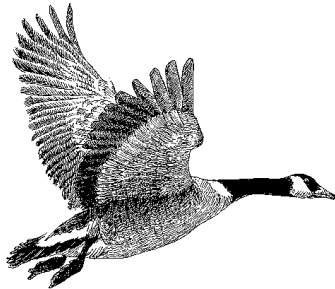


A BREEDING PAIR SURVEY OF CANADA GEESE IN NORTHERN QUÉBEC - 2008



Prepared by:

William F. Harvey

Maryland Department of Natural Resources

and

Jean Rodrigue

Canadian Wildlife Service

Québec Region

Status of Canada geese (*Branta canadensis*) in the Atlantic flyway was traditionally monitored by mid-winter surveys. However, mixing of resident and migrant geese on wintering areas has seriously reduced the value of mid-winter surveys for monitoring 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 Québec 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 Québec 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 initiated in northern Québec 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 2008 breeding grounds survey.

Acknowledgments: This survey was cooperatively funded by the Canadian Wildlife Service (CWS), the U. S. Fish and Wildlife Service (USFWS), and the Atlantic Flyway Council. Jean Rodrigue (CWS) and Bill Harvey (MD DNR) served as observers. John Bidwell (USFWS) served as pilot. Peter May and Alix Gordon (Kuujuuaq, Makivik Corporation) and Aliva Tulugak (Povungnituk) provided logistical support. Others assisting in various phases of the survey included: M. Dionne (CWS), Richard Cotter (CWS), and Larry Hindman (MD DNR).

STUDY AREA

The survey was conducted in northern Québec, 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 Québec'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.

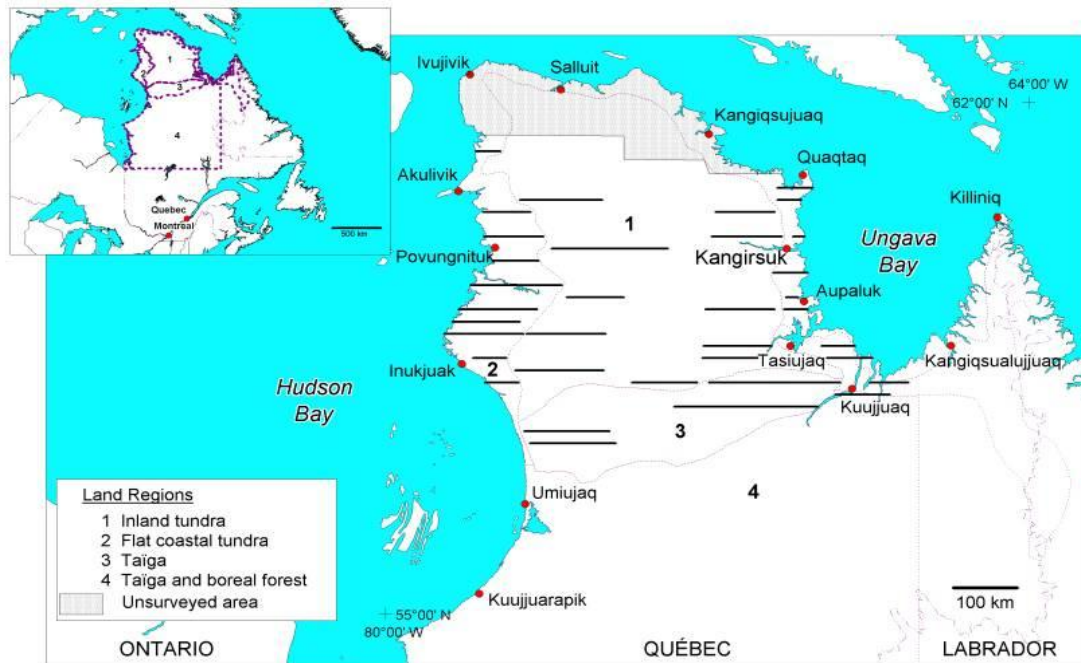


Figure 1. Study area and location of transects for the breeding pair survey in northern Québec.

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. The survey is timed to cover the mid to late incubation period.

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).

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. Parts of two transects (total of 26.0 km²) were not flown in 2008 because of fog.

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. We considered differences to be significant at the 0.10 level. The estimates presented in this report are not adjusted for visibility bias and thus represent an index to the population.

RESULTS AND DISCUSSION

Habitat Conditions and Spring Phenology

Transects were surveyed June 13-18. These dates are similar to surveys conducted during 1993-2007, but later than the 1988 survey (Table 1). Spring temperatures in 2008 were above normal, particularly along Ungava Bay near Kuujjuuaq. Snow melt occurred later along Hudson Bay, but snow was largely gone by May 25 (Aliva Tulugak, pers. commun.). At the time of the survey, ice cover remained only on the largest lakes along Ungava Bay. The area north of Kangirsuk (Figure 1), was more frozen than southern areas, but less so than

average. Large lakes and ponds along the Hudson Bay coast remained ice-covered. Growth of vegetation along the Ungava coast was advanced, particularly near Kuujuaq; tree leaves were fully emerged and grasses were green. The emergence of tree leaves and grasses was less evident on the Hudson Bay coast.

Table 1. Dates of Canada goose pair surveys conducted in northern Québec in 1988 and 1993-2008.

Year	Survey Date	Peak Hatch Date - Hudson Bay	Peak Hatch Date - Ungava Bay
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	5 July	5 July
2005	15-24 June	26 June	24 June
2006	13-18 June		20 June
2007	21-27 June		10 July
2008	13-18 June		22 June

Breeding Pair and Total Population Estimates

The estimated number of breeding pairs on the Ungava Peninsula (regions 1,2, and 3) in 2008 (169,699 pairs, SE = 14,331) was similar to the 2007 estimate of 195,709 pairs (SE = 16,621) ($P = 0.234$) (Table 2, Figure 2). The total population estimate ((indicated pairs x 2) + non-breeders) in 2008 (988,977 individuals; SE = 81,129)

was less than the 2007 estimate of 1,221,779 individuals (SE = 104,191) (P = 0.078). The total population estimate includes breeding pairs, non-breeders (i.e., those not of breeding age), failed breeders, and molt migrants from other areas and should therefore be interpreted cautiously.

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

Year	Total Area (km ²)	Surveyed Area (km ²)	N Transects	Pairs /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)
2006	222700	838	28	0.72 (0.074)	160020 (16419)
2007	222700	1162	34	0.89 (0.075)	195709 (16621)
2008	222700	1188	36	0.76 (0.064)	169699 (14331)

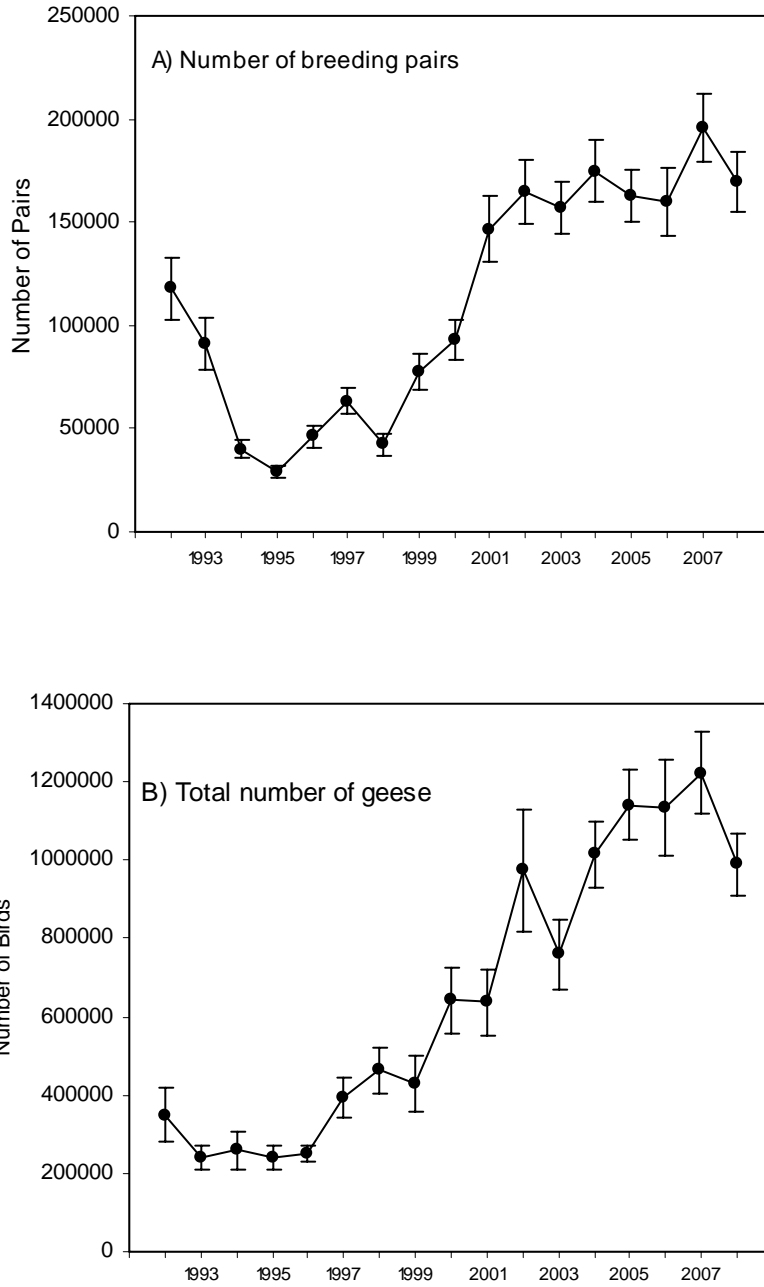


Figure 2. Estimated number (± 1 SE) of Canada goose breeding pairs (A) and total geese (B) on the Ungava Peninsula.

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 2008. This was above average for the 16 years of the survey (range = 34-62%, mean = 51%), consistent with other years of good reproduction (e.g., 2005, 2006), and supports the findings from the nest searches of Ungava Bay study plots in 2008 (i.e., early initiation date and above-average clutch size) (M. Dionne, pers. comm.).

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). Since 2001, the pair density along Hudson Bay has exceeded the density along Ungava Bay (Figure 3). The estimated density of breeding pairs decreased 13% along the Hudson Bay coast and decreased 7% on the Ungava Bay coast in 2008 compared to 2007 (Figure 3). The estimated density of total geese decreased 18% on the Hudson Bay coast (2008: 16.3 geese/km²; 2007: 19.8 geese/km²) and decreased 54% along Ungava Bay (2008: 2.1 geese/km²; 2007: 4.6 geese/km²) compared to 2007. The number of nonbreeding geese observed on the Ungava Bay coastal transects (96 geese) was the lowest observed in any year of the survey (mean = 299 geese; range = 96-704 geese). The percentage of indicated pairs observed as singles was high and similar in the coastal zones along Hudson Bay (62%) and Ungava Bay (64%) in 2008 (Figure 4).

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 km²; Hudson Bay: 33,800 km²) 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 four times the density of breeding pairs than are found on the Ungava Bay coast. This could be related to a number of factors including differential survival or productivity. Productivity surveys have measured lower nest success for geese along the Ungava coast (1996-2005 mean = 52%) than along Hudson Bay (1996-2005 mean = 76%) (Cotter 2006). Similarly, we often observe a lower percentage of single geese along Ungava Bay than Hudson Bay (Figure 4), perhaps indicative of the loss of nests. Whatever the cause, it is increasingly clear that in recent years the potential for growth is more limited for geese nesting along the Ungava Bay coast. Modeling may be useful to examine whether differences in nest success could explain the different population trajectories.

Finally, prior to 2003, the density of breeding pairs was similar on northern and southern transects along the Ungava Bay coast (Figure 5). Since 2003, we have observed a shift in distribution. Northern transects now support higher densities of breeding pairs than southern transects along Ungava Bay (Figure 5). We have not observed a similar shift in distribution on the Hudson Bay coast.

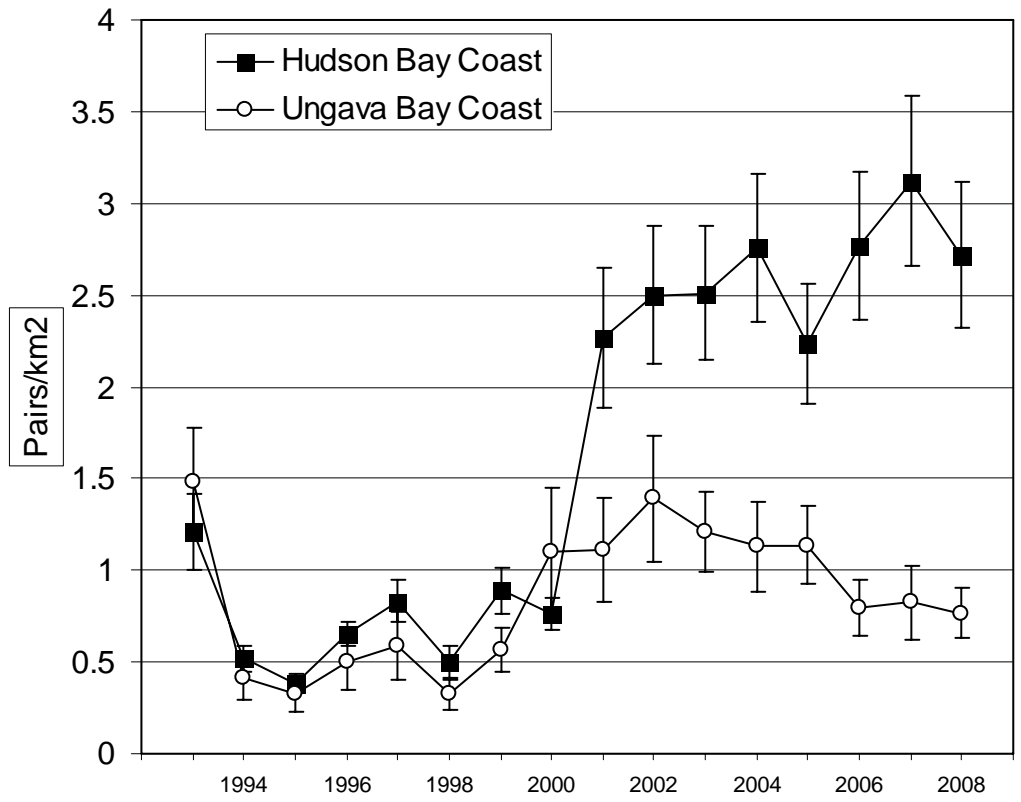


Figure 3. Average density (± 1 SE) of breeding Canada goose pairs for the coastal zones along Hudson Bay and Ungava Bay.

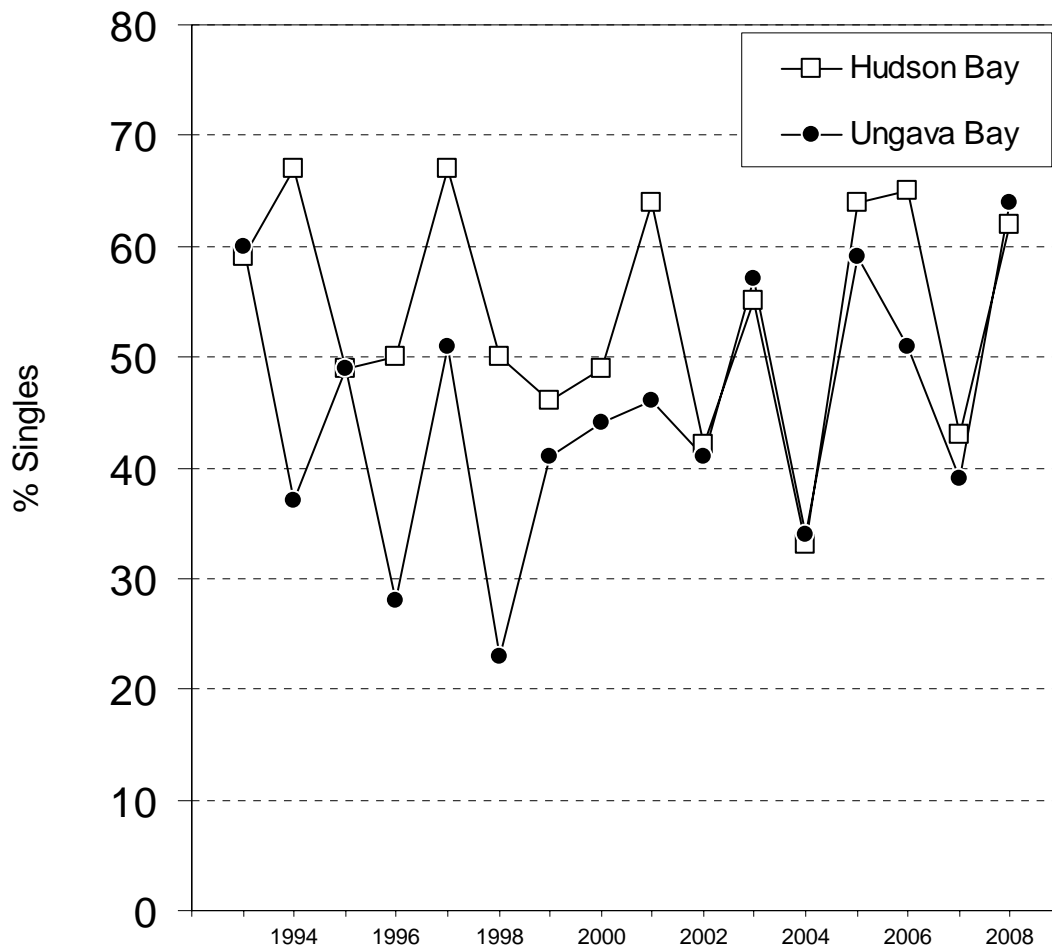


Figure 4. Percent of indicated Canada goose pairs (i.e., singles and pairs) that were observed as singles in the coastal zones along Ungava Bay and Hudson Bay.

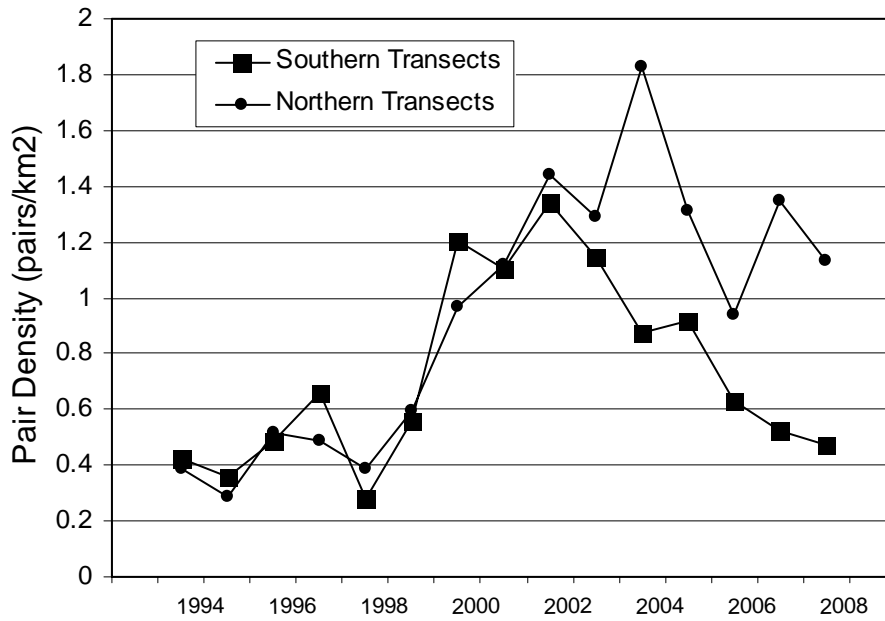


Figure 5. Density of breeding pairs on northern (north of Leaf River; >59° latitude) and southern (south of Leaf River; <59° latitude) transects along the Ungava Bay coast, 1994-2008.

LITERATURE CITED

- Bordage, D., and N. Plante. 1993. A breeding ground survey of Canada geese in northern Québec-1993. Can. Wildl. Serv., Québec Region. 17pp.
- Bordage, D., and N. Plante. 1994. A breeding ground survey of Atlantic flyway Canada geese in northern Québec-cost estimates. Can. Wildl. Serv., Québec Region. 9pp.
- Cochran, W. G. 1977. Sampling techniques, 3rd ed. John Wiley and Sons, Inc. New York. 428pp.
- Cotter, R. 2006. Reproductive success and breeding ground banding of Atlantic Population Canada Geese in northern Québec – 2005. Can. Wildl. Serv., Québec Region. 16pp.
- Gilbert, G., R. G. Helie, and J. M. Mondoux. 1985. Ecosystem sensitivity to acid precipitation for Québec. part a. ecoregions and ecodistricts of Québec. Environment Canada. Ecological Land Classification Series No. 20. 87pp.
- Humburg, D. D., F. D. Caswell, D. H. Rusch, and M. M. Gillespie. 1998. Breeding ground surveys for the Eastern Prairie Population of Canada geese. Pages 9-20 in D. H. Rusch, M. D. Samuel, D. D. Humburg, and B. D. Sullivan, eds. Biology and management of Canada geese. Proceedings of the international Canada goose symposium, Milwaukee, Wisconsin.
- Kaczynski, C. F., and E. B. Chamberlain. 1968. Aerial surveys of Canada geese and black ducks in eastern Canada. U. S. Fish and Wildl. Serv. Spec. Sci. Rep., Wildl. 118. 29pp.
- Malecki, R. E., and R. A. Trost. 1990. A breeding ground survey of Atlantic flyway Canada geese in northern Québec. Can. Field Nat. 104:575-578