project.

Environmental and weather data. — Environmental and weather data continued to be recorded at our four automated stations. Our network includes 3 full stations, two at low and one at high elevation (20 m and 370 m ASL, respectively) where air and ground temperature, air humidity, solar radiation, wind speed and direction are recorded on an hourly basis throughout the year (Fig. 1). A fourth station measures soil surface temperature in areas grazed and ungrazed by geese (i.e. exclosures). All automated stations were visited during the summer to download data and were found to be operating normally. Daily precipitation was recorded manually during the summer. Finally, snowmelt was monitored by measuring snow depth at 50 stations along two 250-m transects and by visually estimating snow cover in the Base-camp Valley, both at 2-day intervals.

Monitoring of goose arrival and nesting. — We monitored goose arrival in the Base-camp Valley by counting goose pairs every two to three days from our arrival on the island until the end of snowmelt on sample plots. Nest searches were carried out within walking distance (~6 km) of both the Base-camp Valley and the Camp-2 area between 11 and 21 June. Nests are found by systematic searches conducted over various areas in the field. At the Base-camp Valley where nest density is always low, nests searches are conducted throughout the valley. At Camp-2, nest searches are conducted in two ways: 1) over an intensively-studied core area (ca 50 ha) located in the centre of the colony every year, and 2) within a variable number of 2.25-ha plots randomly located throughout the colony. Nest density was calculated over a fixed 30-ha area within the intensively-studied core area. We also attempted to find the nests of as many neck-collared females as possible throughout both study areas. All nests were revisited at least twice to determine laying date, clutch size, hatching date and nesting success. During the hatching period, we visited a sample of nests almost every day to record hatch dates and to web-tag goslings.

Tracking of radio-marked geese. — During spring staging in Québec, we captured snow geese at Île-aux-Oies using canon-nets. We captured 10 adult females previously banded on Bylot Island and marked them with a VHF radio-transmitter (i.e. we replaced their plastic neck-band with a new one on which a transmitter had been glued; total package mass: 60g). On Bylot Island, we installed two automated receiving station with antenna on high grounds immediately after arrival, one in the Base-camp Valley (1 June - 2 August) and one at Camp-2 (13 June - 15 July). The receiving stations scanned 24-h a day for the presence of radio signals. Additional manual scans were conducted on snowmobile and on foot during the prelaying and early nesting periods (1-30 June). We also conducted aerial tracking with the helicopter over most of the south plain of Bylot Island (on 22 June) to locate radio-marked geese. Nests of geese with radio-transmitters were found on foot using a portable antenna and a receiver.

Goose banding. — From 8 to 16 August, we banded geese with the assistance of local Inuit people and a helicopter. Goose flocks of a few hundred birds were rounded up and driven by people on foot into a holding pen made of plastic netting. All captured geese were sexed and banded with a metal band, and all recaptures (web-tagged or leg-banded birds) were recorded. A sample of young and adults was measured (mass and length of culmen, head, tarsus and 9th primary) and some adult females were fitted with coded yellow plastic neck-collars. We also collected oral and cloacal swab samples from goslings for the Canadian Inter-Agency Wild Bird Influenza Survey. These samples will be tested for the possible presence of this virus. We marked a few adult females with GPS/ARGOS solar radio-transmitters mounted on the back of the bird with an elastic Teflon harness. These birds will be tracked throughout their annual cycle to relate events occurring during the spring migration with subsequent reproduction and to obtain an unbiased continental population estimate over the next 3 years. Finally, we collected the intestine from a sample of goslings that died accidentally during banding to examine the level of parasite infection.

Breeding activity of foxes at dens and marking. — All known fox dens located within a 475 km^2 area were visited one to five times during the summer and inspected for signs of use and/or presence of reproductive adults with pups. We attempted to trap adults with padded leghold traps at locations where foxes were seen hunting or travelling. At reproductive dens, we noted the species (Arctic Fox, *Alopex lagopus*, or Red Fox, *Vulpes vulpes*) and minimum litter size, and, whenever possible, we trapped pups with Tomahawk© collapsible live traps (cage traps). Cage traps were kept under continuous surveillance and leghold traps were visited at least every 6 hours. Captured foxes were measured, weighed and tagged on both ears using a unique set of coloured and numbered plastic tags. Adult foxes were anaesthetized using Telazol®, an anaesthetic commonly used for dogs, to allow safe manipulation. Among adult Arctic Foxes, 14 were fitted with GPS collars to study their home ranges and movements at fine scale during the summer period. Seven other individuals were also fitted with ARGOS satellite collars to study their large-scale movements and habitat use during the winter. Samples of winter and summer fur, blood, collagen and scats were also collected for genetic and diet analysis.

Small mammals. — We continued to sample the annual abundance of lemmings at two sites in the Base-camp Valley (one in wet meadow habitat and one in mesic habitat) and one site at the Camp-2 (mixed habitat) in July. At each site, we used 204 traps set at 15-m intervals along two to four parallel transect lines 100 m apart (51 to 102 traps/transect depending on the site) and left open for 4 days. We used Museum Special snap-traps baited with peanut butter and rolled oats. We also continued our sampling program based on live-trapping of lemmings initiated in 2004. We trapped on 2 permanent grids at the Base-camp Valley (one in wet meadow habitat and one in mesic habitat). In 2006, we increased the size of the grids to 360×360 m (compared to 300 × 300 m in 2004 and 2005) and the number of traps per grid to 144 (compared to 100 traps in 2004 and 2005) to increase the trapping effort. In July, we set a 3rd permanent grid (300 × 300 m; 100 traps) in mesic habitat and erected a snow-fence for a snow-manipulation experiment. We used Longworth© traps baited with apples and set at each grid intersection every 30-m. We trapped during 3 consecutive days every 17 days on the first two grids from mid-June to mid-August and for one 3-day period in August for the new grid. All trapped animals were identified, sexed, weighed and marked with electronic PIT tags (or checked for the presence of such tags).

Other bird monitoring. — We monitored the nesting activity of Snowy Owls (*Bubo scandiacus*), Jaegers (*Stercorarius* spp.), Glaucous Gulls (*Larus hyperboreus*), and Lapland Longspurs (*Calcarius lapponicus*). Nests were found through systematic searches of suitable habitats and revisited to determine their fate (successful or not) until fledging. We also collected food pellets at gull and owl nests to determine their diet based on prey remains.

Monitoring of plant growth and goose grazing. — The annual plant production and the impact of goose grazing was evaluated in wet meadows dominated by graminoid plants at 2 sites

(Fig. 1): the Base-camp Valley (brood-rearing area), and the Camp-2 area (nesting colony); lack of time and helicopter support prevented us from sample plants at our third usual site near Point-Dufour. At each site, 12 exclosures (1 × 1 m) were installed in late June, and plant biomass was sampled in ungrazed and grazed areas (i.e. inside and outside exclosures) at the end of the plant-growing season between 11 and 16 August. Plants were sorted into sedges (*Eriophorum scheuchzeri* and *Carex aquatilis*) and grasses (*Dupontia fisheri*). Use of the area by geese was monitored by counting faeces on 1 × 10 m transects located near each exclosure every 2 weeks in the Base-camp Valley and once at the end of the season at the Camp-2 area.

Field activities on Ellesmere Island and surrounding areas. — Field work was conducted on Ellesmere Island and surrounding areas during 2 periods, from 21 to 27 June and 1 to 7 August. The field party included 4 persons from the Canadian Wildlife Service (Josée Lefebvre, Austin Reed, Louis Lesage and Francis St-Pierre). In June, we searched for nesting geese during reconnaissance flights on the Fosheim peninsula on Ellesmere Island, and along the coast of Axel Heiberg Island. In August, nests were revisited to determine success. Near Eastwind Lake on the Fosheim peninsula, goose exclosures were installed to evaluate the aboveground primary production and to assess the grazing impact. At this site, small-mammal snap-trapping was also conducted in both mesic and wet meadow habitats. Goose banding took place using the same technique than on Bylot Island. Finally, plant biomass was sampled inside and outside exclosures, again using the same technique than on Bylot Island.

PRELIMINARY RESULTS

Weather conditions. — Temperature in spring were generally cooler than average. Air temperature averaged -1.44°C between 20 May and 20 June (1.21°C below normal), which corresponds to the period of goose arrival and egg-laying. Nonetheless, temperature gradually warmed up during this period and averaged 0.43°C during 1-15 June, the normal laying period, still 0.86°C below normal. However, the snow pack was relatively thin at the end of winter as snow depth on 1 June was only 21 cm, much lower than the long-term average of 31 cm (Fig. 2). Despite the cool temperature in early June, the rate snow-melt was close to normal, and, thanks to the thin snow pack, the snow disappeared slightly earlier than normal the Base-camp. From late June to mid August, weather was exceptionally good with lots of sunshine and very warm temperature. Except for a few short spell of rain in early June (26 mm in 7 days) and August (19 mm on 1 August), most of the summer was very dry, especially in July (10 mm).

Goose arrival and nesting activity. — The number of geese counted on the hills surrounding the Base-camp Valley (the first area used by geese upon arrival) increased from 14 pairs on 1 June to a peak of 53 pairs on 3 June (Fig. 3). These values are the lowest ever recorded since 1996 and are an indication that geese arrived very late on Bylot Island this year. By the time geese started to appear in large numbers (ca 14 June), much of the lowland areas were free of snow and geese proceeded immediately to the nesting areas where they started to lay almost immediately, an unusual pattern on Bylot Island.

Median egg-laying date was 16 June, which is later than the long-term average (Table 1). Nest density in the colony was slightly higher than last year (3.0 nests/ha in 2007 compared to 2.57 nest/ha in 2006) but slightly below the long-term average. Nonetheless, because snow-melt was almost completed by the time geese arrived, the colony tended to be more spread out than in previous years. These observations thus suggest that the reproductive effort of geese was relatively high at the main colony (Camp-2). Only six nests were found at the Base-camp Valley (predominantly a brood-rearing area). Average clutch size was 3.91, which is higher than the long-term average (Table 1).

Nesting success of geese. — Nesting success (proportion of nests hatching at least one egg) was high this year (82%, a value well above the long-term average, Table 1). Activity of predators at goose nests, especially Arctic Foxes, was much lower than in 2006. During nesting and brood-rearing, 345 neck-collared birds were sighted, a number higher than last year (286). Peak hatch was on 11 July, which is slightly later than the long-term average (Table 1). We tagged approximately 2400 goslings in nests at hatch, all in the main colony at Camp-2.

Density of broods. — In 2007, the density of goose faeces at the end of the summer in wet meadows of the Base-camp Valley was low (3.3 ± 0.8 [SE] faeces/m^2, Fig. 4) and was among the lowest value recorded. Accumulation of faeces started unusually late in July, probably a consequence of the relatively late nesting of geese this year, and increased steadily thereafter and continued until the end of the summer. This low level of use of wet meadows by broods near our Base-Camp may be partly due to the near drought conditions that prevailed in July although it is also possible that increased research activity at our camp due to concomitant research project may have disturbed somewhat the geese. However, faeces density at the end of the summer was also low in the wet meadows of the nesting colony at Camp-2 (4.1 ± 0.9 faeces/m^2 vs. 3.2 ± 0.5 in 2006) even though there was very little human presence in the area after hatching.

Goose banding. — The banding operation was again successful this year even though we had a reduced access to the helicopter due to a high demand for it during that period. We nonetheless conducted 9 drives in the lowlands and hills bordering the Base-camp Valley (<8 km). This allowed us to band a total of 4260 geese, including 609 adult females marked with neck-collars and 80 young which had been marked with web-tags at hatch and were recaptured. We also marked 20 adult females with GPS/ARGOS radio-transmitters. In addition, we had 322 recaptures of adults banded in previous years. We collected samples (cloacal and throat swabs) from 289 goslings for the avian influenza survey. The gosling:adult ratio among geese captured at banding (1.11:1) and mean brood size toward the end of brood-rearing (2.9 young, SD = 1.25, n = 212; counts conducted on 30 July) were higher than the long-term averages (Table 1). By combining information on brood size and young:adult ratio at banding, we estimated that 77% of the adults captured were accompanied by young, a value close to the long-term average, which suggests a relatively low mortality rate of young during the summer. Overall, these results are indicative of a good production of young on Bylot Island by the end of the summer.

Tracking of geese fitted with radio-transmitters. — Among, the 25 satellite transmitters fitted on geese in 2006, only 1 was still in operation last summer as the others had either stopped functioning prematurely (9), had been lost by birds (10) or the birds were killed by hunters (5). That bird spent the summer in south-western Baffin in 2007 and had migrated back to southern Quebec (Lac St-Jean area) by late October. We recovered 4 transmitters that had been lost by birds on Bylot Island in 2006. In spring 2007, we marked 10 previously-banded geese with VHF radio-transmitters in Québec and we detected the signal of 5 of them on Bylot Island (plus one that had been similarly marked in spring 2006) but none of them seemed to have nested on the island. In contrast to the previous year, the tracking of birds marked with satellite transmitters in August 2007 has been going very well so far. Data downloaded on 27 October indicated that only 1 bird was still in northern Quebec (Nunavik), 17 were in the southern Quebec, 1 was in Saskatchewan and 3 were in the USA (New York, Maryland and Delaware). The migration away from Bylot Island started around 4 September for most birds.

Breeding activity of foxes at dens and marking. — We found 1 new fox den on the island in 2007, bringing the total to 99 known denning sites still intact. Among these 99 dens, we found signs of activity (fresh digging and/or footprints) at 58 of them, a high number. The breeding activity of foxes was nonetheless moderate as we found 10 different litters (11% of known denning sites) of Arctic Foxes and none of Red Foxes. The level of den use was higher than last year (2% of dens used in 2006) and typical of the proportion of fox dens used in previous years of moderate lemming abundance (~10%). Minimum litter sizes varied between 3 and 12 pups (6.7 pups on average). A total of 18 adult and 50 juvenile Arctic Foxes were captured during trapping sessions and marked with ear-tags. We also recaptured 4 foxes that had been marked in previous years.

Small mammals. — During our survey using snap traps, we cumulated 1567 trap-nights at our 2 trapping sites of the Base-camp Valley from 31 July to 3 August, and 792 trap-nights at the Camp-2 from 11 to 14 July. In the Base-camp sites, we caught 9 Collared Lemmings (*Dicrostonyx groenlandicus*) in the mesic site and none in the wet meadow site, and 1 Brown lemmings (*Lemmus sibiricus*) was caught in the mesic site and 2 in the wet meadow site, which yielded a combined index of abundance of 0.80 lemmings/100 trap-nights, an intermediate value (Fig. 5). The abundance was similar in the Camp-2 area, as 3 Collared Lemmings and 4 Brown Lemmings were caught, for an index of 0.90 lemmings/100 trap-nights. For the fourth year of our live-trapping survey in the Base-camp area, we captured 29 different lemmings, of which 10 were captured more than once, a very low number considering that annual number caught in previous years ranged from 47 in 2006 to 180 in 2004. We captured 9 Brown Lemmings and 4 Collared Lemmings in the mesic habitat, and 8 Collared and 8 Brown ones in the wet habitat. Our two indices of lemming abundance therefore yielded conflicting evidence, as the one based on snap-traps suggests an increase in abundance compared to 2006, whereas the live-trapping suggests that abundance remained very low in 2007.

Other bird monitoring. — After 2 years of nesting absence, we found 1 nest of Snowy Owl in the Base-camp Valley, 1 in the Camp-2 (compared to 22 nests in those areas in 2004), and 15 other nests widely scattered between our 2 camps in areas not searched in previous years. We also found 22 nests of Glaucous Gulls, 29 nests of Long-tailed Jaegers, 1 nest of Parasitic Jaegers and 78 nests of Lapland Longspurs. Nesting success (proportion of nests successful in fledging at least one young) was high for longspurs (62% vs. 9% in 2006), moderate for owls (60% vs. 95% in 2004) and gulls (40% vs. 38% in 2006) but was low for jaegers (9% vs. 0% in 2006). Average clutch size was 6.4 eggs for owls (vs. 7.1 eggs in 2004), 2.3 eggs for gulls (vs. 2.1 eggs in 2006), 5.7 eggs for longspurs (vs. 5.1 in 2006), and 1.9 eggs for jaegers (no data available in 2006).

Plant growth and grazing impact. — Plant production in wet meadows of the brood-rearing area was lower than last year but similar to the long-term average (Fig. 6). Above-ground biomass of graminoid plants in the Base-camp Valley reached 45.1 ± 4.9 [SE] g/m^2 in ungrazed areas in mid-

August compared to 58.3 ± 7.6 in 2006 (long-term average since 1990: 45.2g/m^2). At the Camp-2 area (colony), graminoid biomass in 2007 was much higher than last year (41.3 ± 6.6 vs. 26.2 ± 3.9 g/m^2 in 2006) and above the average value recorded since 1998 (31.7 g/m^2). Plant production thus approached that in the Base-camp Valley (Fig. 6 vs Fig. 7) and was one of the best ever recorded at the Camp-2 area since 1998.

Goose grazing was relatively low in the wet meadows of the Base-camp Valley where geese removed 22% of the above-ground biomass (difference between paired grazed and ungrazed plots) by mid-August compared to 40% in 2006 (long-term average: 35%; Fig. 6). At the Camp-2 area (colony), the grazing impact was higher with 32% of the graminoid biomass removed by geese compared to only 10% in 2006 (long-term average at this site: 29%; Fig. 7).

Goose nesting and banding on Ellesmere Island and surrounding areas. — A total of 28 Greater Snow Goose nests (15 on Ellesmere Island and 13 on Axel Heiberg Island) were found, a relatively small number but more than three times the number of nests found in 1971 in the same area by Richard Kerbes. Most of these nests were widely scattered. The peak hatching date was 16 July, which is about 3 days later than the hatching date observed in 1971, with an average clutch size of 5.04, lower than the average clutch size observed in that year. Nesting success (proportion of nests hatching at least one egg) was 63% this year, a value similar to the long-term average on Bylot Island. Nesting success was not determined in 1971. Similarly, family groups were smaller and more scattered than on Bylot Island, which forced us to conduct 22 banding drives, all on Ellesmere and Axel Heiberg Islands. We banded a total of 1347 geese, including 329 adult females marked with neck-collars. We also marked 2 adult females with GPS/ARGOS radio-transmitters. In addition, we recaptures 9 adults (8 males and 1 female) banded on Bylot Island in previous years as well as 1 adult originally banded at Cap Tourmente (southern Quebec). Finally, we collected 300 samples for the avian influenza survey. The annual plant production and the impact of goose grazing were evaluated in both mesic and wet meadows habitat. In both habitats, 6 exclosures (1 × 1 m) were installed in late June, and plant biomass was sampled in ungrazed and grazed areas (i.e. inside and outside exclosures) at the end of the plant-growing season on 7 August. Plants were sorted into family groups.

CONCLUSIONS

The production of young on Bylot Island was relatively high in 2007. The phenology of migration and reproduction were delayed (i.e. geese arrived very late on the island and consequently initiated nesting later than normal), most likely due to cold and harsh weather conditions encountered during the spring migration and, to a lesser extent, on Bylot island in early June. Indeed, reports from northern Québec, an area through which geese migrate, indicated a very cold and delayed spring this year. Nonetheless, the goose reproductive effort (i.e. the density of nesting geese on the island and their clutch size) was fairly good due to an early snow-melt. Geese further benefited from a low nest predation rate and thus had a high nesting success, which further contributed to the good production observed on Bylot Island. The high reproductive effort of geese combined with a moderate abundance of lemmings explain this good nesting success. Based on this youg:adult ratio, we anticipated a proportion of young in the fall flock of 26%. This prediction was slightly higher than the proportion of young measured during juvenile counts conducted in southern Québec in fall (21%, n = 25,463).

Results from our dead and live-trappings yielded ambiguous results regarding lemming abundance on Bylot Island in 2007. Anecdotal evidence suggests that during snow-melt, lemmings were fairly abundant on several sites on the island, though not around the Base-camp where live-trapping is conducted. A relatively high abundance of lemmings at snow-melt is supported by the good reproductive effort of Arctic Foxes and especially the presence of nesting Snowy Owls, although their abundance was lower than in previous lemming peaks. The snap-trap survey conducted in late July nonetheless suggest that lemming abundance decreased considerably during the summer, which may explain why the nesting success of owls was lower than in previous years. It is also noteworthy that Collared Lemmings outnumbered Brown Lemmings in this survey, whereas in all previous peaks in lemming abundance, the Brown was far more abundant than the Collared. Thus, the dynamic of the two lemming species was probably quite different this year: whereas Collared apparently reached a peak in abundance, this was not the case for Brown. Regardless, it appears that lemming abundance had increased compared to 2006 and was high enough to alleviate predation pressure on goose eggs.

This year, plant production in the wet meadows of Bylot Island was near the long-term average, but somewhat lower than what has been observed in recent years. This may be related to the near-drought conditions that prevailed in July on the island. Despite the good production of young this year, we recorded a relatively low grazing impact by geese. However, this is in accordance with the low use of the usual brood-rearing areas in the wet meadows of the Base-camp Valley. We are unsure why brood density was relatively low in our long-term monitoring sites but this may reflect a higher dispersal of nesting geese than usual on the island because all potential nesting sites were snow-free by the time geese arrived on the island, an unusual situation. Alternatively, movements of geese toward the upland habitats, which occur in some years but not others, may have been more significant this year. The low predation pressure observed on geese may have favoured such movements as the absence of predator refuges (i.e. ponds and lakes) in the uplands usually limits movements of families toward this habitat in years of high predation pressure.

Based on the production encountered this year, the Greater Snow Goose population is expected to increase between 2007 and 2008 under the current exploitation regime, which includes a spring harvest. This assumes that harvest rates, which have declined since 2003 and were at a record low in 2006-2007 since the implementation of the special conservation measures, are maintained at the same level in the coming year. In spring 2007, the population was estimated at 1 019 000 ± 75 000 geese, a level similar to the one recorded at the onset of the special conservation measures in 1999. We can thus expect that this level will be exceeded in spring 2008.

PLANS FOR 2008

The long-term objectives of our work are to study the population dynamics of Greater Snow Geese, and the interactions between geese, plants, and their predators on Bylot Island. A major focus of the project is to monitor changes in demographic parameters (such as survival rate, hunting mortality, breeding propensity, reproductive success, and recruitment) and habitat (annual plant production and grazing impact) in response to the spring conservation harvest and other special management actions implemented since 1999 in Québec. In 2007, field work was initiated at a second arctic field site, Ellesmere Island, in order to increase the spatial coverage of the monitoring and to determine whether Bylot Island was representative of the entire breeding range of the population. This field work should be continued in 2008. Other aspects of the project include *i*) understanding better the links between events occurring during the spring migration and the subsequent breeding success of geese; *ii*) determining the long-term effects of geese on the arctic landscape; *iii*) expanding our estimate of the carrying capacity of Bylot Island for geese to upland habitats; *iv*) study indirect interactions between snow geese and lemmings via shared predators; *v*) study the ecology of the main predator of geese, Arctic Foxes; *vi*) examine the impact of avian predators on goose reproductive success. In 2008, we anticipate to:

1) Monitor productivity (egg laying date, clutch size and nesting success) and nesting distribution of Greater Snow Geese on Bylot Island.
2) Mark goslings in the nest to provide a sample of known-age individuals to assess the growth and pre-fledging survival of goslings by their recapture in late summer.
3) Carry out the aerial survey of snow geese on Bylot Island during brood-rearing (conducted every 5 years since 1983) to determine the size of the breeding colony.
4) Band goslings and adults, and neck-collar adult females at the end of the summer, to continue the long-term study of demographic parameters such as survival and breeding propensity.
5) Mark adult females with satellite radio-transmitters to monitor their behaviour, migration, and subsequent reproduction on Bylot Island.
6) Monitor the level of intestinal parasite infestations in goslings and study their impact on survival.
7) Monitor the abundance of lemmings and study their demography.
8) Monitor the breeding activity of other bird species, in particular avian predators (Snowy Owls, jaegers and Glaucous Gulls).
9) Monitor the breeding activity of foxes at dens and capture and mark adults and pups with ear-tags to study their movements and demography.
10) Sample plants in exclosures to assess annual production and the impact of goose and lemming grazing on plant abundance in wet meadows.
11) Maintain our automated environmental and weather monitoring system.
12) Monitor the goose breeding activity, their grazing impact, and band geese at another arctic colony on Ellesmere Island and surrounding areas.

In 2008, at least 8 graduate students will be involved in the Bylot Island snow goose project. **Peter Fast** (PhD) will continue to study the causes and reproductive consequences of changes in migratory behaviour of snow geese. **Madeleine Doiron** (PhD) will continue to investigate the impact of climate change on the plant nutritive quality and gosling growth. **Arnaud Tarroux** (PhD) will continue to monitor Arctic and Red Foxes and investigate their relative roles in the ecology of the tundra using radio-telemetry. **Cassandra Cameron** (MSc) will continue her genetic study of the social structure of Arctic Foxes. **Jean-François Therrien** (PhD) will continue to study the migration and the nesting ecology of Snowy Owls and jaegers. **David Duchesne** (MSc) will continue to examine climatic impacts on lemming populations. **Marc-André Valiquette** (MSc) will study the nesting ecology of Glaucous Gulls. Finally, **Loïc Valery** (Post-doc) will participate in monitoring the nesting activity of geese and will study the temporal and spatial variability in plant production and goose grazing impact.

Table 1. Productivity data of Greater Snow Geese nesting on Bylot Island over the past decade.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	**2007**	Average[2]
Number of nest monitored	350	266	386	296	470	585	676	346	393	**494**	--
Nest density (nb/ha)	6.66	1.22	3.23	2.70	5.17	8.87	1.10	3.90	2.57	**3.00**	3.41
Median date of egg-laying	7 June	17 June	16 June	13 June	16 June	9 June	11 June	12 June	14 June	**16 June**	12 June
Clutch size	4.00	3.09	3.51	3.43	3.43	3.90	3.65	3.60	3.68	**3.91**	3.71
Nesting success[1]	79%	12%	83%	57%	53%	82%	78%	66%	42%	**82%**	64%
Median date of hatching	4 July	13 July	13 July	9 July	11 July	6 July	7 July	8 July	10 July	**11 July**	9 July
Number of geese banded	3998	1717	4269	3430	2650	5259	3617	5304	4603	**4260**	--
Ratio young:adult at banding	1.09:1	0.54:1	1.08:1	1.03:1	0.81:1	1.31:1	0.94:1	1.03:1	0.74:1	**1.11:1**	1.02:1
Brood size at banding	2.70	1.67	2.78	2.37	1.67	2.74	2.50	2.42	2.20	**2.90**	2.46
Proportion of adults with young at banding	81%	65%	78%	87%	97%	96%	75%	86%	67%	**77%**	82%

[1] Mayfield estimate
[2] Period 1989-2007

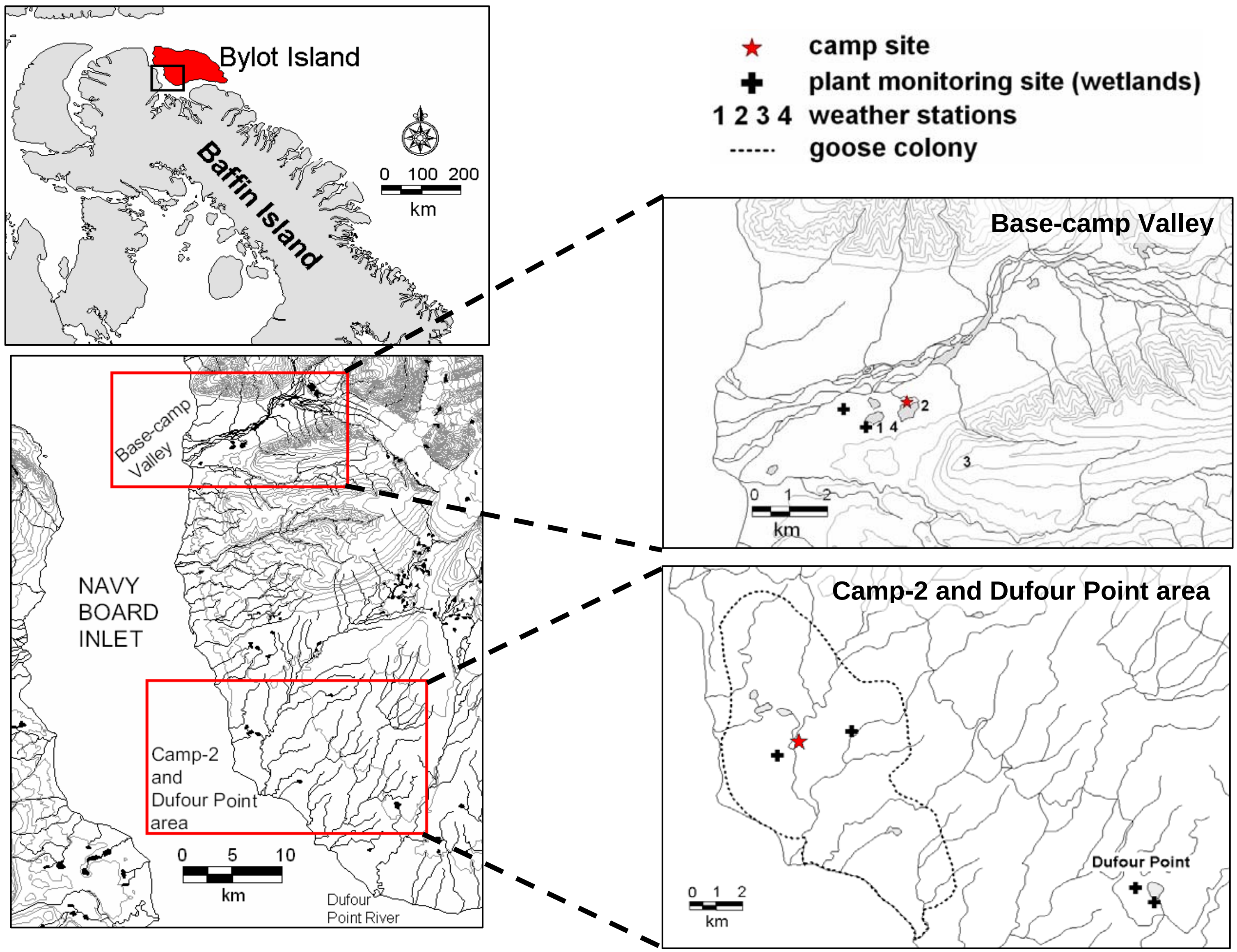

Figure 1.General location of the study area, Bylot Island, Nunavut, and of the two main study sites (Base-camp Valley and the Camp-2 area) on the South plain of the island. Enlarged maps on the right present these study sites in more details, including camp locations, sampling sites and our four weather stations.

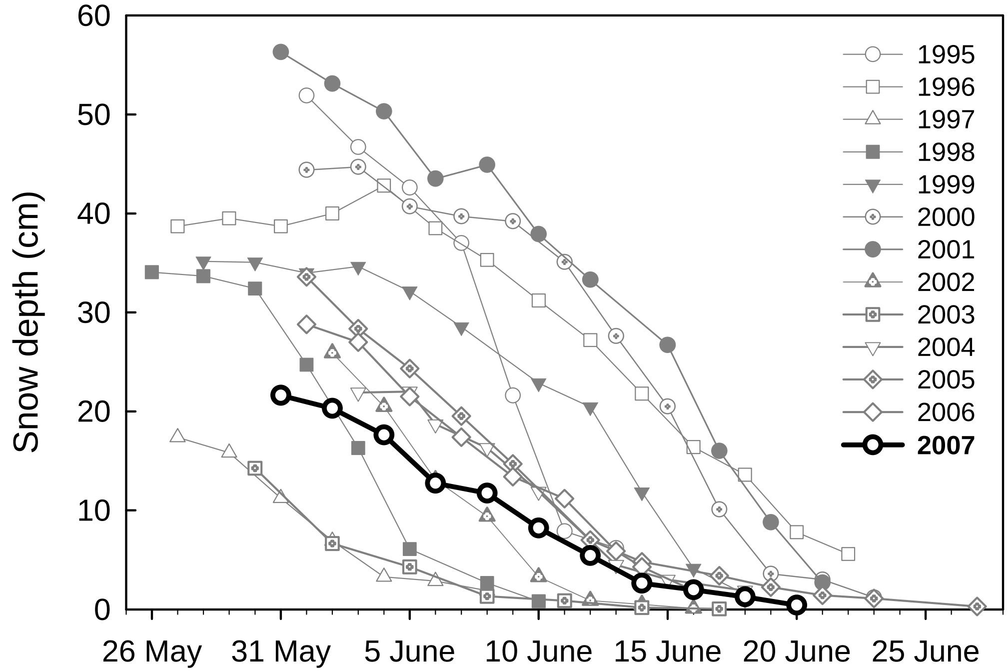

Figure 2. Average depth of snow along 2 transects showing the rate of snowmelt in Bylot Island lowlands (*n* = 50 stations).

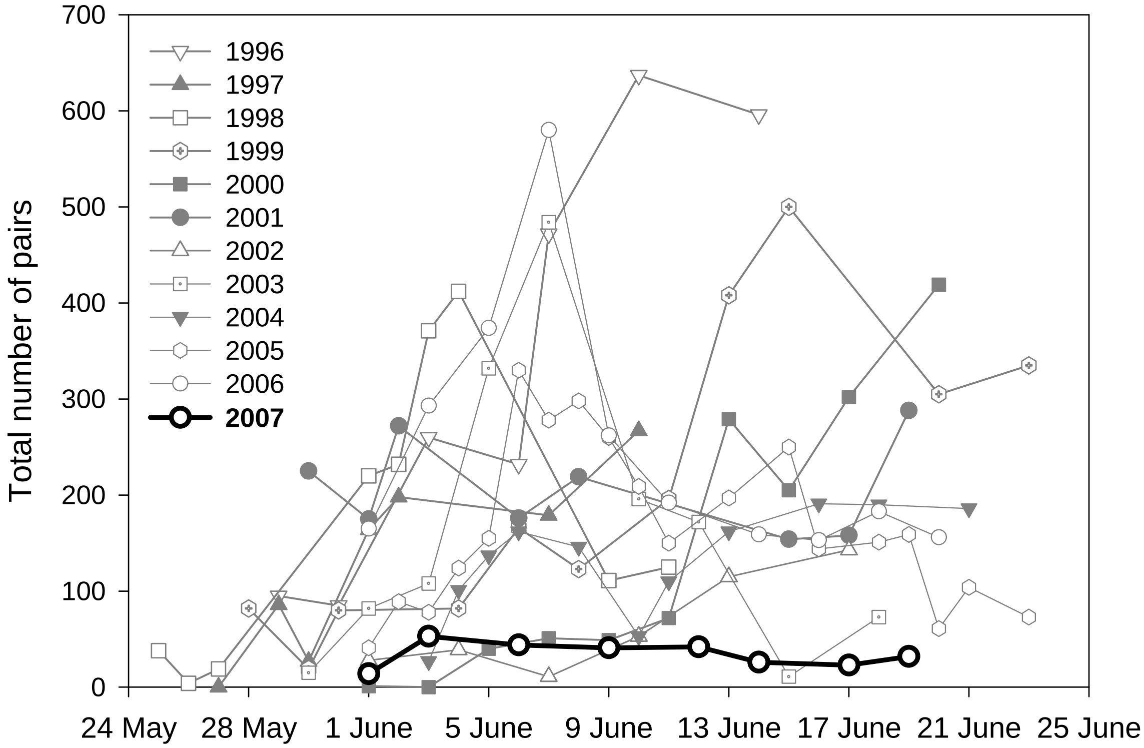

Figure 3. Total number of goose pairs counted in the Base-camp Valley from arrival of our crew on Bylot Island until the end of snowmelt.

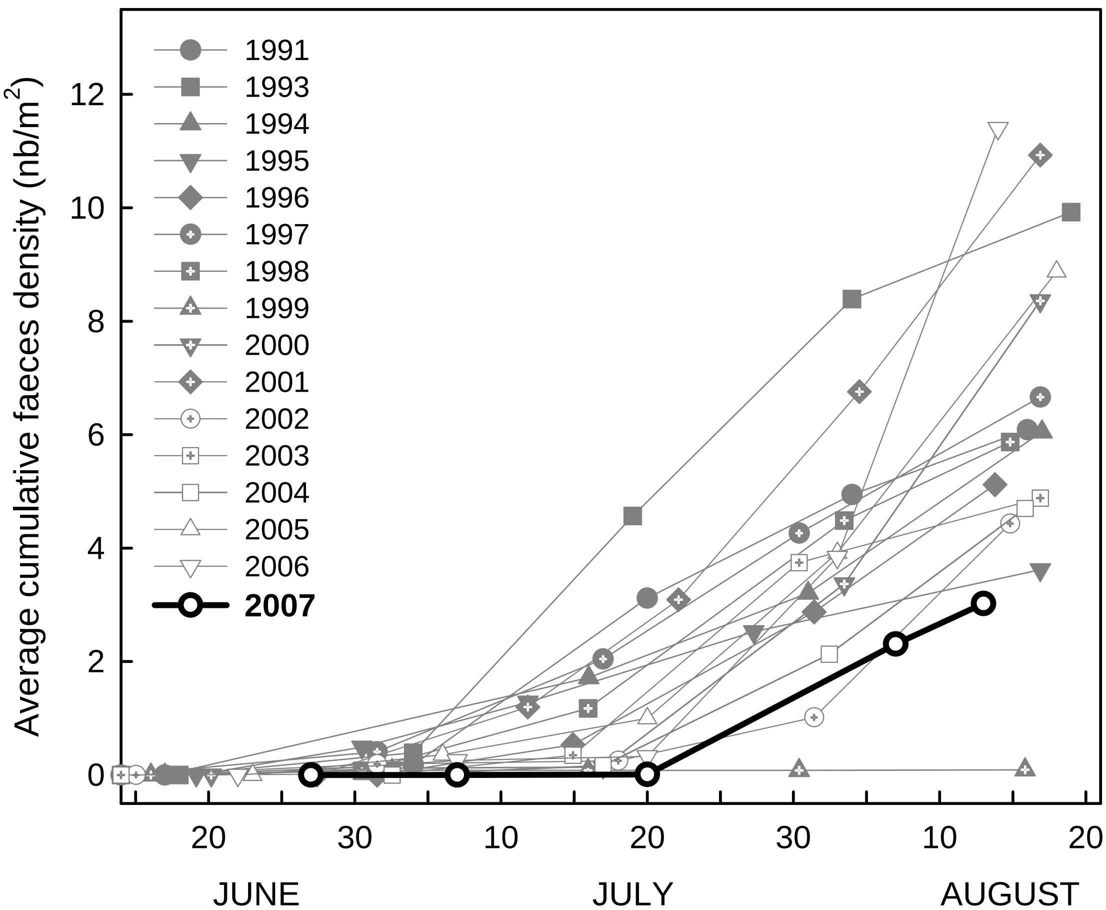

Figure 4. Average cumulative faeces density showing the use of the Base-camp Valley by Greater Snow Goose families on Bylot Island throughout the summer (n = 12 transects of 1 x 10 m).

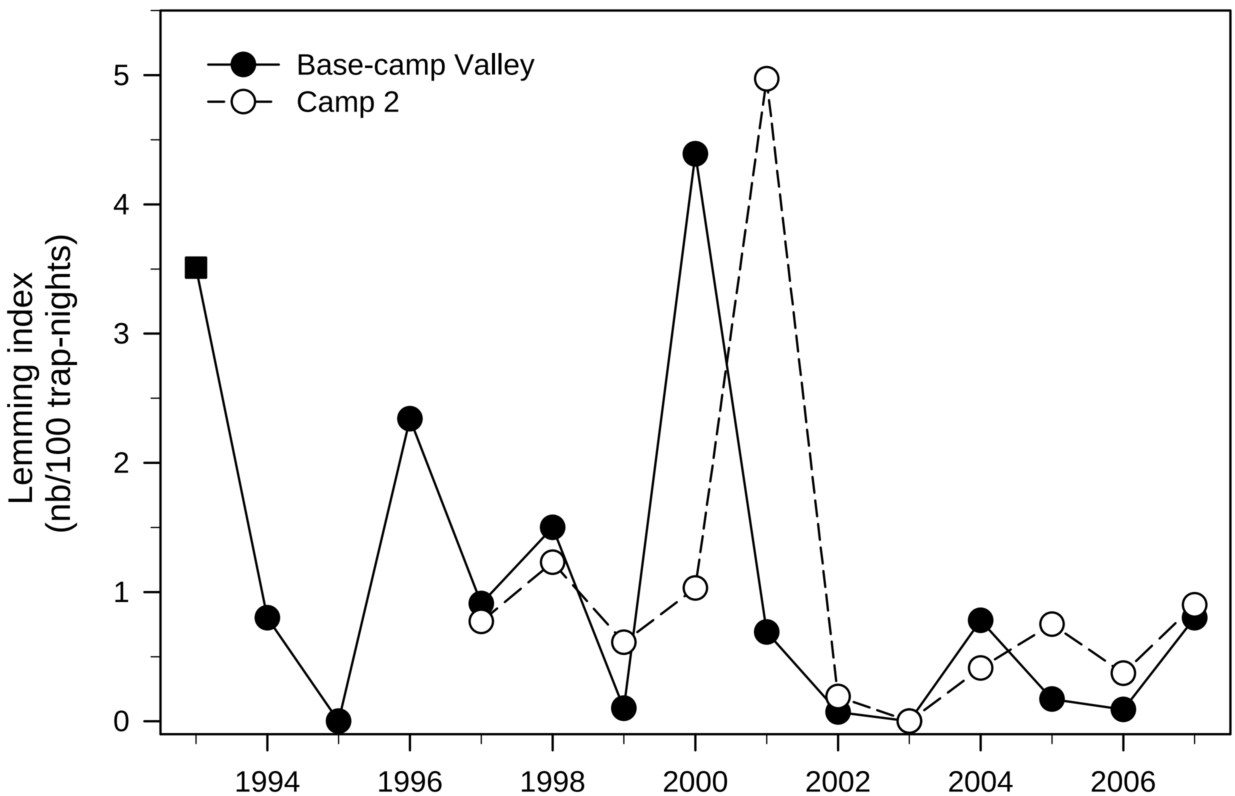

Figure 5. Annual abundance of lemmings at two study areas (Base-camp Valley and Camp-2) located 30 km apart on Bylot Island.

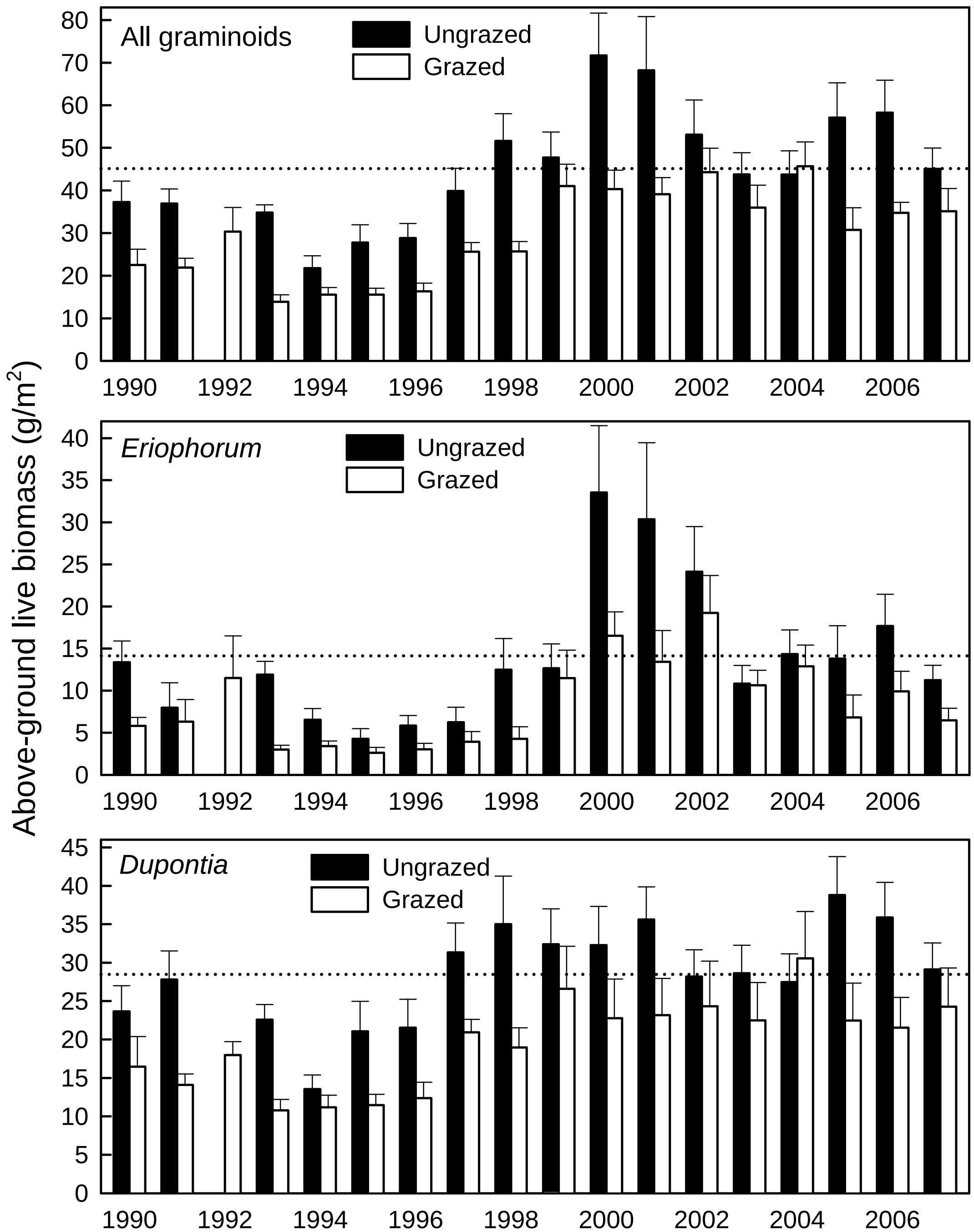

Figure 6. Live above-ground biomass (mean + SE, dry mass) of graminoids on 11 and 12 August in grazed and ungrazed wet meadows of the Base-camp Valley, Bylot Island (n = 12). Total graminoids include *Eriophorum scheuchzeri*, *Dupontia fisheri* and *Carex aquatilis*. There is no data from ungrazed area in 1992. The dashed line is the long-term average for ungrazed area.

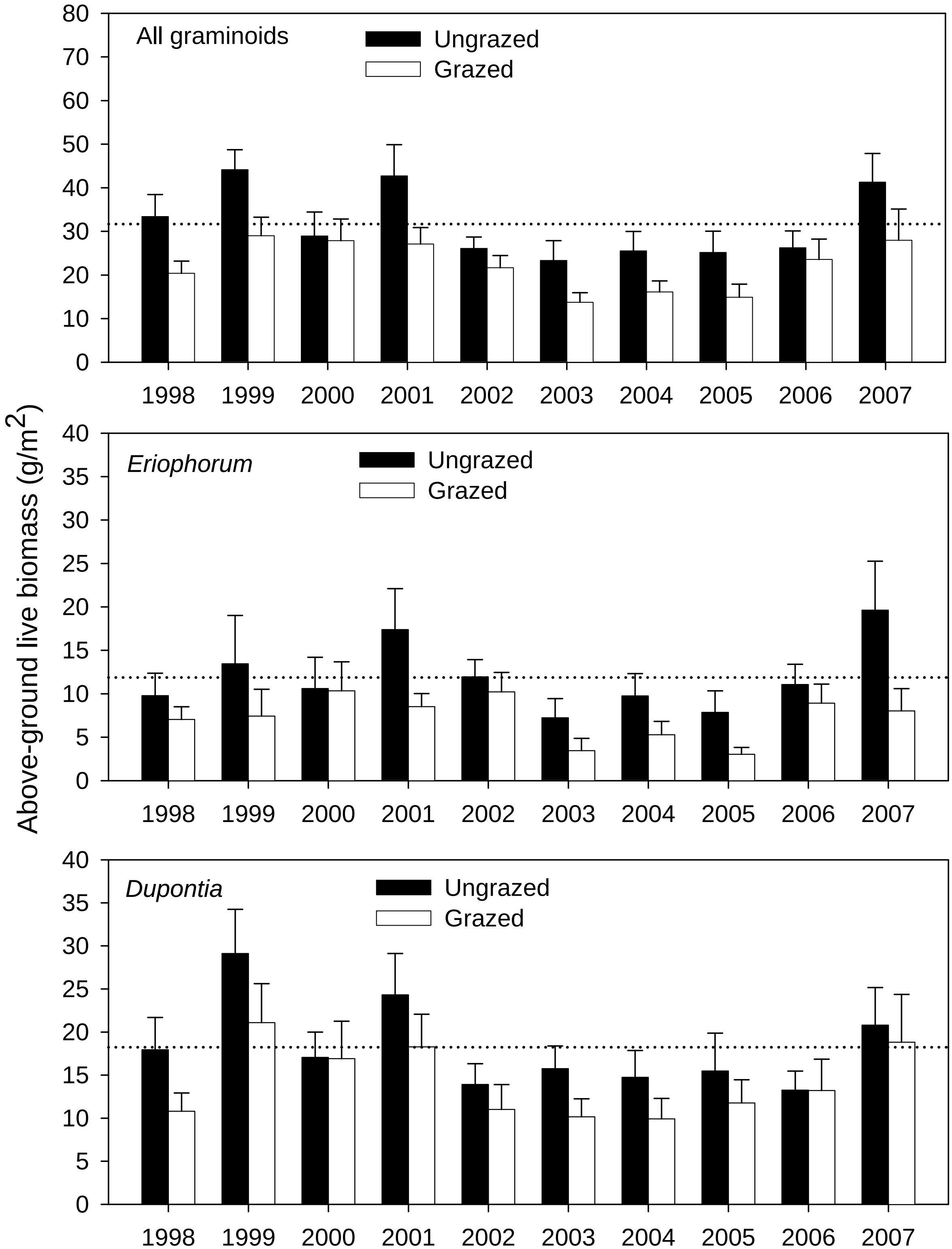

Figure 7. Live above-ground biomass (mean + SE, dry mass) of graminoids on 16 August in grazed and ungrazed wet meadows of the Camp-2 (goose colony), Bylot Island (n = 12). Total graminoids include *Eriophorum scheuchzeri*, *Dupontia fisheri* and *Carex aquatilis*. The dashed line is the long-term average for ungrazed area.

PUBLICATIONS FROM OUR WORK ON BYLOT ISLAND (1990-2007)

Papers in refereed journals

Careau, V., N. Lecomte, J. Bêty, J.-F. Giroux, G. Gauthier & D. Berteaux. 2008. Food hoarding of pulsed resources: temporal variations in egg-caching behaviour of arctic fox. **Ecoscience** (in press).

Lecomte, N., V. Careau, G. Gauthier, & J.-F. Giroux. 2008. Predator behaviour and predation risk in the heterogeneous Arctic environment. **Journal of Animal Ecology** (in press).

Gauthier G. and J.-D. Lebreton. 2008. Analysis of band-recovery data in a multisate capture-recapture framework. **Canadian Journal of Statistics** 36:1-15.

Szor, G., D. Berteaux & G. Gauthier. 2008. Den ecology of an arctic mammal: selection of denning sites and reproductive dens by arctic foxes (*Alopex lagopus*) on Bylot Island, Nunavut, Canada. **Polar Biology** 31:351-352.

Lecomte, N., G. Gauthier, & J.-F. Giroux. 2008. Breeding dispersal in a heterogeneous landscape: the influence of habitat and nesting success in greater snow geese. **Oecologia** 155:33-41.

Gauthier, G., P.Besbeas, J.-D. Lebreton & B.J.T. Morgan 2007. Population growth in snow geese: A modeling approach integrating demographic and survey information. **Ecology** 88:1420-1429.

Audet, B., E. Lévesque & G. Gauthier. 2007. Seasonal variation in plant nutritive quality for greater snow goose goslings in mesic tundra. **Canadian Journal of Botany** 85:457-462.

Audet, B., G. Gauthier & E. Lévesque. 2007. Feeding ecology of greater snow goose goslings in mesic tundra on Bylot Island, Nunavut, Canada. **Condor** 109:361-376.

Careau, V., J.F. Giroux, & D. Berteaux. 2007. Cache and carry: hoarding behaviour of arctic fox. **Behavioral Ecology and Sociobiology** 62 :87-96.

Careau, V., N. Lecomte, J.F. Giroux, & D. Berteaux. 2007. Common ravens raid arctic fox food caches. **Journal of Ethology** 25:79-82.

Mainguy, J., G. Gauthier, J.-F. Giroux & I. Duclos. 2006. Habitat use and behaviour of greater snow geese during movements from nesting to brood-rearing areas. **Canadian Journal of Zoology** 84:1096-1103.

Mainguy, J., G. Gauthier, J.-F. Giroux & J. Bêty. 2006. Gosling growth and survival in relation to brood movements in Greater Snow Geese (*Chen caerulescens atlantica*). **Auk** 123:1077-1089.

Lecomte, N., G. Gauthier, L. Bernatchez & J.-F. Giroux. 2006. A new non-damaging blood sampling technique of waterfowl embryos. **Journal of Field Ornithology** 77:24-27.

Gauthier, G., F. Fournier & J. Larochelle. 2006. The effect of environmental conditions on early growth in geese. **Acta Zoologica Sinica** 52(supplement):670-674.

Gauthier, G., J.-F. Giroux & L. Rochefort. 2006. The impact of goose grazing on arctic and temperate wetlands. **Acta Zoologica Sinica** 52(supplement):108-111.

Féret M., J. Bety, G. Gauthier, J.-F. Giroux & G. Picard. 2005. Are abdominal profiles useful to assess body condition of spring staging Greater Snow Geese? **Condor** 107:694-702.

Gauthier, G., J.-F. Giroux, A. Reed, A. Béchet & L. Bélanger. 2005. Interactions between land use, habitat use, and population increase in greater snow geese: what are the consequences for natural wetlands? **Global Change Biology** 11:856-868.

Calvert, A.M. & G. Gauthier. 2005. Effects of exceptional conservation measures on survival and seasonal hunting mortality in greater snow geese. **Journal of Applied Ecology** 42:442-452.

Menu, S., G. Gauthier & A. Reed. 2005. Survival of young greater snow geese during the fall migration. **Auk** 122:479-496.

Calvert, A.M., G. Gauthier & A. Reed. 2005. Spatiotemporal heterogeneity of greater snow goose harvest and implications for hunting regulations. **Journal of Wildlife Management** 69:561-573.

Reed, E.T., G. Gauthier & R. Pradel. 2005. Effects of neck bands on reproduction and survival of female greater snow geese. **Journal of Wildlife Management** 69:91-100.

Bêty, J., J.-F. Giroux, & G. Gauthier. 2004. Individual variation in timing of migration : causes and reproductive consequences in greater snow geese (*Anser caerulescens atlanticus*). **Behavioural Ecology and Sociobiology** 57:1-8.

Gauthier,G. & J.-D. Lebreton. 2004. Population models in greater snow geese: a comparison of different approaches. **Animal Biodiversity and Conservation** 27:503-514.

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

Béchet, A., J.-F. Giroux, & G. Gauthier. 2004. The effects of disturbance on behaviour, habitat use and energy of spring staging snow geese. **Journal of Applied Ecology** 41:689-700.

Béchet, A., A. Reed, N. Plante, J.-F. Giroux & G. Gauthier. 2004. Estimating the size of large bird populations: the case of the greater snow goose. **Journal of Wildlife Management** 68:639-649.

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

Gauthier, G., J. Bêty & K. Hobson. 2003. Are greater snow geese capital breeders? new evidence from a stable isotope model. **Ecology** 84:3250–3264.

Demers, F., J.-F. Giroux, G. Gauthier & J. Bêty. 2003. Effects of collar-attached transmitters on behavior, pair bond, and breeding success of snow geese. **Wildlife Biology** 9:161-170.

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.

Béchet, A., J.-F. Giroux, G. Gauthier, J.D. Nichols & J. Hines. 2003. Spring hunting changes the regional movements of migrating greater snow geese. **Journal of Applied Ecology** 40:553-564.

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.

Cooch, E.G., G. Gauthier & R. Rockwell. 2003. Apparent differences in stochastic growth rates based on timing of census: a cautionary note. **Ecological Modelling** 159:133-143.

Reed, E.T., J. Bêty, J. Mainguy, G. Gauthier & J.-F. Giroux. 2003. Molt migration in relation to breeding success in greater snow geese. **Arctic** 56:76-81.

Reed, E.T., G. Gauthier, R. Pradel, & J.-D. Lebreton. 2003. Age and environmental conditions affect recruitment in greater snow geese. **Ecology** 84:219-230.

Fournier, F. & G. Gauthier. 2002. The effect of food quality on developmental plasticity and digestive efficiency in greater snow goose goslings. **Integrative and Comparative Biology** 42:1231-1231.

Reed, A., R.J. Hughes, & H. Boyd. 2002. Patterns of distribution and abundance of Greater Snow Geese on Bylot Island, Nunavut, Canada 1983-1998. **Wildfowl** 53:53-65.

Righi, M. & G. Gauthier. 2002. Natural infection by intestinal cestodes: variability and effect on growth in greater snow goose goslings. **Canadian Journal of Zoology** 80:1077-1083.

Bêty, J., G. Gauthier, E. Korpimäki & J.-F. Giroux. 2002. Shared predators and indirect trophic interactions: lemming cycles and arctic-nesting geese. **Journal of Animal Ecology** 71:88-98.

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.

Menu, S., G. Gauthier & A. Reed. 2002. Changes in survival rates and population dynamics of greater snow geese over a 30-year period: Implications for hunting regulations. **Journal of Applied Ecology**39:91-102.

Gauthier, G., R. Pradel, S. Menu & J.-D. Lebreton. 2001. Seasonal survival of greater snow geese and effect of hunting under dependence in sighting probability. **Ecology** 82:3105-3119.

Bêty, J. & G. Gauthier. 2001. Effects of nest visits on predators activity and predation rate in a snow goose colony. **Journal of Field Ornithology** 72:573-586.

Bêty, J., G. Gauthier, J.-F. Giroux & E. Korpimäki. 2001. Is goose nesting success and lemming cycles linked? Interplay between nest density and predators. **Oikos** 93:388-400.

Poussart, C., G. Gauthier.& J. Larochelle. 2001. Incubation behavior of greater snow geese in relation to weather conditions. **Canadian Journal of Zoology** 79:671-678.

Massé, H., Rochefort, L. & G. Gauthier. 2001. Carrying capacity of wetland habitats used by breeding greater snow geese. **Journal of Wildlife Management** 65:271-281.

Menu, S., G. Gauthier & A. Reed. 2001. Survival of juvenile greater snow geese immediately after banding. **Journal of Field Ornithology** 72:282-290.

Morez, V., G. Gauthier & A. Reed. 2000. Effect of body condition on the vulnerability of greater snow geese to hunting and capture. **Journal of Wildlife Management** 64:875-886.

Fortin, D., & G. Gauthier. 2000. The effect of postural adjustment on the thermal environment of greater snow goose goslings. **Canadian Journal of Zoology** 78:817-821.

Poussart, C., J. Larochelle & G. Gauthier. 2000. The thermal regime of eggs during laying and incubation in Greater Snow Geese. **Condor** 102:292-300.

Lepage, D., G. Gauthier & S. Menu. 2000. Reproductive consequences of egg-laying decisions in snow geese. **Journal of Animal Ecology** 69:414-427.

Menu, S., J.B. Hestbeck, G. Gauthier & A. Reed. 2000. Effects of neck bands on survival of greater snow geese. **Journal of Wildlife Management** 64:544-552.

Fortin, D., G. Gauthier & J. Larochelle. 2000. Body temperature and resting behavior of greater snow goose goslings in the High Arctic. **Condor** 102:163-171.

Fortin, D., J. Larochelle & G. Gauthier. 2000. The effect of wind, radiation and body orientation on the thermal environment of greater snow goose goslings. **Journal of Thermal Biology** 25:227-238.

Piedboeuf, N. & G. Gauthier. 1999. Nutritive quality of forage plants for greater snow goose goslings: when is it advantageous to feed on grazed plants? **Canadian Journal of Zoology** 77:1908-1918.

Blouin, F., J.-F. Giroux, J. Ferron, G. Gauthier, & J. Doucet. 1999. The use of satellite telemetry to track greater snow geese. **Journal of Field Ornithology** 70:187-199.

Lepage, D., A. Desrochers & G. Gauthier. 1999. Seasonal decline of growth and fledging success in snow geese *Anser caerulescens*: an effect of date or parental quality? **Journal of Avian Biology** 30:72-78.

Lepage, D., D. N. Nettleship, and A. Reed. 1998. Birds of Bylot Island and adjacent Baffin Island, Northwest Territories, Canada, 1979 to 1997. **Arctic** 51:125-141

Lesage, L. & G. Gauthier. 1998. Effect of hatching date on body and organ development in greater snow goose goslings. **Condor** 100:316-325.

Lepage, D., G. Gauthier & A. Desrochers. 1998. Larger clutch size increases fledging success and offspring quality in a precocial species. **Journal of Animal Ecology** 67:210-216.

Lepage, D., G. Gauthier & A. Reed. 1998. Seasonal variation in growth of greater snow goose goslings: the role of food supply. **Oecologia** 114:226-235

Tremblay, J.-P., G. Gauthier, D. Lepage, & A. Desrochers. 1997. Factors affecting nesting success in greater snow geese: effects of habitat and association with snowy owls. **Wilson Bulletin** 109:449-461.

Lesage, L. & G. Gauthier. 1997. Growth and organ development in greater snow goose goslings. **Auk** 114:229-241.

Gauthier, G., L. Rochefort & A. Reed. 1996. The exploitation of wetland ecosystems by herbivores on Bylot Island. **Geoscience Canada** 23:253-259.

Lepage, D., G. Gauthier & A. Reed. 1996. Breeding site infidelity in greater snow goose: a consequence of constraints on laying dates? **Canadian Journal of Zoology** 74:1866-1875.

Beaulieu, J., G. Gauthier & L. Rochefort. 1996. The growth response of graminoid plants to goose grazing in a High arctic environment. **Journal of Ecology** 84:905-914.

Reed, A., R.J. Hughes & G. Gauthier. 1995. Incubation behavior and body mass of female greater snow geese. **Condor** 97:993-1001

Gauthier, G. & R.J. Hughes. 1995. The palatability of arctic willow for greater snow geese: the role of nutrients and deterring factors. **Oecologia** 103:390-392.

Choinière, L. & G. Gauthier. 1995. Energetics of reproduction in female and male greater snow geese. **Oecologia** 103:379-389

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

Lindholm, A., G. Gauthier & A. Desrochers. 1994. Effects of hatch date and food supply on gosling growth in arctic-nesting greater snow geese. **Condor** 96:898-908.

Hughes, R.J., G. Gauthier & A. Reed. 1994. Summer habitat use and behaviour of greater snow geese *Anser caerulescens atlanticus*. **Wildfowl** 45:49-64.

Hughes, R.J., A. Reed & G. Gauthier. 1994. Variation in space and habitat use by greater snow goose broods. **Journal of Wildlife Management** 58:536-545.

Manseau, M. & G. Gauthier. 1993. Interactions between greater snow geese and their rearing habitat. **Ecology** 74:2045-2055.

Gauthier, G. 1993. Feeding ecology of nesting greater snow geese. **Journal of Wildlife Management** 57:216-223.

Gauthier, G., Giroux, J.-F. & J. Bédard. 1992. Dynamics of fat and protein reserves during winter and spring migration in greater snow geese. **Canadian Journal of Zoology** 70:2077-2087.

Reed, A., H. Boyd, P. Chagnon, and J. Hawkings. 1992. The numbers and distribution of greater snow geese on Bylot Island and near Jungersen Bay, Baffin Island, in 1988 and 1983. **Arctic** 45:115-119.

Gauthier, G. & J. Tardif. 1991. Female feeding and male vigilance during nesting in greater snow geese. **Condor** 93:701-711.

Reports and other publications

Calvert, A.M., G. Gauthier, E.T. Reed, L. Bélanger, J.-F. Giroux, J.-F. Gobeil, M. Huang , J. Lefebvre & A.Reed. 2007. Section I. Present status of the population and evaluation of the effects of the special conservation measures. Pages 5-64 in Reed, E.T. and A.M. Calvert, eds. An evaluation of the special conservation measures for Greater snow geese: report of the Greater Snow Goose Working Group. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington D.C. and Canadian Wildlife Service, Ottawa, ON.

Gauthier, G. & E.T. Reed. 2007. Section II. Projected growth rate of the Greater Snow Goose population under alternative harvest scenario. Pages 65-74 in Reed, E.T. and A.M. Calvert, eds. An evaluation of the special conservation measures for Greater snow geese: report of the Greater Snow Goose Working Group. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington D.C. and Canadian Wildlife Service, Ottawa, ON.

Bélanger, L., G. Gauthier, J.-F. Giroux, J. Lefebvre, A.Reed & E.T. Reed. 2007. Conclusion. Pages 75-78 in Reed, E.T. and A.M. Calvert, eds. An evaluation of the special conservation measures for Greater snow geese: report of the Greater Snow Goose Working Group. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington D.C. and Canadian Wildlife Service, Ottawa, ON.

Gagnon, C., M.-C. Cadieux, G. Gauthier, E. Lévesque, A. Reed & 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. & S. Brault. 1998. Population model of the greater snow goose: projected impacts of reduction in survival on population growth rate. Pp 65-80 *in* The Greater Snow Goose: report of the Arctic Goose Habitat Working Group, B.D.J. Batt ed. Arctic Goose Joint Venture Special

Publication. U.S. Fish and Wildlife Service, Washington D.C. and Canadian Wildlife Service, Ottawa, Ont.

Giroux, J.-F., G. Gauthier, G. Costanzo & A. Reed. 1998. Impact of geese on natural habitats. Pp. 32-57 *in* The Greater Snow Goose: report of the Arctic Goose Habitat Working Group, B.D.J. Batt ed. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington D.C. and Canadian Wildlife Service, Ottawa, Ont.

Reed, A., J.-F. Giroux & G. Gauthier. 1998. Population size, productivity, harvest and distribution. Pp. 5-31 *in* The Greater Snow Goose: report of the Arctic Goose Habitat Working Group, B.D.J. Batt ed. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington D.C. and Canadian Wildlife Service, Ottawa, Ont.

Giroux, J.-F., B. Batt, S. Brault, G. Costanzo, B. Filion, G. Gauthier, D. Luszcz, & A. Reed. 1998. Conclusions and management recommendations. Pp 81-88 *in* The Greater Snow Goose: report of the Arctic Goose Habitat Working Group, B.D.J. Batt ed. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington D.C. and Canadian Wildlife Service, Ottawa, Ont.

Gauthier, G. and Menu, S. 1997. The use of capture-recapture models in greater snow geese: is there a transient effect of capture and marking on survival? *Proceed. of the Survey Methods Section, 24th Annual Meeting of the Statistical Society of Canada*, Fredericton, NB.

Presentations at international conferences

Juillet, C., G. Gauthier, R. Pradel & Rémi Choquet. 2007. Use of mixture of information models to evaluate the effect of special conservation measures on survival in a hunted species, the Greater Snow Goose. *EURING-2007 meeting*, Otago, New Zealand.

Gauthier, G., K. Hobson & J. Bêty. 2006. Diet change inferred from stable-isotopes in spring-staging Greater Snow Geese. *XXIVth International Ornithological Congress*, Hamburg, Germany.

Gauthier, G. 2006. Application of capture-recapture methods to demographic analyses of bird populations: case studies with an emphasis on multistate models. Colloque *Capture 2006*, Université Laval, Québec, QC.

Dickey, M.-H. & G. Gauthier. 2005. Effect of climate variables on the phenology and reproductive success of Greater Snow Geese (*Chen caerulescens atlantica*). *Eleventh North American Arctic Goose Conference*, Reno, NV.

Lecomte, N., G. Gauthier, L. Bernatchez & J.-F. Giroux. 2005. Population structure of a Greater Snow Goose colony. *Eleventh North American Arctic Goose Conference*, Reno, NV.

Gauthier, G., A.M. Calvert & E.T. Reed. 2005. Impacts of special conservation measures on demographic parameters in Greater Snow Geese (*Chen caerulescens atlantica*). *Eleventh North American Arctic Goose Conference*, Reno, NV.

Mainguy, J., G. Gauthier, J.-F. Giroux & J. Bêty. 2005. Long distance brood movements in Greater Snow Geese : effects on goslings growth and survival. *Eleventh North American Arctic Goose Conference*, Reno, NV.

Ouellet, N., J. Larochelle & G. Gauthier. 2005. Effect of locomotion on growth in Greater Snow Goose goslings (*Chen caerulescens atlantica*). *Eleventh North American Arctic Goose Conference*, Reno, NV.

Lecomte, N., G. Gauthier & J.-F. Giroux. 2005. Habitat effects on nest predation risks : the case of the Greater Snow Goose. *Eleventh North American Arctic Goose Conference*, Reno, NV.

Audet, B., G. Gauthier & E. Lévesque. 2005. Feeding ecology of Greater Snow Goose (*Chen caerulescens atlantica*) goslings in upland tundra on Bylot Island, Nunavut. *Eleventh North American Arctic Goose Conference*, Reno, Nevada.

Bêty, J., J.-F. Giroux, & G. Gauthier. 2004 Individual variation in timing of migration : causes and reproductive consequences in greater snow geese. *122nd American Ornithologist Union Meeting*, Québec, Canada.

Calvert, A.M. & G. Gauthier. 2004. Exceptional conservation measures: how have they affected survival and hunting mortality in greater snow geese. *122nd American Ornithologist Union Meeting*, Québec, Canada.

Audet, B., G. Gauthier & E. Lévesque. 2004. Feeding ecology of Greater Snow Goose (*Chen caerulescens atlantica*) goslings in upland tundra on Bylot Island, Nunavut. *122nd American Ornithologist Union Meeting*, Québec, Canada.

Lecomte, N., G. Gauthier & J.F. Giroux. 2004. Habitat effects on nest predation risks: the case of the Greater Snow Goose. *122nd American Ornithologist Union Meeting*, Québec, Canada.

Gauthier, G., J.-F. Giroux, A. Reed, A. Béchet & L. Bélanger. 2004. Interactions between land use, habitat use and population increase in greater snow geese: what are the consequences for natural wetlands? Intecol 7th Interational Wetlands conference, Utrecth, Netherlands.

Giroux, J.-F., G. Gauthier, A. Béchet, M. Féret, J. Mainguy, J. Bêty & V. Lemoine. 2003. Controling overabundant bird populations: the case of the greater snow goose. Third International Wildlife Management Congress, 1-5 December 2003, Christchurch, New Zealand.

Gauthier, G. & J.D. Lebreton. 2003. Population models in Greater Snow Geese: a comparison of different approaches. *EURING-2003 meeting*, Radolfzell, Germany.

Reed, E., G. Gauthier & J.-F. Giroux. 2003. Effects of spring conditions on breeding propensity of greater snow goose females. *EURING-2003 meeting*, Radolfzell, Germany.

Calvert, A.M. & G. Gauthier. 2003. Applying band recovery models to an evaluation of the demographic impacts of exceptional conservation measures. *EURING-2003 meeting*, Radolfzell, Germany.

Gauthier, G., J. Bêty, J.-F. Giroux & L. Rochefort. 2003. Trophic interactions in a High Arctic Snow Goose colony. *Annual Meeting of the Society for Integrative and Comparative Biology*, Toronto, Ont.

Fournier, F., G. Gauthier & J. Larochelle. 2003. The effect of food quality on developmental plasticity and digestive efficiency in Greater Snow Goose goslings. *Annual Meeting of the Society of integrative and comparative biology*, Toronto, Ont.

Gauthier, G. 2002. Are Greater Snow Geese overabundant? A review of population Dynamics and management actions on this population in North America. *7th Annual Meeting of the Goose Specialist Group of Wetlands International*, El Rocio, Spain.

Gauthier, G., F. Fournier & J. Larochelle. 2002. The effect of environmental conditions on early growth in geese. *XXIIIrd International Ornithological Congress*, Beijing, China

Gauthier, G., J.-F. Giroux & L. Rochefort. 2002. The impact of goose grazing on Arctic and temperate wetlands. *XXIIIrd International Ornithological Congress*, Beijing, China.

Bêty, J., G. Gauthier, E. Korpimäki & J.-F. Giroux. 2001. Shared predators and indirect trophic interactions: lemming cycles and arctic-nesting geese. *119th American Ornithologist Union Meeting*, Seattle, WA.

Bourguelat, G., G. Gauthier & R. Pradel. 2001. New analytical tools to study stopover length in birds : what can we learn from the greater snow goose example? *119th American Ornithologist Union Meeting*, Seattle, WA.

Gauthier, G. 2001. The effects of management actions on populations: greater snow goose. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Gauthier, G. & J.D. Lebreton. 2001. Population models in greater snow geese: a comparison of different approaches. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Gauthier, G., K. Hobson & J. Bêty. 2001. The role of nutrient reserves in egg formation in greater snow geese: a reply to Ankney (1995). *Tenth North American Arctic Goose Conference*, Québec, Qc.

Mainguy, J., J. Bêty & G. Gauthier. 2001. Is body condition of laying greater snow geese affected by the Québec spring conservation hunt? *Tenth North American Arctic Goose Conference*, Québec, Qc.

Bêty, J., G. Gauthier, E. Korpimäki & J.-F. Giroux. 2001. Cyclic lemmings and greater snow geese: direct observations of an indirect trophic interaction. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Reed, E. & G. Gauthier. 2001. The costs of raising a family in greater snow geese *Chen caerulescens atlantica*. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Righi, M. & G. Gauthier. 2001. Abundance and distribution of intestinal helminths in greater snow geese on the breeding colony, and during their fall and spring migration. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Renaud, M., G. Gauthier & J. Larochelle. 2001. Energetic cost of thermoregulation for greater snow goose goslings growing in a natural environment. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Féret M., G. Gauthier, J.-F. Giroux & K. Hobson. 2001. Impact of spring conservation hunt on nutrient storage of greater snow geese staging in Québec. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Bourguelat, G., G. Gauthier & R. Pradel. 2001. Estimation of the fall stopover length of the greater snow goose in the St. Lawrence estuary using capture-recapture methods. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Béchet, A. J.-F. Giroux & G. Gauthier. 2001. Impact of a spring hunt on the regional movements of staging greater snow geese. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Demers, F. J.-F. Giroux, G. Gauthier & J. Bêty. 2001. Effect of collar-attached transmitters on pair bond, breeding success and behavior of greater snow geese. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Otis, P., J. Larochelle & G. Gauthier. 2001. Energy cost of locomotion in greater snow goose goslings. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Duclos, I., E. Lévesque & L. Rochefort. 2001. Mesic habitats of the Greater Snow Goose (*Chen caerulescens atlantica*) on Bylot Island (Nunavut): characterization and feeding potential. *Tenth North American Arctic Goose Conference*, Québec, Qc.

Gauthier, G., R. Pradel, S. Menu & J.D. Lebreton. 2000. Modelling seasonal survival rate of greater snow geese in presence of trap-dependence. *EURING-2000 meeting*, Point Reyes, Calif.

Gauthier, G., R. Pradel, S. Menu & J.D. Lebreton. 2000. Seasonal variations in survival rate of a migratory and hunted species, the greater snow goose. *118th American Ornithologist Union Meeting*, St. John's, NF.

Gauthier, G., L. Rochefort, & A. Reed. 2000. Short- and long-term impact of snow goose herbivory on wetland ecosystems of Bylot Island. *Weltand-2000 international meeting*, Quebec city, Qc.

Lévesque, E., C. Pineau, L. Rochefort & G. Gauthier. 1999. Combined influence of grazing and warming in a high arctic wet meadow. Abstract in *Plant response to climate change*, R.D. Hollister (ed), Proceedings from the *9th International Tundra Experiment Meeting*, East Lansing, MI.

Bêty, J, G. Gauthier & J.-F. Giroux. 1998. Factors affecting nesting success in greater snow geese: the interplay between nest density, lemming abundance and association with snowy owls. *Ninth North American Arctic Goose Conference*, Victoria, BC.

Massé, H., L. Rochefort & G. Gauthier. 1998. Estimating the carrying capacity of wetland habitats used by breeding greater snow geese on Bylot island (N.W.T, Canada). *Ninth North American Arctic Goose Conference*, Victoria, BC.

Demers, F., J.-F. Giroux & G. Gauthier. 1998. How faithful to their mate are radio-marked greater snow geese? *Ninth North American Arctic Goose Conference*, Victoria, BC.

Giroux, J.-F., F. Blouin, J. Ferron, G. Gauthier & J. Doucet. 1998. The fall migration of greater snow geese tracked by satellite. *Ninth North American Arctic Goose Conference,* Victoria, BC.

Menu S., G. Gauthier & A. Reed. 1998. Survival of young greater snow geese during the fall migration. *Ninth North American Arctic Goose Conference*, Victoria, BC.

Poussart, C., G. Gauthier & J. Larochelle. 1998. Incubation behavior of greater snow geese in relation to weather conditions. *Ninth North American Arctic Goose Conference*, Victoria, BC.

Gauthier, G. 1998. The role of food and timing of nesting in greater snow goose reproduction. *Ninth North American Arctic Goose Conference*, Victoria, BC.

Gauthier, G. 1997. Population regulation in Greater Snow Geese. *Symposium on how to manage thriving goose populations,* Zwolle, Netherlands.

Reed, A. & G. Gauthier. 1997. Changes in demographic and physical parameters of greater snow geese during an extended population growth phase. *Symposium on Over-abundant goose population: an emerging challenge in wildlife conservation, Wildlife Society 4th annual conference,* Snowmass, Colorado.

Gauthier, G. 1997. The use of capture-recapture models to estimate survival and movements in Greater Snow Geese *Session on biostatistics and survey methods in wildlife management, Annual meeting of the statistical society of Canada,* Fredericton, New-Brunswick.

Menu, S., G. Gauthier, A. Reed & J. Hestbeck. 1997. Effects of neck band on the survival of adult female greater snow geese. *Large-scale studies of marked birds, EURING 97,* Norwich, United Kingdom.

Gauthier, G. 1996. Energetics of reproduction in greater snow geese: the female condition model revisited. *International workshop on energetics of reproduction in birds, mammals and reptiles: exploring new technologies*, Chizé, France.

Giroux, J.-F., F. Blouin, J. Ferron, G. Gauthier, & J. Doucet. 1996. The use of satellite telemetry to track the fall migration of greater snow geese. *5th European conference on wildlife telemetry,* Strasbourg, France.

Piedboeuf, N. & G. Gauthier, G. 1996. Nutritional quality of feeding sites in Greater Snow Goose goslings: is it advantageous to use grazed sites? *Comparative Nutrition Society Symposium*, Washington, DC.

Lepage, D., G. Gauthier, & A. Desrochers. 1996. Le rôle des parents dans la variation de croissance et de survie chez la Grande Oie des neiges (*Chen caerulescens atlantica*). *Congrès international francophone sur le comportement animal,* Québec, Québec.

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). *25th Arctic Workshop*, Québec, Qc.

Gauthier, G., D. Lepage & A. Reed. 1995. Site infidelity in nesting Greater Snow Geese (*Chen caerulescens atlantica*). *Eighth North American Arctic Goose Conference*, Albuquerque, NM.

Beaulieu, J., G. Gauthier & L. Rochefort. 1995. Growth responses of plants to goose grazing in a High Arctic environment. *Eighth North American Arctic Goose Conference*, Albuquerque, NM.

Lepage, D., A. Desrochers & G. Gauthier. 1995. Clutch manipulation in Greater Snow Geese: the causal relationship between hatch date, brood size and pre-fledging growth. *Eighth North American Arctic Goose Conference,* Albuquerque, NM.

Lesage, L. & G. Gauthier. 1995. Effect of hatch date and brood-rearing site on growth pattern and organ development in Greater Snow Geese. *Eighth North American Arctic Goose Conference*, Albuquerque, NM.

Tremblay, J.-P., G. Gauthier, D. Lepage, A. Desrochers. 1995. Relationship between nest site characteristics and nesting success in greater snow geese. *Eighth North American Arctic Goose Conference*, Albuquerque, NM.

Blouin, F., J.-F. Giroux, J. Ferron, G. Gauthier & J. Doucet. 1995. Tracking the fall migration of greater snow geese using satellite telemetry. *Eighth North American Arctic Goose Conference*, Albuquerque, NM.

Gauthier, G. & D. Lepage. 1994. The interaction between food supply and gosling growth in greater snow geese. *XXIst Interational Ornithological Congress*, Vienna, Austria.

Gauthier, G. 1992. Diet, food quality and food intake of pre-laying and laying greater snow geese. *Seventh North American Arctic Goose Conference,* Vallejo, CA.

Choinière, L. & G. Gauthier. 1992. Reproductive energetics of female greater snow geese on Bylot Island (NWT), Canada. *Seventh North American Arctic Goose Conference,* Vallejo, CA.

Hughes, J., A. Reed & G. Gauthier. 1992. Habitat use by brood-rearing greater snow geese. *Seventh North American Arctic Goose Conference*, Vallejo, CA.

Lindholm, A. & G. Gauthier. 1992. Hatch date, food quality and growth of juvenile greater snow geese. *Seventh North American Arctic Goose Conference*, Vallejo, CA.

Manseau, M. & G. Gauthier. 1992. Brood-rearing habitats in greater snow geese: a comparative study based on the animal perception of its environment. *Seventh North American Arctic Goose Conference*, Vallejo, CA.

Reed, A. 1992. Incubation behavior and body mass of female greater snow geese. *Seventh North American Arctic Goose Conference*, Vallejo, CA.

Graduate student theses

Lecomte, N. 2007. Risque de prédation, hétérogénété de l'habitat et fidélité au site de reproduction: Le cas de la Grande Oie des neiges dans le Haut-Arctique. PhD thesis, dépt. biologie, Univ. Laval.

Gruyer, N. 2007. Étude comparative de la démographie de deux espèces de lemmings (*Lemmus sibericus* et *Dicrostonyx groenlandicus*), à l'Île Bylot, Nunavut, Canada. MSc thesis, dépt. biologie, Univ. Laval.

Careau, V. 2006. Comportement de mise en réserve du renard arctique dans une colonie d'oies des neiges à l'Île Bylot, Nunavut. MSc thesis, dépt. biologie, Univ. Québec à Montréal.

Szor, G. 2006. Sélection des sites de tanières et des tanières de reproduction chez le renard arctique à l'Île Bylot, Nunavut. MSc thesis, dépt. biologie, Univ. du Québec à Rimouski

Dickey, M.H. 2006. Effet des facteurs climatiques sur la phénologie et le succès reproducteur de la grande oie des neiges (*Chen caerulescens atlantica*) à l'Île Bylot. MSc thesis, dépt biologie, Univ. Laval.

Pouliot, R. 2006. Les effets fertilisants de la grande oie des neiges sur la dynamique des milieux humides de l'île Bylot au Nunavut : impact du tapis de bryophites. MSc thesis, dépt phytologie, Univ. Laval.

Audet, B. 2006. Écologie alimentaire des oisons de la grande oie des neiges (*Chen caerulescens atlantica*) en milieux mésiques sur l'Île Bylot, Nunavut. MSc thesis, dépt. biologie, Univ. Laval.

Calvert, A.M. 2004. Variations spatiales et temporelles de la mortalité due à la chasse et les effets des mesures de gestion chez la grande oie des neiges (*Chen caerulescens atlantica*). MSc thesis, dépt. biologie, Univ. Laval.

Mainguy, J. 2003. Déplacements des familles de la grande oie des neiges durant la période d'élevage, Île Bylot, Nunavut. MSc thesis, dépt. biologie, Univ. Laval.

Bourguelat, G. 2003. Durée de séjour automnale de la grande oie des neiges dans l'estuaire du Saint-Laurent : une nouvelle approche méthodologique. MSc thesis, dépt. biologie, Univ. Laval.

Reed, E. 2003. Coûts des soins parentaux et effet des conditions environnementales sur la reproduction de la Grande Oie des neiges. PhD thesis, dépt. biologie, Univ. Laval.

Béchet, A. 2003. Ecologie et comportement de la grande oies des neiges lors de sa migration pré-nuptiale dans le Quebec méridional. PhD thesis, dépt. biologie, Univ. Québec à Montréal.

Otis, P. 2002. Adaptations au froid chez les oisons, juvéniles et adultes et modèles de croissance chez la grande oie des neiges. MSc thesis, dépt. biologie, Univ. Laval.

Féret, M. 2002. Effet d'une chasse printanière sur la condition physique de la Grande Oie des neiges en migration. MSc thesis, dépt. biologie, Univ. Laval.

Bêty, J. 2001. Interactions trophiques indirectes, prédation et stratégies de reproduction chez l'oie des neiges nichant dans le Haut-Arctique. PhD thesis, dépt. biologie, Univ. Laval.

Demers, F. 2000. Effets des colliers émetteurs sur le maintien du couple, le succès reproducteur et le comportement de la grande oie des neiges. MSc thesis, dépt. biologie, Univ. Québec à Montréal.

Rioux, S. 2000. Effets du vent et du rayonnement sur la thermorégulation chez les oisons de la grande oie des neiges, *Chen caerulescens atlantica*. MSc thesis, dépt. biologie, Univ. Laval.

Renaud, M. 1999. Coûts énergétiques de la thermorégulation chez les jeunes de la grande oie des neiges en milieu naturel. MSc thesis, dépt. biologie, Univ. Laval.

Pineau, C. 1999. Facteurs limitant la croissance des plantes graminoïdes et des mousses dans les polygones de tourbe utilisés par la grande oie des neiges. MSc thesis, dépt. phytologie, Univ. Laval.
Massé, H. 1998. Estimation de la capacité de support des différents écosystèmes humides utilisés par la grande oie des neiges nichant à l'Île Bylot (TNO, Canada). MSc thesis, dépt. phytologie, Univ. Laval.
Menu, S. 1998. Survie de la grande oie des neiges : aspects méthodologiques et implications dans la dynamique de population. PhD thesis, dépt. biologie, Univ. Laval.
Ratté, J. 1998. Thermorégulation et croissance chez les oisons de la Grande Oie des neiges (*Chen caerulescens atlantica*). MSc thesis, dépt. biologie, Univ. Laval.
Poussart, C. 1997. Patron d'incubation et régime thermique des oeufs chez la Grande oie des neiges. MSc thesis, dépt. biologie, Univ. Laval.
Lepage, D. 1997. Variations saisonnières du succès reproducteur chez la Grande Oie des neiges (*Chen caerulescens atlantica*). PhD thesis, dépt. Biologie, Univ. Laval.
Piedboeuf, N. 1996. Qualité nutritive des sites d'alimentation des oisons de la grande oie des neiges: est-il avantageux d'utiliser des sites déjà broutés? MSc thesis, dépt. biologie, Univ. Laval. 74 pp.
Lesage, L. 1995. La croissance corporelle, et l'influence de la date d'éclosion et du site d'élevage sur le développement tissulaire chez les oisons de la grande oie des neiges. MSc thesis, dépt. biologie, Univ. Laval., 99 pp.
Fortin, D. 1995. L'environnement thermique des oisons de la grande oie des neiges (*Chen caerulescens atlantica*) dans l'Arctique canadien. MSc thesis, dépt. biologie, Univ. Laval.
Beaulieu, J. 1995. La croissance des plantes arctiques (*Dupontia fisheri* et *Eriophorum scheuchzeri*) en réponse au broutement par les oisons de la grande oie des neiges. MSc thesis, dépt. biologie, Univ. Laval.
Hughes, J. 1992. Utilisation de l'habitat par la grande oie blanche pendant la période d'élevage des couvées à l'Ile Bylot, Territoires du Nord-Ouest. MSc thesis, dépt. biologie, Univ. Laval.
Choinière, L. 1992. Stratégie énergétique de la grande oie blanche (*Chen caerulescens atlantica*) pendant la reproduction. MSc thesis, dépt. biologie, Univ. Laval.
Manseau, M. 1991. Habitats d'élevage des oisons de la grande oie des neiges (*Chen caerulescens atlantica*): une approche comparative incluant la perception de l'animal. MSc thesis, dépt. biologie, Univ. Laval.
Boismenu, C. 1991. Physiologie du jeûne prolongé chez la grande oie des neiges (*Chen caerulescens atlantica*). MSc thesis, dépt. biologie, Univ. Laval.
Tardif, J. 1990. Comportement d'alimentation de la grande oie blanche (*Chen caerulescens atlantica*) en période pré-reproductrice. MSc thesis, dépt. biologie, Univ. Laval.