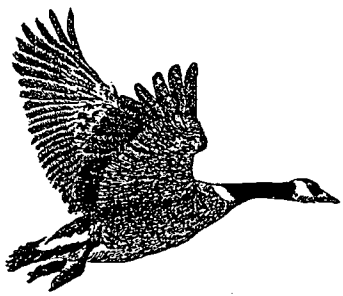
A BREEDING PAIR SURVEY OF CANADA GEESE IN NORTHERN QUEBEC - 2003



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INTRODUCTION

Status of Canada geese (Branta canadensis) in the Atlantic flyway was traditionally monitored by mid-winter surveys (Hindman and Ferrigno 1990). However, the dramatic increase in resident (i.e., non-migratory) Canada geese and mixing of resident and migrant geese on wintering areas has seriously reduced the value of mid-winter surveys for monitoring individual populations. Therefore, emphasis of population monitoring has shifted to surveys on breeding areas, where population affiliation is more obvious.

During the 1960's, aerial surveys identified the Ungava Peninsula in northern Quebec as the primary nesting area for Atlantic flyway Canada geese (Kaczynski and Chamberlain 1968). Malecki and Trost (1990) used a more quantitative approach to estimate the number of breeding pairs throughout the boreal forest and Ungava Peninsula of northern Quebec in 1988. Their findings confirmed that the highest densities were located along the coastal areas of Ungava Bay and Hudson Bay. In 1993, an annual survey was begun in northern Quebec using methods developed by Malecki and Trost (1990) (Bordage and Plante 1993). The objective of this survey is to monitor the status of the migrant population by estimating the number of breeding pairs. This report presents the results of the 2003 breeding grounds survey.

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STUDY AREA

The 2003 survey was conducted in northern Quebec, north of 51° latitude and west of 67° longitude (Figure 1). The survey is stratified based on Malecki and Trost's (1990) modification of northern Quebec's ecoregions (Gilbert et al. 1985). The regions have been described by Malecki and Trost (1990) and Bordage and Plante (1993). Regions 1-3 comprise the area known as the Ungava Peninsula (Figure 1). Region 1 is comprised of inland tundra, with much of the surface covered by granitic bedrock. Region 2 consists mainly of flat coastal tundra, characterized by low relief and numerous ponds and lakes. Region 3 is taiga, with stunted black spruce and tamarack in protected valleys. Elevations range from 100 - 400 m in region 1, 0 - 200 m in region 2, and 100-300 m in region 3. The northern tip of the coastal zone from Ivujivik, southeast to about 150 km north of Kangirsuk, was excluded (Figure 1). Exploratory transects flown in 1993 indicated that few geese use this mountainous area.

METHODS

The survey followed the methodology of Malecki and Trost (1990). Aerial transects were flown in a Partenavia twin engine at 30 m above ground level and a ground speed of 140 km/h. Observers recorded the number of geese observed as singles, pairs, or in groups (3 or more geese) within 200 m of each side of the plane. We occasionally observed multiple pairs of geese in close association (< 10-15 m apart). We classified these geese as grouped birds, since they were unlikely to be associated with a territory. Observers also recorded similar information for other waterfowl species. Coordinates for each location were generated using a global positioning system (GPS) and stored on a lap-top computer. Transects were flown using a GPS to assist with navigation. Transect width was calibrated before the survey began.

Transects flown in 2003 were established in 1994 and repeated each year thereafter. Total length

of transects sampled in each region was determined using variance estimates from the 1993 survey and a target of 10% coefficient of variation (Bordage and Plante 1994). Transects were randomly located within regions until the desired length was reached. All transects were orientated along east-west lines (Figure 1).

The number of indicated breeding pairs on a given transect was the sum of the singles and pairs observed by both observers over the length of the transect. Density of breeding pairs within regions was estimated using quotient estimators while the total population density was estimated using a separate stratified quotient estimator (Cochran 1977). Variances were estimated using the jack-knife procedure (Cochran 1977). The significance of differences in population size between years was assessed with a z-test, using the sum of the sampling variances for the 2 years being compared. The estimates presented in this report are not adjusted for visibility bias and thus represent an index to the population.

RESULTS

Habitat Conditions and Spring Phenology

Transects were surveyed from June 13-21. These dates are similar to surveys conducted during 1993-2002, but later than the 1988 survey (Table 1). Several days of warm temperatures in late April resulted in early snow melt. However, temperatures remained colder than normal throughout May and early June and lakes and ponds thawed slowly.

At the time of the survey, inland areas had 5-10% snow cover, but many lakes and ponds were completely or mostly frozen. In coastal habitat along Ungava Bay, south of Kangirsuk, there was little snow cover and most small to medium-sized lakes and ponds were open. Northwest of Kangirsuk, snow cover was more extensive and most lakes and ponds were frozen. Along the Hudson Bay coast, snow covered 5-10% of the land and considerable ice remained on medium to large lakes and ponds. Growth of

tree leaves and some grasses had occurred on the Ungava coast. Little or no growth had occurred along the Hudson Bay coast.

Breeding Pair and Total Population Estimates

The estimated number of breeding pairs on the Ungava Peninsula (regions 1,2, and 3) in 2003 (156,937 pairs) was similar to the 2002 estimate of 164,840 pairs (P = 0.653) (Table 2, Figure 2). The number of indicated pairs increased on 15 transects and decreased on 22 transects in 2003 compared to 2002. The total population estimate ((indicated pairs x 2) + non-breeders) in 2003 (760,269 individuals, SE = 89,049) was similar to the 2002 estimate of 973,600 (SE = 154,588) (P = 0.230). (Note: see discussion for interpretation of total population estimates).

Composition of Indicated Pairs

The number of indicated pairs includes birds recorded as pairs and singles. Single birds are likely to be males associated with an incubating female while pairs include some nesting birds as well as subadult or failed breeders. Therefore, the proportion of indicated pairs observed as singles may provide a more reliable indicator of the proportion of indicated pairs that are actually nesting (see Humburg et al. 1998). The percentage of indicated pairs observed as singles on the Ungava Peninsula was 55% in 2003. This was above the average for the 1993-2003 surveys (range = 40-60%, mean = 51%).

Comparison of Hudson and Ungava Bay Coasts

From 1993-2000, the estimated density of breeding pairs was similar in the Hudson and Ungava Bay coastal zones (Figure 3), although density along Hudson Bay tended to be slightly higher. Beginning in 2001, the pair density along Hudson Bay has exceeded the density along Ungava Bay. In 2003, density along Hudson Bay (2.51 pairs/km2, SE = 0.367) was greater than along Ungava Bay (1.21 pairs/km2, SE = 0.218) (P < 0.001) (Figure 3). In 2003, the estimated density of breeding pairs was essentially

unchanged along the Hudson Bay coast and decreased 13% on the Ungava Bay coast compared to 2002 (Figure 3). The estimated density of total geese in 2003 decreased 19% on the Hudson Bay coast (2002: 16.6 geese/km2; 2003: 13.3 geese/km2) and increased 14% along Ungava Bay (2002: 4.1 geese/km2; 2003: 4.7 geese/km2) compared to 2002.

The percentage of indicated pairs observed as singles was similar in the coastal zones (region 2) along Ungava Bay (57%) and Hudson Bay (55%) in 2003 (Figure 3). However, in 5 of 11 years (1994, 1996, 1997, 1998, and 2001), the percentage of indicated pairs observed as singles was lower on the Ungava Bay coast than along Hudson Bay (Figure 4). These measures may indicate lower average productivity along the Ungava Bay coast.

DISCUSSION

Number of Breeding Pairs

The estimated number of Canada goose pairs on the Ungava Peninsula in 2003 was essentially unchanged from 2002 (down about 5%). The lack of growth may be attributed to poor production in 2 of the last 3 years, combined with resumption of hunting seasons throughout the Atlantic Flyway. The percent of indicated pairs observed as singles (a better measure of the pairs actually nesting) in 2003 was above the average for the 11 years of this survey. This finding is consistent with the nest initiation dates and clutch sizes observed during nest searches of Hudson Bay and Ungava Bay study plots (R. Cotter, pers. comm.). Larger clutch sizes and higher rates of nesting should result in a fall flight larger than that of 2002.

Total Population

The total population estimate for 2003 decreased from 2002 (Figure 2), probably reflecting, in part, the poor recruitment that occurred in 2002. However, caution should be used when interpreting the

estimate of total population size. Total population estimates include breeding pairs, non-breeders (i.e., those not of breeding age), failed breeders, and molt migrants from other areas. Flocks of geese moving north (likely molt migrants) were very abundant along the Hudson Bay coast while we were conducting the survey this year. For example, between 0920-1030 hrs on June 17, we observed 22 flocks of 2-34 geese moving north past the hotel in Povungnituk. The 2003 survey was completed 6 days earlier than in 2002. Differences in survey timing may well account for some of the variability in the total population estimates. Abraham et al. (1999) recently examined molt migration in the breeding range of the Southern James Bay Population of Canada geese. They cautioned that the presence of molt migrants is likely to bias total population estimates upwards. Therefore, they concluded that estimates of nesting pairs may provide the most reliable information for monitoring trends in breeding ground populations.

Hudson Bay and Ungava Bay Coasts

The coastal habitat bordering Hudson Bay and Ungava Bay is well known for its high density of breeding Canada geese (Malecki and Trost 1990). However, the Hudson Bay coast supports a much larger breeding population than the Ungava Bay coast. The smaller breeding population along the Ungava Bay coast is a function of less land area (Ungava Bay: 9,700 km^2; Hudson Bay: 33,800 km^2) and until recently, a slightly lower density of breeding pairs in most years. The difference in density of breeding pairs has become much more obvious since 2001 (Figure 3). The Hudson Bay coast now supports about twice the density of breeding pairs. The percentage of indicated pairs observed as singles is often higher along Hudson Bay compared to Ungava Bay (in the other years, the percentage was similar between the 2 areas), indicating that average productivity may also be lower along the Ungava Bay coast (Figure 4) (see Humburg et al. 1998).

We recommend that monitoring of productivity and population size should consider the Hudson and

Ungava Bay coasts separately. Given the small breeding population associated with Ungava Bay relative to Hudson Bay, the potential for different productivity in some years, and the possibility of different migration (and therefore harvest) patterns, combining both areas may mask important changes, particularly along Ungava Bay. Furthermore, other factors, such as feeding or interference competition between molt migrants and breeding geese (Abraham et al. 1999), may be more important along one coast or the other. It may be necessary to adjust survey coverage to obtain estimates along each coast with an acceptable level of precision.

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Table 1. Dates of Canada goose pair surveys conducted in northern Quebec[1] in 1988 and 1993-2003.

Year	Survey Date	Peak Hatch Date - Hudson Bay[2]	Peak Hatch Date - Ungava Bay[2]
1988	23 May - 3 June		
1993	11-21 June		
1994	21 June - 1 July		
1995	18-24 June		
1996	17-25 June	7 July	2 July
1997	21-26 June	29 June	23 June
1998	20-27 June	20 June	22 June
1999	12-17 June	24 June	26 June
2000	14-27 June	30 June	30 June
2001	11-23 June	22 June	19 June
2002	16-27 June	10 July	3 July
2003	13-21 June		

[1] In 1988, 1993, and 1996, the boreal forest was surveyed prior to the Ungava Peninsula.
[2] Peak hatching dates on Ungava Peninsula from Hughes (2001) and J. Hughes (pers. comm.).

Table 2. Number of Canada goose breeding pairs estimated for the Ungava Peninsula (regions 1,2 and 3) of northern Quebec.

YEAR[a]	TOTAL AREA (km^2)	SURVEYED AREA (km^2)	n[b]	PAIR /km^2 (SE)	TOTAL PAIRS (SE)
1988	222700	575	16	0.53 (0.068)	118031 (15144)
1993	222700	838	35	0.41 (0.056)	91307 (12471)
1994	222700	1214	36	0.18 (0.020)	40086 (4454)
1995	222700	1211	36	0.13 (0.013)	29302 (2967)
1996	222700	1211	36	0.21 (0.023)	46058 (5052)
1997	222700	1239	36	0.28 (0.028)	63216 (6201)
1998	222700	1214	36	0.19 (0.023)	42166 (5009)
1999	222700	1208	35	0.35 (0.040)	77451 (8792)
2000	222700	1107	34	0.42 (0.044)	93230 (9850)
2001	222700	1029	31	0.66 (0.073)	146662 (16185)
2002	222700	1214	36	0.74 (0.068)	164840 (15169)
2003	222700	1208	36	0.71 (0.055)	156937 (12273)

[a]1988 (Malecki and Trost 1990).

[b] Number of transects.

Figure 1. Study area and location of transects for 2003 breeding pair survey in northern Quebec.

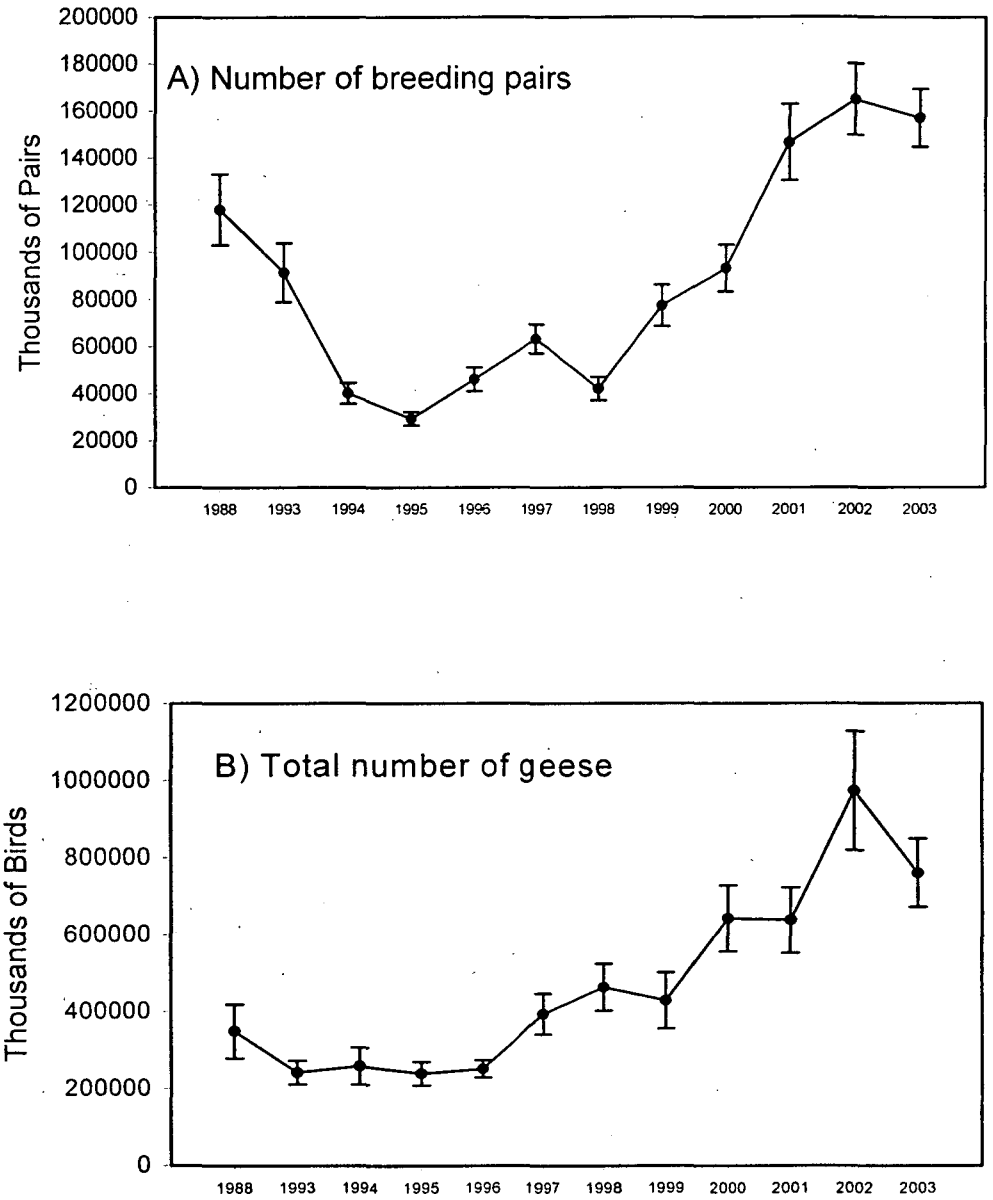

Figure 2. Estimated number (± 1 SE) of Canada goose breeding pairs (A) and total geese (B) on the Ungava Peninsula.

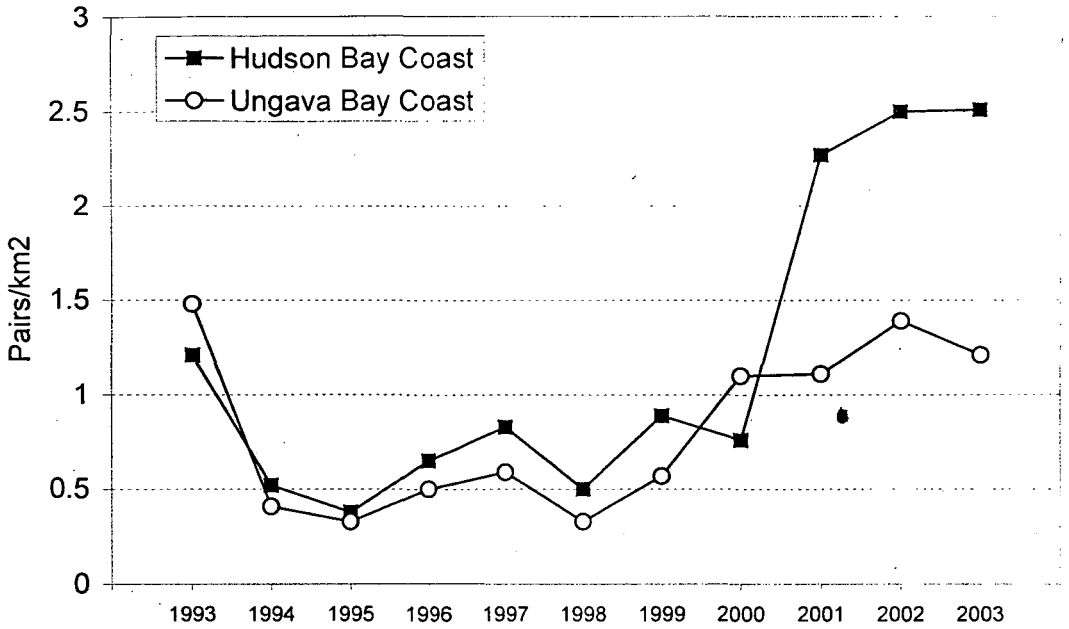

Figure 3. Average density of breeding Canada goose pairs for the coastal zones along Hudson Bay and Ungava Bay.

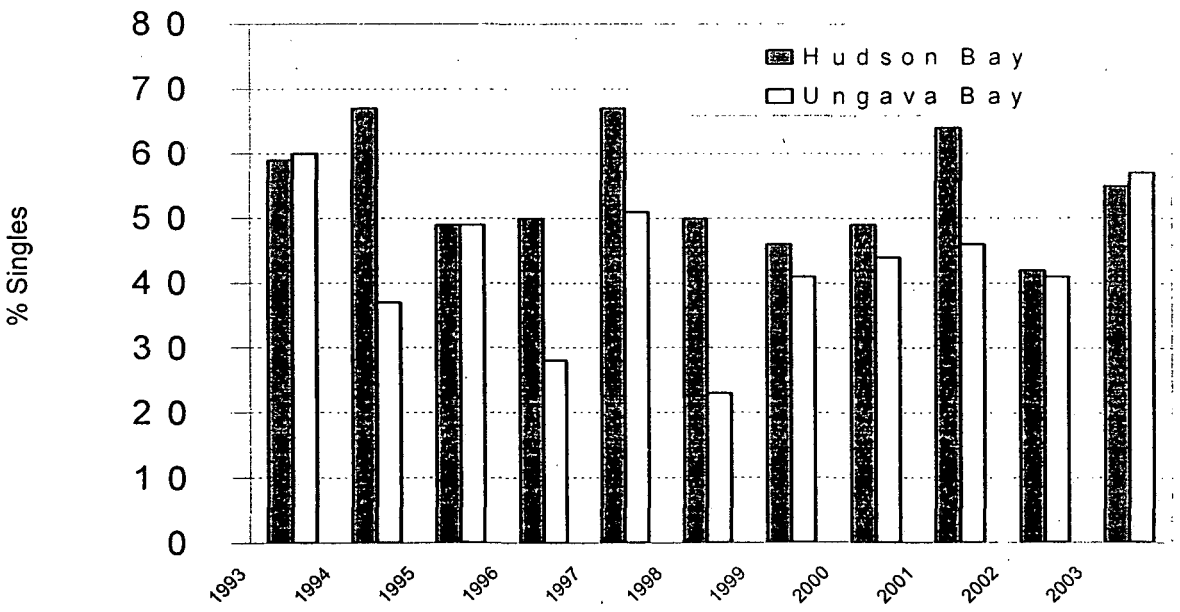

Figure 4. Percent of indicated Canada goose pairs (i.e., singles and pairs) that were observed as singles in the coastal zones along Ungava Bay and Hudson Bay.