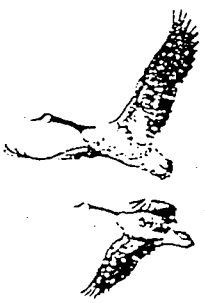
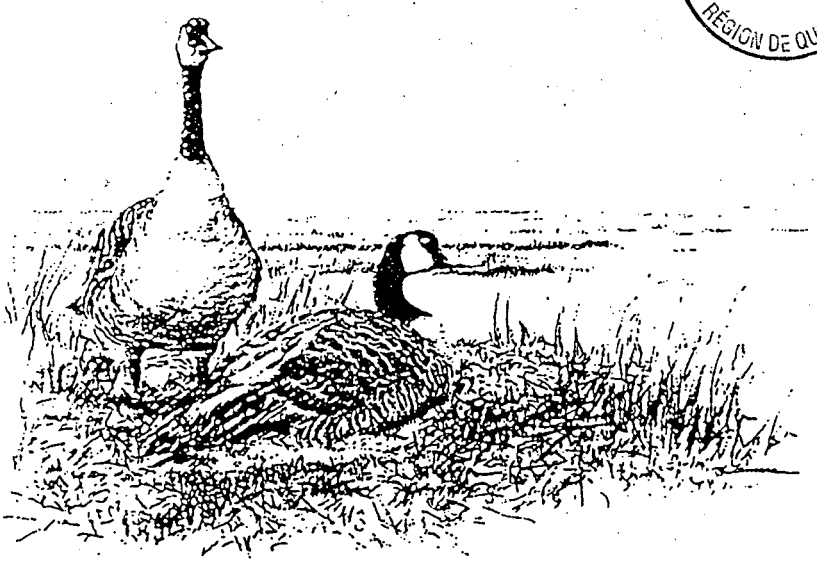
A BREEDING PAIR SURVEY OF CANADA GEESE IN NORTHERN QUEBEC - 1994





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INTRODUCTION

The population status of Canada geese (Branta canadensis) in the Atlantic flyway is monitored mainly by trends in mid-winter surveys (Hindman and Ferrigno 1990). These surveys include both resident and migratory Canada geese since they are not possible to differentiate at this time of year. Mid-winter estimates of Canada geese in the Atlantic flyway peaked during the early 1980's and have since declined to about 60% of their former levels. Resident (i.e., non-migratory) Canada geese are believed to have increased dramatically during this period, particularly in the northeast and mid-Atlantic states (Hindman and Ferrigno 1990). Therefore, increasing resident goose numbers may be masking a more serious decline in the migrant population than indicated by mid-winter surveys. Concern for the migrant population has increased the need for breeding grounds surveys where estimates are not confounded by the presence of resident geese.

The breeding grounds of migratory Canada geese affiliated with the Atlantic flyway were delineated during the 1960's (Kaczynski and Chamberlain 1968). These surveys identified the Ungava peninsula as the primary nesting area for Atlantic flyway Canada geese. Malecki and Trost (1990) used a more quantitative approach to estimate the number of breeding pairs throughout the boreal forest region 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 similar to Malecki and Trost (1990) (Bordage and Plante

1993). The objective of this survey was to monitor the status of the migrant flock by estimating the size of the breeding population. This report presents the results of the 1994 breeding grounds survey.

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STUDY AREA

The 1994 survey was conducted in northern Quebec, approximately north of 57° latitude (Figure 1). The survey sampled 3 regions based on Malecki and Trost's (1990) modification of northern Quebec's ecoregions (Gilbert et al. 1985). A fourth region, approximately bounded by 51° and 57° latitude, was included in the 2 previous surveys but

was excluded in 1994. This boreal forest region has relatively low densities of nesting geese (Malecki and Trost 1990, Bordage and Plante 1993) and little annual variation in goose density (Reed 1994). A 26,800 km^2 area in region 3 (Figure 1) was excluded from the 1993 survey after transects in this area were dropped because of financial limitations. A comparison of 1994 data indicated no gross differences in goose densities between the excluded area ($\bar{x}$ = 0.089 pairs/km^2) and the remainder of region 3 ($\bar{x}$ = 0.123 pairs/km^2). Therefore, the entire area of region 3 was included and densities were recalculated for the 1988 and 1993 data.

The regions sampled in 1994 have been described by both Malecki and Trost (1990) and Bordage and Plante (1993). Briefly, region 1 included the inland tundra, region 2 consisted mainly of flat coastal tundra, and region 3 is a transition zone between boreal forest and tundra (Figure 1). The portion of the coastal zone located from Ivujivik, southeast to about 150 km north of Kangirsuk was excluded. Exploratory transects flown in 1993 indicated that this high elevation, mountainous area had few geese.

METHODS

The 1994 survey followed the methodology of Malecki and Trost (1990). Aerial transects were flown in a Cessna 185 Amphibian at an altitude of 30 m and a ground speed of approximately 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. In addition to geese, observers also recorded similar information for other waterfowl species. Transect

width was calibrated before the survey began. Transects were flown using a global positioning system (GPS) to assist with navigation.

The total length of transects to be 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 total length desired was reached. All transects were orientated along east-west lines.

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).

RESULTS

Habitat Conditions

Transects were sampled from June 21-July 1, about 1 week later than in 1993. The later sampling dates made assessment of habitat conditions difficult. In general, however, discussions with local residents indicated that the spring thaw was delayed relative to 1993, particularly along the Ungava Bay coast. Habitat conditions observed during the survey supported this assessment. Plant growth along the Ungava Bay coast was obviously delayed relative to the Hudson Bay coast. Along Ungava Bay, snow coverage averaged about 5-15% and ice covered most large and medium ponds and some small ponds were partly covered.

In contrast, the Hudson Bay coast was generally free of snow except for drift areas and ice existed on only the larger lakes and ponds.

Density of Breeding Pairs

The overall density of breeding pairs was lower in 1994 (40,086 pairs) than in 1988 (118,031 pairs) ($P < 0.001$) or in 1993 (91,307 pairs) ($P < 0.001$) (Table 1). In region 1, the density of breeding pairs in 1994 was lower than in 1988 ($P = 0.016$) but similar to 1993 ($P = 0.327$) (Table 1). Region 2 densities were lower in 1994 than in either 1988 ($P < 0.001$) or 1993 ($P < 0.001$) (Table 1). No differences in average density were detected in region 3 between 1994 and 1988 ($P = 0.490$) or 1993 ($P = 0.259$) (Table 1).

Total Population Estimate

The total population estimate (breeding pairs + non-breeders) was similar between 1994 (258,332 individuals; SE = 48,504) and 1993 (241,407 individuals; SE = 30,599) ($P = 0.768$).

DISCUSSION

The density of breeding pairs was markedly lower in 1994 than in either 1988 or 1993. The reduced number of breeding pairs is consistent with a late spring in 1994 compared to 1988 or 1993. Breeding pairs, particularly those in marginal body condition, may lay fewer eggs or forego nesting if the availability of nesting habitat (i.e., snow-free nest sites) is delayed (Raveling and Lumsden 1977) . The reduction in breeding pairs in 1994 was widespread and consistent over the study area. For example, in the high density

coastal area (region 2), no individual transect surveyed in 1994 achieved a pair density that equalled the average of all transects in region 2 in 1993.

Despite the reduced breeding population, the total population estimate indicated no change between 1993 and 1994. This estimate includes breeding pairs, non-breeders (i.e., those not of breeding age), failed breeders, and molt migrants from other areas. Flightless geese banded on the Ungava peninsula are frequently recovered in the Mississippi flyway (Malecki and Trost 1990). Interpreting the results of the total population estimate is difficult without knowing the number, timing, and annual variation of molt migrants from other populations entering the surveyed area . For example, slight differences in survey timing may result in large variation in the number of molt migrants counted. In both 1993 and 1994, flocks of nonbreeding geese were observed flying north along the Hudson Bay coast and then following rivers inland, presumably to molting areas.

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Table 1. Average densities of Canada goose breeding pairs estimated for the Ungava Peninsula of northern Quebec.

REGION[a]	YEAR[b]	TOTAL AREA (km^2)	AREA SURVEYED (km^2)	n[c]	PAIRS /KM^2 (SE)	TOTAL PAIRS (SE)
1	1988	116,000	285	6	0.30 (0.084)	35,016 (9,744)
	1993	116,000	242	4	0.16 (0.063)	18,185 (7,308)
	1994	116,000	458	11	0.09 (0.022)	10,633 (2,542)
2	1988	43,500	119	7	1.63 (0.245)	70,833 (10,658)
	1993	43,500	420	25	1.31 (0.166)	57,122 (7,221)
	1994	43,500	491	21	0.48 (0.062)	20,917 (2,692)
3	1988	63,200	171	3	0.18 (0.067)	11,491 (4,253)
	1993	63,200	176	6	0.26 (0.110)	16,432 (6,952)
	1994	63,200	265	4	0.13 (0.038)	8,124 (2,421)
1,2,3	1988	222,700	575	16	0.53 (0.068)	118,031 (15,144)
	1993	222,700	838	35	0.41 (0.056)	91,307 (12,471)
	1994	222,700	1,214	36	0.18 (0.020)	40,086 (4,454)

[a] Region 1 - inland tundra; Region 2 - coastal tundra; Region 3 - transition zone between boreal forest and tundra.

[b] 1988 (Malecki and Trost 1990); 1993 (Bordage and Plante 1993); 1994 (this report).

[c] Number of transects.

Figure 1. Study area for 1994 breeding pair survey in northern Quebec.