Beverly and Kaminuriak
Caribou Monitoring and Land Use
Controls 1979

William R. Darby
N.W.T. Wildlife Service
Yellowknife, N.W.T.
1980

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ABSTRACT

In 1979, the Department of Indian Affairs and Northern Development (DIAND) implemented a revised system of land use controls to protect the Beverly and Kaminuriak populations of barren-ground caribou (Rangifer tarandus groenlandicus) during calving, post-calving and other sensitive periods. The zones and conditions were more flexible than those used in 1978. However, an interim injunction, dated 24 April 1978, required the Crown to specify special permit conditions when issuing land use permits and mineral exploration permits in the Baker Lake area, Northwest Territories. A monitoring program conducted by the N.W.T. Wildlife Service from April to September 1979 recorded caribou movements, advised DIAND land use personnel on caribou-related matters, and evaluated the effectiveness of 1979 controls. Caribou distribution and movements were recorded during aerial reconnaissance and systematic surveys. Beverly caribou were late migrating northward, and their distribution became elongated in late May. Most calving occurred near Sand Lake in the northern portion of the area under land use restrictions, but some cows calved to the west in the Thelon Game Sanctuary. During July, most Beverly cows and calves moved through the Thelon Game Sanctuary west of the area of land use restrictions. Kaminuriak cows occupied the traditional calving and post-calving areas during the period of land use restrictions. The land use zones for Beverly and Kaminuriak caribou are considered to be correctly located. Some Beverly cows calved west of the pertinent zone, but this seemed to be a result both of late migration and the fact that all cows were headed for the northern portion of their traditional calving ground. With some exceptions, land use conditions associated with the zones are appropriate. Recommendations for controls and monitoring are given.

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INTRODUCTION

The effect of mineral exploration and industrial development on barren-ground caribou (Rangifer tarandus groenlandicus) near Baker Lake, Northwest Territories, has continued to be a major issue in 1979. Since 24 April 1978, an interim injunction pertaining to the "Baker Lake Area" (Figure 1) required DIAND, the Department of Indian Affairs and Northern Development, as administrators responsible for land use, to specify permit conditions restricting land use activities.[1] The conditions, based mainly upon recommendations in Interdisciplinary Systems Ltd.'s (1978) report, are intended to protect the Beverly and Kaminuriak caribou herds from disturbance by mineral exploration activities. The conditions prohibited activity associated with new land use permits in (Figure 1);

a) the "Calving Areas" between 15 May and 30 June;

b) the "Post-calving Areas" from 1 to 31 July, and;

c) within 4.8 km of any "Major Crossing Site" year round.

In 1978, DIAND imposed land use conditions in the injunction area and in the surrounding parts of the Beverly and Kaminuriak caribou ranges. A program to monitor caribou movements and evaluate the existing controls was conducted by Darby (1978).

In 1979, DIAND modified their existing system of land use zones and permit conditions for the Beverly and Kaminuriak caribou ranges, subject to terms of the interim injunction. The zones are shown on the "Caribou

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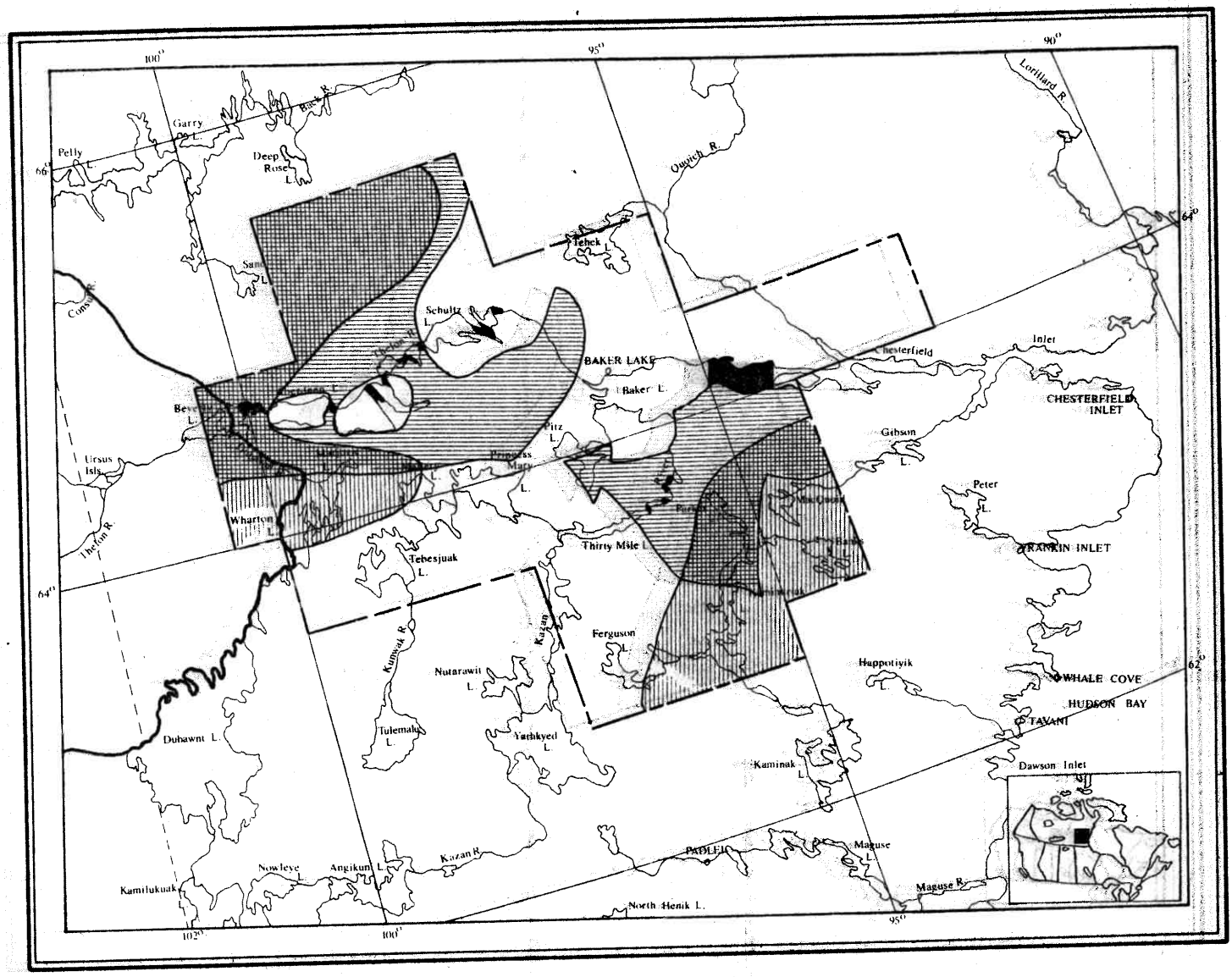
[1] A federal court decision, released on 15 November 1979, withdrew the interim injunction on 17 December 1979.



Legend

- Boundary of the Baker Lake Study Area
- Calving Area
- Post-Calving Area
- Water Crossing
- Boundary of the Thelon Game Sanctuary

Figure 1. The Baker Lake Area showing calving and post-calving areas and water crossings identified by Interdisciplinary Systems Ltd.

Protection Map 1979" (Figure 2). Area "A" is a traditional calving and post-calving area. Area "B" is a potential calving and post-calving area. The permit conditions were:

a) The Permittee shall not conduct any activity between 15 May and 31 July within Caribou Protection Area "A". The Permittee may commence or resume activities prior to 31 July within those parts of Area "A" released by the Land Use Inspector (on the advice of a wildlife biologist of the N.W.T. Wildlife Service) if caribou cows are not expected to use those parts for calving or post-calving.

b) Permit operations within any part of Caribou Protection Area "B" will be suspended by the Land Use Inspector between 15 May and 31 July if (on the advice of a wildlife biologist of the N.W.T. Wildlife Service) caribou cows are using that part for calving or post-calving.

c) During spring migration between 20 April and 15 May, the Permittee shall not conduct any operations which block or cause significant diversion to the migration.

d) In the event that caribou cows calve along the route of spring migration, permit operations within the area used for calving will be suspended by the Land Use Inspector between 15 May and 30 June.

e) The Permittee shall not conduct any activity at any time of the year within 4.8 kilometers of any major water crossing as designated by the "Caribou Protection Map 1979".

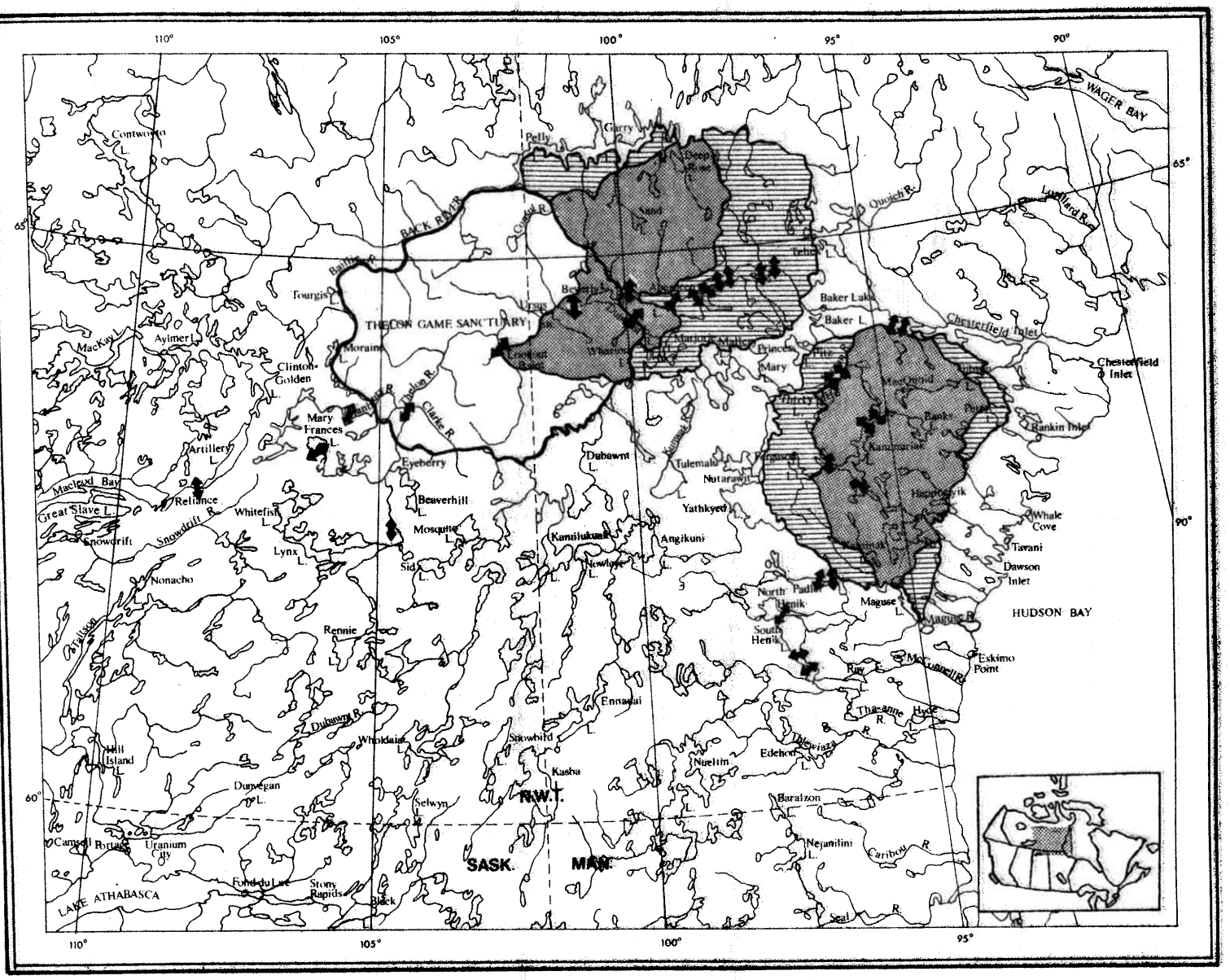


Figure 2. The 1979 Caribou Protection Map (Department of Indian Affairs and Northern Development).

Recommended flight restrictions were not listed in the Land Use Permit conditions but were made known to pilots by a Ministry of Transport Information Circular.

From April to September 1979, a monitoring program was conducted by the N.W.T. Wildlife Service. The objectives of the program were:

a) to monitor and record the distribution and activities of the Beverly and Kaminuriak caribou herds during spring migration, the calving period and post-calving period (through approximately 31 August);

b) to determine caribou and native peoples' past and present use of water crossing sites;

c) to observe the behavioural response of caribou to human activities, including activities related to mining exploration, where encountered during monitoring surveys, and;

d) to advise DIAND Land Use personnel on matters related to land use activities.

This report presents the results of the 1979 caribou monitoring program and evaluates this year's land use conditions and the effectiveness of the "Caribou Protection Map 1979" (Figure 2). Recommendations for subsequent changes to existing land use controls and monitoring are made.

THE STUDY AREA

The study area (about 600,000 km^2) extended from Hudson Bay west to Great Slave Lake and from 59°N to the Back River (Figure 3). The summer ranges of the Beverly and Kaminuriak caribou herds approximate the tundra portion of the study area. The climate and vegetation of the study area are described by Parker (1972) and Kelsall (1968).

MATERIALS AND METHODS

Aerial Survey

The N.W.T. Wildlife Service, DIAND and the Manitoba Department of Mines, Natural Resources and Environment monitored the movements of the Beverly and Kaminuriak caribou herds from April to September 1979 (Table 1). Each herd was surveyed once in April, and from May to September surveys were conducted every 2 to 3 weeks. Nine surveys were conducted in association with the 1979 Caribou Monitoring Program and were the coordinated efforts of N.W.T. Wildlife Service personnel in Yellowknife, Baker Lake and Rankin Inlet, and of DIAND personnel in Baker Lake and Rankin Inlet. In addition, R. Decker, N.W.T. Wildlife Service, conducted four surveys of the Beverly herd for the Arctic Land Use Research (ALUR) wildlife mapping project, and S. Kearney, of the Manitoba Department of Mines, Natural Resources and Environment, flew one survey flight in the southeastern Keewatin.

The monitoring program concentrated on describing cow and calf movements. The distribution of other caribou was investigated only as time and circumstance permitted. Portions of areas "A" and "B" were also surveyed

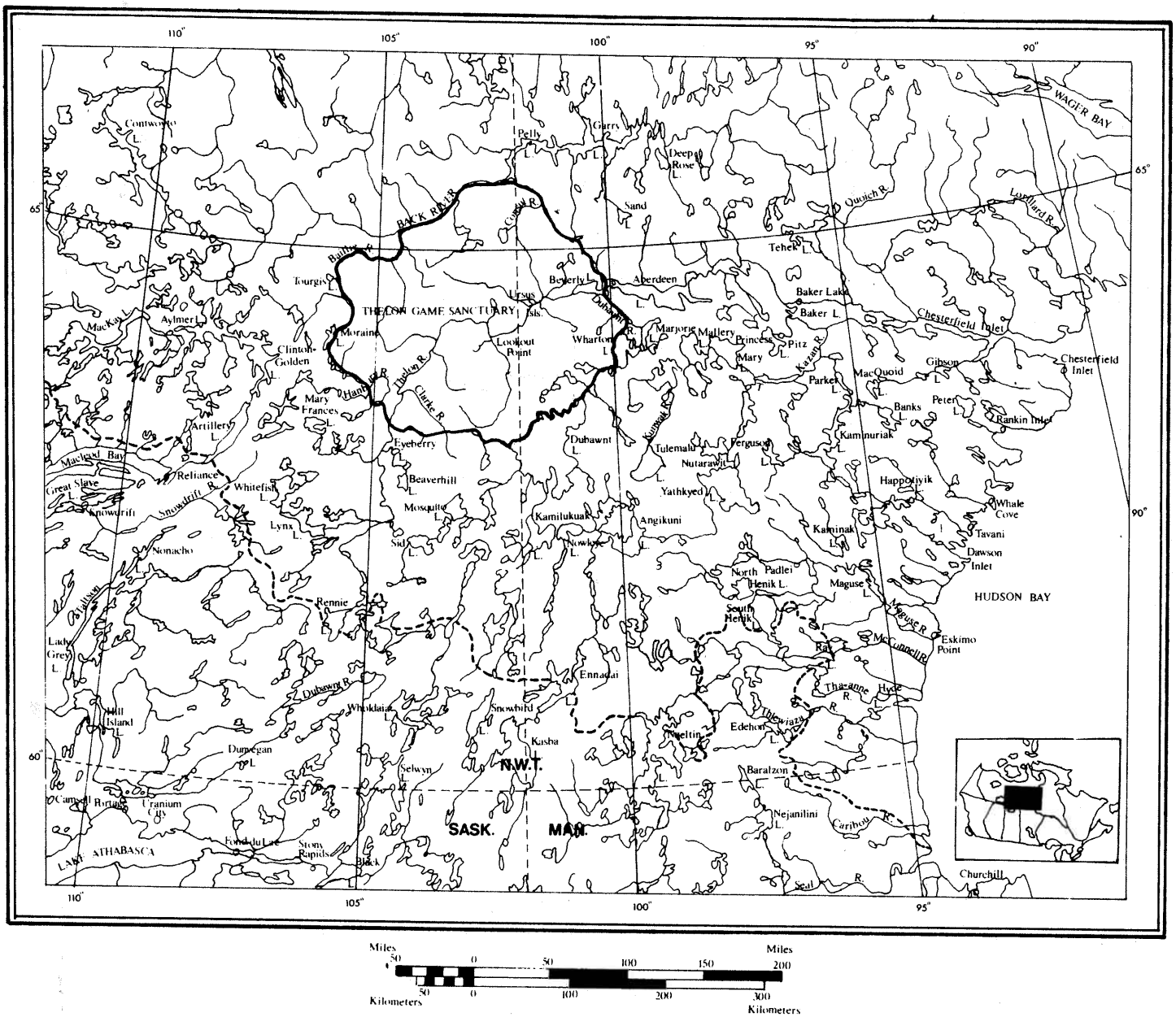


Figure 3. The study area of the 1979 N.W.T. Wildlife Service caribou monitoring program.

Table 1. Hours and distance in monitoring the Beverly and Kaminuriak caribou herds, April to September 1979.

Program	Beverly		Kaminuriak		Total	
	Distance flown (km)	Hours	Distance flown (km)	Hours	Distance flown (km)	Hours
Arctic Land Use Research	9,400	42	1,740	10	11,140	52
Manitoba Dept. of Mines, Natural Resources and Environment			1,040	8	1,040	8
1979 Caribou Monitoring Program	35,110	204	23,980	182	59,090	386
Total	44,510	246	26,760	200	71,270	446

in the second half of July when few caribou were expected to be present. This was done to consider release of parts of area "A" and to confirm suspected low densities of caribou. The aircraft types most commonly used were Cessna 337, DeHavilland DHC-2 Beaver and Bell 206 helicopter.

Most monitoring flights were conducted at 300 m above ground level (agl) to avoid disturbing caribou. Sometimes it was necessary to fly at 150 m agl to observe caribou when dark summer pelage made them difficult to see, or to determine the age/sex class of caribou. Non-systematic reconnaissance surveys were flown to investigate areas of suspected caribou activity, or to conduct site-specific monitoring. Systematic reconnaissance surveys were flown along transects at 20 km intervals to search for caribou.

When caribou were seen, a series of transects was flown over groups at 10, 16, or 20 km intervals, depending on their density. Transects were flown beyond the area of caribou distribution to verify the boundaries. All systematic transect surveys were flown at either 150 or 300 m agl at 160 to 225 km/h. Two pieces of black tape were placed on each wing strut to delineate the transect width. Each of two observers watched a strip 0.5 km or 1 km wide on either side of the aircraft, depending on survey altitude. The observers recorded on a tape recorder the number of caribou 1 year of age or older and whether they were on or off transect. These caribou were classified as cows, bulls, others or unknown. The number or estimated percentage of calves in the group was also recorded. Different observers were often used, some of whom had no special training in aerial survey procedure. Each sighting was plotted on a 1:250,000 scale map by the navigator or pilot. Tape-recorded data were transcribed to transect coding forms and transect data summary forms (Appendix I).

The data were not used to calculate density estimates directly, but to delineate the boundaries of high and low density distributions and to calculate the percentage of caribou in each area. During June, when cows and calves had not yet mixed with other members of the herd, these percentages were applied to current population estimates for caribou on the calving grounds to estimate density figures. Calving ground census data were provided by the N.W.T. Wildlife Service (D. Heard pers. comm.). Where recorded data were used directly to calculate density estimates, survey altitude did not exceed 150 m agl, and a correction factor was used on the assumption that 20% of the caribou on transect were missed (Parker 1972, Thomas 1969). During July, systematic surveys were still used, but dense post-calving aggregations were estimated visually from 300 m agl. Some aggregations were photographed with a 35 mm camera, to check visual estimates.

Flight report forms (Appendix I) and 1:1,000,000 scale maps showing flight lines and caribou locations and movements were made available to DIAND officials. Original flight report forms and maps are on file with the N.W.T. Wildlife Service, Yellowknife, N.W.T.

Community Involvement

A public meeting was held on 10 July 1979 with the Baker Lake Hunters' and Trappers' Association (HTA) and the community of Baker Lake to explain the 1979 land use controls and the purpose of the caribou monitoring program and to discuss caribou movements. Two meetings were also held with local HTA members on 3 and 12 July 1979 to discuss these topics and proposed monitoring at water crossings. The caribou monitoring program was conducted from the

N.W.T. Wildlife Service office in Baker Lake and several Inuit residents were employed as field assistants.

Water Crossings

A number of major water crossings were designated on the Caribou Protection Map 1979 (Figure 2). Observations concerning crossing activity in 1979 at nine locations were made during aerial surveys and from interviews with canoeists and Inuit hunters. In addition, pairs of Inuit assistants monitored caribou activity at two designated water crossings. From 26 July to 10 August and 22 to 29 August 1979, James Ikinilik and Alec Iqaqat recorded caribou activity near the central water crossing in Aberdeen Lake (Figure 2). From 13 to 29 July 1979, Samson Arnauyok and Barnabas Kudja'aq monitored caribou activity at the designated water crossing downstream from Kazan Falls on the lower Kazan River (Figure 2). Edwin Evo and Barnabas Kalluk watched that area from 21 to 31 August 1979. The monitors recorded the number, sex and age of caribou, their direction of travel, any disturbance to the caribou, and whether or not they crossed the river.

The pattern of caribou trails at the central crossing at Aberdeen Lake was mapped from a helicopter on 1 September 1979. The direction and pattern of trails were recorded on a 1:250,000 scale map. The effect of vegetation and substrate type on trail establishment was considered in evaluating the trail pattern. Previous records of caribou activity at the crossing were summarized from the caribou literature.

Caribou and Land Use Interactions

Caribou and human activity interactions in 1979 were documented mainly from second-hand records. The behavioural response forms describing interactions are filed with the N.W.T. Wildlife Service, Yellowknife, N.W.T.

RESULTS AND DISCUSSION

Movements of the Beverly Caribou Herd 1979

The herd was distributed in a large crescent from Kasba Lake west to Lady Grey Lake and northwest to Great Slave Lake from 4-8 May (Figure 4). Most Beverly caribou were located south and southeast of the Thoa River. Only a small portion of the herd was located east and northeast of the East Arm of Great Slave Lake, an area also used by approximately 15,000 to 30,000 caribou of the Bathurst herd (R. Decker, pers. comm.).

Beverly caribou did not migrate through the area between Smalltree and Ivanhoe Lakes until approximately 10 May. In 1978, most Beverly cows occupied that area on 25 March (Darby 1978). Kelsall (1968) suggested that cows normally reach treeline (Rennie Lake area) during the first week of May. In 1979, Beverly cows probably reached the area east of Rennie Lake about 11 or 12 May. The delay in starting migration may be partly due to the freezing temperatures which prevailed until 8 May. The average date (1953 - 1976) for onset of thawing temperatures is 24 April (Appendix III).

Most Beverly cows migrated through the area of Beaverhill and Eyeberry Lakes from 22 to 24 May (Figure 4). The Bathurst caribou west of Artillery Lake were also moving northward at this time. Small groups of Beverly

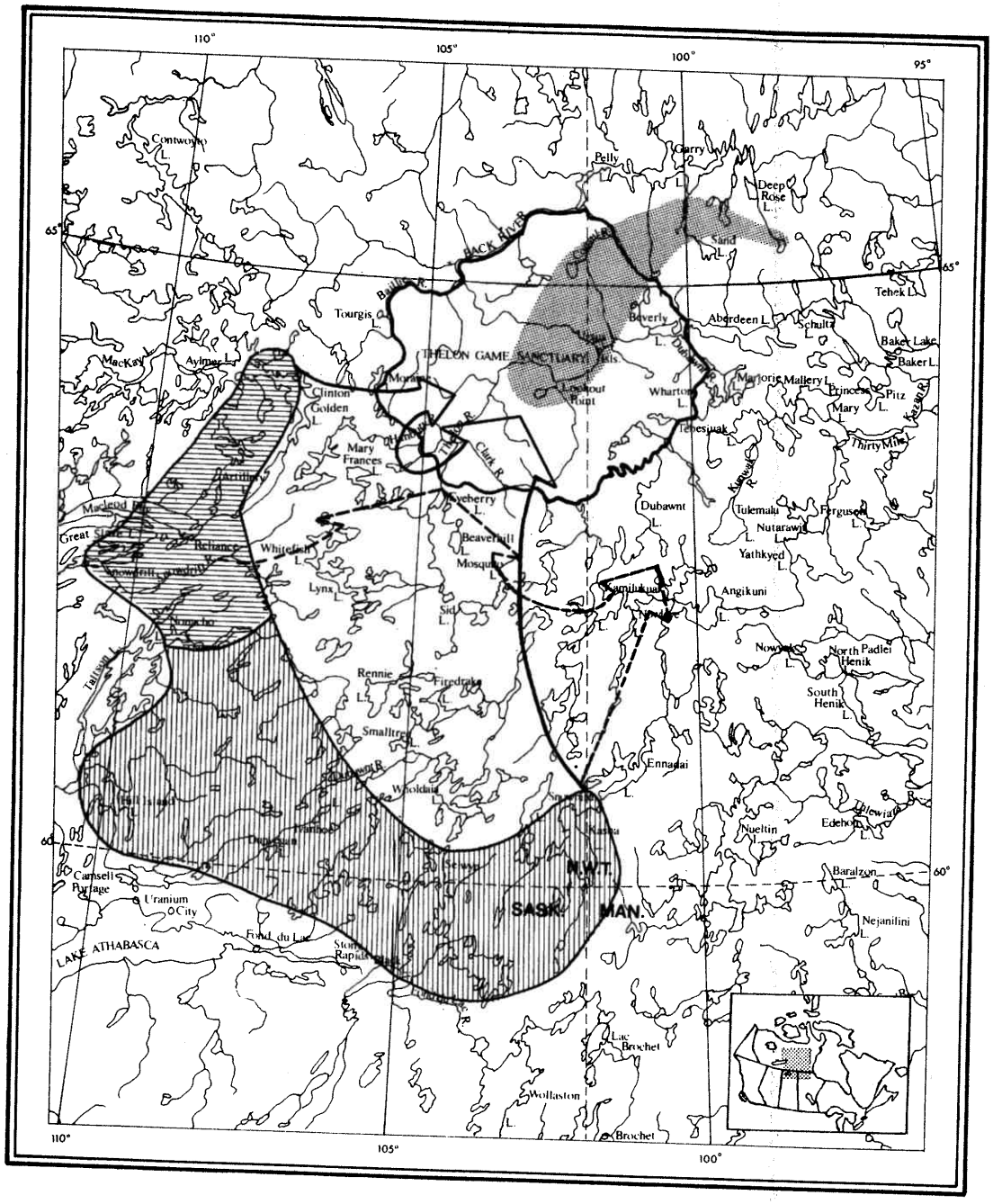


Figure 4. The late winter distribution, spring migration routes and calving distribution of Beverly caribou for 1979.

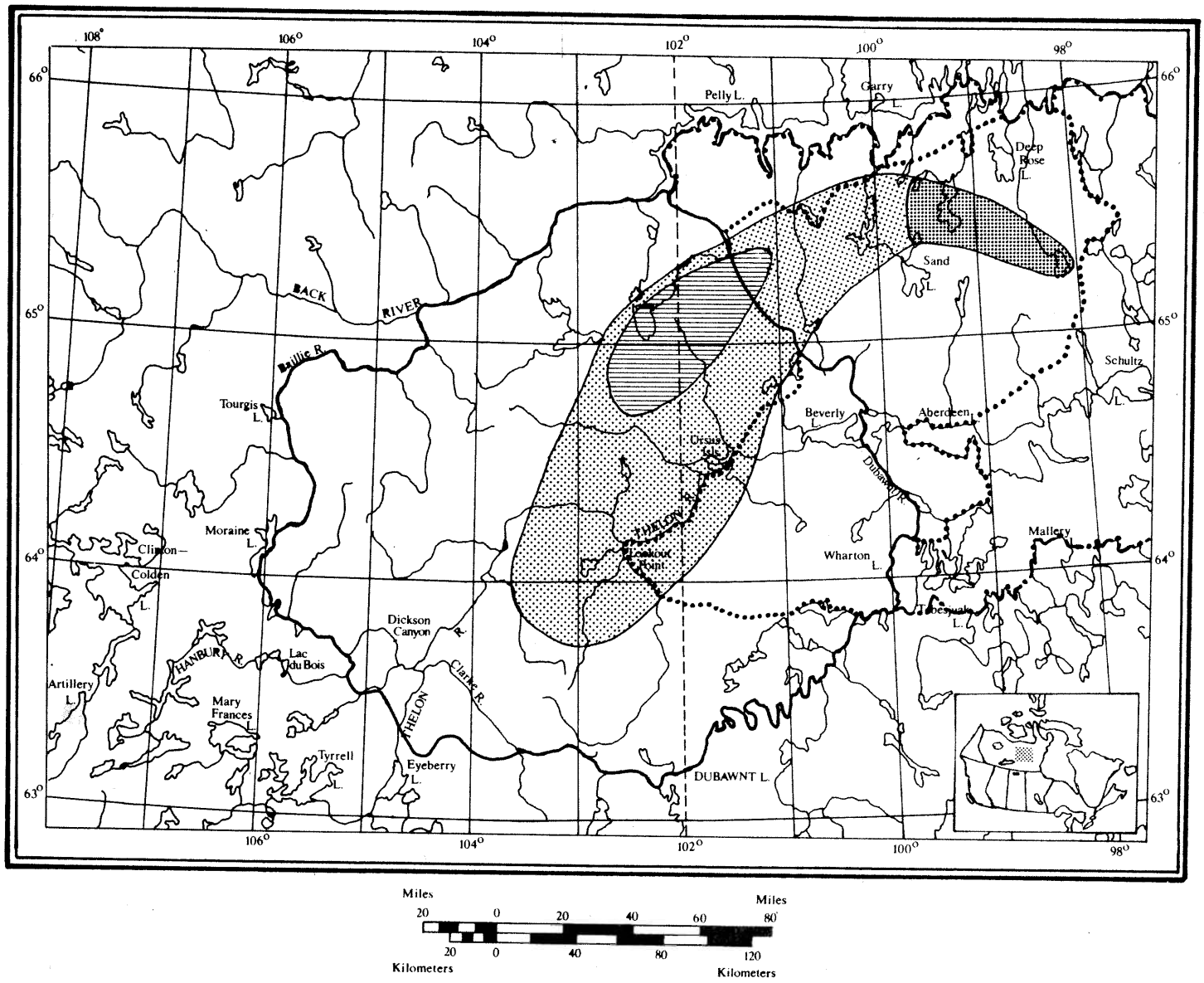
animals mixed with Bathurst caribou apparently left the Bathurst movement and headed eastward through the Hanbury River area.

In 1978, most Beverly cows traversed the area of Beaverhill and Eyeberry Lakes on approximately 1 May (Darby 1978). Thomas (1969) recorded Beverly cows moving through that area on 13 May in 1967.

Thus, the migrating cows were late moving northward, and were distributed over a long area. However, all cows travelled quickly after passing Eyeberry Lake. Daily rates of movement were calculated from the number of days taken for caribou to travel a recorded distance. From 24 May to 9 June, the vanguard travelled an average of 22 km/day, and the tail of the cow migration progressed at an average of 15 km/day. These figures compare to an average of 16 km/day for Beverly cows in 1978 (Darby 1978).

All cows headed for the northern portion of area "A" rather than the portion south of Beverly Lake. This further reduced the chances of all cows reaching the calving ground before giving birth. Most cows crossed the Thelon River at or near Lookout Point between 24 May and 9 June. Cows that crossed in early June encountered broken ice and some open water.

Caribou were calving when surveyed from 4 to 9 June, but many cows had not reached the calving ground. Although most cows were located northeast of Sand Lake within area "A", approximately half the calving distribution was located further southwest within the Thelon Game Sanctuary (Figure 5). Estimated average densities for high, moderate, and low density areas were 32.1, 4.0 and 0.7 caribou 1 year of age or older/km^2 respectively. These figures are based on the 1978 census estimate of 65,600 caribou 1 year of age or older on the calving ground (D. Heard, pers. comm.); the census estimate incorporates a correction factor for caribou on transect that were missed (52,000 x 1.25). The area of the calving distribution in 1979 was approximately 16,000 km^2.



Legend

- High density
- Moderate density
- Low density
- ..... Boundary of Area A, 1979 Caribou Protection Map.
- -·-·-·-·- Boundary of Area B, 1979 Caribou Protection Map.
- ——— Boundary of the Thelon Game Sanctuary.

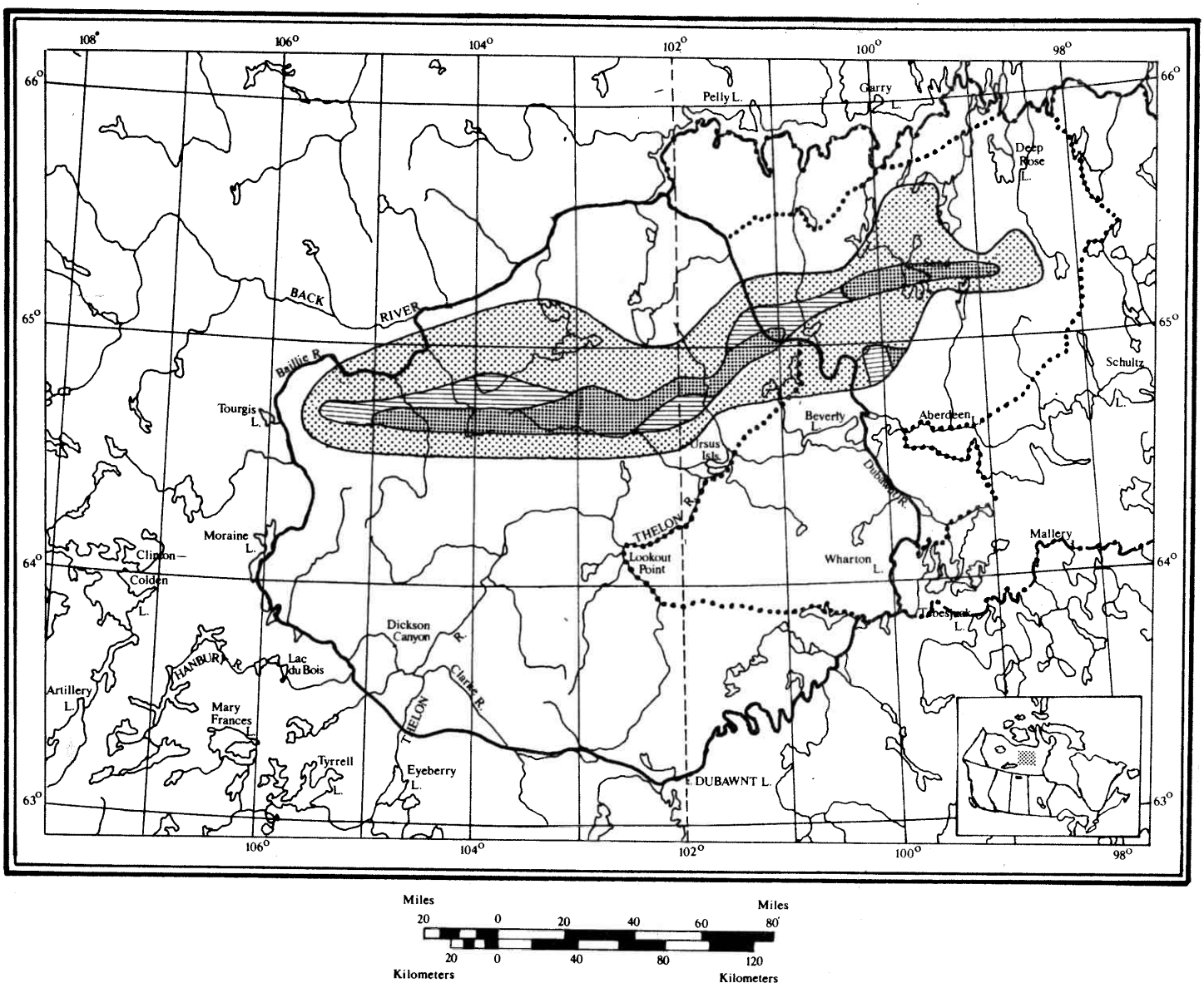
Figure 5. The distribution of Beverly cows during calving from 4 to 9 June 1979.

Snow cover on the calving ground near Sand Lake was estimated to be 80 to 100% in the first week of June. By 25 June it was less than 5%. Daily temperatures recorded for May and June at Baker Lake show that thawing conditions prevailed from 18 May, about 5 days earlier than normal (Appendix III). In 1978, thawing conditions did not become prevalent until 12 June (Darby 1978).

Spring migration of bulls and non-breeding caribou was along similar routes to those used in 1978 (Figure 4). Most bulls and non-breeders followed the general path of cow migration, but over a wider front, while some travelled northeast through the area of Kamilukuak and Nowleye Lakes.

After 9 June, the eastern limit of the cow distribution was further to the west. From 25 to 29 June 1979, many cows and calves were still within area "A", but most had moved in a westerly direction (Figure 6). Cows that calved in the centre of the Thelon Game Sanctuary moved north and west and by 29 June, the lead animals had reached the Baillie River. Large post-calving aggregations were common at this time. Estimated average density figures for high, moderate and low density areas were 35.5, 1.6 and 0.2 caribou over 1 year of age/km^2 respectively.

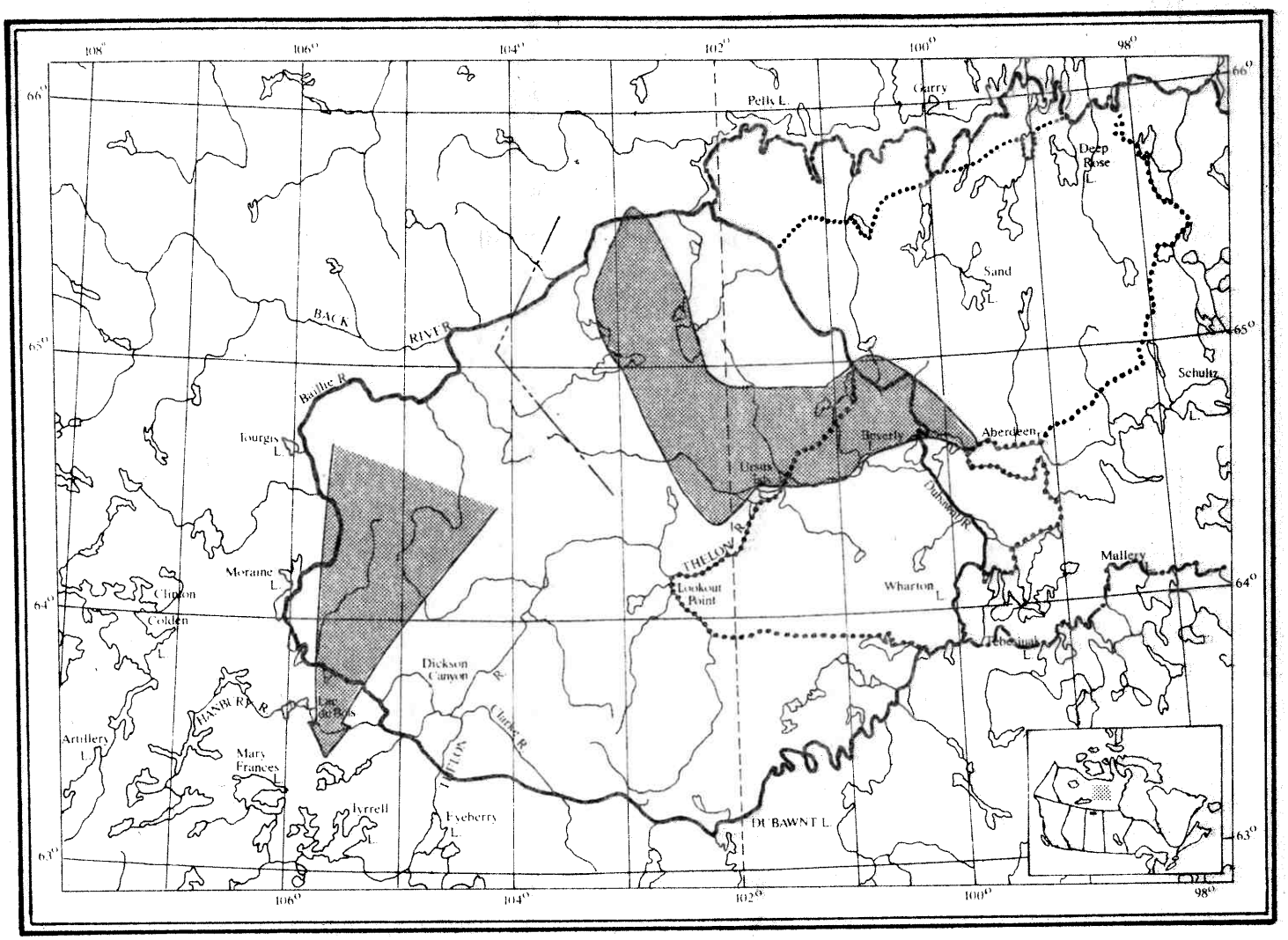
By late July, the cows and calves had been joined by some bulls and non-breeders. Caribou east of 103°30'W dispersed between the Back and Thelon Rivers into scattered groups of 1 to 800 caribou, mostly cows and calves (Figure 7). Several thousand caribou were north of Beverly Lake, but a few groups remained northeast of the Thelon Game Sanctuary. Caribou west of 103°30'W presumably travelled south - southwest after being surveyed in late June, because on 24 July, six canoeists saw large numbers of caribou, mostly cows and calves, crossing the Hanbury River east of Lac du Bois heading west and south (J. Dunn, pers. comm.).



Legend

- High density
- Moderate density
- Low density
- Boundary of Area A, 1979 Caribou Protection Map.
- Boundary of Area B, 1979 Caribou Protection Map.
- Boundary of the Thelon Game Sanctuary.

Figure 6. The distribution of Beverly cows and calves from 25 to 29 June 1979.



Legend

- Scattered groups of 1 to 800 caribou, mostly cows and calves.
- Estimated movement of many cows and calves, 29 June to 24 July 1979.
- Western limit of aerial survey, 21 to 28 July 1979.
- Boundary of Area A, 1979 Caribou Protection Map.
- Boundary of Area B, 1979 Caribou Protection Map.
- Boundary of the Thelon Game Sanctuary.

Figure 7. The distribution of Beverly cows and calves from 21 to 28 July 1979.

From results of survey flights on 21, 22 and 23 July, the District Manager, DIAND, Rankin Inlet, was advised that the part of the area "A" northeast of the Thelon Game Sanctuary and north and west of the injunction area could be opened to land use activities as of 24 July 1979, 1 week before the stipulated opening.

Most caribou northwest of Beverly Lake continued to disperse in August and moved slowly to the southwest. By the end of August they were still scattered between the Back and Clarke Rivers, but more than 10,000 were located southwest of Ursus Islands along the Thelon River (Figure 8). Estimated average density for high and low density areas was 4.8 and 1.2 caribou over 1 year of age/km^2 respectively. In contrast to the southwesterly movement of most caribou in the Beverly Lake area in August, some cows and calves (500 to 4,000) moved east along the northern shore of Aberdeen Lake from 27 July to 9 August. Their subsequent movements were not followed.

Movements of the Kaminuriak Caribou Herd 1979

Most of the herd was distributed along the Hudson Bay coast from Whale Cove south to the Manitoba border and as far as 145 km inland from 5 to 12 April 1979 (Figure 9). The cows migrated north through the area of Maguse Lake and northwest from Dawson Inlet during May, and reached area "A" before calving. By 21 to 26 May, they occupied the area around Kaminuriak and Kaminak Lakes (Figure 9).

The calving distribution of Kaminuriak cows from 5 to 10 June 1979 encompassed approximately 6,500 km^2 (Figure 10). Most cows calved in the area of Kaminuriak Lake as far south as Kaminak Lake. The estimated average

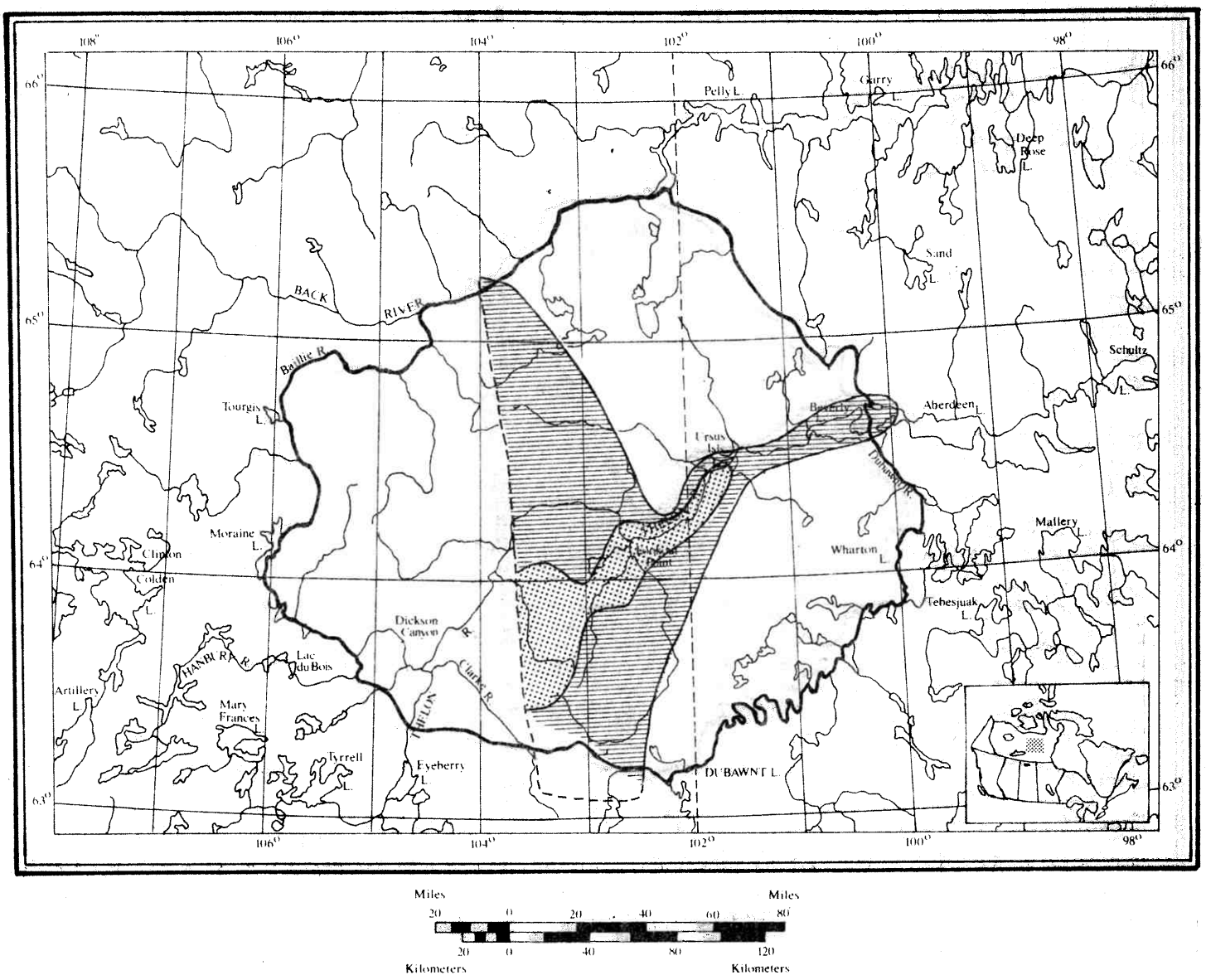


Figure 8. Northeastern portion of the distribution of Beverly caribou from 25 August to 2 September 1979.

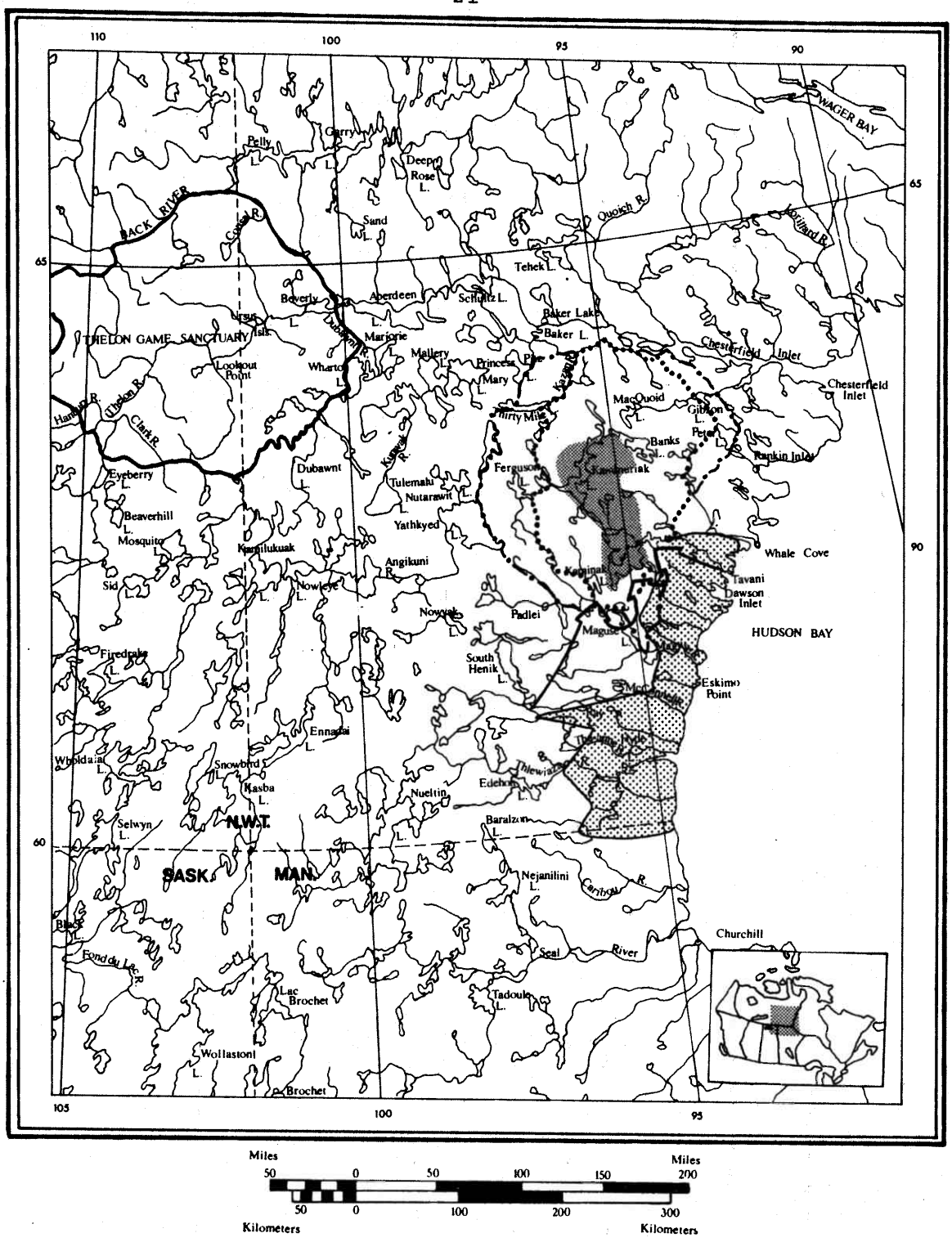
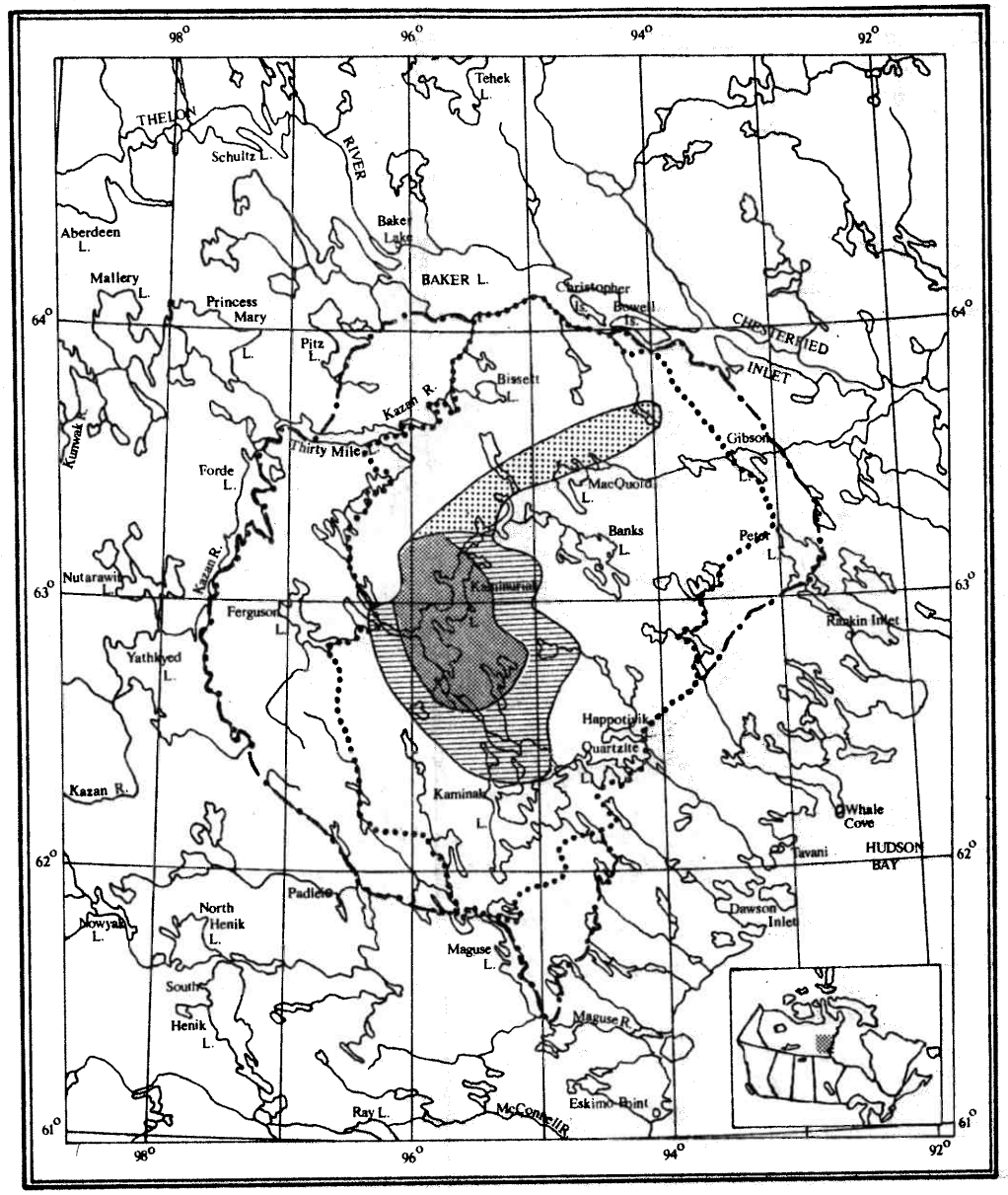


Figure 9. The late winter distribution of Kaminuriak caribou, and the spring migration routes and pre-calving distribution of Kaminuriak cows for 1979.



Legend

- High density of cows.
- Moderate density of cows.
- Low density of cows.
- ..... Boundary of Area A, 1979 Caribou Protection Map.
- —·—·— Boundary of Area B, 1979 Caribou Protection Map.

Figure 10. The distribution of Kaminuriak cows and calves during calving from 5 to 10 June 1979.

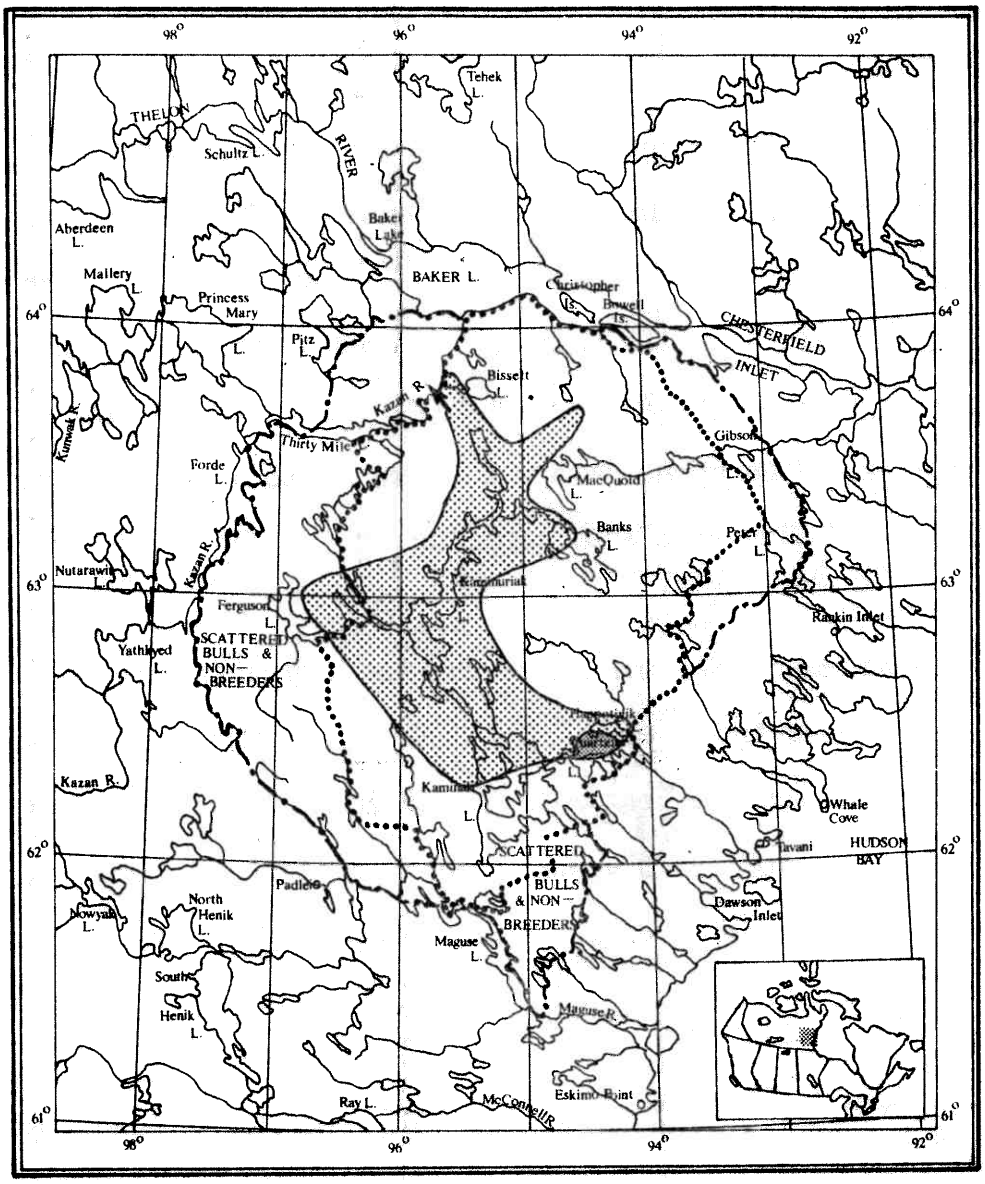
density figures for high, moderate and low density areas were 8.3, 0.8 and 0.2 caribou 1 year of age or older/km^2 respectively. These figures are based on the 1977 census estimate of 20,600 caribou 1 year of age or older present on the calving ground (Heard In Prep.); the census estimate incorporates a correction factor for caribou on transect that were missed (16,500 x 1.25).

Snow cover on the calving ground was estimated to be 5 to 10% from 5 to 10 June, except on 8 June when snow cover varied from 25% to 100% because of a snowfall.

After calving, many cows and calves did not aggregate into large groups but remained dispersed in the area from Parker Lake south to Kaminak Lake, and from Banks Lake west to Ferguson Lake (Figure 11). Group size ranged from 1 to 600 cows with undetermined numbers of calves. However, larger aggregations were seen in a small area between Happotiyik and Quartzite Lakes: approximately 6,800 cows with undetermined numbers of calves were aggregated into seven groups.

During late June, bulls and non-breeding caribou were scattered in the area south and west of the cow-calf distribution. Some apparently travelled northeast through the area east of Forde Lake as they did in 1978 (Darby 1978) because on 8 July 1979, Joe Neigo (pers. comm.), of Baker Lake, observed an estimated 6,000 bulls and non-breeding caribou crossing Kazan River near Kazan Falls heading northwest (Figure 11).

During July, many cows and calves dispersed into parts of their range surrrounding area "A", and most began to mix with other animals in the herd. Aerial survey flights in late July were inconclusive in determining the distribution of all Kaminuriak cows and calves. Some scattered groups were known to occupy the area north and south of Ferguson Lake, the area south and southeast of Banks Lake, and the area east of Ray Lake along the McConnell



Legend

Scattered groups of 1 to 600 cows with undetermined numbers of calves.

Distribution of approximately 6,800 cows with undetermined numbers of calves.

Boundary of Area A, 1979 Caribou Protection Map.

Boundary of Area B, 1979 Caribou Protection Map.

Reported crossing of approximately 6,000 bulls and non-breeders, 8 July 1979.

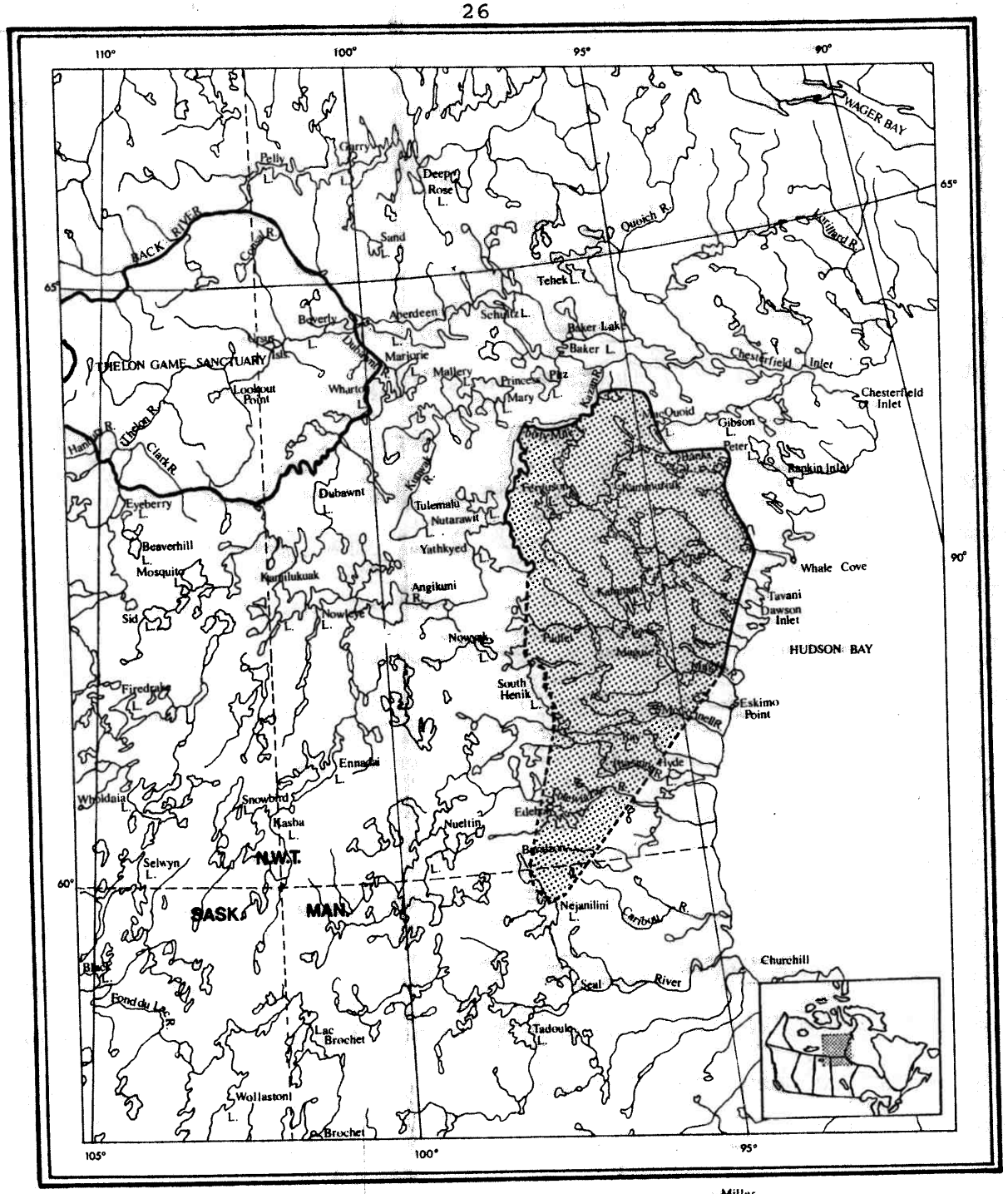
Figure 11. The distribution of Kaminuriak cows and calves from 30 June to 2 July 1979.

River. The trail of a large aggregation of cows and calves was followed from Ferguson River to Maguse River, approximately 20 km from the Hudson Bay coast. These caribou were heading south - southwest and passed through the area from approximately 15 to 22 July. They may have been the same animals sighted south of Happotiyik Lake on 2 July, but the trail was not back-tracked to verify this. South of Maguse River, the trail became difficult to follow by aircraft. In general, Kaminuriak caribou were probably scattered throughout the area from Baker Lake to the Manitoba border, but survey altitude (300 m agl) was too high to readily observe scattered caribou in summer pelage. Groups of caribou observed were small, comprised of one to 350 caribou of mixed age and sex. Consequently, no portion of Kaminuriak area "A" was recommended for release before the designated date of 31 July.

Survey flights from 13 to 31 August 1979 were flown at 240 m agl and were more successful than those conducted during late July. In late August, all Kaminuriak caribou were dispersed over a large area from Baker Lake south to Nejanilini Lake, Manitoba, and from the Hudson Bay coast west to Yathkyed and Henik Lakes (Figure 12). The scattered groups observed were comprised of one to 300 caribou of mixed age and sex.

Water Crossings of the Beverly Herd 1979

Some Beverly cows crossed open parts of the Thelon River at or near Lookout Point during spring migration. In addition, reports of caribou crossing the Hanbury and Thelon rivers during July and August were obtained from canoeists and an assistant working on the monitoring program. Large numbers of caribou crossed the Hanbury River east of Lac du Bois on 24 July



Legend

——— Limit of distribution.

– – – – – – – – Estimated limit of distribution.

——— Boundary of the Thelon Game Sanctuary.

Figure 12. The distribution of Kaminuriak caribou from 13 to 31 August 1979.

(J. Dunn, pers. comm.). Several crossings of smaller numbers of caribou (perhaps as many as 3,000) were reported for various locations along the Thelon River from Lookout Point to Beverly Lake during the period 25 July to 6 August (Appendix II). In most cases caribou were travelling south.

The Central Aberdeen Crossing

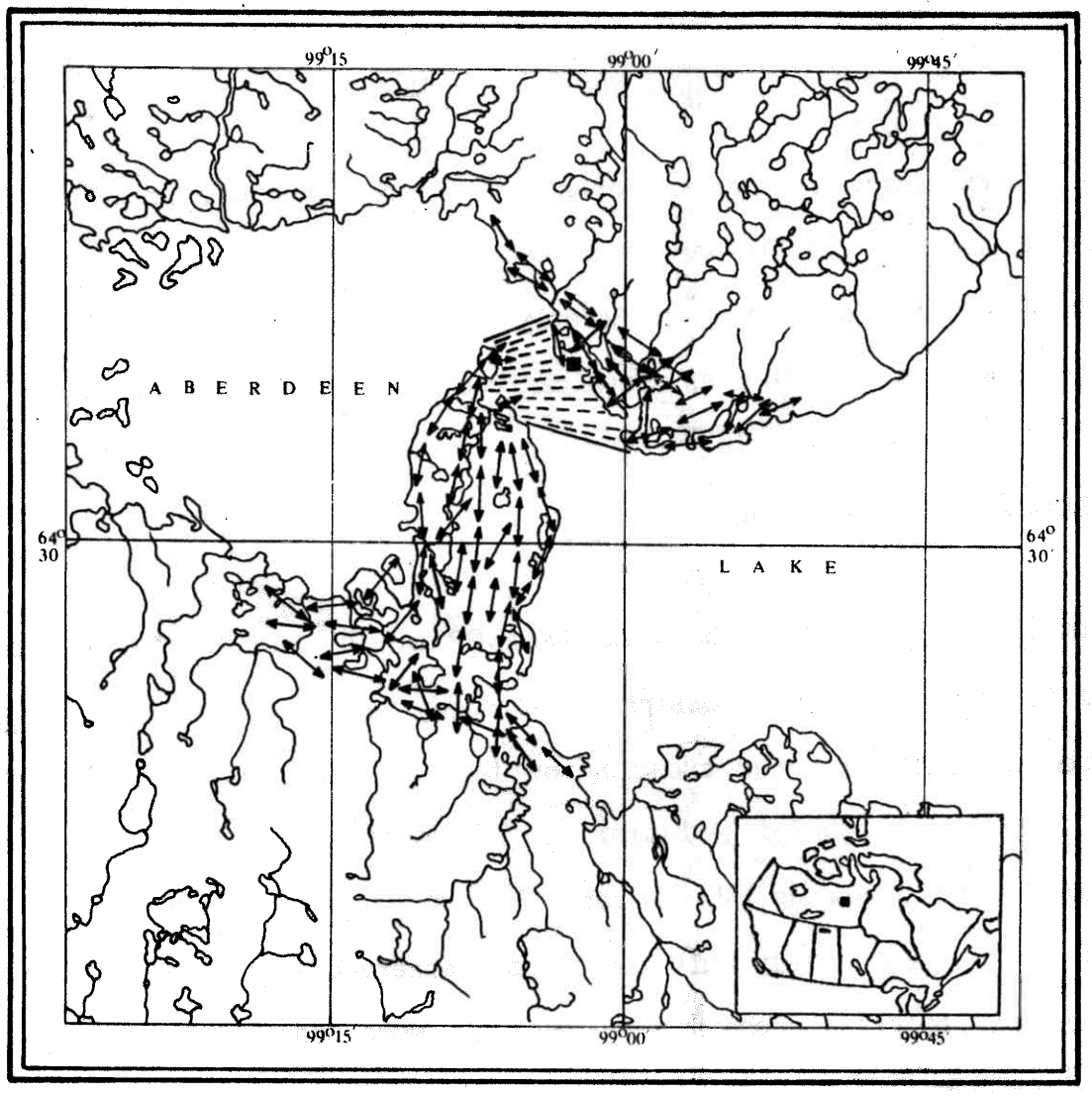
From 26 July to 10 August and from 22 to 29 August, two monitors observed the central water crossing at Aberdeen Lake (Figure 13) which was designated as a major water crossing on the 1979 Caribou Protection Map (Figure 2). They recorded sightings of 352 caribou during late July and early August, and 39 during late August. Some sightings may have been of the same animals. Approximately half the caribou observed were cows and calves. No caribou were observed crossing the lake; all were travelling east or west along the northern shore.

On 1 September 1979, a helicopter was used to map old caribou trails in the area of the central Aberdeen crossing (Figure 13). The pattern of trails clearly indicated that the crossing has been used extensively in past years. The trail pattern suggests that caribou leave or enter the water at the two most northerly points on the peninsula and swim in a northeast - southeast direction to or from the northern shore.

Several records of crossing activity at the central narrows of Aberdeen Lake are known.

Kelsall (1957:40) stated:

> "On August 11, 1951, dead caribou were found scattered along a ten-mile stretch of the north shore of Aberdeen Lake, including the narrows, which is about 4 1/2 miles long. ... there may have been up to 450 carcasses along the ten miles of shoreline (most were calves). The presence of dead adults which were otherwise uninjured suggested that a high wind was blowing (when the crossing occurred)."



Legend

General direction of caribou trails.

Location of most crossing activity as indicated by caribou trails.

Campsite of Inuit monitors, July-August 1979.

Figure 13. Caribou trails at the central water crossing of Aberdeen Lake.

Kelsall (1960:138 and 142) recorded cow-calf aggregations of the Beverly herd crossing the narrows at Aberdeen Lake, heading north, in early and mid-July of 1957 and 1958.

There was apparently less activity at the central Aberdeen crossing in 1959 and 1960. McEwan (1960:6 and 33) referred to crossings of many cows and calves at the west end of Schultz Lake on 29 July 1959, and at the east end of Beverly Lake (Box Crossing) in June and July 1960. He (1960:33) stated:

"Other crossings were observed on Aberdeen and Schultz Lakes which were not used extensively by animals this year, but had been used during other years."

Water Crossings of the Kaminuriak Herd 1979

Only one water crossing of a large group of Kaminuriak caribou was reported in 1979. Joe Neigo (pers. comm.), of Baker Lake, reported seeing approximately 6,000 bulls and non-breeders cross Kazan River north of Kazan Falls, at 63°44'N, 95°39'W, on 8 July 1979. The caribou were heading in a northwesterly direction.

The Lower Kazan River Crossings

The pattern of caribou trails along the portion of Kazan River from Thirty Mile Lake to Baker Lake was mapped in 1978 (Darby 1978). Four major water crossings were designated in the area by the 1979 Caribou Protection Map (Figure 2).

From 13 to 29 July and from 21 to 31 August, 1979, two monitors observed caribou activity in the area immediately downstream from Kazan Falls (Figure 14). Only 12 caribou were seen crossing the river, but there were many animals of all age and sex groups on the eastern shore of the river.

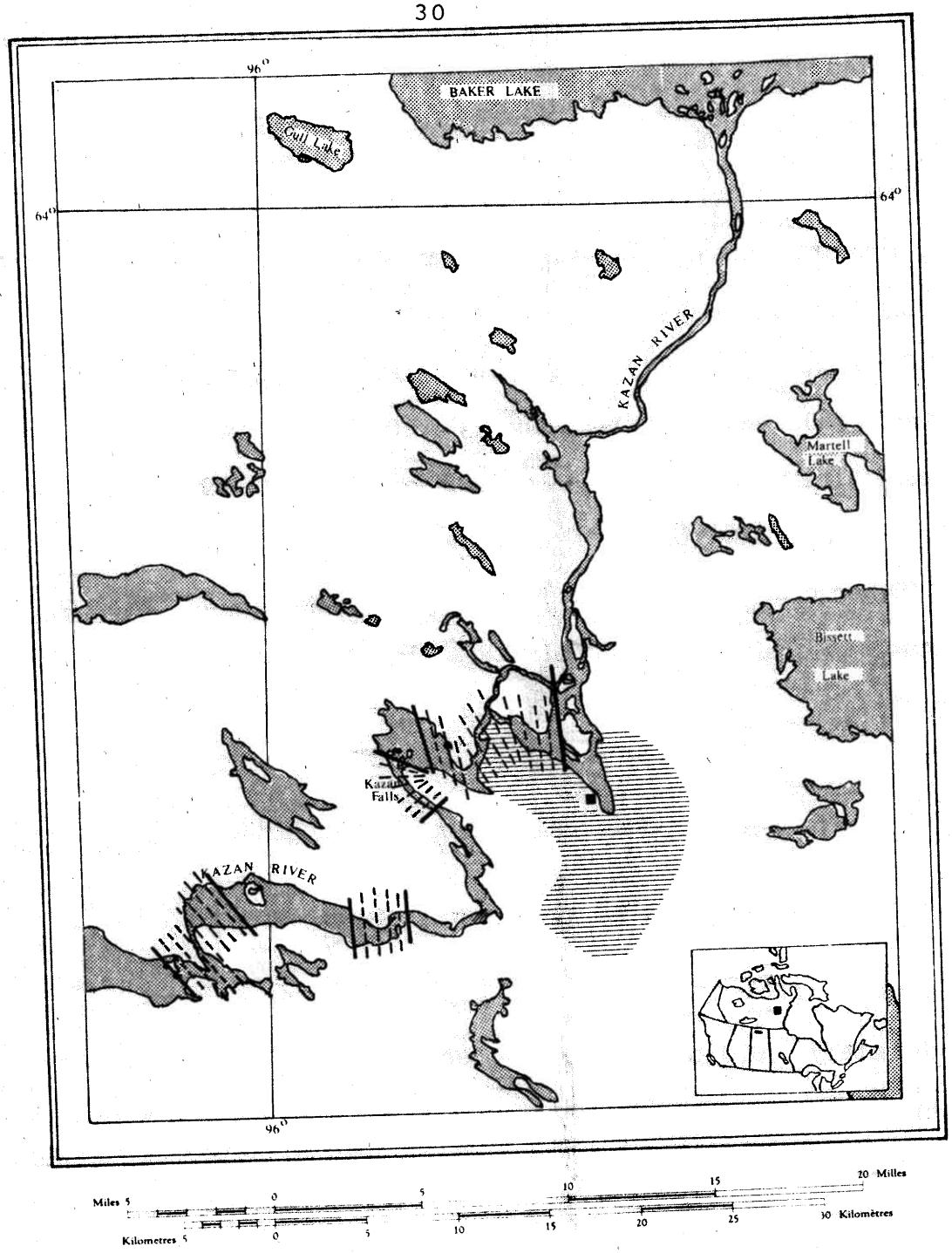


Figure 14. Caribou activity in the lower Kazan River area from 13 to 29 July and from 21 to 31 August 1979.

The monitors recorded sightings of an estimated 25,480 caribou in July and 110 in August. Some sightings may have been of the same animals. Most caribou seen in July were either bulls or were not identified as to sex; most seen in August were cows and calves. These estimated figures do not allow for error in visual estimates.

Caribou and Land Use Interactions

The observation of caribou and land use interactions is difficult; it requires mobility and the full-time efforts of one investigator. This was not possible in 1979, but seven interactions were reported to the monitoring biologist by other individuals. Four of these involved caribou and helicopters; one involved caribou, a helicopter and three diamond drills; and two involved caribou and people on the ground. The reports are summarized here to outline the kinds of interactions that are commonplace.

Two of the four interactions between caribou and helicopters involved a single low pass of one helicopter over one or two caribou. The other two interactions concerned single caribou that approached a helicopter on the ground; one of the helicopters was running at idle, the other was not running.

The interaction involving caribou, a helicopter and three diamond drills occurred in early June. Approximately 10 to 15 bulls and non-breeders occupied an area about 0.5 km from one of the operating drills (model 17A). A Bell 206B helicopter, slinging equipment, approached the area from behind the drill and landed at the drill site. The caribou watched the helicopter as it approached the drill, and trotted approximately 0.5 km away from the area as it landed.

The two interactions involving caribou and people on the ground produced some avoidance and curiosity reactions by the caribou. One of these interactions occurred between four people and approximately 3,000 cows and calves; the other occurred between one person and a mixed group of eight caribou.

EVALUATION OF 1979 CONTROLS

The calving grounds of the Beverly herd extended west of Beverly area "A" within the Thelon Game Sanctuary in 1979. The extension of the calving ground was apparently the result of weather conditions which may have delayed the start of spring migration. Most cows calved within area "A" and the present boundary of Beverly area "A" is still considered to be correctly located.

Most Beverly cows moved westward through the northern half of the Thelon Game Sanctuary during the post-calving period, but 500 to 4,000 cows and calves moved eastward into area "B" during late July. Some calving and post-calving activity has been recorded in the northern half of the Thelon Game Sanctuary in past years. In 1978, large aggregations of cows and calves moved west through the area in late June and early July (Darby 1978). In addition, calving was also recorded there in 1957 (Kelsall 1960). Consequently, the boundary of Beverly post-calving area "B" is currently appropriate, but if more calving or post-calving activity occurs in the northern half of the Sanctuary in future, the western boundary of Beverly area "B" will become increasingly dependent on the integrity of the Thelon Game Sanctuary which is presently off limits to all exploration.

The boundaries of Kaminuriak areas "A" and "B" were consistent with the movements of Kaminuriak cows. During late May and June, the Kaminuriak cows were located within area "A". In July, the cows and calves gradually dispersed; some continued to occupy area "A" while others moved into parts of area "B" and surrounding areas.

Some caribou movements recorded in 1979 verify the use of certain designated water crossings shown on the 1979 Caribou Protection Map (i.e. Hanbury River, Lookout Point and west of Beverly Lake on the Thelon River). The position of crossings near Kazan Falls, shown on the 1979 Caribou Protection Map, do not reflect information on caribou trail patterns presented in the 1978 caribou monitoring report (Darby 1978, Figure 10). The designation of all "major crossing sites" should be re-evaluated to ensure that they are correctly located and that they warrant special protection. Some designated crossings may experience no more or less caribou activity than adjacent sites (e.g. the crossing at $62^{o}35'N$, $104^{o}49'W$).

The N.W.T. Wildlife Service considers that land use conditions pertaining to the 1979 Caribou Protection Map are adequate to protect caribou from potential disturbance by the present level of mineral exploration activities, with the following exceptions:

(1) Available information suggests that the suspension of permit operations within a part of area "B" is not necessary when caribou cows and calves are using that part during July, as long as low level aircraft activity (less than 300 m agl) does not occur near the cows and calves, and as long as motorized vehicles are not used in their vicinity. If DIAND decides that effective control of aircraft or vehicular activity is not possible, then operations should be required to cease while cows and calves are present in the permittee's area of operation.

(2) Section 3(a) of the land use conditions should read:

> During spring migration of caribou the Permittee shall not locate any operations so as to block or divert the migration.

(3) There is no documented evidence to indicate that the operation of a diamond drill interferes with spring migration. Consequently, permittees should not be required to cease drilling when caribou cows are migrating through the permittee's area of operation. However, the permittee should cease low level aircraft activity near caribou, or as indicated in the land use conditions, any other activities that would interfere with spring migration.

(4) Section 3(c) of the land use conditions should indicate that the area of suspended operations should not be fixed in location but should depend on where the cows are.

Finally, it is important to stress that long term industrial development is a potentially more serious threat to the welfare of migratory barren-ground caribou than mineral exploration activities. DIAND should develop guidelines for the construction of mines, airstrips, roads and related structures to avoid disturbance to caribou.

RECOMMENDATIONS

Land Use Controls

(a) The position of designated water crossings near Kazan Falls on the lower Kazan River should be changed to reflect information on caribou trail patterns presented in the 1978 caribou monitoring report (Darby 1978, Figure 10).

(b) Subject to recommendation (a), land use conditions for 1980 should be similar to those used in 1979, but they should be modified to reflect the alterations suggested in the evaluation section of this report. The Caribou Protection Map should also be modified accordingly.

(c) DIAND should develop guidelines for the construction of mines, airstrips and other activities related to long term industrial development to avoid disturbance to caribou.

(d) Subject to the above recommendations, DIAND should act on recommendations in the 1978 caribou monitoring report (Darby 1978).

Monitoring Program

(a) A field program should be conducted in 1980 to monitor movements of the Beverly and Kaminuriak caribou herds and to advise Land Use inspectors on caribou-related matters. A wildlife biologist should be assigned to co-ordinate the program and act as an advisor to DIAND personnel. In addition, information should be obtained on the past and present use of water crossings designated by the 1979 Caribou Protection Map. This water crossing program should be co-ordinated with the caribou monitoring program, but it should be conducted by a second wildlife biologist or technician. Experience gained in 1978 and 1979 indicates that the monitoring program demands the full-time attention of one biologist.

(b) It is only feasible to submit flight reports and data maps once a month. It would be better to telephone survey results to DIAND officials immediately and later submit a preliminary map of caribou

distribution and movements [e.g. Darby (1978) Figure 20] with comments after each survey. DIAND officials should be provided once a month, with a schedule of anticipated survey flights and monitoring activities.

ACKNOWLEDGEMENTS

I thank the Department of Indian Affairs and Northern Development for its cooperation and assistance during the monitoring program, especially Jim Umpherson, District Manager, Rankin Inlet, and Joan Scottie, Land Use Inspector, Baker Lake, for liaison, program co-ordination and advice. Aerial surveys were efficient and pleasant due to the efforts and companionship of Rudy VanderKroft, Keewatin Air Ltd.

N.W.T. Wildlife Officers Doug Stewart, Ken Davidge, Paul Kraft and Grant Pryznyk, and Steve Kearney, Manitoba Department of Mines, Natural Resources and Environment, conducted survey flights and provided information. The Keewatin Regional Biologist, Cormack Gates, also provided assistance. I am grateful to Bob Decker and Doug Heard for providing other data. Laura Comishen and Mark Williams assisted with preparation of the report and the Publications Committee, N.W.T. Wildlife Service, reviewed the manuscript.

I am most grateful to the Baker Lake Hunters' and Trappers' Association for assistance and cooperation, and to the community of Baker Lake for its hospitality. Residents of Baker Lake who participated in the monitoring program and provided much valuable information are Samson Arnauyok, Edwin Evo, James Ikinilik, Alex Iqaqat, Barnabus Kalluk, Barnabus Kudja'aq, John Tagoona and James Kalluk.

I also thank personnel of the various mining companies, especially Chris Marmont of Urangesellschaft Canada Ltd., and Jim Gaunt of Essex Minerals Ltd. for their cooperation and hospitality. Don Speller, Environmental Biologist for Urangesellschaft Canada Ltd., was most helpful in exchanging information.

PERSONAL COMMUNICATIONS

Decker, Robert. A.L.U.R. Technician, N.W.T. Wildlife Service, Yellowknife, N.W.T. X1A 2L9.

Dunn, Jim. P.O. Box 126, Piercefield, N.Y., U.S.A. 12973.

Evo, Edwin. General Delivery, Baker Lake, N.W.T. X0C 0A0.

Frost, Norm. 136 Marie Street, Shelbourne, Ontario.

Heard, Doug. Caribou Biologist, N.W.T. Wildlife Service, Yellowknife, N.W.T.

Johnston, Karen. 405 N.E. 11th Ave., Little Falls, Minn., U.S.A.

Neigo, Joe. General Delivery, Baker Lake, N.W.T. X0C 0A0.

Wacko, Dwain. Box 670, Jasper, Alberta.

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APPENDIX I: Data Forms

TRANSECT CODING FORM

Transect Number: Stratum: Date: Daily Code: Form Number:	Observer: Transect Length (km): Percent Snow Cover:

Location Point	Bulls	Cows	Calves	Others	Total
TOTALS					

TRANSECT DATA SUMMARY

Census Type:

Date:

Stratum area (Z):

Stratum:

Tr. no.	Tr. area (km)	Number non-calves seen			Number calves seen			Total caribou		
		left	right	total	left	right	total	left	right	total
TOTALS										

Memo to: DINA Baker Lakers and others (Laporte, Parks, Umpherson)
From: K.L. MacInnes
Re: Caribou Behavioural Responses

The following is a preliminary guide to organizing observations of disturbance (natural or human related) to caribou which I have prepared using reports and papers as a guide (Miller and Gunn, Calef et al). I expect FWS to compile their own official form. In the meantime, you might try recording any caribou-human interactions which you encounter. NOTE: WANT UNBIASED RESULTS OF ENCOUNTERS RECORD CHANGE OR NO CHANGE. BE CRITICAL. COMMENT ON LIMITATIONS

Date: _____

Observers: _____

_____

BACKGROUND:

1. Human or other activity (e.g. wolves)

Location: _____ Weather: _____ Time: _____

Duration: _____ Terrain/Vegetation: _____

Describe activity: (people, aircraft, equipment) _____

_____

Location of Observer(s): _____

2. Caribou

Time: Precalving: _____ Calving: _____ Post Calving: _____

Group Size: Count _____ Estimate: _____

Age/Sex Composition: Unknown _____ With calves: _____ Without calves: _____

Other: _____

Distance from disturbance - Vertical: _____ Horizontal: _____

Recorded for: Majority of group _____ Strongest response by some _____

Response: Approach _____ Closest Contact _____ Departure _____

Undisturbed _____ During disturbance _____ Post disturbance _____

Animal Activity

a) lying/bedded
b) foraging
c) travelling
d) standing

Behavioural Response

1. none visible-continued resting, feeding or moving in same direction.
2. alert to disturbance but no appreciable change.
3. lying animal stands.
4. slow movement away.
5. running (trotting) How far? How long?
6. panic-out of control, stumbling, colliding, running into obstacles.
7. other - calves separated from mothers.

Comments: _____

_____

_____

FLIGHT REPORT FORM - D.I.A.N.D.

☐ Kaminuriak ☐ Beverly Date:_____

Aircraft_____ Pilot_____IFR Yes/No

Rad Altimeter_____ GNS_____Weather:Cloud_____

Wind: Speed/Direction _____Temperature_____Visibility_____

% Snow Cover_____Lakes/Rivers Frozen_____

Comments_____

_____

_____

Survey Type:_____

1. Reconaissance_____ 2. Transects (line, strip width)_____
   Other_____

Altitude(s)_____Air Speed_____

Duties of observers(Names)

1. Navigate_____
2. Write Obs._____
3. Tape Obs._____4. Observe Only_____
5. Photograph_____

Distance Flown_____Hours Flown_____

Location(s): Maps Used NTS 1:250,000_____

_____

1:1,000,000 submitted_____

Vegetation types: trees, treeless tundra, shrubby tundra, dwarf shrub (< 50 cm)
tundra_____

Number and Type of data sheets attached:_____

_____

Proposed next aerial survey and/or ground observations_____

_____

FLIGHT REPORT FORM

Comments on survey and caribou activity_____

_____

_____

_____

_____

_____

_____

_____

Water Crossings noted_____

_____

Human Activities Noted_____

_____

Aerial/ on ground_____

_____

Submitted By_____ _____

Signature (s) Date

Appendix II: Water crossing activity reported for Beverly caribou in 1979.

Date	Location of crossing Latitude	Longitude	Designated major crossing	Approximate number of caribou reported	Composition	Direction of travel	Personal communication
24-7-79	63°33'	105°35'	Yes	10,000+	mixed	S & W	J. Dunn
25-7-79	63°48'	104°18'	No	60	mixed	N	N. Frost
25-7-79	63°48'	104°20'	No	150	mixed	S	N. Frost
28-7-79	64°11'	102°22'	No	300	mixed	S	K. Johnston
28-7-79	64°16'	101°53'	No	200	cows & calves	S	D. Wacko
29-7-79	64°30'	101°30'	No	100	cows & calves	S	D. Wacko
29-7-79	64°31'	101°15'	Yes	100	bulls	S	D. Wacko
6-8-79	64°31'	101°15'	Yes	3,000	cows & calves	N	E. Evo
6-8-79	64°31'	101°15'	Yes	3,000	bulls & non-breeders	N	E. Evo

APPENDIX III: Temperature charts for Fort Reliance and Baker Lake, N.W.T.

Daily temperatures for the period 15 April to 15 May 1979, Fort Reliance N.W.T. (Atmospheric Environment Service, Edmonton, Alberta).

Date		Max. temp. °C	Min. temp. °C	Mean temp. °C
April	15	- 4	- 9	- 6.5
	16	- 6	-10	- 8.0
	17	- 8	-16	-12.0
	18	-10	-17	-13.5
	19	- 9	-14	-11.5
	20	- 9	-17	-13.0
	21	- 3	-25	-14.0
	22	- 3	-16	- 9.5
	23	- 1	-16	- 8.5
	24	- 7	-17	-12.0
	25	- 2	-18	-10.0
	26	- 3	-22	-12.5
	27	- 3	-22	-12.5
	28	2	-14	- 6.0
	29	2	- 8	- 3.0
	30	- 7	-16	-11.5
May	1	- 4	-19	-11.5
	2	-10	-18	-14.0
	3	-10	-22	-16.0
	4	- 7	-25	-16.0
	5	-13	-20	-16.5
	6	-12	-23	-17.5
	7	- 5	-25	-15.0
	8	8	-14	- 3.0
	9	10	- 2	4.0
	10	7	0	3.5
	11	7	- 1	3.0
	12	9	- 4	2.5
	13	9	- 2	3.5
	14	11	- 3	4.0
	15	11	1	6.0

Mean daily temperatures for the period 15 April to 15 May averaged over 23 years from 1953 to 1976, Fort Reliance, N.W.T. (Atmospheric Environment Service, Edmonton, Alberta).

Date	Average daily max. temp. °C.	Average daily min. temp. °C.	Average daily mean temp. °C.
April 15	- 3.9	-16.1	-10.0
16	- 5.0	-17.2	-11.1
17	- 3.9	-17.2	-10.6
18	- 0.6	-15.0	- 7.8
19	- 0.6	-11.1	- 9.8
20	- 1.1	-13.9	- 7.5
21	0.0	-12.8	- 6.4
22	0.0	-12.2	- 6.1
23	0.0	-12.2	- 6.1
24	0.6	-11.1	- 5.9
25	0.6	-11.7	- 6.2
26	1.1	-12.2	- 5.6
27	0.6	-11.7	- 5.6
28	1.1	-10.6	- 4.8
29	1.7	- 9.4	- 3.9
30	0.0	-10.0	- 5.0
May 1	- 0.6	-11.1	- 5.9
2	0.0	-11.7	- 5.9
3	3.3	- 9.4	- 3.1
4	3.3	- 7.8	- 2.3
5	4.4	- 6.7	- 1.2
6	4.4	- 6.1	- 0.9
7	3.9	- 6.1	- 1.1
8	5.6	- 6.1	- 0.3
9	4.4	- 5.6	- 0.6
10	4.4	- 5.6	- 0.6
11	3.9	- 5.6	- 0.9
12	5.0	- 6.1	- 0.6
13	7.2	- 3.9	1.7
14	5.0	- 4.4	0.3
15	5.6	- 3.9	0.9

Daily temperatures for the period 1 May to 15 June 1979, Baker Lake N.W.T. (Atmospheric Environment Service, Baker Lake, N.W.T.).

Date	Max. temp. °C	Min. temp. °C	Mean temp. °C
May 1	-11.8	-22.2	-17.0
2	-14.0	-22.0	-18.0
3	-13.8	-25.0	-19.4
4	-13.8	-21.9	-17.9
5	-12.4	-24.1	-18.3
6	-7.6	-19.8	-13.7
7	-12.2	-22.5	-17.4
8	-6.1	-17.9	-12.0
9	-3.7	-18.7	-11.2
10	-0.6	-13.7	-7.2
11	0.0	-9.8	-4.9
12	2.0	-6.9	-2.5
13	1.1	-11.1	-5.0
14	-0.4	-13.1	-6.8
15	-0.3	-11.2	-5.8
16	-1.6	-14.9	-8.3
17	-1.3	-13.1	-7.2
18	0.8	-10.9	-5.1
19	3.3	-9.9	-3.3
20	5.0	-8.7	-1.9
21	52.	-3.3	1.0
22	2.4	-2.8	-0.2
23	5.9	-4.0	1.0
24	5.1	-2.0	1.6
25	4.7	0.8	2.8
26	4.5	1.0	2.8
27	3.1	-0.5	1.3
28	1.6	-0.3	0.7
29	3.0	0.5	1.8
30	2.9	-3.4	-0.3
31	9.2	-2.9	3.2
June 1	7.7	0.1	3.9
2	2.3	-0.6	0.9
3	4.9	0.4	2.3
4	4.6	0.3	2.5
5	5.4	-0.2	2.6
6	3.9	0.1	2.0
7	1.3	-3.8	-1.3
8	0.4	-4.2	-1.9
9	2.3	-1.9	0.2
10	1.0	-2.7	-0.9
11	1.6	-4.1	-1.3
12	13.4	-3.3	5.1
13	16.8	0.2	8.5
14	15.9	3.0	9.5
15	10.2	1.3	5.8

Daily temperatures for the period 20 May to 15 June averaged over 10 years from 1968 to 1977, Baker Lake, N.W.T. (Atmospheric Environment Service, Toronto, Ontario).

Date	Average daily max. temp. °C	Average daily min. temp. °C	Average daily mean temp. °C
May 20	-2.6	-8.6	-5.6
21	-1.7	-7.7	-4.8
22	-1.2	-6.8	-4.6
23	0.0	-5.8	-3.1
24	1.7	-4.1	-1.3
25	3.0	-3.7	-0.3
26	2.2	-5.1	-0.3
27	1.6	-3.4	-0.9
28	1.6	-3.9	-1.4
29	3.1	-2.9	-0.3
30	3.4	-2.9	-0.3
31	3.3	-2.8	-1.7
June 1	3.7	-3.1	-0.3
2	2.8	-3.0	0.0
3	4.0	-1.9	1.2
4	4.0	-1.5	1.3
5	5.3	-0.9	2.3
6	3.4	-2.1	0.7
7	4.1	-2.2	1.1
8	5.3	-1.8	1.8
9	6.7	-0.9	3.0
10	7.9	-0.4	3.9
11	6.2	-0.2	3.2
12	7.5	-0.1	3.8
13	8.1	0.7	4.6
14	8.8	0.8	4.8
15	9.7	2.3	5.4