Wilson Bull., 94(4), 1982, pp. 494–504

MIGRATION AND SUMMER DISTRIBUTION OF LESSER SNOW GEESE IN INTERIOR KEEWATIN

PETER L. MCLAREN AND MARGARET A. MCLAREN

Lesser Snow Goose (*Chen caerulescens caerulescens*) numbers have increased substantially over the last 30 years, especially at colonies in the eastern and central Arctic. The numbers of birds nesting at the west Hudson Bay colonies increased from an estimated 15,000 in 1955 (Cooch 1961) to 400,000 in 1973 (Kerbes 1975). Similarly, the nesting population at Cape Henrietta Maria, Ontario, has tripled since 1957, to about 50,000 birds in 1973 (Kerbes 1975). In the central Arctic, the Queen Maud Gulf population expanded from about 8400 nesters in 1965 (Ryder 1971) to 50,000 in 1977 (Kerbes, unpubl. cited by Dzubin 1979). Palmer (1976) identified the Baker Lake, Keewatin District, area as a major breeding area. However, there is only one record of 15 pairs nesting south of Baker Lake (Miller 1972).

Migration routes of Snow Geese in southern Canada and the United States are well documented (Bellrose 1976, Palmer 1976) but those over northern Canada are poorly understood. Eastern Arctic Snow Geese (Hudson Bay, Baffin Island) are believed to follow the coastlines of Hudson and James bays (Cooch 1961, Blokpoel 1974, Bellrose 1976); central Arctic Snow Geese (Queen Maud Gulf) are thought to arrive directly from and return directly to staging areas in northern Saskatchewan (Bellrose 1976, Palmer 1976). Palmer (1976), however, indicated the possibility of a route between Queen Maud Gulf and Hudson Bay. Dzubin (1979) believed that at least part of the increase of the central Arctic population was a result of immigration from the west Hudson Bay colonies along such a pathway. This belief was based on an increase in the proportion of blue morph geese in the central Arctic from 5% in 1966–1968 (Ryder 1971) to 15% in 1976 (Kerbes, unpubl. cited by Dzubin 1979); the latter value is much closer to the 24% figure at the west Hudson Bay colonies (Kerbes 1975). Dzubin, (1979), however, did not provide direct evidence of such a pathway.

Aerial surveys in Keewatin District, Northwest Territories, in 1975–1977 provided much new information on the distribution and movements of Lesser Snow Geese. This paper documents the 1975–1977 status of Lesser Snow Geese in northern Keewatin and the existence of previously unreported migration routes through interior Keewatin, and relates these to the present dynamics of Snow Goose populations in Keewatin District.

METHODS

Aerial surveys were conducted either by helicopter or fixed-wing aircraft. For surveys of molting and nesting areas a Hughes 500 helicopter was flown at an altitude of 15 m and a ground speed of 80 km/h. For surveys during the post-breeding and migration periods, a Cessna 185 or Cessna 337 fixed-wing aircraft was flown at 30 m and 160 km/h. Surveys of spring migration consisted of north-south transect lines, ranging from 120 km inland at the Manitoba border to 300 km inland west of Baker Lake, flown once to several times in 1976 (total of 1712 km); a single line flown from near the mouth of the Tha-anne River northwest to Henik Lake (160 km); and several lines flown in June 1976 in the Baker Lake–Pitz Lake area (370 km) (Fig. 1a). Surveys to record post-breeding dispersal in late summer in southern Keewatin consisted of a series of parallel lines from the Maguse to the Thlewiaza rivers flown twice in late summer 1975 and four times in late summer 1976. Each line consisted of 6–12 transects, each about 16 km in length (total of 4111 km). Sightings along each transect were recorded separately. Surveys of autumn migration in 1976 consisted of five surveys along the south side of Baker Lake in the 14 August–20 September period (total of 334 km), plus one to three surveys (depending on location) of the same route from Baker Lake south to the Manitoba border that were flown in spring (1433 km) (Fig. 1b).

Observers sat in the right front and left rear seats of the aircraft. For each sighting the observer dictated (into a tape recorder) the number of individuals and, except during nesting and molting surveys, whether the birds were within 200 m of the transect center-line. In this paper, many of the results are simply the flock sizes observed. However, results of surveys of the post-breeding movements in southern Keewatin are expressed as densities (number of geese/km^2) based on a total transect width of 400 m (200 m on each side of the aircraft). Densities reported are a simple extrapolation based on the total transect area. No correction factors have been applied.

RESULTS

Spring migration, southern and central Keewatin.—A total of 5451 Snow Geese in 19 flocks was recorded in interior southern Keewatin in spring 1976 (Fig. 1a). Flocks seen east of Yathkyed Lake and southeast of the Henik Lakes were flying north; most of those in the Baker Lake area were on the ground. In addition, we saw a flock of 1200 Snow Geese flying north over the Caribou River in extreme northern Manitoba, 50 km inland from the coast of Hudson Bay, on 22 May; and several flocks were seen passing north over the town of Baker Lake on 8–10 June.

Nesting and molting areas, central and northern Keewatin.—Although the major colonies in southern Keewatin are along the west coast of Hudson Bay, geese also nest at several locations inland (Clarke 1940, Miller 1972). During surveys between Pitz and Baker lakes in 1977, we found single nests and colonies totalling 139 nests, and 16 flocks containing a total of at least 47 young. In 1975 we located 76 nests and four flocks containing 99 young.

In early July 1975, we counted 543 nests and 3742 molters at four sites in the Rasmussen Basin lowlands of northern Keewatin (Fig. 2). Of 4832

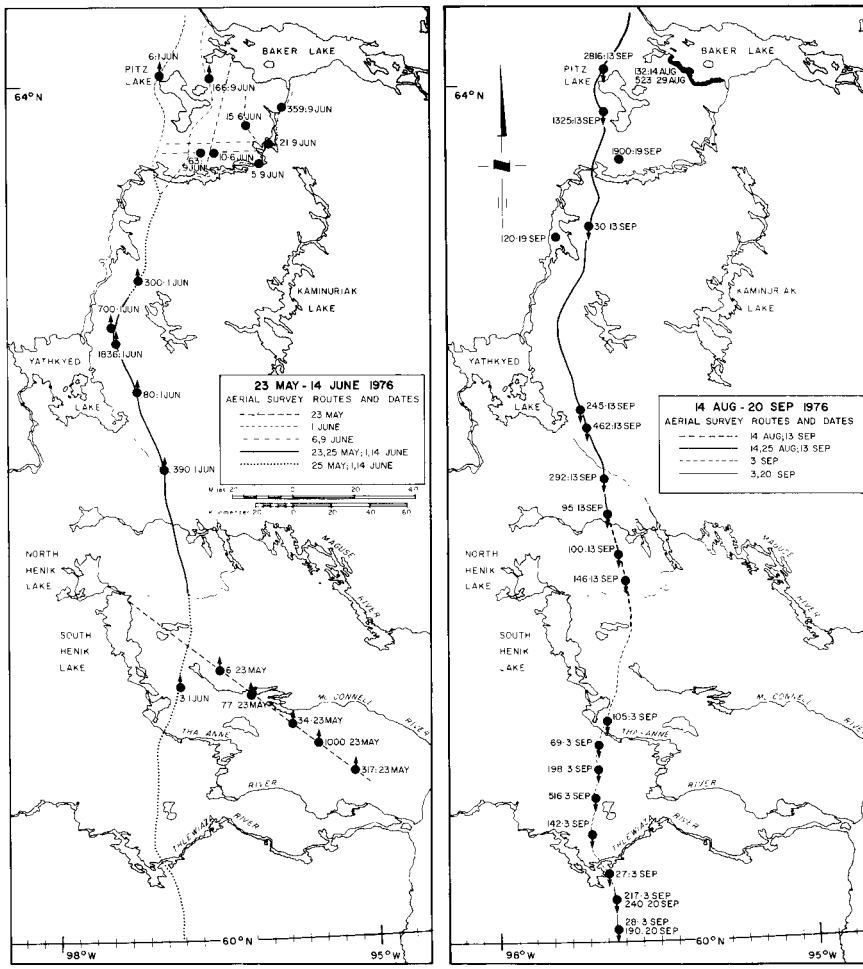

FIG. 1. Lesser Snow Goose sightings in southern Keewatin District, 23 May–14 June 1976 (Fig. 1a) and 14 August–20 September 1976 (Fig. 1b). Numbers indicate number of geese seen and date. Dark circle indicates location of flock and arrow indicates direction of flight.

nesting and molting geese classified, 21.7% were blue phase. Spring thaw was late in 1976; about 4800 molting Snow Geese but only 10 nests (nine at the colonies) and 15 broods were found in the Rasmussen Basin lowlands that year. In early July 1977, over 300 nests and 3772 molting birds were estimated from a photographic record of the colony sites. Of 927 geese classified from photographs, 21.9% were blue phase.

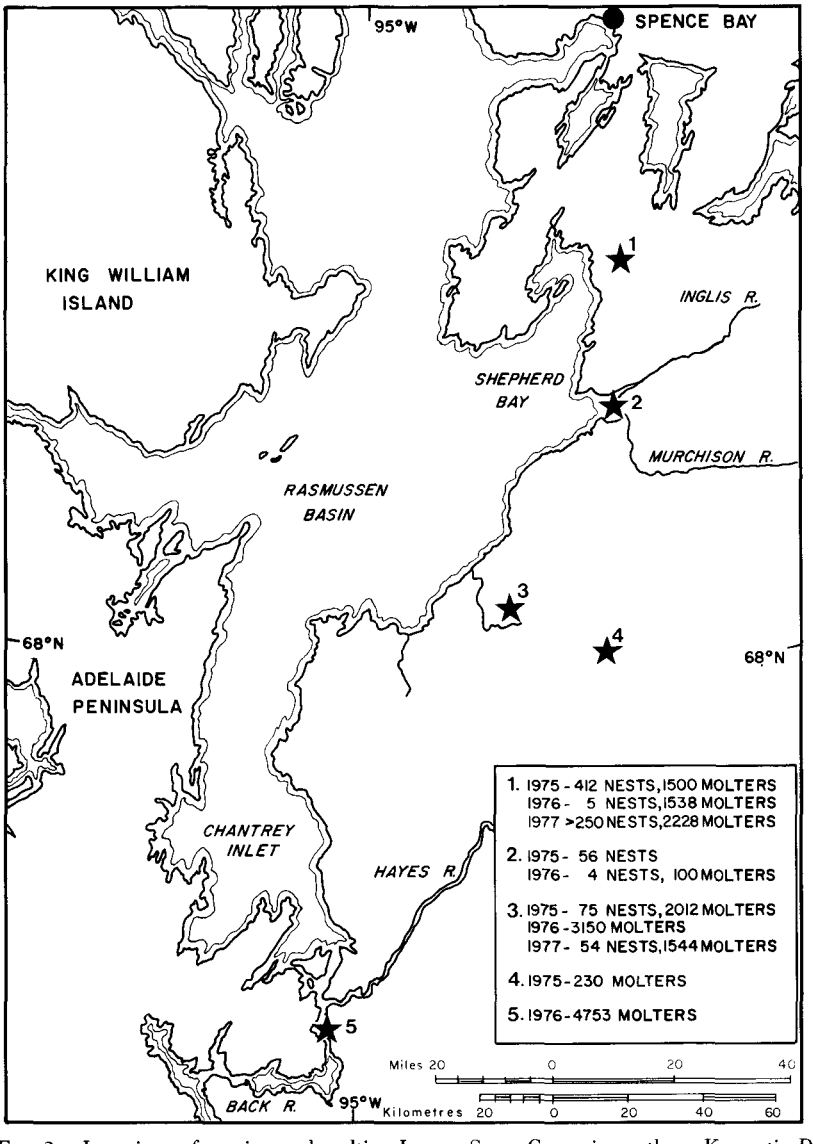

FIG. 2. Locations of nesting and molting Lesser Snow Geese in northern Keewatin District, 1975–1976.

We did not find a nesting colony at the mouth of the Back River but we did observe recently fledged young among the 717 Snow Geese recorded there in late August 1975, and three broods in early July 1976 when little nesting occurred in northern Keewatin. We also recorded 4753 molting Snow Geese in this area in early July 1976 but no estimate of the proportion of blue morphs was made (Fig. 2).

Post-nesting dispersal, southern Keewatin.—The main portion of the west Hudson Bay colonies is located along the coast between the mouths of the Maguse and Thlewiaza rivers (Kerbes 1975). We did not survey coastal areas, where many geese remain throughout the brood-rearing period, but we found that, as the summer progressed, many Snow Geese, including family groups, moved inland from these colonies. On 15 August 1976, the young were not yet able to fly and all young-of-the-year seen were along the lines 8 km and 24 km inland from these colonies. Older geese were present up to at least 72 km inland. During each subsequent survey, the number of geese 8 km inland became proportionately smaller and the numbers farther inland proportionately larger (Fig. 3, Table 1). Both adults and young-of-the-year were seen throughout the area after 15 August. By then the young could fly, but it is uncertain whether they flew or walked inland. The timing of the movement was apparently similar in 1975 when densities on 28 August were highest on the lines from 48–96 km inland and lowest on the line 8 km from the coast (Table 1).

In late August many of the 1.3 million Snow Geese from the west Hudson Bay colonies (Kerbes 1975) are in interior Keewatin. In late August 1976, we counted 4467 Snow Geese on the transect strips and an additional 12,000 beyond the edge of the transect. The transect strips covered only 2% of the area surveyed; simple extrapolation would indicate that 225,000 Snow Geese were in the area up to 120 km inland between the Thlewiaza and Maguse rivers. Although confidence limits cannot be placed on this estimate, the fact that 73% of the geese seen were beyond the transect strip suggests that the estimates are not unrealistic.

Autumn migration, central and southern Keewatin.—Results of the late summer surveys conducted around Baker Lake and south from the Baker Lake–Pitz Lake area to 60°N are shown in Fig. 1b. Numbers of Snow Geese seen along the southwest shore of Baker Lake increased in late August, to a maximum of 523 on 29 August. Other than on the surveys inland from the west Hudson Bay colonies (see above), Snow Geese were not seen south of Baker Lake during two surveys in August, but were present in the 3–20 September period (Fig. 1b). The geese in interior southern Keewatin on 3 September may have come from the coastal colonies 125+ km to the east as part of the inland dispersal described above. However, several large flocks (most notably 1900 Snow Geese near Pitz Lake on 19 September) were seen north of the Maguse River on 13 and

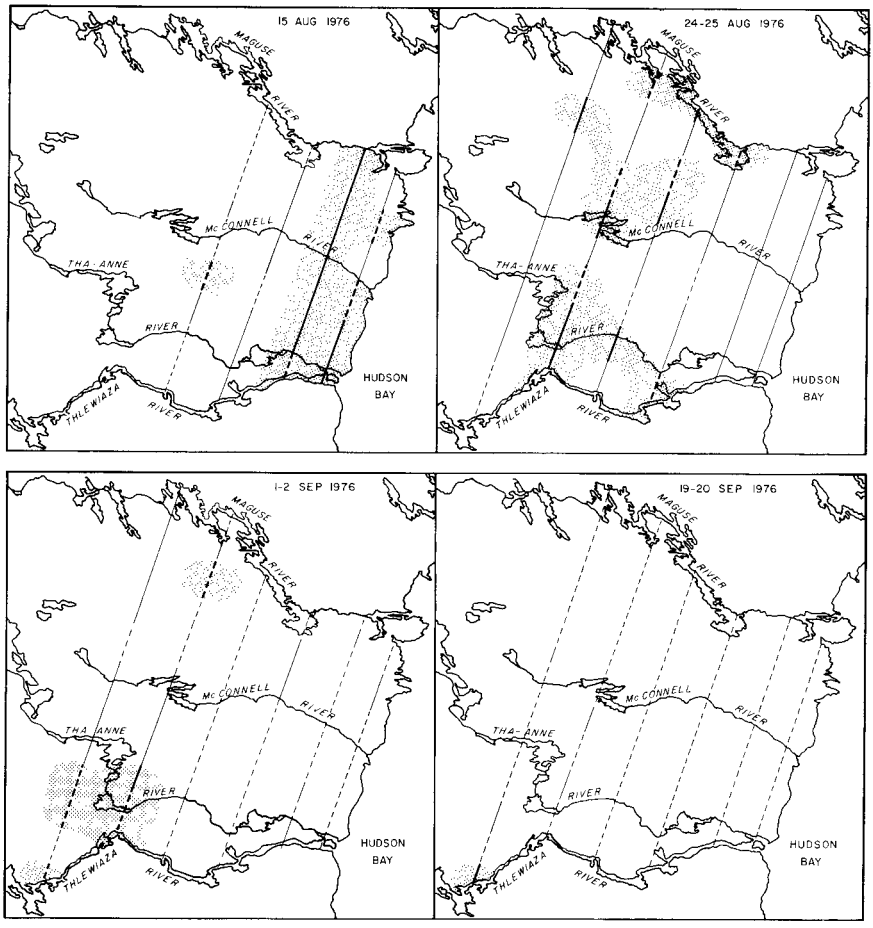

FIG. 3. Distribution of Lesser Snow Geese in southern Keewatin District, 15 August–20 September 1976. – – –: 0 geese/km²; ———: 1–20 geese/km²; – – –: 20–40 geese/km²; ———: 40+ geese/km². Shaded areas denote approximate areas with densities of greater than 20 geese/km². The areas shown are approximately 60°N to 62°N and 92°W to 97°30′W.

19 September. The latter date is considerably later than the peak of dispersal of geese inland from the west Hudson Bay colonies, and Pitz Lake is 340 km NNW of the northernmost west Hudson Bay colony.

DISCUSSION

Many of the recently observed changes in Snow Goose migration, e.g., the appearance of blue phase geese in Saskatchewan (Dzubin 1979), as well as changes in color-phase ratios at some colonies (Cooke et al. 1975),

TABLE 1

NUMBERS AND DENSITIES OF SNOW GEESE BETWEEN THE MAGUSE AND THLEWIAZA RIVERS IN LATE SUMMER OF 1975 AND 1976

Distance from Hudson Bay	23 July 1975		28 Aug. 1975		15 Aug. 1976		24–25 Aug. 1976		1–2 Sept. 1976		19–20 Sept. 1976	
	No.[a]	No./km²	No.	No./km²	No.	No./km²	No.	No./km²	No.	No./km²	No.	No./km²
8 km	—[b]	—	111	2.8	1400	37.0	108	2.9	6	0.2	0	0.0
24 km	2620	55.0	415	7.3	3591	81.5	192	4.4	10	0.2	0	0.0
48 km	14	0.3	1622	33.4	130	2.6	629	12.8	7	0.1	0	0.0
72 km	6	0.1	2034	37.6	194	3.6	1054	19.4	64	1.2	0	0.0
96 km	—	—	1990	32.5	—	—	1777	28.9	925	15.1	60	1.0
120 km	—	—	352	4.8	—	—	707	9.4	801	10.7	410	5.5

[a] Includes only birds seen "on transect."
[b] Indicates line not flown.

have occurred concurrently with the rapid increase in numbers of Snow Geese at the west Hudson Bay colonies. In this paper we present data that show probable changes in Snow Goose distribution, including apparently new migration routes through interior Keewatin in both spring and fall, the presence of new colonies, and extensive inland dispersal from the west Hudson Bay colonies.

Inland migration.—Data from our spring surveys in 1975 and 1976 suggest that many Snow Geese summering in the Keewatin District migrate through inland Keewatin rather than along the Hudson Bay coast. This inland movement also occurred in 1977 when Allen and Hogg (1978) saw 6100 Snow Geese east of Yathkyed Lake on 30 May. The destination of these geese is unknown but the Rasmussen Basin–Chantrey Inlet and/or the Queen Maud Gulf areas seem likely.

Similarly, Snow Geese seen near Baker Lake and Pitz Lake from late August to mid-September 1976 probably came from one or both of these areas. Snow melt and nest initiation were probably late in Queen Maud Gulf in 1976. (June temperatures at Cambridge Bay, the nearest weather station, were 2°C below normal.) If nest initiations peaked about 15 June, as they did in another late spring (Ryder 1971), most young would have fledged in late August–early September. Thus, adults and young could well have been in central Keewatin by mid-September.

Movements through inland Keewatin (as well as the westward dispersal from the west Hudson Bay colonies) are consistent with observed westward shifts in migration corridors farther south. Blokpoel (1974), and Blokpoel and Gauthier (1975) documented a westward shift of spring migration staging areas in southern Manitoba, and Dzubin (1979) documented increasing numbers of blue-phase geese (presumably originating from west Hudson Bay colonies) at Saskatchewan staging areas in fall.

Blokpoel (1974) documented departure directions for Snow Geese leaving southern Manitoba in spring. He assumed that all eventually intersected the Hudson Bay coast, but some of his reported tracks were toward interior Keewatin, not Hudson Bay. Whether Snow Geese were, in fact, migrating over interior Keewatin in 1970–71, when Blokpoel's study was conducted, is unknown. We have been unable to find any records prior to our own of Snow Geese migrating through inland Keewatin in the spring.

Dzubin (1979) postulated that 60,000 Snow Geese from the Queen Maud Gulf area migrate southeast to the coast of Hudson Bay and there join southward migrating geese from the west Hudson Bay colonies. Dzubin based his hypothesis on the disjunct distribution of band recoveries from southern Canada and the northern United States but had no direct evidence of such a corridor (Dzubin, pers. comm.). (Melinchuk and Ryder [1980], however, reported a direct recovery along the southern Hudson

Bay coast, of a Ross' Goose [*Chen rossii*] banded near Queen Maud Gulf.) While we have no data to disprove the existence of a corridor reaching to the coast of Hudson Bay, our data do suggest that many geese moving south from northern Keewatin remain well inland.

Rasmussen Basin, Chantrey Inlet Snow Geese.—We believe that the Snow Goose population in the Rasmussen Basin lowlands and probably that at the mouth of the Back River (Chantrey Inlet) are derived from the west Hudson Bay colonies. The presence of Snow Geese in both areas is apparently a recent phenomenon. Neither Bellrose (1976) nor Palmer (1976) included these areas in the breeding range of the Snow Goose; J. P. Ryder (pers. comm.) observed no Snow Geese at the mouth of the Back River in 1968. Both of these areas have thus been colonized recently, perhaps originally by molt migrants. In early July 1975, we found approximately three molting geese for every nesting goose in the Rasmussen Basin lowlands. The molting geese seen so early in the summer presumably were primarily pre-breeders, which begin to molt about 2.5 weeks earlier than breeding adults (Cooch 1958).

Abraham (1980) has documented the existence of molt migrations of non-breeding Lesser Snow Geese from the La Pérouse Bay (Manitoba) colony to the McConnell River area. Brace et al. (1978) suggested that non-breeders from the McConnell River colony migrate to other areas to molt. The Rasmussen Basin lowlands may be such an area. Prevett (pp. 139 *in* Palmer 1976) reported that small flocks of yearlings continued to overfly the McConnell River colony in a northerly direction in 1970 for several days after nesting birds had arrived at the colony. Birds that molt in the Rasmussen Basin lowlands as pre-breeders may return there to form the nucleus of the relatively small breeding colonies.

The phase ratio of geese in the Rasmussen Basin lowlands (22% blue geese in both 1975 and 1977) is similar to both the 24% blue geese along west Hudson Bay and the 23% blue geese on SW Southampton Island (Kerbes 1975). Proximity, possible introduction via molt migration, and population increases at west Hudson Bay colonies suggest that area as the most likely source of the Rasmussen geese. It is less likely that Rasmussen geese are derived from Queen Maud Gulf colonies since only 15% of the geese there are blue phase (Kerbes, unpubl. cited in Dzubin 1979).

Inland dispersal from west Hudson Bay colonies.—The dispersal of post-nesting geese inland from west Hudson Bay may be a response to feeding pressures on the coastal sedge meadows. Cooch (1958) observed brood-flock movements of up to 50 km on Baffin Island and suggested that such movements occurred in response to competition for limited sedge resources. Kerbes (1982) suggested that over-grazing at west Hudson Bay nesting areas may cause geese to move inland.

Geese with broods had moved on foot up to 24 km inland from Hudson Bay, or about 10 km west of the western edge of the nesting areas, by mid-August. We estimated that on 28 August 1975, 225,000 Snow Geese were in interior Keewatin between the Maguse and Thlewiaza rivers. Most of these geese were 72 km inland. We have been unable to find previous reports of large numbers of Snow Geese this far inland and Dzubin (pers. comm.) states that Inuit who lived in the vicinity of Henik Lakes in the early 1960's were not aware of Snow Geese inland in late summer.

Most geese seen in southern Keewatin in late August and early September were probably from the west Hudson Bay colonies. Adults and young from Queen Maud Gulf, Rasmussen Basin or Southampton Island do not arrive in southern Keewatin until September, since fledging at these colonies occurs in late August (Cooch 1958, Ryder 1971). However, some of the geese were probably non-breeders which leave the central Arctic colonies in late August. Thus, interior southern Keewatin may represent a point of contact between geese from west Hudson Bay and from the central Arctic. Maintenance of this contact over the winter could then result in a distributional shift of west Hudson Bay birds away from that area to the Rasmussen Basin-Chantrey Inlet area and possibly Queen Maud Gulf.

SUMMARY

Previously unreported migration routes, molting areas, and post-nesting dispersal patterns of Lesser Snow Geese (*Chen c. caerulescens*) in interior Keewatin District, Northwest Territories, were documented by aerial surveys in 1975–1977. In late May and June 1976, over 6000 migrants were seen over inland areas between the Caribou River, Manitoba, and Baker Lake, N.W.T. These geese probably summer in the Baker Lake area (ca. 300 geese), the Rasmussen Basin-Chantrey Inlet area (ca. 10,000 geese), and possibly the Queen Maud Gulf. Substantial numbers of Snow Geese, including broods, from the colonies along western Hudson Bay disperse inland in late August, presumably to feed. The movement is initially on foot. In September, migrants from areas farther north pass southward through interior Keewatin. The present of large numbers of Snow Geese in the Rasmussen Basin-Chantrey Inlet area and in interior southern Keewatin, the inland dispersal from western Hudson Bay, and the use of inland migration routes are all recent developments, and are probably related to the very rapid increase in Snow Goose numbers and consequent increased feeding competition at the west Hudson Bay colonies.

ACKNOWLEDGMENTS

This work was part of a larger study undertaken by LGL Ltd., Toronto, Ontario, for the Polar Gas Project. Coordination of logistics was provided by A. B. Ross of Polar Gas. Surveys were conducted by the authors and by W. G. Alliston, R. A. Davis, D. Fidler, W. G. Johnston, L. A. Patterson, and W. E. Renaud of LGL Ltd. Assistance and guidance in analysis were provided by R. A. Davis, C. Holdsworth, and W. J. Richardson of LGL Ltd. J. Riddick of Polar Gas, R. A. Davis, and W. J. Richardson of LGL Ltd., A. Dzubin and R. Kerbes of the Canadian Wildlife Service, J. P. Ryder of Lakehead University, and K. F. Abraham of the University of Western Ontario reviewed early versions of the manuscript. B. DeLong prepared the figures.

LITERATURE CITED

ALLEN, D. L. AND T. H. HOGG. 1978. Bird studies in the Keewatin District. Can. Wildl. Serv. ESCOM Rept. No. AI–27.

ABRAHAM, K. 1980. Moult migration of Lesser Snow Geese. Wildfowl 31:89–93.

BELLROSE, F. C. 1976. Ducks, geese and swans of North America. Stackpole Books, Harrisburg, Pennsylvania.

BLOKPOEL, H. 1974. Migration of Lesser Snow and Blue geese in spring across southern Manitoba. Pt. 1. Distribution, chronology, directions, numbers, heights and speeds. Can. Wildl. Serv. Rept. Ser. No. 28.

——— AND M. C. GAUTHIER. 1975. Migration of Lesser Snow and Blue geese in spring across southern Manitoba. Pt. 2. Influence of weather and prediction of major flights. Can. Wildl. Serv. Rept. Ser. No. 32.

BRACE, R. K., R. H. KERBES, A. X. DZUBIN, AND G. W. BEYERSBERGEN. 1978. International arctic Snow Goose study. Report to the Mississippi and Central Flyway Council Technical Sections in the 1977 pilot program. Can. Wildl. Serv. Rept., unpubl.

CLARKE, C. D. H. 1940. A biological investigation of the Thelon Game Sanctuary. Natl. Mus. Can. Bull. 96.

COOCH, F. G. 1958. The breeding biology and management of the Blue Goose *Chen caerulescens*. Ph.D. thesis, Cornell Univ., Ithaca, New York.

———. 1961. Ecological aspects of the Blue-Snow Goose complex. Auk 78:72–89.

COOKE, F., C. D. MACINNES, AND J. P. PREVETT. 1975. Gene flow between breeding populations of Lesser Snow Geese. Auk 92:493–510.

DZUBIN, A. 1979. Recent increases of Blue Geese in western North America. Pp. 141–175 *in* Management and biology of Pacific flyway geese (R. L. Jarvis and J. C. Bartonek, eds.). OSU Bookstores, Corvallis, Oregon.

KERBES, R. H. 1975. Lesser Snow Geese in the Eastern Canadian Arctic. Can. Wildl. Serv. Rept. Ser. No. 35.

———. 1982. Lesser Snow Geese and their habitat on west Hudson Bay. Nat. Can. 109 (in press).

MELINCHUK, R. AND J. P. RYDER. 1980. The distribution, fall migration routes and survival of Ross's Geese. Wildfowl 31:161–171.

MILLER, F. L. 1972. Birds nesting at Kazan Falls. Auk 89:183–185.

PALMER, R. S. (ED.). 1976. Handbook of North American birds. Vol. 2. Waterfowl. Yale Univ. Press, New Haven, Connecticut.

RYDER, J. P. 1971. Distribution and breeding biology of the Lesser Snow Goose in central Arctic Canada. Wildfowl 22:18–28.

LGL LTD., 414-44 EGLINTON AVE. W., TORONTO, ONTARIO M4R 1A1, CANADA. ACCEPTED 20 MAY 1982.

WILDLIFE CONFERENCE

The 7th Annual Dr. Barbara Sawyer Memorial Wildlife Conference will be held at the California Academy of Sciences in San Francisco, California, 5–6 February 1983. The conference theme is raptor rehabilitation and will include such topics as captive raptor husbandry, rehabilitation techniques, population dynamics, nutritional requirements, veterinary techniques, and captive propagation.

Registration information is available from San Francisco Zoological Society, Sloat Blvd. at the Pacific Ocean, San Francisco, California 94132.