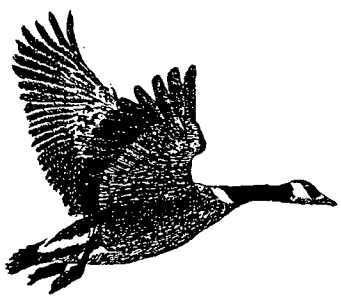
A BREEDING PAIR SURVEY OF CANADA GEESE IN NORTHERN QUEBEC - 2005



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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 2005 breeding grounds survey.

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STUDY AREA

The 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 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. 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 15-24. These dates are similar to surveys conducted during 1993-2004, but later than the 1988 survey (Table 1). Spring temperatures in 2005 were extremely mild and breeding areas were largely snow-free by early May. Although the arrival of geese on breeding areas occurred relatively late (A. Tulugak and P. May, pers. comm.), the excellent habitat conditions allowed birds to begin nesting almost immediately. Five days of bad weather at the end of the survey delayed completion of the last day of flying until June 24. On June 24 we observed a number of pairs with broods (n = 53) along the Hudson Bay coast. No broods were observed prior to June 24.

At the time of the survey, inland areas had only scattered snow patches and only medium –

large lakes remained ice covered. Lakes and ponds in the coastal region were ice-free with the exception of large lakes north of Kangirsuk on the Ungava Bay coast. Conditions appeared similar on the Hudson Bay and Ungava Bay coasts. Growth of tree leaves and grasses was advanced. Water levels were low throughout the survey area, reflecting the early snowmelt and lack of rain during May – mid June.

Breeding Pair and Total Population Estimates

The estimated number of breeding pairs on the Ungava Peninsula (regions 1,2, and 3) in 2005 (162,395 pairs) was similar to the 2004 estimate of 174,793 pairs (P = 0.529) (Table 2, Figure 2) . The number of indicated pairs increased by $\geq$ 25% on 7 transects, decreased by $\geq$ 25% on 9 transects, and remained about the same (< 25% change) on 14 transects in 2005 compared to 2004. The total population estimate ((indicated pairs x 2) + non-breeders) in 2005 (1,140,755 individuals, SE = 90,609) was similar to 2004 estimate of 1,014,616 individuals (SE = 85,584) (P = 0.312). (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 61% in 2005. This was the highest value observed in the 13 years of the survey (range = 34-61%, mean = 50%).

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, although density along Hudson Bay tended to be slightly higher (Figure 3). Beginning in 2001, the pair density along Hudson Bay has exceeded the density along Ungava Bay. In 2005, density along Hudson Bay (2.23 pairs/km2, SE = 0.327) was greater than along Ungava Bay (1.14 pairs/km2, SE = 0.215) ($P < 0.001$) (Figure 3). In 2005, the estimated density of breeding pairs decreased 19% along the Hudson Bay coast and increased 1% on the Ungava Bay coast compared to 2004 (Figure 3). The estimated density of total geese in 2005 increased 22% on the Hudson Bay coast (2005: 18.6 geese/km2; 2004: 16.2 geese/km2) and decreased 9% along Ungava Bay (2005: 4.0 geese/km2; 2004: 4.3 geese/km2) compared to 2004. The percentage of indicated pairs observed as singles was high in the coastal zones along Ungava Bay (59%) and Hudson Bay (64%) in 2005 (Figure 4). The percentage of indicated pairs observed as singles on the Hudson Bay coast would have been higher had we completed the transects before nests hatched.

DISCUSSION

Number of Breeding Pairs

The estimated number of Canada goose pairs on the Ungava Peninsula in 2005 decreased about 7% from 2004. The lack of growth in the breeding population may be a function of the very poor production year in 2002 and the 3 years it takes for young to enter the breeding population. The percent of indicated pairs observed as singles (a better measure of the pairs actually nesting) was the highest recorded in the 13 years this survey has been conducted. This finding is consistent with the early nest initiation dates and large clutch sizes observed during nest searches of Hudson Bay and Ungava Bay

study plots (R. Cotter, pers. comm.).

Total Population

The total population estimate for 2005 was about 12% higher than in 2004 (Figure 2). 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) are often observed along the Hudson Bay coast, especially when winds are from the south. For example, between 0920-1030 hrs on June 17 in 2003 we observed 22 flocks of 2-34 geese moving north past the hotel in Povungnituk. We observed numerous flocks in 2005. Differences in survey timing and the abundance of molt migrants can clearly introduce substantial variability in the total population estimates.

Abraham et al. (1999) 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 partly 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 more than twice the density of breeding pairs than the along Ungava Bay. This could be related to a number of factors including differential survival or productivity. However, the 6 consecutive years of lower productivity along Ungava Bay (as indexed by the % of breeding pairs observed as singles) between 1996-2001 may explain some of the change (Figure 4).

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Table 1. Dates of Canada goose pair surveys conducted in northern Quebec[1] in 1988 and 1993-2005.

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	30 June	30 June
2004	19-26 June	July 5	July 5
2005	15-24 June	June 27-30	

[1] In 1988, 1993, and 1996, the boreal forest was surveyed prior to the Ungava Peninsula.
[2] Peak hatching dates on Ungava Peninsula from R. Cotter (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)
2004	222700	1181	35	0.79 (0.068)	174793 (15049)
2005	222700	1214	36	0.73 (0.057)	162395 (12622)

[a]1988 (Malecki and Trost 1990).
[b] Number of transects.

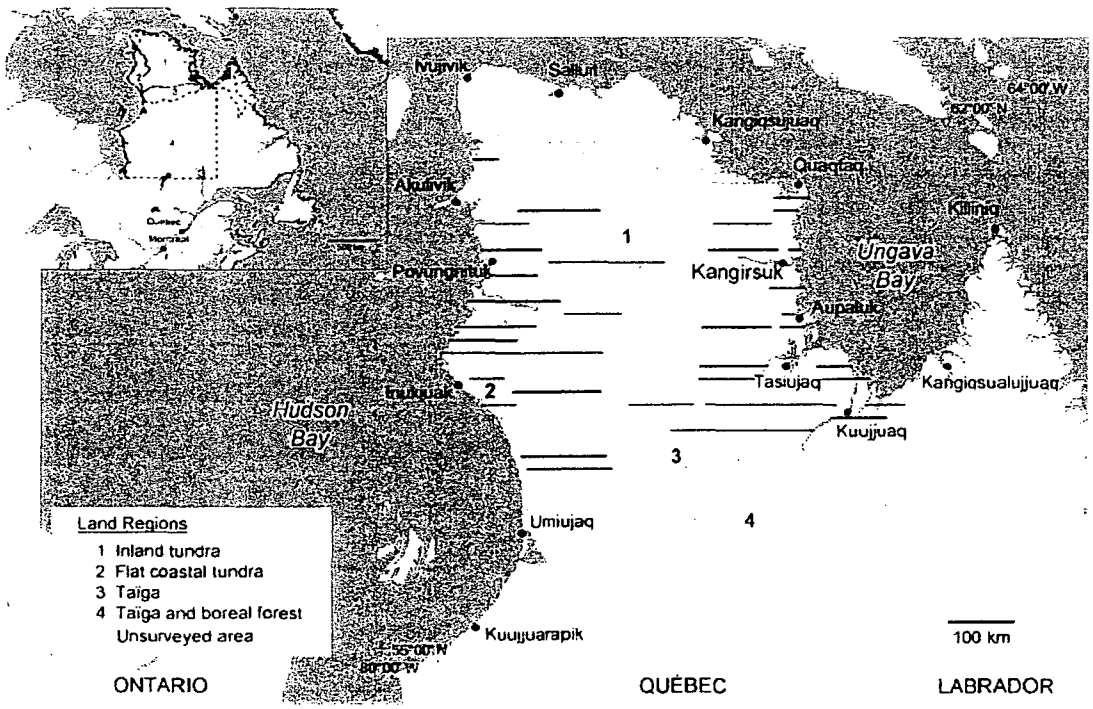

Figure 1. Study area and location of transects for the breeding pair survey in northern Quebec.

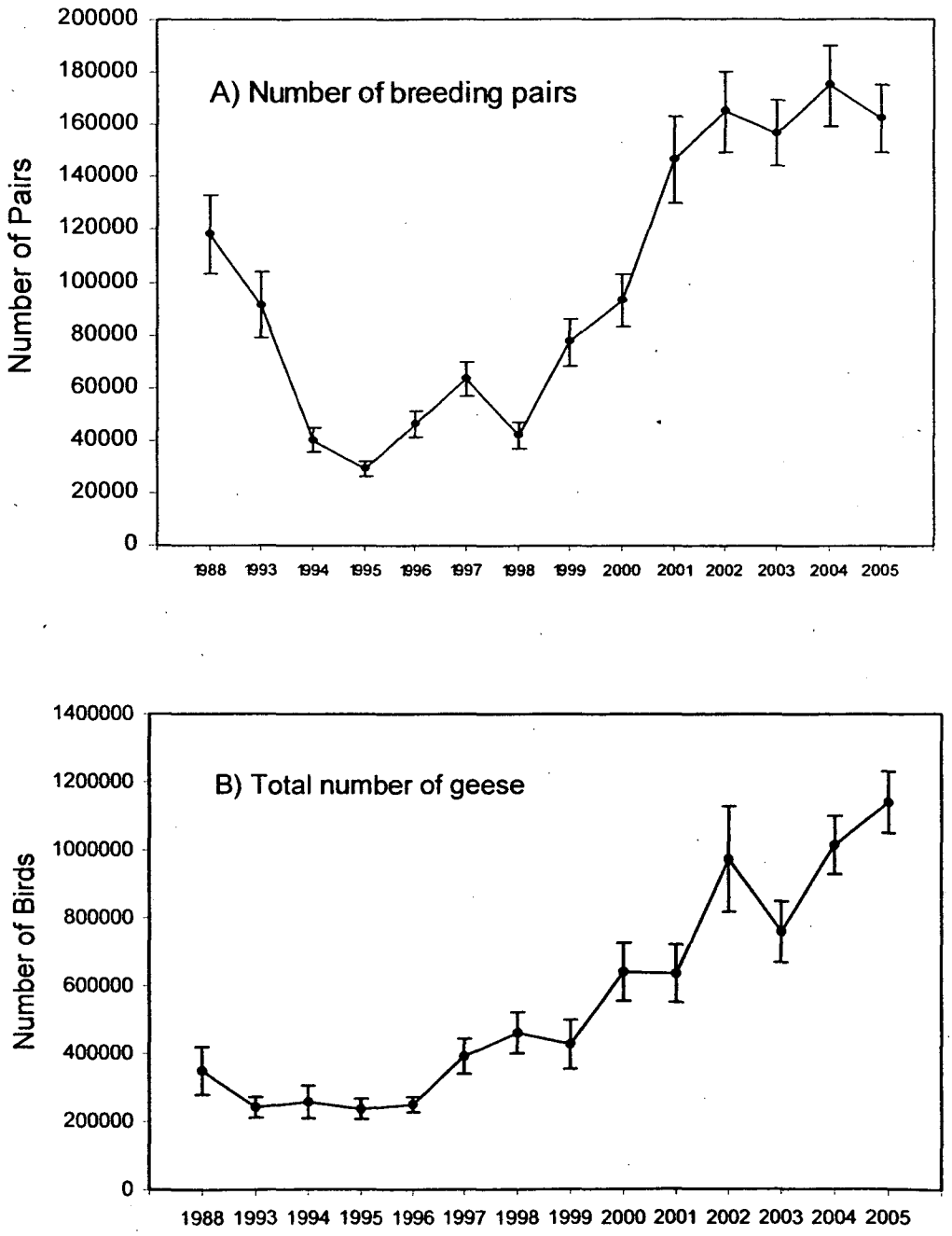

Figure 2. Estimated number (± 1 SE) of Canada goose breeding pairs (A) and total geese (B) on the Ungava Peninsula.

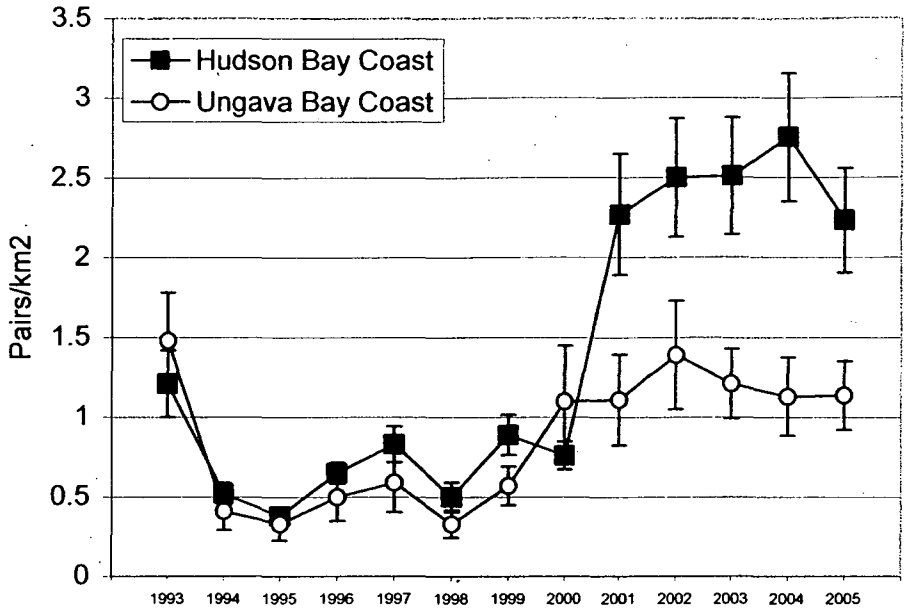

Figure 3. Average density (± 1 SE) of breeding Canada goose pairs for the coastal zones along Hudson Bay and Ungava Bay.

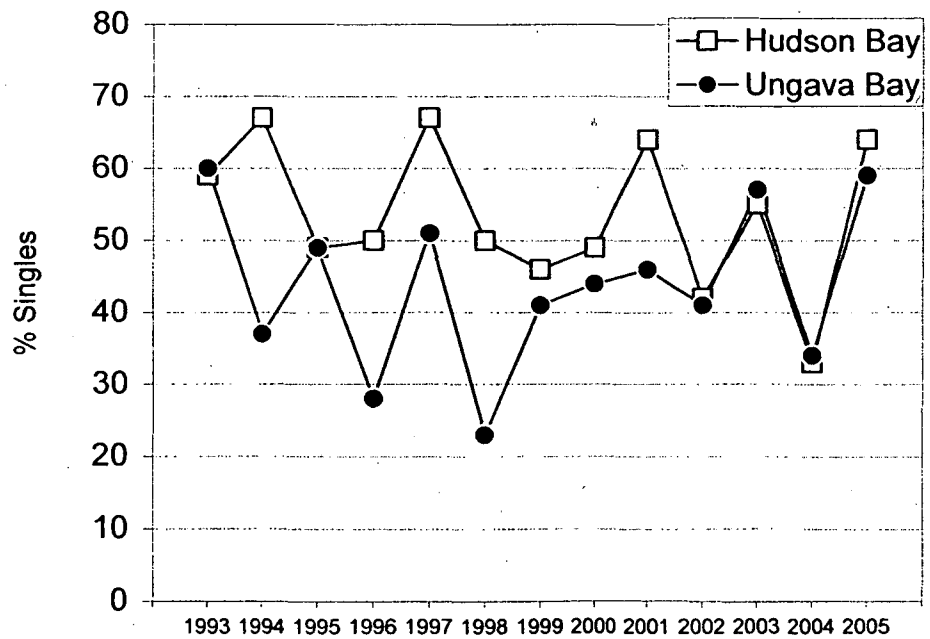

Figure 4. Percent of indicated Canada goose pairs (i.e., singles and pairs) that were observed as singles in the coastal zones along Ungava Bay and Hudson Bay.