A SURVEY OF MOULTING CANADA GEESE ON THE SNOWDRIFT AND THELON RIVERS NORTHWEST TERRITORIES: 1989

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ABSTRACT

An aerial survey of moulting Canada Geese was conducted along the Snowdrift and Thelon rivers on 6-7 July, 1989. The objectives of the study were: 1) to determine the distribution and abundance of moulting Canada Geese along both rivers; 2) to evaluate the importance of key habitat sites along the Thelon River, and; 3) to record ancillary observations on other wildlife along the survey route.

We observed 133 Canada Geese along the Snowdrift River and 6511 along the Thelon River. The most heavily used area was from about 100 km west of Ursus Island to and including the Ursus Island. The number of Canada Geese in 1989 was modest compared to expectations based on recent increases in continental populations.

Other observations include 27 Tundra Swans, 59 Greater White-fronted Geese, and 444 Snow Geese. We identified two colonies of Snow Geese, one with 120 pairs and the other with 18 pairs, in eastern Beverly Lake. Mergansers were common on both rivers, with Common Mergansers more abundant on the Snowdrift River and Red-breasted Mergansers more abundant on the Thelon River. We saw 238 Arctic Terns along much of the Thelon River, some of which appeared to be in colonies

RÉSUMÉ

Nous avons effectué un inventaire aérien de Bernaches du Canada en mue sur les rivières Snowdrift et Thelon, le 6 et le 7 juillet 1989. Nous avions pour objectifs: 1) de déterminer la distribution et l'abondance des bernaches le long des deux rivières; 2) d'évaluer l'importance des sites jugés comme exceptionnels pour les oiseaux (Key Habitat Sites) le long de la rivière Thelon; et 3) de noter toute observation d'intérêt particulier sur la faune.

Nous avons observés 133 Bernaches du Canada sur la rivière Snowdrift et 6511 sur la Thelon. Les concentrations les plus importantes furent observées dans la région d'île Ursus ainsi qu'au long des 100 km précédant cette région. Somme toute, peu de bernaches ont été énumérées si l'on compare notre inventaire aux populations continentales de bernaches qui d'ailleurs continuent de croître.

Nous avons également observé 27 Cygnes siffleurs, 59 Oies rieuses et 444 Oies des neiges. Nous avons trouvé deux colonies d'Oies des neiges dans l'est du lac Beverly, une de 120 couples et une autre de 18 couples. Les bec-soies étaient communs sur les deux rivières. Le Grand Bec-soie étaient plus abondant sur la rivière Snowdrift alors que le Bec-soie à poitrine rousse dominait sur la Thelon. Enfin, 238 Sternes arctiques furent comptées sur la rivières Thelon, certaines d'entre elles apparemment regroupées en colonies.

ACKNOWLEDGEMENTS

Ranjit Soniassy, Environment and Conservation, Indian and Northern Affairs Canada, provided generous financial assistance for this project. I also thank Jacques Sirois for participating in the survey and for reviewing this report; Jim Hines, Kevin McCormick, and Dick Russell for critically reviewing this report; and Susan Popowich for preparing the figures and arranging the printing.

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1.0 INTRODUCTION

1.1 Thelon Sanctuary Review and Key Habitat Sites

Indian and Northern Affairs Canada (INAC) released the Northern Mineral Policy in December 1986. A primary concern of the mining industry is access to land for exploration and development. In this context, the Policy committed the federal government to a review of the Thelon Game Sanctuary to ensure that the lands it contained are necessary to achieve the conservation objectives for which it was established.

In 1984, CWS completed a compilation of 61 key migratory bird terrestrial habitat sites in the Northwest Territories (McCormick et al. 1984). Any site that supports at least one percent of the Canadian population of a migratory bird species or subspecies, for any portion of the year, is considered to be a Key Habitat Site. Evaluations are based on the best available estimates of national and regional populations and the number of individuals present at each site. Sites have been ranked with regard to updating the appropriate information and will be surveyed as financial and personnel resources permit.

The Thelon Sanctuary includes two Key Habitat Sites: the Middle Thelon River and the Beverly-Aberdeen lakes. Both of these sites provide habitat for moulting Canada Geese (scientific names of birds are given in Appendix 4). Most of the data pre-dates 1966, and since that time, continental goose populations have expanded considerably. Thus more current information is required to adequately assess the importance of the two sites to Canada Geese and other waterbirds. Accordingly, in response to the Northern Mineral Policy, a three-year study was initiated in 1988 to examine the distribution and abundance of moulting Canada Geese along the Thelon River and Snowdrift River, which is also known to harbour moulting geese (McCormick et al. 1990). This report presents the results from the second year of surveys.

1.2 Objectives

The objectives of this study were:

1. to determine the distribution and abundance of moulting Canada Geese on the Snowdrift and Thelon rivers;
2. to evaluate the importance of Key Habitat Sites along the Thelon River;

3. to record ancillary information on other wildlife in the area.

2.0 STUDY AREA

The study area includes 200 km of the Snowdrift River from its mouth (near the community of Snowdrift) to approximately 108°W, and 1025 km of the Thelon River and associated lakes from Eyeberry Lake (63° 08'N, 104° 43'W) to the community of Baker Lake (Figure 1).

2.1 Physiography

The Snowdrift and Thelon rivers are situated within the Kazan Region of the Canadian Precambrian Shield. This region consists of great areas of massive rocks that form broad sloping and undulating uplands, plateaux and lowlands (Bostock 1970). The study area includes two units of the Kazan Region: the East Arm Hills and the Thelon Plain.

The Snowdrift River rises in Whitefish Lake (62°41'N, 106°48'W) and flows southwestward for approximately 260 km before emptying into Great Slave Lake near the community of Snowdrift (62°24'N, 110°44'W). The river flows through the East Arm Hills which are formed of down-faulted and folded, differentially eroded sediments and gabbro sills. On the north side, the resistant sills dip southerly forming broad cuestas as much as 300 m above Great Slave Lake. Most intervening valleys are flooded by arms of Great Slave Lake and other lakes. On the south side the hills are narrow and lower, ending abruptly at the fault scarp bordering the Kazan Upland (Bostock 1970).

The Thelon River originates in and near Lynx Lake (62°25'N, 106°15'W) and flows in an easterly direction for over 800 km to Baker Lake. The Thelon River flows through the Thelon Plain which includes areas of nearly flat lying sandstones and volcanic rocks that are characteristically expressed on the surface by sandy flats which are sparsely covered by vegetation (Bostock 1970). South of the river, the peneplain rises from near sea level to approximately 500 m near Kasba Lake (60°18'N, 102°07'W). North of the Thelon the land rises to a watershed about 300 m above sea level, separating the Thelon and Back rivers.

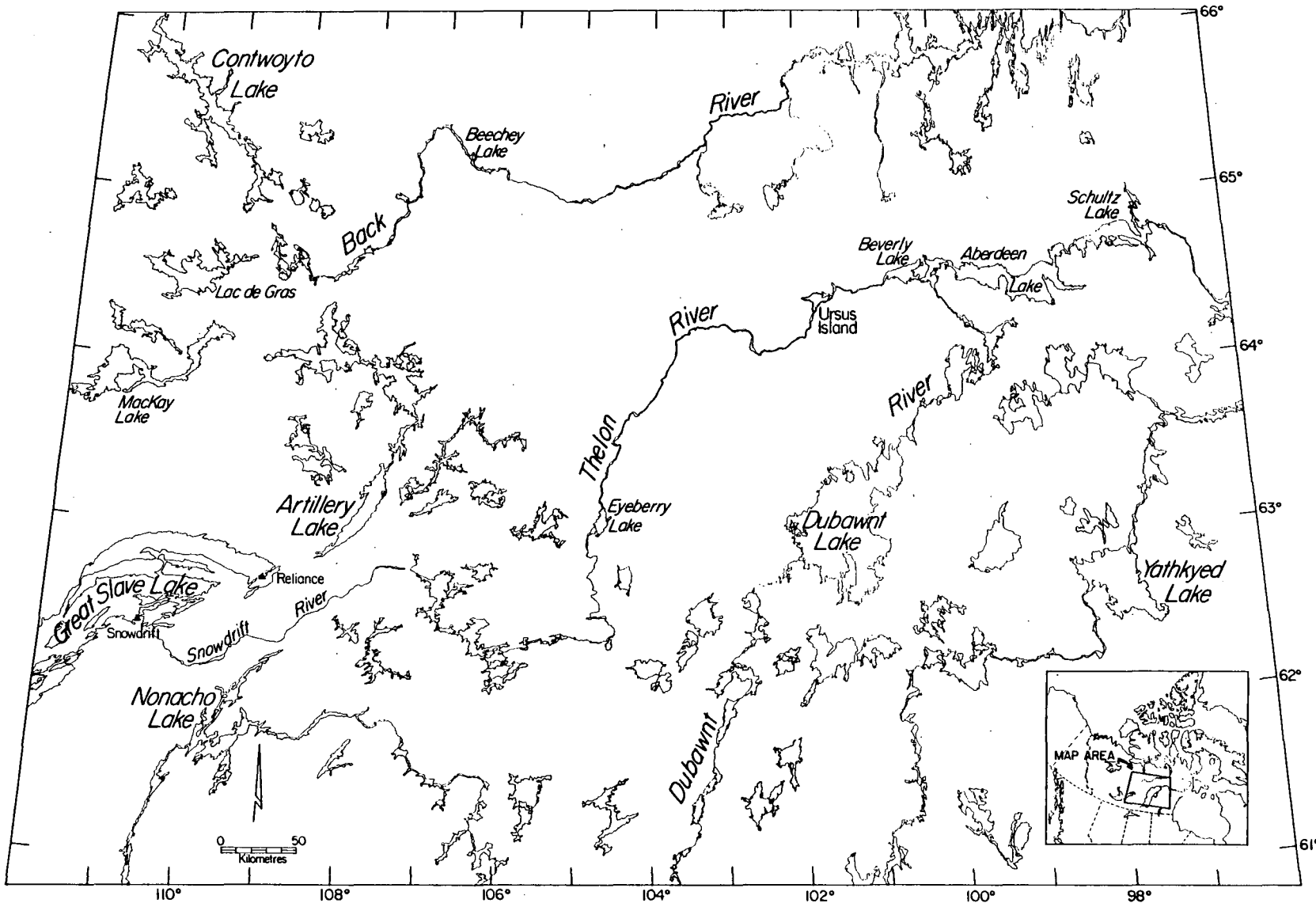


Figure 1. Map of the study area.

2.2 Surficial Geology

Although the Snowdrift River follows a narrow, deeply incised valley for much of its length, evidence of past glaciation is apparent at certain locations. Sandy areas and dunes become progressively more common east of Siltaza Lake.

The central Keewatin District was subject to multiple glaciations. Available evidence suggests that the ice originated in Hudson Bay and moved northwest across the Thelon Valley (Bird 1951). The Thelon Valley, from the Hanbury River to the east end of Aberdeen Lake was submerged at one stage by a glacial lake. Although the highest level of the lake is unknown, a raised beach is found at 225 m above sea level south of Aberdeen Lake (Bird 1951). Englacial rivers deposited deltas in the lake at the ice front and larger deltas (Grassy Island, Ursus Islands) are conspicuous features in the present landscape. Much of the once-submerged area is now characterized by deep deposits of till and sand. Sand dunes are common around Tibielik River (64°41'N, 100°04'W) and along the Thelon River between Hornby Point and Finnie River.

2.3 Climate

The Snowdrift River is subject to a subarctic continental climate (Wiken 1986). Precipitation is low (175-200 mm annually) and temperatures are cool to cold. The mean daily January temperature ranges from -17.5°C to -27.5°C and for July the range is 7.5°C to 17.5°C. The average annual number of frost-free days ranges from 70 to 100 (Wiken 1986).

The Thelon River passes through an area subject to a southern arctic climate. However, the sheltered areas in the valley are likely influenced by a mixture of subarctic continental and southern arctic climates. The latter is characterized by long cold winters and short cool summers enhanced by long periods of daylight. The mean daily January temperatures for January and July are -30°C and 10°C, respectively. Precipitation ranges from 200-400 mm annually and the frost-free period varies from 40-80 days (Wiken 1986).

2.4 Vegetation

The Snowdrift River occurs entirely within the Taiga Shield ecozone (Wiken 1986). Boreal forest is a prominent feature, except in the northeast margins of the watershed where lichen woodlands merge into areas of open tundra. Stunted

coniferous and deciduous stands on the uplands contrast with the taller White Spruce (Picea glauca), Black Spruce (Picea mariana), Tamarack (Larix laricina), White Birch (Betula papyrifera), and Balsam Poplars (Populus balsamifera) in the valley. Jack Pine (Pinus banksiana) occurs on the sandy sites. Green Alder (Alnus crispa) and willows (Salix spp.) border many sections of the river. Cattails (Typha latifolia), River Horestail (Equisetum fluviatile) and other emergent species grow in the sheltered wetlands.

The Thelon River valley is characterized by an enclave of subarctic forest in an area of tundra. White and Black spruce, up to 10 m high, grow in the sheltered valley. The forested corridor stretches over 200 km between the Clarke River and Ursus Island. The forest floor is vegetated by numerous Ericaceae, bryophytes and lichens. Associated waterbodies have limited emergent vegetation, but willows (Salix sp.) and other shrubs are common along much of the river.

3.0 METHODS

The survey was flown on 6-7 July in a Cessna 185 airplane on floats, at 60 to 100 m above ground and at an air speed of approximately 160 km/h. One observer occupied the right front seat while the other was in the left rear seat. The front observer navigated along a pre-determined route, which had been drawn on 1:250,000 topographic maps (Appendix 1). The route was chosen to maximize the amount of shoreline that could be observed. On very narrow sections of the river, we flew off the right side of the river and the left-hand observer recorded the birds.

The survey route was divided into 10 km units to facilitate recording data. An additional transect approximately 25 km long was flown over the Ursus Island area. The size and identity of all flocks of birds within sight of the survey route were noted on a cassette tape recorder and transcribed later. Observations of other wildlife were also recorded.

4.0 RESULTS AND DISCUSSION

4.1 Survey conditions, accuracy, and coverage

In general, the weather during the survey was favourable, and the visibilty was good. Skies were both clear and overcast, the latter also accompanied by

intermittent, light rain. Wind was moderate (up to 20 km/hr) but had little effect on the surface texture of the water. Glare was not perceived to be a problem in seeing Canada Geese.

The accuracy and precision of aerial surveys for wildlife depend on a number of factors including the species, group size, behaviour, habitat type, weather, observer, and aircraft type. One tends to underestimate animal numbers during aerial surveys and often in an inconsistent manner. Many authors have suggested computational correction factors to compensate for inaccuracies (Stott and Olson 1972, Caughley 1974, Haddock and Evans 1974, Cook and Jacobsen 1979, Grier et al. 1981, Malecki et al. 1981, Caughley and Grice 1982, Savard 1982, Kavanagh and Recher 1983, Anon. 1987).

Our primary objective in this survey was to estimate numbers of moulting Canada Geese along the Thelon and Snowdrift rivers. Correction factors for moulting Canada Geese have never been published (A. Dzubin, CWS, pers. comm. in McCormick et al. 1990, R. Reynolds and G. Smith, US Fish and Wildlife Service, pers. comm.). McCormick and Arner (1986) and McCormick and Bromley (1990) suggest a correction factor of 2.0 based on studies by Haddock and Evans (1975) and Stott and Olson (1972). However, Stott and Olson's (1972) work was on wintering seaducks in the open ocean, which are far more difficult to survey than Canada Geese on a sheltered and narrow river (pers. obs.). Therefore, it is not reasonable to apply a correction factor for seaducks to Canada Geese. The correction factor reported by Haddock and Evans (1975) was for helicopter surveys of breeding dark geese. Scattered breeding birds are likely less detectable than groups of moulting birds, rendering the correction less applicable to our surveys. Furthermore, the imprecision of the correction factor (2.07 ± 2.81; 95% confidence limits) raises some concern about its utility. The Standard Operating Procedures manual for waterfowl surveys (Anon. 1987) recommends not correcting counts of Canada Geese, although the rationale for this is based largely on experience rather than quantitative testing (G. Smith, USFWS, pers. comm.). Some researchers conducting breeding surveys correct only counts of single birds by assuming that such birds represent pairs; group counts are uncorrected (R. Reynolds, USFWS, pers. comm.). The only other correction factor for Canada Geese that I am aware of also comes from breeding studies; Malecki et al. (1981) reported that they saw about 1.4 times as many breeding Canada

Geese from a helicopter as from a Cessna 180.

The habitat type and the behaviour of the geese during our survey were very different from those on the breeding grounds. Goose observations took precedence over other observations, thereby reducing the inaccuracy associated with multiple species counts (Watson et al. 1969). The geese tended to move out into the water as the aircraft approached and so were usually very conspicuous on the river. Our ability to detect the geese was helped by the fact that Canada Geese do not dive (although one gave it a good try), and virtually all (99%) were in the flightless stage of moult. Therefore, we are confident that we were able to see most flocks of geese that were present along the survey route.

However, underestimates increase with flock size (Cook and Jacobsen 1979). Flocks of up to 15 birds are easily counted. Flocks from about 16 to 29 birds often have to be estimated but the estimations are generally quite good (from personal simulations of counting Canada Geese using dried beans). Estimates of flocks numbering from 30 to 200 are less accurate; however, both overestimates and underestimates are common and in large samples they may cancel each other out. Along the Thelon River, the mean flock size was 26 birds. The largest flock was an estimated 200 birds, and 74 flocks (4160 birds or about 64%) were larger than 29 birds. For the flock sizes encountered during this survey, I believe the error in estimation is small (<10%), but does not clearly result in an underestimate of population size.

Thus rather than a correction factor of 2.0, as suggested by McCormick and Arner (1986) and McCormick and Bromley (1990), I suggest adding 10% for estimation errors and 30% for detectability errors for a correction factor of 1.4. A further point is that, for the purpose of recognizing Key Habitat Sites (see Section 5.0), we rely on winter population indices, which are essentially uncorrected counts of Canada Geese on the wintering grounds. Thus it may be more valid to compare our uncorrected counts with the winter indices. Alternatively, comparing uncorrected counts of moulting birds (adults) with winter counts (adults and young) would tend to underestimate the importance of the moulting site.

In addition to the errors discussed above, the intensity of aerial surveys is another well recognized source of error in estimating abundance (eg. Gaston

and Smith 1984). However, in our survey this is greatly reduced because the Thelon River is essentially a narrow strip of habitat. Sterling and Dzubin (1967) noted that the habitat used by moulting Canada Geese was restricted mainly to stream and lake shorelines. They also conducted some exploratory surveys over upland tributary streams and lakes in the vicinity of the Thelon River, and saw very few birds. Thus our surveys probably covered most of the Canada Goose moulting habitat along the Thelon River. There are three notable exceptions. 1) The river in segments 41 to 44 (see Appendix 1) is about 1 km wide and full of islands that provide a lot of shoreline habitat; our coverage in this area was about 75%. 2) There is approximately 30 km^2 of wetlands immediately south of Ursus Island; we covered about 1/3 of this area incidentally. 3) The largest and most difficult area to assess after the fact is the Dubawnt River delta in eastern Beverly Lake. Corrections associated with poor survey coverage will be discussed below.

Because our attention was directed mainly towards geese, our counts of other species, particularly dabbling ducks, are less reliable.

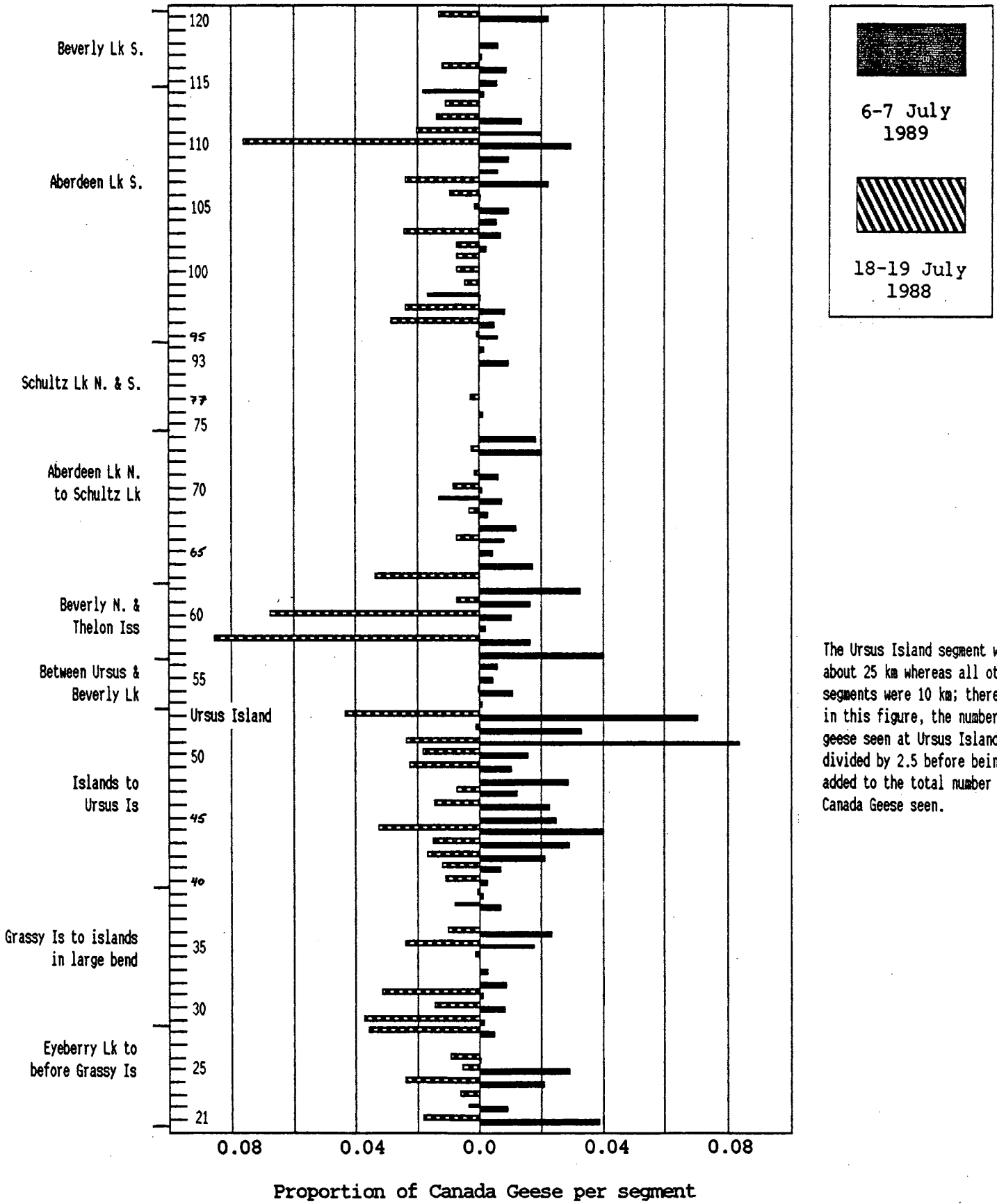
All references to data from 18-19 July 1988 surveys are from McCormick et al. (1990).

4.2 Canada Geese

We counted 6511 Canada Geese along the Thelon River (see Appendix 2). We also recorded an additional 386 birds immediately south of Ursus Island, in an area off the survey route, the day after the survey. Along the Snowdrift River we counted 133 Canada Geese. Fewer birds were seen in 1988: 4449 and 94 for the Thelon and Snowdrift rivers, respectively. As in 1988, we saw no birds east of Schultz Lake (Figure 2); therefore, the Thelon geese were spread out over a distance of about 915 km (7.1 birds/km). Along the Snowdrift River there were 0.7 birds/km. The remainder of this section concerns the Thelon River, which supported the most geese.

The distribution of Canada Geese along the Thelon River was somewhat different in the two years (Figure 2; Table 1). The differences occurred primarily in two areas: first, there were proportionately (and absolutely) more geese in 1989 than 1988 from the islands in the large bend north of Hornby Point to and including

Figure 2. The proportion of Canada Geese seen in each segment of the aerial survey along the Thelon River in 1988 and 1989. The segments from Schultz Lake to Baker Lake had no geese and have been excluded.



The Ursus Island segment was about 25 km whereas all other segments were 10 km; therefore, in this figure, the number of geese seen at Ursus Island was divided by 2.5 before being added to the total number of Canada Geese seen.

Table 1. Number and linear density of Canada Geese observed during aerial surveys in 1988 and 1989 in regions along the Thelon River outlined on Figure 2, and an index of relative importance* of the regions that corrects for total number of birds seen in 1988 versus 1989.

Region (km)	1989			1988		
	No. birds	Birds/km	Index	No. birds	Birds/km	Index
Eyeberry Lk to before Grassy Is (80)	601	7.5	1.2	420	5.3	1.2
Grassy Is to islands in large bend (110)	407	3.7	0.6	532	4.8	1.1
Islands to Ursus Is (155)	2976	19.2	3.0	1178	7.6	1.7
Between Ursus Is and Beverly Lk (40)	123	3.1	0.5	2	0.1	<0.1
Beverly Lk N. and Thelon Islands (60)	688	11.5	1.8	669	11.2	2.5
Aberdeen Lk N. (120)	562	4.7	0.7	291	2.4	0.6
Schultz Lk N. and S. (70)	68	1.0	0.2	12	0.2	<0.1
Lower Thelon R (110)	0	0.0	0.0	0	0.0	0.0
Aberdeen Lk S. (200)	841	4.2	0.6	1231	6.2	1.4
Beverly Lk S. (60)	245	4.1	0.6	105	1.8	0.4

* A region's relative importance is the linear density divided by the total number of birds seen in the year; ie. relative importance = $1000n(Nd)^{-1}$. where:
n = number of birds in the region
N = total number of birds in all regions for a particular year
d = distance surveyed in the region
1000 = a constant to eliminate decimal places

Ursus Island; and second, there were proportionately fewer geese in 1989 than 1988 along the south shore of Aberdeen Lake (Table 1). In 1989, the Ursus Island area was clearly the most heavily occupied region, whereas in 1988, this region was relatively less occupied compared to some other areas.

Ice conditions on eastern parts of the Thelon River in 1989 may have had an influence on both the distribution and abundance of Canada Geese. Both Schultz Lake and the east portion of Aberdeen Lake were over 90% ice-bound. The west portion of Aberdeen Lake was 60-70%, and Beverly Lake was about 10% ice-bound. The channels between the lakes were mostly clear of ice.

The following historical account of Canada Geese on the Thelon River is extracted from McCormick et al. (1990):

> "Sterling and Dzubin (1967) suggested that goose populations on the Back and Thelon rivers had been increasing since the mid 1950s. Kelsall (1951) estimated that there were no fewer than 3000 birds on the Thelon River and associated lakes. They were particularly numerous from the Thelon-Hanbury junction to Beverly Lake. He also considered Grassy Island to be a major moulting and breeding area. From 1958 to 1960, Macpherson (in Sterling and Dzubin 1967) observed as many as 3000 moulting geese on the islands between Beverly and Aberdeen lakes but only scattered groups to the east of Aberdeen Lake. Chamberlain and Perroux (1961) estimated that there were more than 8000 geese in the vicinity of the Thelon-Dubawnt river junction in early August 1961."

Canada Goose populations in North America have increased from a winter index of about 1.2 million in the late 1950s and early 1960s to 2.8 million by the mid-1980s (Anon. 1988a:54). This prompted McCormick et al. (1984) to suggest that there may be a concurrent increase in the number of Canada Geese moulting along the Thelon River, and also along the Back River. The authors estimated from data gathered in the first half of the 1960s that in some years, up to 11,500 Canada Geese moulted along the Thelon River (see Sections 5.1 and 5.2). If the Thelon River reflected the continental increases, then one would have expected the number of Canada Geese in the mid-1980s to be in the order of 26,000 birds. Thus, McCormick et al. (1990) felt they had seen surprisingly few geese during their survey on 18-19 July; they suggested that they had surveyed too late into

moult, and that many birds could fly and had already left the Thelon River.

The 1989 count of 6511 Canada Geese, although higher than the 1988 count by 2062 birds (46% of the 1988 count), is similarly low relative to the expected increase based on continental increases. Multiplying by the correction factor of 1.4 gives estimates of 9115 birds in 1989 and 6230 in 1988. We scheduled the 1989 survey earlier than the 1988 survey to avoid the problem of post-moult exodus. Just over 1% of the Canada Geese were able to fly during our survey. This factor could account for some of the difference in numbers between the two years.

Undoubtedly, in both years, some birds were moulting in areas that we did not survey. As mentioned above, three areas are of particular note. 1) We surveyed approximately 75% of the habitat in transects 41 to 44, and counted 570 birds; therefore an additional 190 birds may have been present there. 2) We counted 386 birds in about 1/3 of an area of good habitat off transect, just south of Ursus Island; therefore, a total of 1170 birds may have been there. 3) In addition, the Isarurjuaq Peninsula and Dubawnt River delta on eastern Beverly Lake was very poorly surveyed and may have had sizeable concentrations of moulting geese, as noted by Chamberlain and Perroux (1961). However, we saw only four birds on segment 117 (zero birds in 1988), which passed through the center of this area, and a total of 81 in the flanking segments (116 and 118; 50 in 1988). These observations tend to indicate that the Dubawnt-Isarurjuaq area was not well used in either year. On the other hand, Sterling and Dzubin (1967) have observed flocks of up to 2000 birds in the Thelon and Back river area, and perhaps one such flock was sitting just out of view. Addition of the birds from areas 1 and 2 above increases the corrected total to 11,020 Canada Geese.

With all the above in mind, there was probably a moulting Canada Goose population in the order of 10,000 to 13,000 birds along the Thelon River in early July 1989. Thus our data and those of McCormick et al. (1990) do not provide strong evidence that the number of Canada Geese using the Thelon River has increased with the continental populations.

Similar surveys for Canada Geese were conducted along the Back River in 1984 and 1986 (McCormick and Arner 1986, McCormick and Bromley 1990). Their counts of birds on transect and estimate of birds in unsurveyed areas were 10,014 and 27,420 birds, which they multiplied by 2.0 to get grand estimates of 20,028 and 54,840 birds for 1984 and 1986 respectively (15,021 and 41,130 using this paper's correction factor of 1.4). They compared this to Sterling and Dzubin's (1967) estimate of 8000 birds and concluded that the number of Canada Geese moulting on the Back River had increased as expected. The data for the Back River provides more convincing evidence of a population increase than the data for the Thelon River.

4.3 Lesser Snow Geese

Snow Geese were the second most abundant birds observed. We counted 444 birds, all between the east end of Beverly Lake and the middle of Aberdeen Lake. The count in 1988 was slightly more than half (235) of the 1989 estimate, but the distributions were virtually identical.

We saw two colonies, one of 120 pairs (segment 64) and one of 18 pairs (segment 65) (Appendix 1). In 1988, there were no colonies recorded but young Snow Geese were seen in segments 64 and 114. Small numbers of breeding Snow Geese have been observed from east Beverly Lake to west Aberdeen Lake by several people since the early 1900's (see McCormick et al. 1990 for a review).

Blue phase Snow Geese were noticeably present, but we did not conscientiously record the colour-phase ratio of flocks, even entirely white flocks. With that in mind, 19 out of 124 of the Snow Geese were blue phase (85% white).

4.4 Greater White-fronted Geese

We counted only 59 Greater White-fronted Geese along the Thelon River, 32 of which were quite able to fly. In 1988, 279 were recorded. Whitefronts are regular but not very common breeders in this area (see McCormick et al. 1990 for a review). We did not see any Greater White-fronted Geese along the Snowdrift River.

4.5 Tundra Swans

We observed 27 Tundra Swans along the Thelon River, compared to 46 in 1988. The birds were distributed from Grassy Island to Ursus Island. In 1988, swans were observed as far east as the west portion of Aberdeen Lake. Small numbers of Tundra Swans have been regularly observed in this part of the Thelon River (see McCormick et al. 1990). As in 1988, we did not see any cyngets or incubating birds.

4.6 Other birds and mammals

Numbers of all birds seen per segment and total numbers seen are recorded in Appendix 2.

The most abundant (and perhaps the most conspicuous) ducks were the Common and Red-breasted mergansers, most of which could fly. We counted 173 along the Thelon River and 65 on the Snowdrift River. Most of the mergansers (163) on the Thelon were spread over a distance of 395 km upstream of Beverly Lake; thus the frequency of mergansers was similar for the Thelon and Snowdrift rivers (0.4 and 0.3 birds/km, respectively). However, Common Mergansers were the more abundant species on the Snowdrift River (91% of 65 mergansers), whereas Red-breasted Mergansers were the more abundant species on the Thelon River (85% of 147 mergansers). Most of the mergansers along the Snowdrift River were males (83% of 65 mergansers). We were not so diligent in recording merganser sex along the Thelon River, but the impression we had was that, likewise, most of the mergansers were males.

Terns (probably Arctic Terns; Norment 1979) were the third most abundant birds along the Thelon River. We counted 238 birds, many of which were congregated around gravel islands that appeared to provide good nesting habitat (15 birds in segment 23; 40 in 25; 80 in 42; 16 in 118).

Shorebirds were distinctly absent along the Thelon and Snowdrift rivers during our survey.

All mammal sightings were within a few hundred metres of the water. The only mammals we saw along the Snowdrift River were seven Wolves (Canis lupus). We counted five more Wolves along the Thelon River, two of which appeared to have

a den. The other mammals we saw were 34 Muskoxen (Ovibus moschatus), 36 Caribou (Rangifer tarandus) (all downstream of Aberdeen Lake), three Moose (Alces alces), and one Grizzly Bear (Ursus arctos) (Appendix 3).

5.0 KEY HABITAT SITES

Key Habitat Sites are regions that support at some time during the year 1% or more of the national population of a migratory bird species or subspecies (McCormick et al. 1984). The study area contains two potential sites for moulting Canada Geese. Most of the Canada Geese banded on the Thelon River belong to the maxima race with fewer numbers of moffitti (Sterling and Dzubin 1967). The combined national population of these two subspecies is approximately 423,000 birds (based on winter indices from 1983/84 to 1987/88; Anon. 1983, Anon. 1986, Anon. 1988b), 1% of which is 4230 birds.

5.1 Middle Thelon River

This site stretches from Lookout Point to the western shore of Beverly Lake (McCormick et al. 1984). The authors estimated that 1500 Canada Geese moulted in this area in the early 1960's (based on Kuyt 1966). In 1989, we saw 3134 Canada Geese, both on and off transect, in this area, and may have missed about 772 birds in unsurveyed areas (corrected total=5468). In 1988, McCormick et al. (1990) saw 953 birds (corrected=1334). Thus the Middle Thelon can be designated as a Key Habitat Site for the maxima and moffitti subspecies.

5.2 Beverly-Aberdeen Lakes

This site includes the shoreline of Beverly Lake and the shoreline of Aberdeen Lake to 99°10'W. Based on a count of 3400 Canada Geese by Sterling and Dzubin (1967), McCormick et al. (1984) estimated that this site has supported up to 10,000 geese in some years. In 1989, we saw 1638 Canada Geese in this area (corrected=2293). In 1988, McCormick et al. (1990) saw 1524 birds (corrected=2134). However, this site also includes the Dubawnt River delta, which recieved only cursory coverage in both 1988 and 1989, and so both years are underestimates. Furthermore, in 1989, extensive ice on the lakes may have discouraged some birds from moulting in this area. Nonetheless, based on the surveys conducted to date, the Beverly-Aberdeen Lakes does not qualify as a Key Habitat Site for the maxima and moffitti subspecies.

5.3 Thelon River

There appear to be some discrete areas along the Thelon River that provide the best habitat for moulting Canada Geese (Figure 2, Table 1). However, it may be more meaningful to view the entire river from Eyeberry Lake to and including Aberdeen Lake as one continuous strip of habitat, thus one continuous site. In 1989, we saw 6829 Canada Geese, both on and off transect, in this region, plus an additional 772 in unsurveyed areas (corrected=10,641). In 1988, McCormick *et al*. (1990) saw 3665 geese (corrected=5131). Additional birds may have been in the Dubawnt River delta. This extended area qualifies as a Key Habitat Site for the *maxima* and *moffitti* subspecies of Canada Geese.

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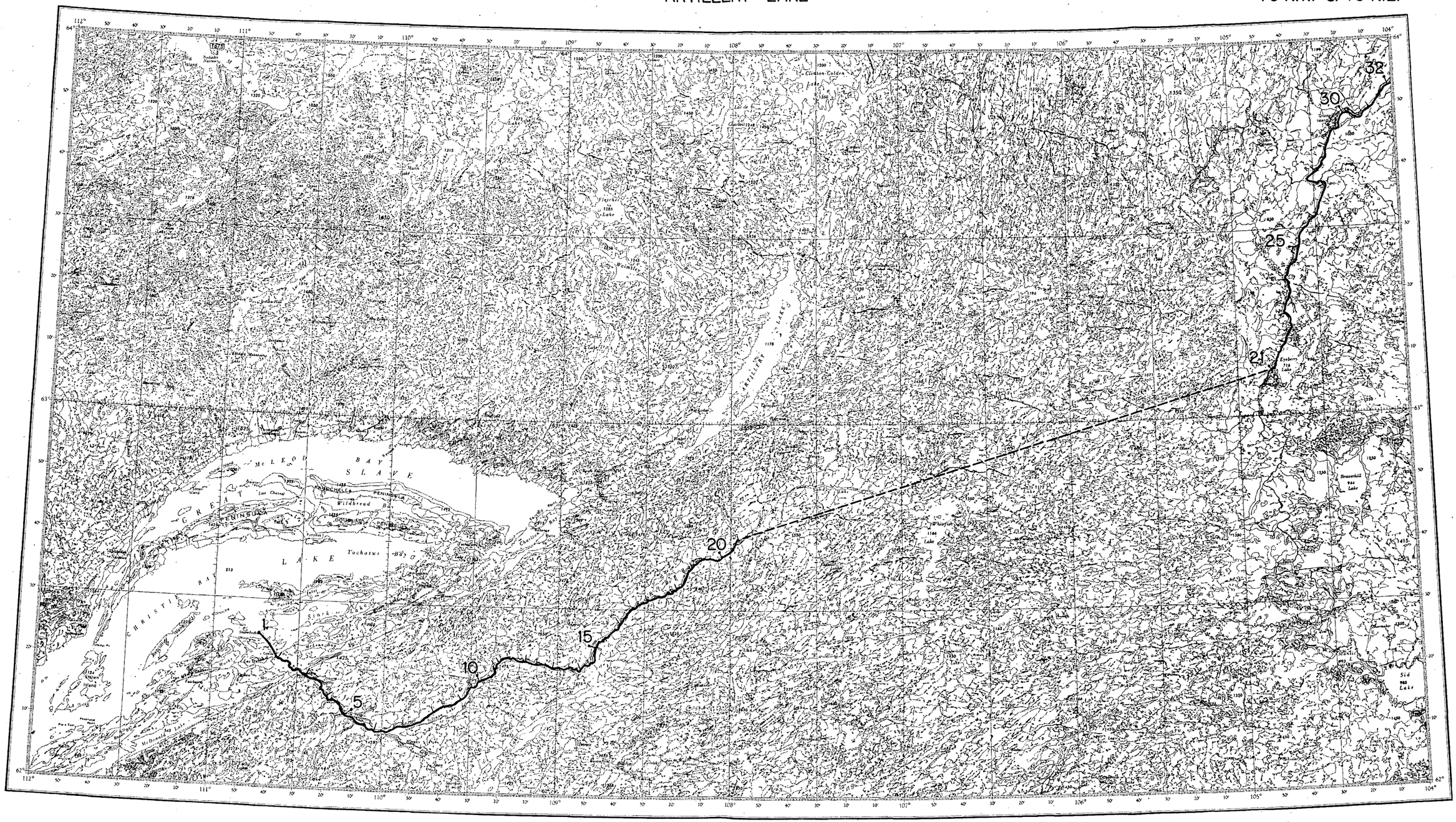
Appendix 1. Map of the route surveyed along the Snowdrift and Thelon rivers, 6-7 July 1989.

ARTILLERY LAKE

75 N.W. & 75 N.E.



0 100
Kilometres

SURVEY ROUTE

DUBAWNT LAKE

65 N.W. & 65 N.E.

33

DUBAWNT LAKE

TULEMALU LAKE

KAMILUKUAK LAKE

YATHKYED LAKE

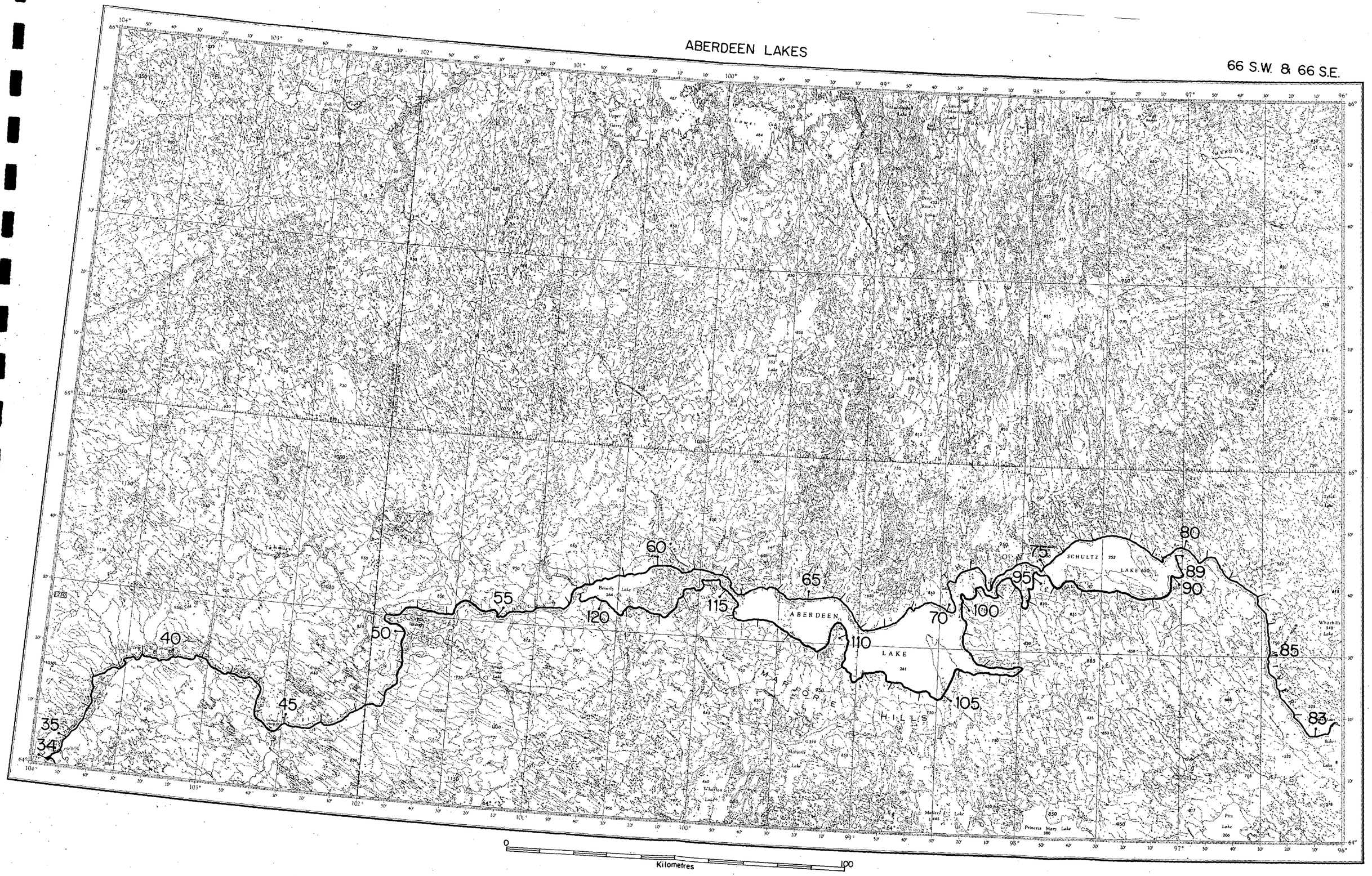
0 100

Kilometres

SURVEY ROUTE

ABERDEEN LAKES

66 S.W. & 66 S.E.



SURVEY ROUTE

Appendix 2. Birds observed along the Snowdrift and Thelon rivers during aerial surveys conducted 6-7 July 1989.

Appendix 2a. Birds observed in 10 km segments along the Snowdrift River during an aerial survey on July 6, 1989 (segment numbers as in Appendix 1).

Segment	Species															
	TUSW	GWFG	SNGO	CAGO	DABB	NOPI	DIVE	SCAU	OLDS	MERG	COME	RBME	JAEG	HEGU	BOGU	TERN	OTHR
4				40												20	
5							[a]3										
6				15							5				20		[b]1
7												1					
8											4						
9					[c]2						2						
10				30													
11											17	5					
16				10							16						
18				9							12						
19				15							3						
20				4													

a. Scoters
b. Red-necked Grebe
c. American Wigeons

Appendix 2b. Birds observed in 10 km segments along the Thelon River during an aerial survey on July 6, 1989 (segment numbers as in Appendix 1).

Segment	Species																
	TUSW	GWFG	SNGO	CAGO	DABB	NOPI	DIVE	SCAU	OLDS	MERG	COME	RBME	JAEG	HEGU	BOGU	TERN	OTHR
Eyeberry Lk to before Grassy Is																	
21				227	25							28					
22				53													
23												1				17	
24				122								5					
25				171										9		43	[a]1
26				2													
28				26	20												
Grassy Is to islands in large bend																	
29				7								6		9		43	
30	4			47													
31	2			5						20	8	1					
32	3			50						1		1					
33	1			15						2		2					
34	1							40						1			
35				102				6				11				4	
36	1	1		136							2	7					
37	1											2					
38				40						1		1					
39				5										1			
Islands in large bend to Ursus Is inclusive																	
40	1			15								3					
41				40								4				2	
42				125	6											80	
43	4			171	[b]2		16					5					
44	2			234			1			1							
45				146	3							5		2		20	
46				132						1		1				4	
47	2			71								14					[c]1
48				168								2		2		3	[d]1
49				61													
50				92		1						6				4	
51				492													
52	3			195													
Ursus Is	2	8		1034	4	30					1						

Appendix 2b. Continued.

Segment	Species															
	TUSW	GWFG	SNGO	CAGO	DABB	NOPI	DIVE	SCAU	OLDS	MERG	COME	RBME	JAEG	HEGU	BOGU	TERN	OTHR
Between Ursus Is and Beverly Lk																	
53				4													
54		4		63													
55		2		24							10	2					
56				32							1	3					
Beverly Lk N. and Thelon Islands																	
57				235										2			
58				96													
59				10													
60		2		60													
61			16	96													
62			15	191								2					
Aberdeen Lk N. to Schultz Lk																	
64		5	277	101													
65			48	25													
66			20	45													
67				70									[e]20				[c]2
68				15													
69				42													
70				4										5			
71				35										2			
73				117													
74		2		108													
Schultz Lk N. and S.																	
76				6													
77								10	6					1			
80												2		9			
82												1					
86									6								
89													[e]20				
90									7								
91													15				
93		5		55													
94				7													

Appendix 2b. Continued.

Segment	Species																
	TUSW	GWFG	SNGO	CAGO	DABB	NOPI	DIVE	SCAU	OLDS	MERG	COME	RBME	JAEG	HEGU	BOGU	TERN	OTHR
Aberdeen Lk S.																	
95				32													
96		8		26		20											
97				47													
98				2										1			
100		2															
102		11		11													
103				40								5		1			
104				31													
105		2		55												2	
106				2													
107				131	6												
108		2		33													
109		1	4	55													
110			33	173													
111		4	6	115										1			
112				80													
114			12	8													
Beverly Lk S.																	
115				30									10	21			
116			13	49													
117				4													[f]1
118				32												16	
120				130													
TOTAL	27	59	444	6511	66	51	17	56	19	26	22	125	65	69	0	238	6

a. Peregrine Falcon
b. American Wigeons
c. Red-throated Loon
d. Unidentified eagle
e. Long-tailed Jaeger
f. Sandhill Crane

Appendix 3. Mammals observed in 10 km segments along the Snowdrift and Thelon rivers during aerial surveys 6-7 July 1989 (segment numbers as in Appendix 1).

Segment	Species				
	Wolf	Grizzly Bear	Muskox	Moose	Caribou
10	6				
11	1				
23			4		
29				1	
36	1			1	
38			1		
40			3		
41		1		1	
45			1		
47			2		
48	3				
49			1		
52			11		
56			3		
57			5		
60			3		
62					1
67					5
70					2
73					25
80					3
111	1				
TOTAL	12	1	34	3	36

Appendix 4. Scientific names and four-letter codes for species or birds observed during aerial surveys of the Snowdrift and Thelon rivers.

Common Name	Code	Scientific Name
Red-throated Loon	RTLO	Gavia stellata
Tundra Swan	TUSW	Cygnus columbianus
Greater White-fronted Goose	GWFG	Anser albifrons
Lesser Snow Goose	SNGO	Anser caerulescens caerulescens
Canada Goose	CAGO	Branta canadensis
Dabbling duck	DABB	
Mallard	MALL	Anas platyrhynchos
Northern Pintail	NOPI	Anas acuta
American Widgeon	AMWI	Anas americana
Diving duck	DIVE	
Scaup sp.	SCAU	Aythya
Oldsquaw	OLDS	Clangula hyemalis
Scoter sp.	SCOT	Melanitta
Merganser sp.	MERG	Mergus
Red-breasted Merganser	RBME	Mergus serrator
Common Merganser	COME	Mergus merganser
Bald Eagle	EAGL	Haliaeetus leucocephalus
Golden Eagle	EAGL	Aquila chrysaetos
Sandhill Crane	SACR	Grus canadensis
Long-tailed Jaeger	LTJA	Stercorarius longicaudus
Herring Gull	HEGU	Larus argentatus
Bonaparte's Gull	BOGU	Larus philadelphia
Arctic Tern	TERN	Sterna paradisaea