

# Previously Unrecorded Colonies of Ross' and Lesser Snow Geese in the Queen Maud Gulf Bird Sanctuary

RAY T. ALISAUSKAS<sup>1</sup> and HUGH BOYD<sup>2</sup>

(Received 11 February 1993; accepted in revised form 24 June 1993)

**ABSTRACT.** In late June 1990 and 1991, during helicopter surveys of geese on the lowlands south of Queen Maud Gulf in the central Canadian Arctic, we found 26 colonies of nesting Ross' (*Chen rossii*) and Lesser Snow Geese (*Chen c. caerulescens*). In the 1960s, colonies were found exclusively on islands in shallow lakes; in 1990-91, only 39% of previously unreported colonies were on such lakes. We suggest that, due to massive growth in local populations of both species, lack of unoccupied nesting sites on islands in small lakes has obliged Ross' and Lesser Snow Geese to select other nesting habitats. Snow and Ross' Geese appear to be expanding toward the coast and westward within the Queen Maud Gulf Bird Sanctuary into areas currently favoured by White-fronted and Canada Geese.

**Key words:** Snow Geese, Ross' Geese, goose colonies, Central Arctic, Queen Maud Gulf

**RÉSUMÉ.** Lors de relevés effectués en hélicoptère à la fin juin 1990 et 1991, afin d'évaluer la population d'oies sur les terres basses du sud du golfe Reine-Maud situé au centre de l'Arctique canadien, on a dénombré 26 colonies d'oies de Ross (*Chen rossii*) et de petites oies blanches (*Chen c. caerulescens*). Dans les années 1960, on ne trouvait des colonies que sur des îles de lacs peu profonds; en 1990-91, seulement 39 p. cent des colonies qui n'avaient pas été reportées précédemment se trouvaient sur ces lacs. On suggère qu'en raison de la très forte croissance de la population locale des deux espèces, la pénurie d'aires de nidification libres sur les îles des petits lacs a forcé l'oie de Ross et la petite oie blanche à choisir d'autres habitats de nidification. L'oie de Ross et la petite oie blanche semblent étendre leur territoire en direction de la côte et vers l'ouest à l'intérieur du refuge d'oiseaux du golfe Reine-Maud vers des régions qui représentent actuellement un habitat de prédilection pour l'oie à front blanc et la bernache du Canada.

**Mots clés:** petite oie blanche, oie de Ross, colonies d'oies, Arctique central, golfe Reine-Maud

Traduit pour le *Journal* par Nésida Loyer.

## INTRODUCTION

Since the 1960s, nesting Ross' and Lesser Snow Geese have been steadily increasing and spreading in the lowlands south of Queen Maud Gulf (Kerbes *et al.*, 1983; Kerbes, 1993). Most of this area is included in the Queen Maud Gulf Bird Sanctuary (hereafter referred to as the Sanctuary; Fig. 1). Gavin (1947) first reported nesting by Ross' Geese there in 1940. Aerial reconnaissances in this area increased the number of known nesting colonies from 3 in 1949 (Hanson *et al.*, 1956) to 37 by 1967 (Ryder, 1969). Photographic inventories in 1976 revealed that total numbers of Ross' and Snow Geese nesting at colonies described by Ryder (1969) had increased two-fold and five-fold respectively, with 5 new colonies discovered in 1976 (Kerbes *et al.*, 1983). Later photographic inventories increased the number of known colonies of white geese (Ross' and/or white and blue phase Lesser Snow Geese) in the Sanctuary and adjacent areas to the southeast to 44 in 1982 and 66 in 1988 (Kerbes, 1993) (Fig. 2). South of this area, along the Back River system, McCormick (1989) documented 14 colonies of Lesser Snow Geese from aerial surveys in 1984, 1986 and 1987.

Here we provide further evidence of continued spatial expansion of populations and numerical growth of colonies of these two species in the central Canadian Arctic and give locations of additional "white goose" colonies in the Sanctuary. These were found incidentally during systematic helicopter surveys for White-fronted (*Anser albifrons*) and Canada (*Branta canadensis*) Geese in 1990-91. Some of these colonies contained thousands of geese and should be included in future censuses of Ross'/Snow Geese nesting in this area.

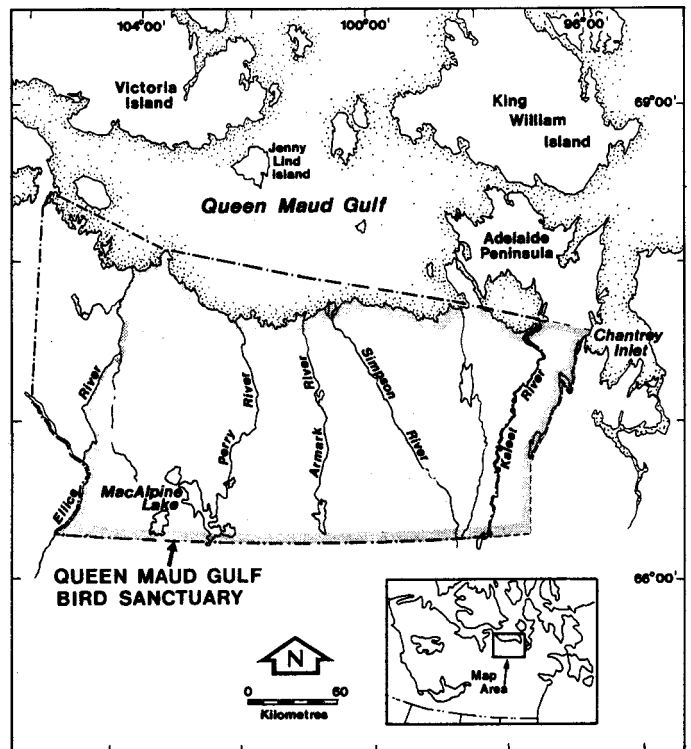


FIG. 1. Queen Maud Gulf Bird Sanctuary, in the central Canadian Arctic.

## METHODS

During 21-26 June 1990 and 21-29 June 1991, we conducted systematic aerial surveys in the Sanctuary. Surveys

<sup>1</sup>Prairie and Northern Wildlife Research Centre, Canadian Wildlife Service, 115 Perimeter Road, Saskatoon, Saskatchewan, Canada S7N 0X4, and Department of Biology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 0W0

<sup>2</sup>National Wildlife Research Centre, Canadian Wildlife Service, Ottawa, Ontario, Canada K1A 0H3

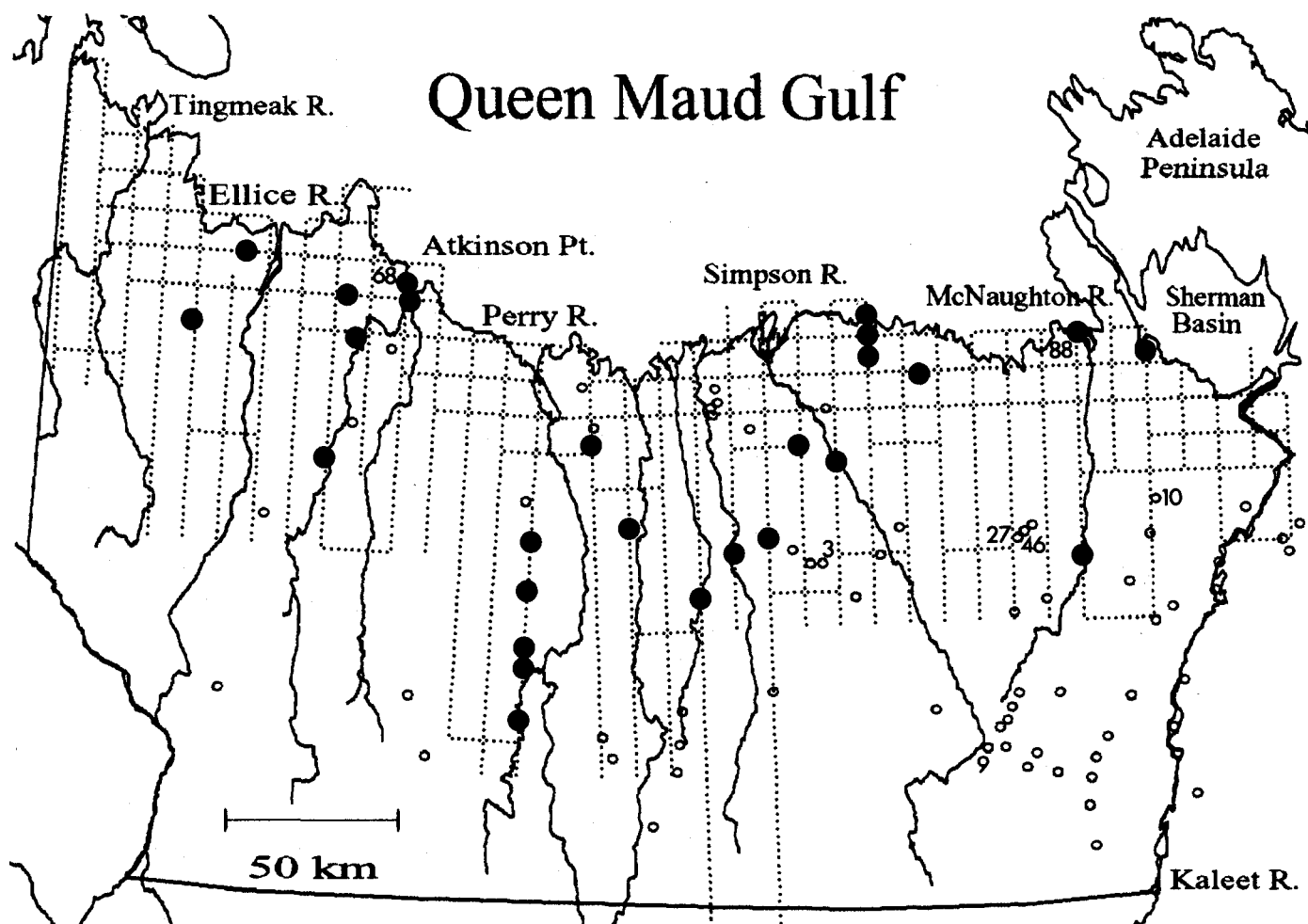


FIG. 2. Locations of new Ross' and Snow Goose colonies discovered in 1990-91 (solid circles) and of previously known colonies (small open circles). Shown also are flight lines of surveys done in 1990-91 combined. Numbers correspond to colonies mentioned in the text.

were timed to coincide with the first half of incubation by geese. Our observations were made from a Bell 206B helicopter flying at 100-140 km/h at about 50 m above ground level. Navigation was done by the pilot using flight lines (Fig. 2) corresponding to Universal Transverse Mercator (zone 13 west of 102°W, and zone 14 east of that longitude) grid lines, spaced 10 km apart, on 1:250 000 National Topographic Series map sheets. An observer in the left front passenger seat recorded sightings on the left and directly ahead. A second observer in the right rear seat recorded sightings on the right side of the flight line. The pilot was sometimes asked to add or verify sightings. Frequent verification of sightings between observers prevented duplication when recording directly on data sheets.

In 1990, we surveyed east-west transects in the northern part of the Sanctuary in addition to north-south transects, because we were interested in delineating the spatial distribution of White-fronted and Canada Geese in areas where their densities were noticeably greatest. In 1991, we restricted surveys to north-south transects only. Spatial coverage of the northern portion of the Sanctuary was not identical in both years: the study area sampled was 27 405 km<sup>2</sup> in 1990 and 30 738 km<sup>2</sup> in 1991; the area sampled in both 1990 and 1991 was 34 437 km<sup>2</sup>.

The primary objective was to count "dark geese" (White-fronted and Canada Geese) that fell within 200 m of the flight line. Within these strip transects, data were recorded by segments measuring 2 × 0.4 km. When "white goose" colonies were visible, we noted their general direction and distance from the aircraft and attempted to estimate the total number of nesting pairs present. Subsequently, the number of nesting pairs in each colony was estimated using size classes that spanned one order of magnitude, i.e., on a logarithmic scale (Table 1). Because Snow and Ross' geese often cannot be distinguished reliably from the air, we estimated their combined abundance at each colony. We could not spend much time attempting to estimate precisely the number of white geese seen, as this conflicted with the primary objective of enumerating widely dispersed Canada and White-fronted Geese. We also noted principal physiographic features of colonies. Our ability to detect colonies probably varied with their size and certainly with their distance from the flight line. The exact nature of this bias is unknown. From our observations while passing over previously recorded colonies (their locations were marked on 1:250 000 NTS maps), we judged that nearly all colonies with < 100 nesting pairs were visible to us within 1 km of the flight line and that those with > 100 pairs were visible within 2 km.

TABLE 1. Persistence of Ross'/Snow Goose colonies known before 1990 on the mainland south of Queen Maud Gulf, Northwest Territories, Canada

Colony number	Latitude <sup>a</sup>		Longitude <sup>a</sup>		Pairs nesting in 1990 or 1991	Colony presence by year <sup>b</sup>					
	Deg.	Min.	Deg.	Min.		65	76	82	88	90	91
1	67	34	101	48	1000-10 000	+	+	+	+	+	+
2	67	23	102	15	1000-10 000	+	+	+	+	+	+
3	67	14	100	16	> 10 000	+	+	+	+	+	+
4	66	35	101	23	0	+	-	+	+	-	-
5	67	19	99	45	0	+	-	-	+	-	-
6	67	15	99	53	0	+	-	+	+	-	-
7	67	08	98	47	0	+	-	-	-	?	-
10	67	22	98	02	> 10 000	+	+	+	+	+	+
25	66	48	101	43	100-1000	?	+	+	+	+	+
27	67	17	98	58	> 10 000	?	+	+	+	+	+
28	67	17	98	05	0	?	-	-	+	-	?
30	67	04	98	04	0	?	+	+	+	-	?
44	67	40	101	53	100-1000	?	?	+	+	+	+
49	66	55	100	36	10-100	?	?	+	+	?	+
56	67	06	99	00	0	?	?	?	+	?	-
60	67	36	101	00	100-1000	?	?	?	+	+	?
62	67	15	97	12	?	?	?	?	+	+	?
66	67	37	100	14	?	?	?	?	+	+	?

<sup>a</sup>Colony locations from Ryder (1969), Kerbes *et al.* (1983), Kerbes (1993).

<sup>b</sup>+: present; -: absent; ?: not checked.

When recording numbers of white geese, we defined breeding birds as all pairs in which one or both birds remained on the ground or flew later as the helicopter passed near. Two geese flying close together might have been nesting birds that rose while the helicopter was still distant from them or mated pairs that had not yet nested. They also were classed as breeding pairs. Groups of more than two flying geese were classed as non-breeders. This categorization probably underestimates the number of breeding pairs because it ignores the occurrence of a small proportion of persistent family groups in which geese that fledged in the previous year remain with their parents for part of the next nesting period (Prevet and MacInnes, 1980).

## RESULTS

We completed 3328 and 2906 km of aerial transect in 1990 and 1991 respectively, with 1604 km of transect surveyed in both 1990 and 1991. As only north-south transects were flown in 1991, this shared coverage was composed only of north-south transects.

We were able to check for the presence of 18 colonies known to have existed before 1990 (Table 1). Eleven were present in both years or either 1990 and 1991. We located 26 colonies that had not been reported previously (Table 2). Of the 7 colonies discovered west of the Ellice River sector (west of Atkinson Point), 6 were within 30 km of the coast (Fig. 2). Of the 12 found in the Perry River Region (from Atkinson Point east to the Simpson River), only 1 was within 30 km of the coast. Six of 7 colonies found farther east between the Simpson and Kaleet rivers were within 15 km of the coast.

Assuming visibility of 1 km for colonies <100 pairs and 2 km for colonies >100 pairs, we directly censused 6292 km<sup>2</sup> for colonies of <100 pairs and 12 008 km<sup>2</sup> for colonies of >100 pairs in 1990, and 5812 km<sup>2</sup> for colonies <100 pairs and 11 624 km<sup>2</sup> for colonies >100 pairs in 1991.

Thus, extrapolation of new colonies to each year's study area provides an estimate of 52 colonies of <100 pairs and 18 colonies of >100 pairs in 1990, and 26 colonies of <100 pairs and 18 colonies of >100 pairs in 1991.

Of 26 new colonies observed in either year, the locations of 22 were visited in both 1990 and 1991: 14 were occupied in only one year, and 8 were active in both years. Persistence of colonies tended to be related to colony size, as only 2 of 13 colonies containing fewer than 100 nesting pairs were seen in both years, whereas 5 of 8 colonies containing more than 100 nesting pairs were seen in both years (Likelihood ratio  $\chi^2 = 4.99$ ,  $df = 1$ ,  $P = 0.026$ ).

Most new colonies were associated with islands: 10 (38.5%) on lacustrine islands, 9 (34.6%) on riverine islands, 3 (11.5%) on mainland sites, 2 (7.7%) on offshore islands and 2 (7.7%) on delta islands in the mouths of large rivers. The two largest colonies each were on deltaic islands in the mouth of an unnamed river to the southwest of Atkinson Point (#68) and in the mouth of the McNaughton River (#88) (Fig. 2).

The total number of active Ross' or Snow Goose colonies observed within the area covered by aerial surveys was 37. Of this total, 15 were colonies of <100 pairs, 10 of >100 pairs and 12 of undetermined size.

## DISCUSSION

### Habitat Selection

From 1965 to 1967, Ryder (1969) found Ross' and Snow Goose colonies only on islands in shallow lakes, where ice melts earlier than on deeper lakes. Nesting on these islands presumably deters predation by Arctic foxes (*Alopex lagopus*) because this predator avoids swimming. Only 9 of 26 colonies observed for the first time in 1990-91 were exclusively on lake islands; one colony with nests on islands also had nests on a peninsula in the same lake (Table 2). This apparent

change in preferred colony sites may reflect a shortage of unoccupied islands in shallow lakes suitable for colonization.

Growth in number of colonies may increase likelihood of abandonment of new colony sites. If colony persistence is related to habitat suitability, a high frequency of inter-year abandonment may be related to use of less suitable islands or of lake shores more susceptible to unfavourable local environmental influences (such as greater snow depth and spring run-off) than sites occupied by older colonies. Nesting may have been attempted on what Ryder (1969) classified as low-level or Type 1 islands, rising less than 1 m above water level, which in some years become inundated by melt-water. A second possibility is that persistent ice cover, allowing access by Arctic foxes, may have deterred geese from nesting. Ryder (1969) suspected that abandonment of some nesting islands was a direct result of fox predation; in one instance, he documented the destruction of > 100 nests in less than 5 hours by a single fox.

#### Increase in Numbers of White Geese

In addition to increasing abundance of colonies, total numbers of nesting Lesser Snow and Ross' Geese at large colonies have increased rapidly in the Sanctuary since 1965 (Ryder, 1969; Kerbes *et al.*, 1983). Kerbes (1993) estimated that in 1988, 467 000 Ross' and Snow Geese nested at known colonies on the mainland south of Queen Maud Gulf; 91% of them were counted at only 4 colonies — colony 3: 214 800;

colony 10: 112 000; colony 9: 74 700; and colony 46: 23 400. We flew over parts of colonies 3 and 10 in both 1990 and 1991. Each had expanded up to 6-7 km outward from the previously mapped edge of the colony; certainly, each covered at least twice the area that it covered in 1988. Nesting densities in much of the recently occupied expansion areas appeared comparable to those in areas already occupied in 1988. Thus, the numbers of birds nesting at colonies 3 and 10 seem likely to have been at least double what they were in 1988 (i.e., over 650 000). We do not know to what extent other colonies existing before 1988 may have grown, but we observed that colonies 27 and 46, originally centred about 3 km from one another, had expanded far beyond their boundaries of 1988 (Kerbes, 1993) and had coalesced.

The estimated number of non-breeding white geese observed during the nesting season was 231 300 ± 96 800 (95% CI) on an area of 27 405 km<sup>2</sup> (most of which was mainland contiguous to Queen Maud Gulf) in 1990 and 268 500 ± 98 500 on 30 738 km<sup>2</sup> in 1991 (Alisauskas, 1992). The number of non-breeding birds present in the Sanctuary outside the 1990-91 study area is unknown.

Taken together, the sum of these values provides a very incomplete estimate of over 900 000 *adult* Ross' and Snow Geese within the 1990-91 study area. If each breeding pair fledge two young, resulting in a 1:1 age ratio of juveniles to breeding adults at fledging, this would result in 1.5 million Ross' and Snow Geese living within the 1990-91 study area in late summer. This does not include 1) numbers of breeders

TABLE 2. Reference locations of Ross'/Snow Goose nesting colonies discovered in Queen Maud Gulf Bird Sanctuary in 1990 and 1991

Colony number <sup>a</sup>	Latitude <sup>b</sup>		Longitude <sup>b</sup>		Number of nesting pairs	Presence <sup>c</sup>		Physiography <sup>d</sup>	
	Deg.	Min.	Deg.	Min.		'90	'91	1°	2°
67	67	28.59	103	35.78	10-100	+	-	IR	
68	67	54.13	103	5.65	1000-10 000	+	+	DI	M
69	66	50.94	102	15.85	10-100	-	+	IR	
70	66	58.47	102	15.01	10-100	+	-	IL	
71	67	0.62	102	14.76	100-1000	+	+	IL	
72	67	10.30	102	13.66	10-100	+	-	M	
73	67	16.75	102	12.92	10-100	+	+	IL	
74	67	58.44	104	12.69	10-100	+	?	M	
75	67	52.76	103	30.04	100-1000	+	?	IR	
76	67	52.50	103	4.36	100-1000	+	+	IR	
77	67	47.76	104	32.97	1000-10 000	+	-	IR	
78	67	31.80	101	48.85	10-100	+	-	IL	
79	67	19.13	101	33.41	10-100	+	+	IR	
80	67	8.77	101	4.61	10-100	+	-	IL	PL
81	67	15.40	100	51.27	100-1000	?	+	IR	
82	67	17.70	100	37.51	10-100	+	-	IR	
83	67	28.70	100	10.19	10-100	+	+	IL	
84	67	44.94	99	56.79	100-1000	-	+	IL	
85	67	48.17	99	56.93	1000-10 000	+	+	IC	
86	67	50.32	99	57.01	10-100	-	+	IC	
87	67	13.85	98	32.22	< 10	+	?	IL	
88	67	47.21	98	31.56	1000-10 000	+	+	DI	
89	67	43.86	98	3.25	< 10	+	-	IR	
90	67	31.27	100	25.78	100-1000	+	-	IL	
91 <sup>e</sup>	67	41.81	99	36.83	10-100	-	+	IL	
92 <sup>e</sup>	67	46.81	103	26.16	?	-	+	M	

<sup>a</sup>Numbering scheme based on numbers assigned to known colonies (Kerbes *et al.*, 1983; Kerbes, 1993).

<sup>b</sup>Geocentroid of segment from which colony was most visible.

<sup>c</sup>+: present; -: absent; ?: not checked.

<sup>d</sup>1°: major feature on which most pairs were seen, 2°: other features with which colony was associated; IR = islands in rivers, DI = deltaic islands in mouths of rivers, IL = islands in lakes, M = mainland, IC non-deltaic coastal islands, PL = peninsula in lake.

<sup>e</sup>Colonies located off-transect.

at colonies other than 3, 10 and 67-93; 2) numbers of Ross' and Snow Geese (breeding adults, non-breeding adults, or young of the year) outside the 1990-91 study area; or 3) new colonies in the southern portion of the Sanctuary, which contained most of the colonies known before 1990 but was not surveyed in 1990-91 (Figs. 1, 2). Note also that this incomplete estimate does not include unknown numbers of non-breeders in the southern portion. This speculative estimate points out the need for complete coverage and statistically valid estimation of the total numbers of Ross' and Snow Geese summering on the lowlands south of Queen Maud Gulf. Research into the causes and consequences of these increases is also needed.

#### ACKNOWLEDGEMENTS

We thank the Polar Continental Shelf Project for supplying a helicopter in 1990 and pilots Conan Taylor and John Faulkner, of Canadian Helicopters Ltd. and Sunrise Helicopters Ltd. respectively. Ken Abraham, Graham Cooch, Bob Clark, Tony Diamond, Alex Dzubin, Dick Kerbes, Kevin McCormick, Don Pattie, John Ryder, Stuart Slattery and two anonymous reviewers provided valuable comments on an earlier version of the manuscript.

#### REFERENCES

- ALISAUSKAS, R.T. 1992. Distribution and abundance of geese in the Queen Maud Gulf Bird Sanctuary. Unpubl. progress report. Available at the Arctic Goose Joint Venture Coordination Office, Canadian Wildlife Service, 2nd Floor, Twin Atria Building, 4999 98 Avenue, Edmonton, Alberta, Canada T6B 2X3.
- GAVIN, A. 1947. Birds of the Perry River district, Northwest Territories. *Wilson Bulletin* 59:195-203.
- HANSON, H.C., QUENEAU, P., and SCOTT, P. 1956. The geography, birds, and mammals of the Perry River region. Special Publication 3. Montreal: Arctic Institute of North America.
- KERBES, R.H. 1993. Ross' Geese and Lesser Snow Geese of Queen Maud Gulf. Unpubl. ms. Available at the Prairie and Northern Wildlife Research Centre, Canadian Wildlife Service, 115 Perimeter Road, Saskatoon, Saskatchewan, Canada S7N 0X4.
- KERBES, R.H., McLANDRESS, M.R., SMITH, G.E.J., BEYERSBERGEN, G.W., and GODWIN, B. 1983. Ross' Goose and Lesser Snow Goose colonies in the central Canadian Arctic. *Canadian Journal of Zoology* 61:168-173.
- McCORMICK, K.J. 1989. Lesser Snow Goose colonies in the Pelly Lake area, Northwest Territories, 1988. Canadian Wildlife Service Progress Note 185.
- PREVETT, J.P., and MacINNES, C.D. 1980. Family and other social groups in Snow Geese. *Wildlife Monographs* No. 44.
- RYDER, J.P. 1969. Nesting colonies of Ross' Goose. *Auk* 86:282-292.