SEX AND AGE COMPOSITION OF THE BEVERLY HERD OF BARREN-GROUND CARIBOU IN THE FALL OF 1981 AND 1982

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ABSTRACT

The composition of the Beverly herd of barren-ground caribou (*Rangifer tarandus groenlandicus*) was described in the fall of 1981 and 1982. Observers were positioned by helicopter and classified the caribou as cows, prime bulls, young bulls, yearlings and calves. The caribou migrated mostly through the Damant-Labyrinth Lakes complex in both years; however, a late freeze-up in 1982 delayed the migration. In 1981, 8094 caribou were classified and 7653 were classified in 1982. The proportion of cows aged 1 year and older was 63.5% in 1981 and 62.2% in 1982. Among the males over 1 year-old, 50.6% were prime in 1981 and 44.6% in 1982.

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INTRODUCTION

Barren-ground caribou (*Rangifer tarandus groenlandicus*) concentrate together for breeding in late October and early November. The rut of the Beverly herd usually occurs as the caribou are moving from the tundra to the taiga, where the frozen rivers and lakes are preferred travel routes and resting areas. The mingling of the different sex and age classes into concentrations of the caribou on lakes facilitates sampling to determine the sex and age composition of the herd.

The objective of each survey in the fall of 1981 and 1982, was to classify caribou of the Beverly herd to determine the sex ratio and the proportion of calves to cows. The surveys were part of a cooperative research project with the Canadian Wildlife Service (CWS) to describe the causes of newborn calf mortality and survival of calves during their first year of life.

METHODS

F.L. Miller and I flew in a Cessna 337 aircraft out of Stony Rapids, Saskatchewan on 22, 24, 25 and 26 October 1981 to describe the locations and direction of movements of the caribou. Subsequently, we operated with a helicopter out of a Forestry Service cabin on an unnamed lake that is known as "Forestry" Lake ($60^{o}56'N$, $105^{o}30'W$) near Smalltree Lake (Fig. 1). Turbo fuel and camp gear had been cached on Forestry Lake by a Twin Otter aircraft on floats a month previously. The helicopter was used to position observers close enough to caribou to classify them. We moved to Forestry Lake on 30 October to work with Ed Kowal (Biologist, Department of Northern Saskatchewan), Leon Cook (Black Lake) and George St. Pierre (Wollaston Lake) until 2 November, when they returned to Saskatchewan, while Miller and I continued classifying caribou until 13 November.

In October 1982 as descriptions of movement patterns were available from aerial reconnaissance flights of a CWS project (D.C. Thomas pers. comm.) we started classifying the caribou using the helicopter to position us. Miller and I again worked with Ed Kowal, Victor Echodt (Black Lake) and Joe Martin (Uranium City) from 23 October to 29 October at Forestry Lake. We continued working out of Forestry Lake until 3 November when we moved our base of operation to the Forestry cabin at Porter Lake where we were based until 14 November.

Drum pick-up was carried out when the 1982 fuel was cached but there was insufficient funding to retrieve the 1982 empty drums (10) at "Forestry Lake".

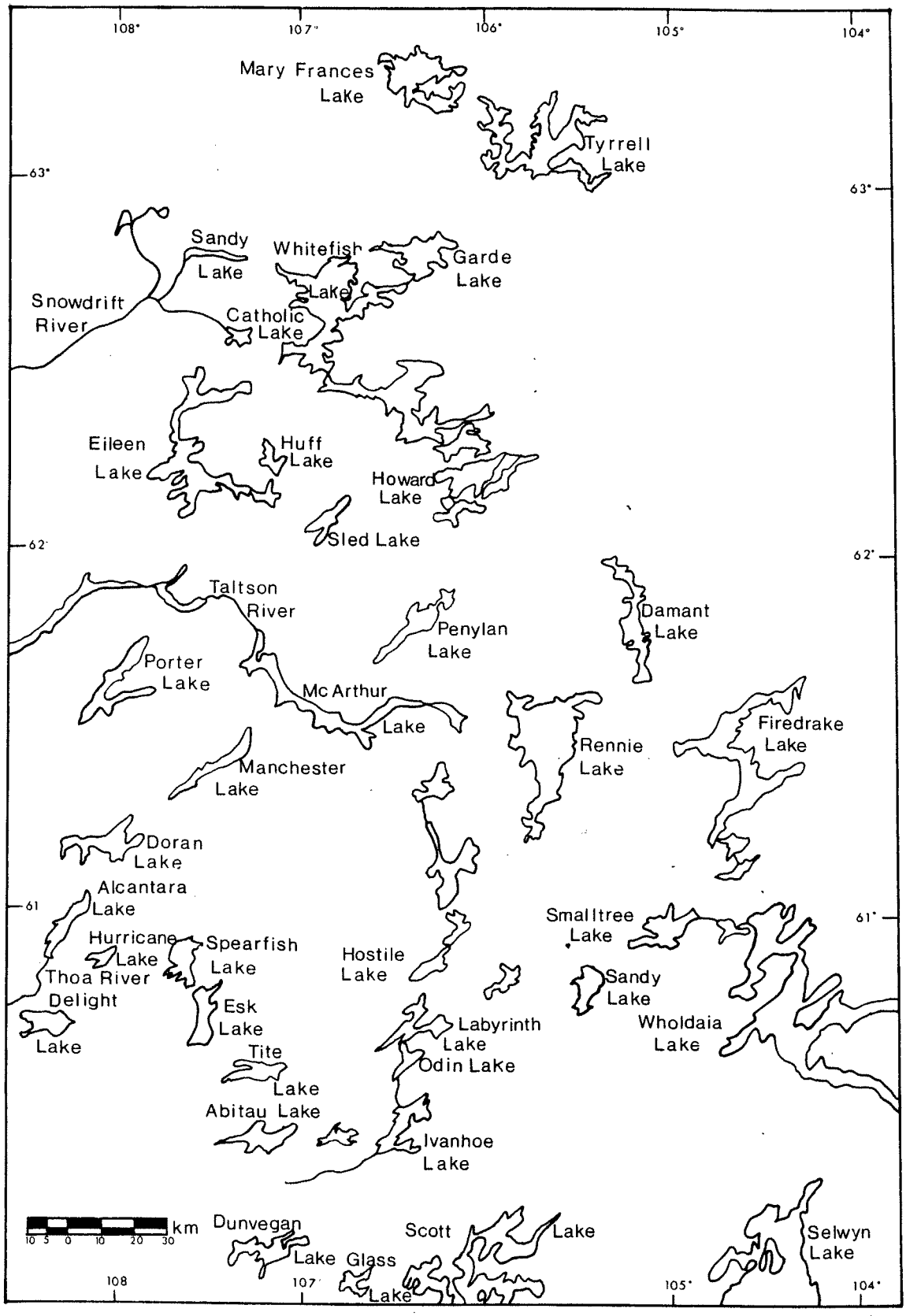

Figure 1. Location of lakes and rivers named in the text.

On the ground the caribou were observed through a 15x40 zoom spotting scope to identify the sex and age class of each animal in a group. The second observer recorded the results in a field book. Calves were identified from their small body size, relatively short face, and velvet spikes. Yearlings were distinguished by their relatively smaller body size. The presence of a darkened vulval patch was the criterion that distinguished cows from bulls (as the penis sheath of young bulls was often relatively inconspicuous). The bulls were assigned as a prime bull if the length of the antlers could be imagined to exceed the distance between the ground and the top of the shoulder, or a young bull if the length of the rack was less than the apparent distance between the shoulder and the ground. Behaviour was also used as a field guide in assigning caribou to sex and age classes using the following categories: 1) calves follow and stay close to their maternal cows; 2) yearlings frequently bunch together and tend to orientate to and approach the observers; 3) cows, especially with calves, are usually the first caribou to leave a lake; 4) we did not observe any bouts of antler sparring by cows or female yearlings.

When possible cows with one or no antlers were carefully observed through the spotting scope and were termed antlerless if no pedicels could be distinguished. Whether or not prime bulls had shed their antlers was also recorded.

RESULTS

Caribou Distribution, 1981

The survey in 1981 used 24 h of Cessna 337 fixed wing and 40 h of 206B helicopter time including ferrying from Hay River to Stony Rapids and Yellowknife to "Forestry Lake", respectively. In 1982, the helicopter was also used for reconnaissance and including ferrying from Hay River to Fort Smith and "Forestry Lake", 73 h were flown. In 1981, fuel was cached at "Forestry Lake" and in 1982 also at Porter Lake by Twin Otter on floats in September.

We located only scattered trails east of Penylan Lake east to Dubawnt Lake (101°W) during the reconnaissance flights on 24 October (Figs. 2 and 3). Intensively used trail systems and hundreds of caribou were observed travelling southwest along the west shore of Penylan Lake on 25 October. Further searching on 26 October confirmed the presence of a narrow (5-8 km wide) front approaching the Taltson River to Porter Lake. These caribou were observed south of the Taltson River on 31 October and 1 November. We sampled the few caribou groups in the area on 1 November and designated them as the McCann segment (Fig. 4).

By 5 and 6 November the front of the movement was spread between Dunvegan and Ivanhoe Lakes; most caribou were travelling southeast and were designated as the Dunvegan segment (Fig. 5). There was also a second segment of caribou which were also moving from the northeast through the area around Hostile and Sylvan Lakes east to within 30 km west of Forestry Lake by 8 November.

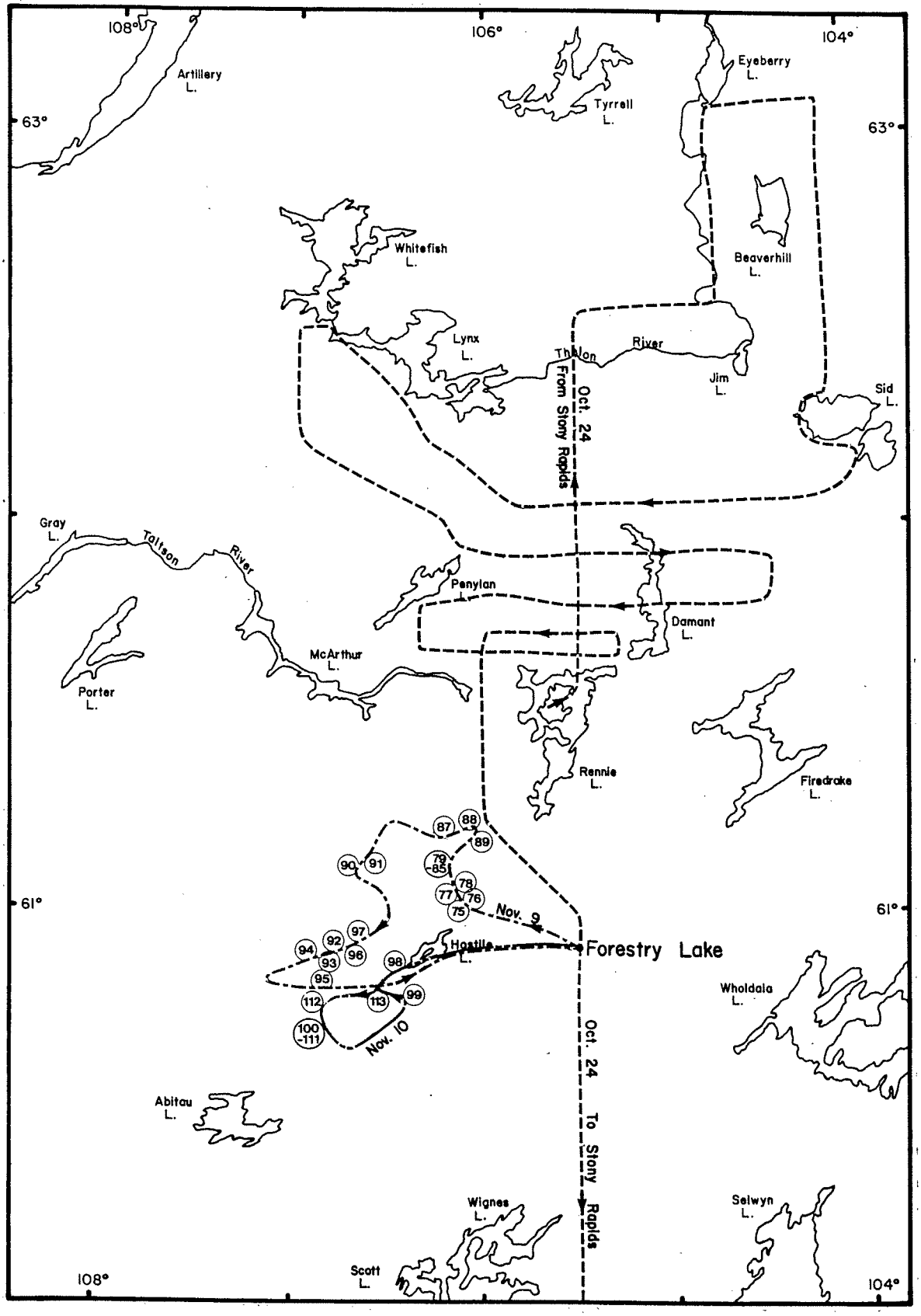

Figure 2. Reconnaissance flight (24 October) and segregation flights (9 and 10 November) during fall segregation survey of the Beverly herd, N.W.T., 1981.

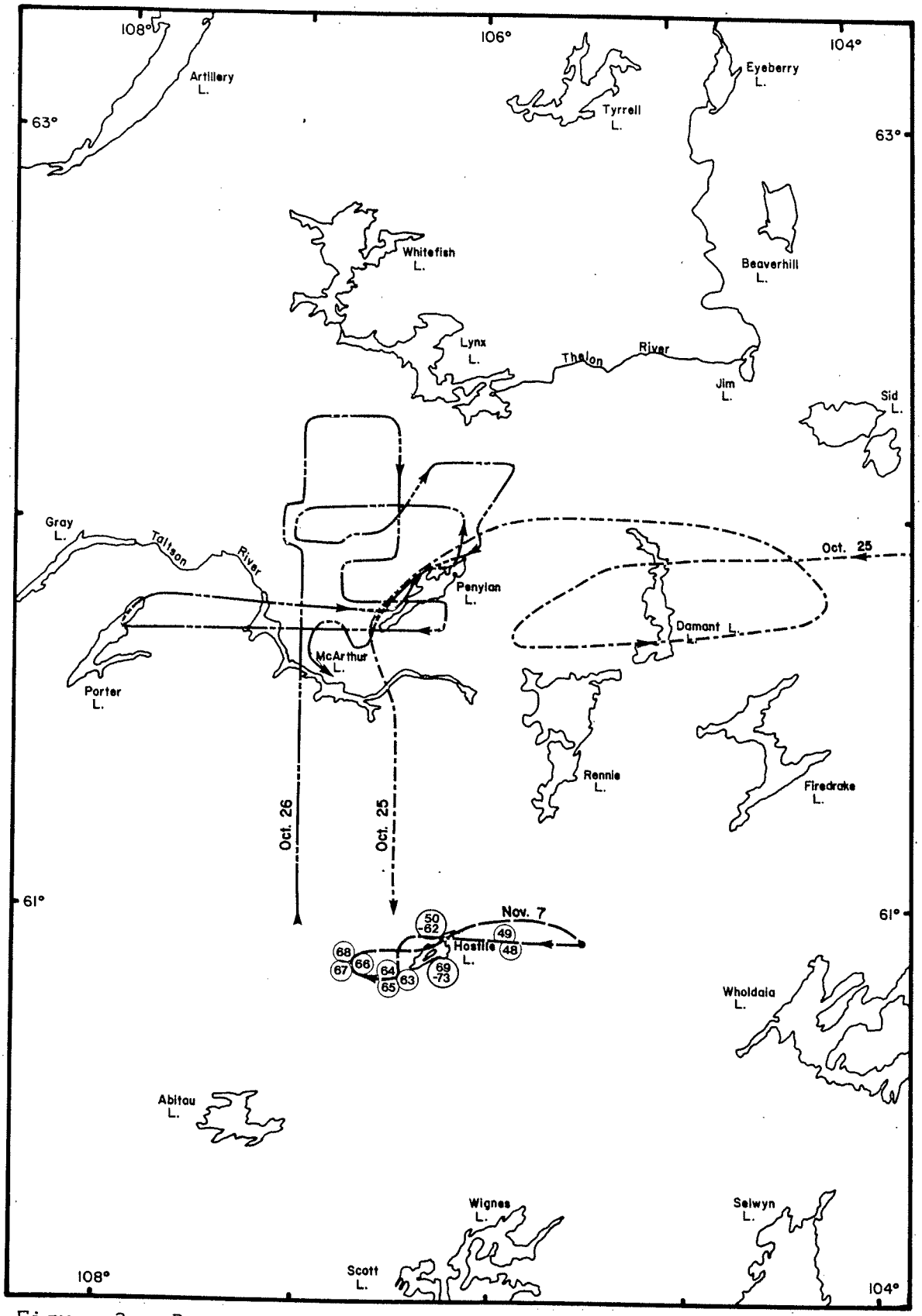

Figure 3. Reconnaissance flights (25 and 26 October) and segregation flight (7 November) during fall segregation survey of the Beverly herd. N.W.T., 1981.

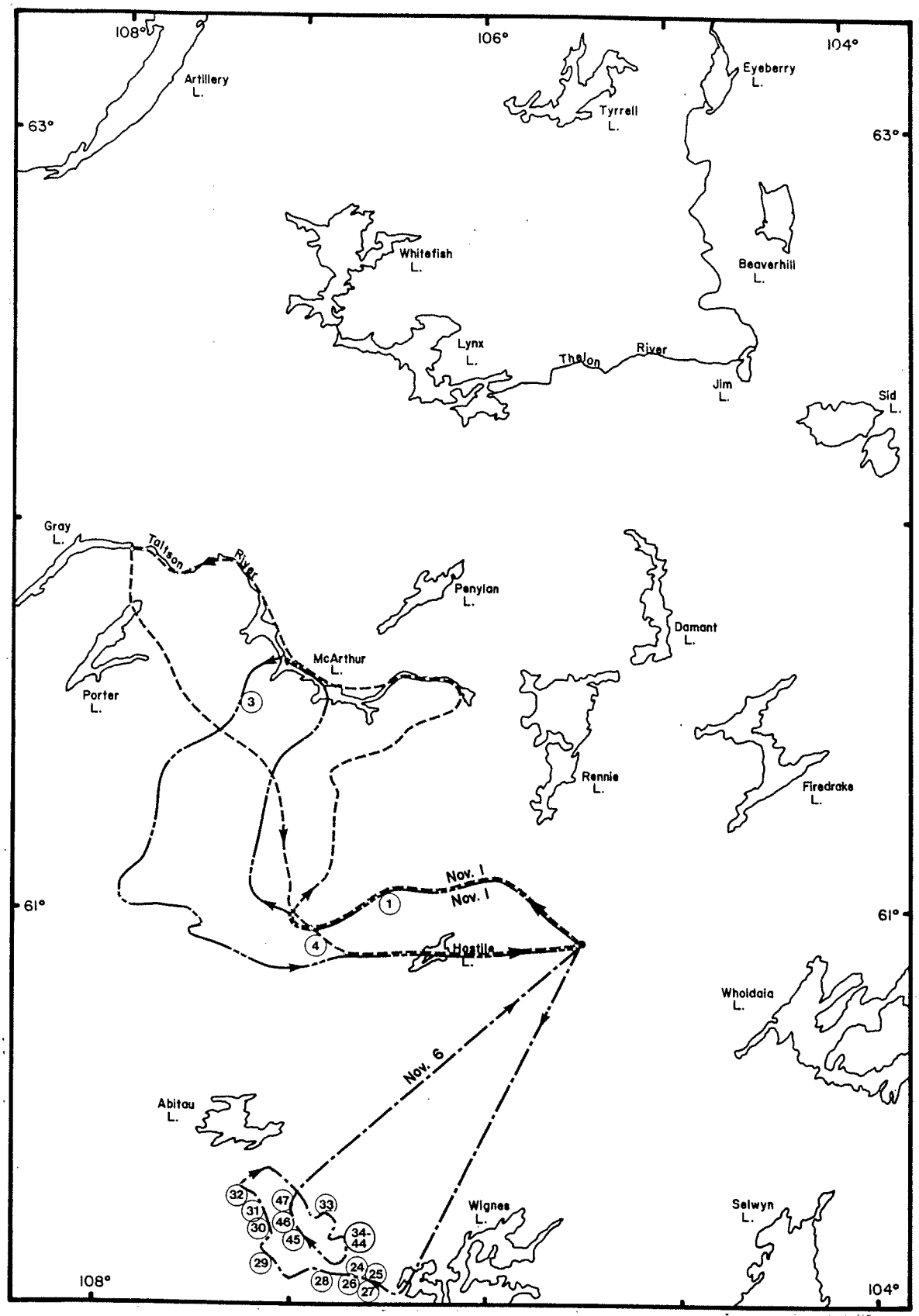

Figure 4. Segregation flights (1 and 6 November) during fall segregation survey of the Beverly herd, N.W.T., 1981.

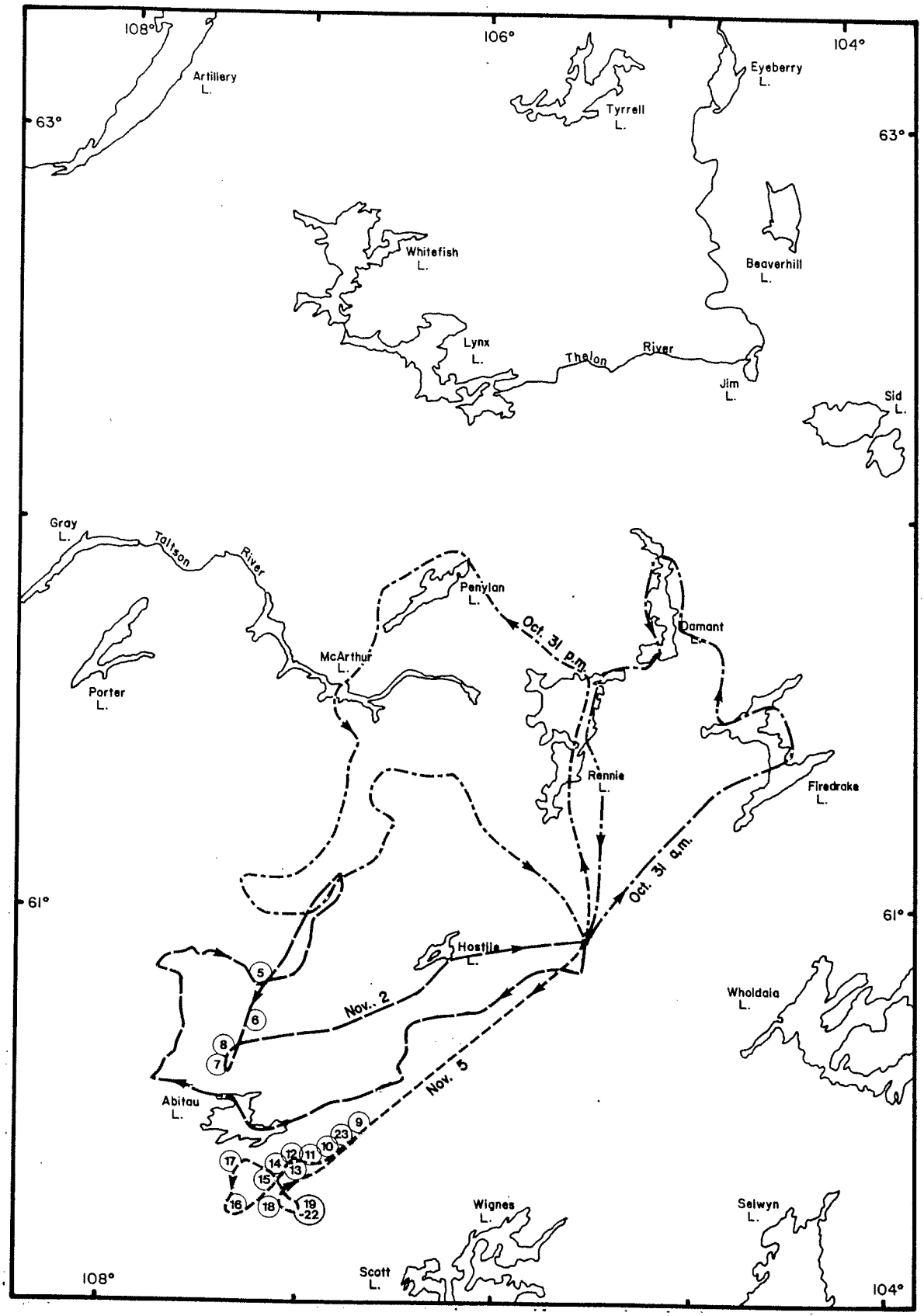

Figure 5. Sex and age composition flights (31 October, 2 and 5 November) during fall segregation survey of the Beverly caribou herd, N.W.T., 1981.

The caribou were congregated into large groups and tended to be in single files when crossing the large lakes. Before then we had seen only small groups of caribou scattered on muskegs and small lakes; we sampled that movement and called it the Hostile segment. The heavy movement of caribou through Hostile and Sylvan Lakes continued and by 12 November we located large numbers of caribou crossing the river between Abitau and Glass Lakes with the front of the movement on the western side of Scott Lake on 13 November. We designated the samples obtained on 12 and 13 November as the Ivanhoe segment (Fig. 6).

Caribou Movements, 1982

In 1982 an undefined wide front of caribou was orientated southwest with caribou spread from Sandy Lake to Abitau Lake (D.C. Thomas pers. comm.). Caribou had been reported as moving through the Damant Lake area in early October (V. Echodt pers. comm.). Between 24 and 31 October caribou moved through the areas around Forestry Lake and Labyrinth Lake, and then turned south and southeast (probably because Labyrinth, Odin and Ivanhoe Lakes were still open). Caribou also continued to move west from Labyrinth Lake probably along the Dubawnt River as part of a front stretched between Doran and Meadow Lakes by 31 October (Fig. 7). An earlier segment had moved through the Alcantara Lake area as cows with calves were hunted there in mid-October. On 31 October the caribou were in small groups averaging less than 50, and were travelling in the bush and on small, ice covered lakes; the large lakes were still open. No trails were found southeast of Forestry

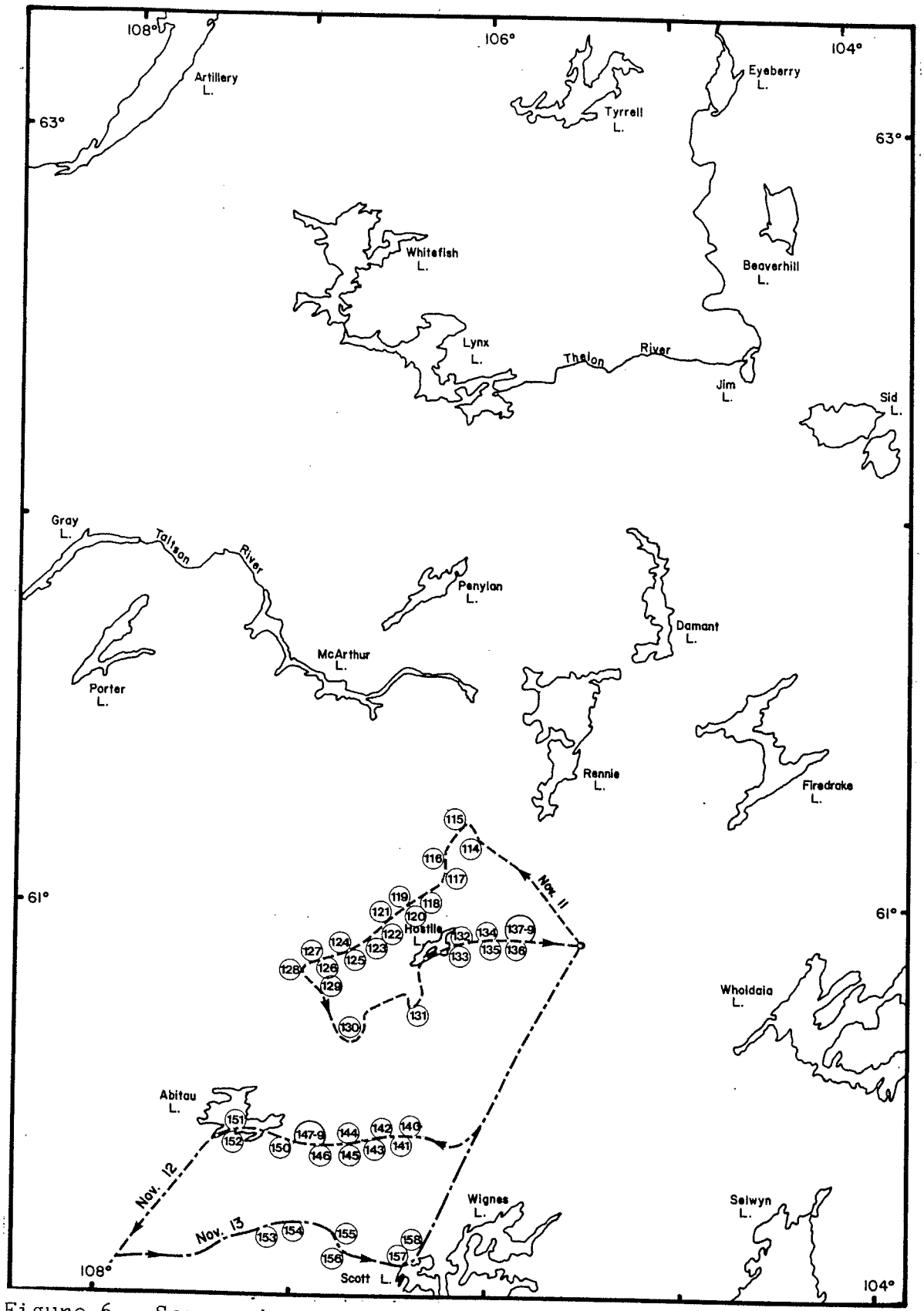

Figure 6. Sex and age composition flights (11, 12 and 13 November) during fall segregation survey of the Beverly caribou herd, N.W.T., 1981.

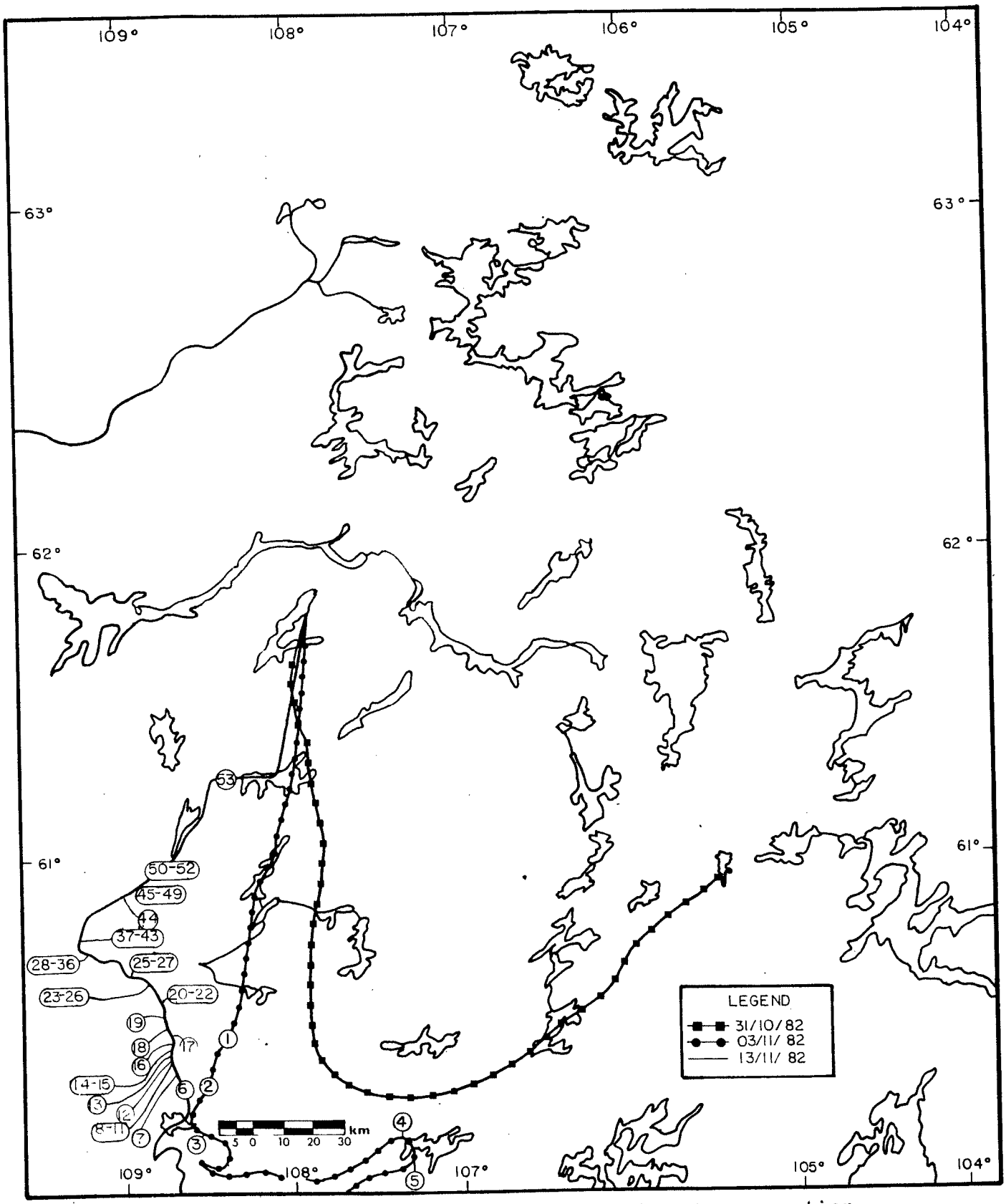

Figure 7. Reconnaissance flight (31 October) and segregation flights (3 and 13 November, 1982) during fall segregation survey of the Beverly caribou herd, N.W.T., 1981.

Lake to Selwyn Lake on 2 November. By 4 November there was an absence of trails along the east side of D'Aoust, Nonacho, and Tejean Lakes; however, heavily used trails, oriented northwest and west at Doran Lake, were observed to Delight Lake and the Thoa River. Flights on 8 November (Fig. 8) revealed that caribou were still moving from the northeast through the Labyrinth, Insula and Tite Lakes areas turning west and northwest to Spearfish and Esk Lakes then to Acantara Lake. Trails also continued southwest to Abitau Lake before turning west to Anderson Lake. By 11 November caribou had reached the north end of Porter Lake, and caribou were also migrating along the southwest side of Manchester Lake (Fig. 9). Trails oriented north-northeast extended from Manchester Lake east to the west side of Burpee Lake. On the east side of Burpee Lake, however, there were fresh, heavily used trails and groups of caribou walking west and southwest.

Herd Composition

I classified 8094 caribou during the first 2 weeks of November 1981 and 7653 caribou in the last week of October and the first 2 weeks of November 1982 (Tables 1 and 2). E. Kowal classified 397 caribou, which are included in the total of 7653 for 1982. As I did not sex most yearlings, I have assumed the sex ratio of yearlings is equal in the calculations of the sex ratio of the caribou over 1-year-old. The proportion of cows in the 6117 caribou over 1-yr-old in 1981 was 63.5%, which is similar to the 62.2% cows classified in 5903 caribou over 1-yr-old in 1982. Among the males over 1-yr-old, 50.6% were prime in 1981 and 44.6% in 1982.

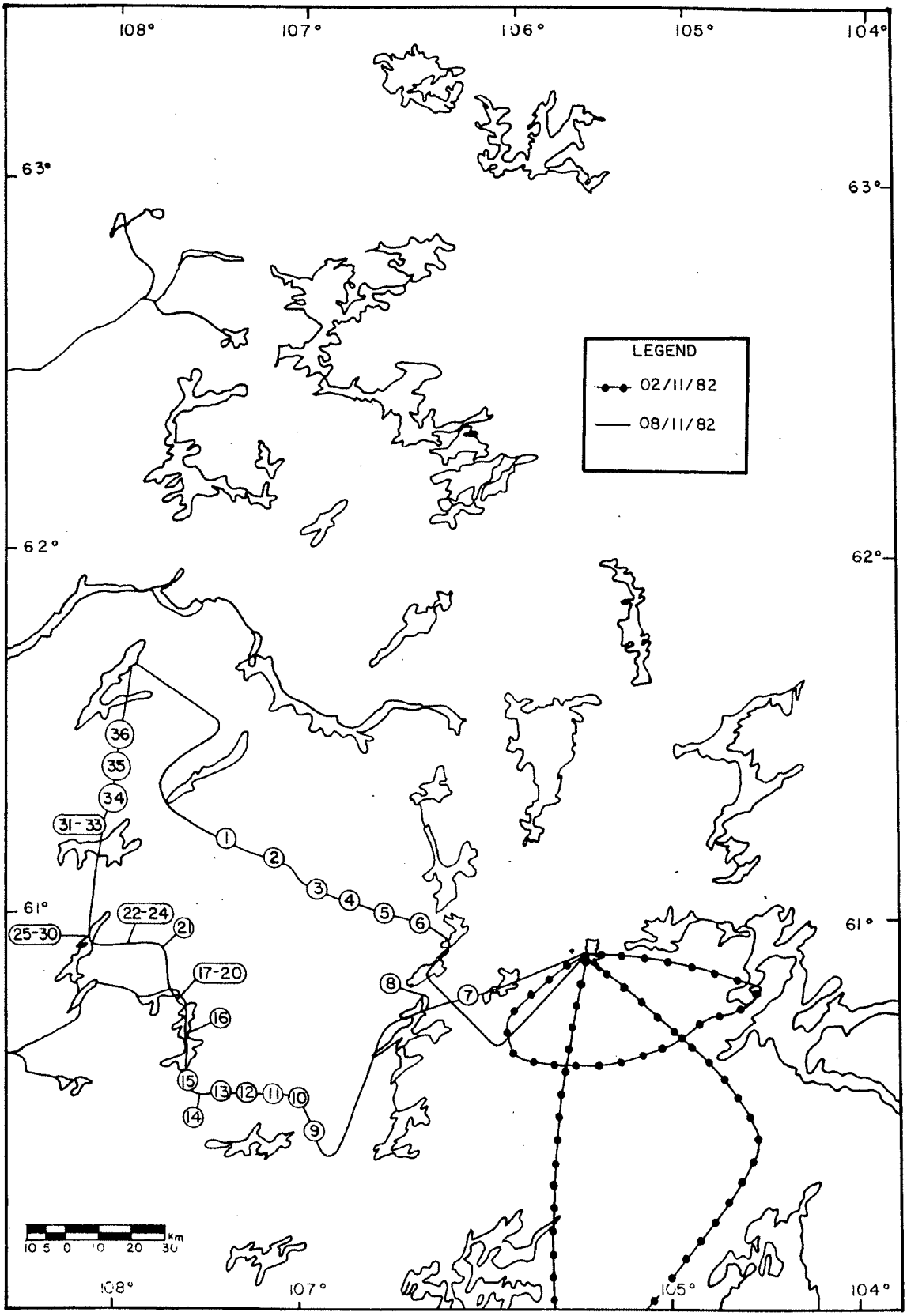

Figure 8. Reconnaissance flight (2 November) and segregation flights (8 November) during fall segregation survey of the Beverly caribou herd, N.W.T., 1982.

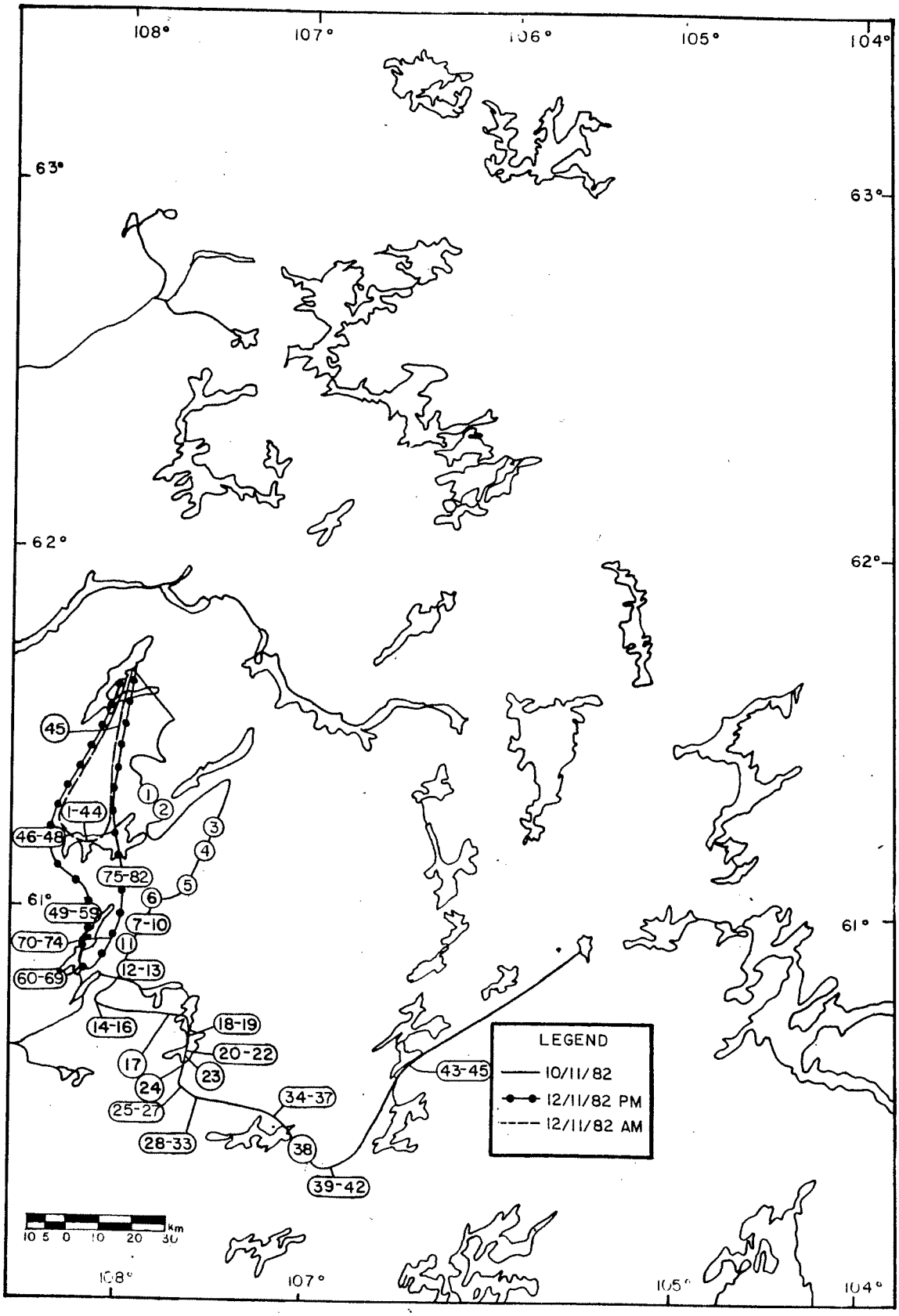

Figure 9. Segregation flights (10 and 12 November during fall segregation survey of the Beverly caribou herd, N.W.T., 1982.

Table 1. Daily summaries of sex and age classes of caribou of the Beverly herd segregated during November 1981.

Date	Prime bulls	Young bulls	Cows	Calves	Yearlings	Total
November						
1	1	7	7	5	3	23
2	7	1	23	17	6	54
5	10	10	77	60	17	174
6	27	43	218	140	28	456
8	176	158	510	249	81	1174
9	303	226	719	461	159	1868
10	92	122	355	168	43	780
11	63	59	223	68	38	451
12	117	147	647	295	79	1285
13	191	189	824	514	111	1829
Total	987	962	3603	1977	565	8094

Table 2. Daily summaries of sex and age classes of caribou of the Beverly herd segregated in October and November 1982.

Date	Prime bulls	Young bulls	Cows	Calves	Yearlings	Total
October						
24	8	8	24	9	7	56
25	47	64	109	49	15	284
26	67	61	202	99	70	499
28	26	29	100	46	17	218
29	6	9	29	12	8	64
30	0	2	4	2	1	9
31	3	4	17	6	2	32
November						
1	2	7	13	9	0	31
2	7	4	35	12	3	61
3	2	0	3	3	1	9
5	15	14	54	23	12	118
8	29	45	190	73	45	382
9	49	34	136	73	27	319
10	85	144	479	217	88	1013
11	60	158	493	274	111	1096
12	153	181	726	392	133	1585
13	119	106	285	185	59	754
14	150	183	424	266	100	1123
Total	828	1053	3323	1750	699	7653

The ratio of calves to cows over 1 yr of age was 51:100 in 1981 and 48:100 in 1982. The ratio of yearlings to cows over 1 yr-old was 16:100 in 1981 and 21:100 in 1982.

The sampling sites were located over a wide area and included different segments of the caribou herd. An analysis of the contributions of time, location, and group size to the variation in the classification counts will be reported in another report.

Behaviour

On our first day on the ground, 1 November 1981, we saw few caribou and no rutting activity, with the exception of two sparring prime bulls. The first sign of prime bulls shedding their antlers was observed on 5 November. On 5 and 6 November we also observed both prime and immature bulls tending and sniffing cows and we continued to see sporadic rutting activity (approaches, sniffing, tending, chasing) by prime bulls until 13 November.

On 24 October 1982 rutting activity was almost constant with prime bulls panting and tending the cows. On 27 October the level of rutting activity appeared to be similar; we did not begin to notice a decrease until 29 October. We continued to see sporadic tending, chasing and mounting by prime bulls until 5 November, and sniffing of cows by prime bulls until 11 November. Prime bulls shedding their antlers were first observed on 8 November 1982.

Predation

Eight wolves were observed in 1981 and six in 1982 (Table 3). Three caribou carcasses were found in 1981 and four in 1982; the cause of death for all seven was attributed to wolf predation, as all carcasses had torn and lacerated throats (Appendix A).

Table 3. Locations and numbers of wolves sighted during fall sex and age composition counts of the Beverly herd of barren-ground caribou, N.W.T., 1981 and 1982.

Date	Location	Number	Remarks
1981			
22 October	61°00'N, 108°18'W	3	light grey; travelling on small lake.
24 October	62°03'N, 105°44'W	1	light grey; travelling on lake.
25 October	60°55'N, 104°15'W	2	grey; travelling along esker.
1 November	61°36'N, 106°55'W	2	white; sat by lake edge and watched helicopter fly by.
1982			
26 October	61°38'N, 107°08'W	2	white; running along frozen river.
3 November	61°03'N, 106°30'W	2	grey; one stood, one sat on a sandy esker.
3 November	61°10'N, 108°20'W	2	white; trotted from lake into trees.

DISCUSSION

Distribution and Movements

The pattern of movements in late October and early November 1981 was further west than that documented in 1979 (R. Decker pers. comm. 1983). In 1979 Labyrinth Lake was on the western edge of the movements which extended east to 102°W; and the caribou reached the N.W.T.-Saskatchewan border in mid-October. In 1980 the caribou used the same routes as in 1978 and 1979 (Heard 1982) and reached the border by 5 November. In 1981 the caribou migrated from further west (Penylan Lake), but were in the area of the border by about the same time as in 1980.

In 1982 freeze-up was approximately 1-week later than in 1981 -- the large lakes did not freeze until 6 November in 1982 and there was only a skiff of 2-4 cm of snow on the lakes after 5 November when the caribou started to travel on the lakes. Only on 10 November 1982, when there was 5-10 cm of snow on the lakes, did caribou begin to bed on the lakes, whereas in 1981, caribou were bedding on the lakes by 1 November. The late freeze-up forced caribou to migrate through the bush and muskeg and the migration remained diffused over a large area until after 8 November. Again, as in 1981, the movements seemed to be further west as caribou moved southwest from McArthur to Damant Lake. In neither 1981 nor 1982 were there trails east of Smalltree Lake, although scattered caribou had been reported at Selwyn Lake in early October, 1982 (P. Ashcroft pers. comm. 1982). In 1982, although some caribou may have reached the border in early and late

October, most caribou turned west, then northwest and northeast before turning south and reaching the border.

The documented patterns of movements in 1981 and 1982 demonstrate some similarities to southward migrations described in 1957-1959 when large numbers migrated through the Damant-Labyrinth Lakes complex. Data on fall distributions and movements of the Beverly herd is available for 1949, 1950, 1957, 1958, 1959, 1978 and 1980 (Britton 1981).

The location of the caribou in late summer largely influences the fall migration routes, but as to why summer distribution varies between years is not yet understood.

The timing and duration of freeze-up may influence the rate and the type (dispersed or narrow fronts) of the fall migration, which in turn, influences the location of the caribou during and after the rut. The caribou did not start to migrate in steady streams across large lakes in 1981 or 1982 until after the rut when the lakes were frozen and snow-covered. In 1982 even when the larger lakes were freezing, the lack of snow on the ice seemed to deter the caribou from travelling extensively on the lakes. Wilke (1958) noted that the lack of snow and ice on the large lakes slowed down the southward migration in October 1958 when freeze-up of the large lakes did not occur until 15 November.

Classification Counts

Regular classification counts of the Beverly herd only started in 1978 (Decker 1978) and were repeated in 1980 (Heard 1982). Earlier composition counts of the Beverly herd had focused

on calf:cow ratios (McEwan 1960) to describe calf survival. The fall results in 1958 were considered to be anomalous due to sampling difficulties.

The ratio of prime to immature bulls was 44.2% prime in 1981 and 35.5% in 1982. The proportion of prime bulls appears to have consistently declined since 1978; 61.6% in 1978 and 55.3% in 1980. Such a comparison, however, has to be treated with caution as different criteria were used to separate the two bull classes. In 1978 Decker (1978) classsified as immature, bulls with cow-like antlers, and grey-brown pelage; Heard (1982) classified bulls with antlers less than 90 cm in length as immature. In 1981-1982 we classified on the criterion that for immature bulls, the antler length was shorter than the distance between the ground and the point of shoulder. As the shoulder height of 27+ month old bulls averages 97 cm (Dauphiné 1976), the criterion in 1980 and 1981-1982 are similar and comparable. As some bulls classified as immature in 1981 and 1982 did have chocolate-brown flank markings and a short mane, the prime category is likely more restrictive than Decker's (1978) category of prime, which included all bulls with brown flank markings and manes.

A comparison of sex ratio observed between 1978, 1980, 1981, and 1982 (Table 4) suggest either a decrease in the proportion of bulls or an increase in the proportion of cows. The proportion of cows was 59.6% in 1978, 56.2% in 1980, 63.5% in 1981 and 62.2% in 1982. The slight increase in the proportion of cows may also be reflected in the yearling:cow ratio which has decreased slightly (Table 4). Calf survival, at least, has been high during that

Table 4. Composition of the Beverly herd of barren-ground caribou in fall 1978 and 1980-1982.

Year	Total classified	Males:100 females 1 + year	Calves:100 cows	Yearlings:100 cows
1978	11,568	71.2	29.5	28.1
1980	2,034	77.6	51.1	27.2
1981	8,094	57.4	50.9	15.7
1982	7,656	60.7	47.6	20.8

period (Gunn in prep.) so the decreasing ratio of yearlings to cows may be the result of the increase in the numbers, rather than decreased yearling survival.

The survival of the calves during their first summer in 1981 and 1982 is comparable to 1980. Survival was lower in 1978, which was expected because high mortality occurred on the calving ground (Heard and Decker 1981).

Behaviour

The peak of the rut was over by the time we were on the ground on 1 November in 1981; however, in 1982, the peak was in progress when we arrived on 24 October, and rutting activity had declined on 27 October. Wilke (1958) noted sparring between prime bulls on 28 September 1958, sniffing and tending of cows by 9 October and the peak to be 20-30 October. Heard (1982) suggested the peak was 16-26 October. Some quantitative behavioural observations would better define the timing and duration of the peak to establish the extent of annual variations in the rut. Variation in the timing of the peak of calving (Gunn et al. 1982) is not necessarily evidence that the peak of the rut is variable. The duration of gestation can vary according to the plane of nutrition during pregnancy: gestation is a few days shorter for cows on a high nutritional plane (McEwan and Whitehead 1972).

The earliest dates that antlerless bulls were seen which had shed their antlers were 6 November 1958 (Wilke 1958), 31 October 1980 (Heard 1982, 4 of 211 bulls), 5 November 1981 (2 of 10 prime bulls) and 8 November 1982 (3 of 29 prime bulls). Subsequent to

the earliest date the proportion of antlerless prime bulls varied between 4 and 25% on a daily basis. The shedding of antlers after the rut by prime bulls is charcteristically rapid in prime male caribou compared to other North American cervids.

Wilke (1958) commented on "muley" (antlerless) cows; his accounts mention "several" and "in most" cases muley cows were trailing calves without antlers (p. 23). He also described two antlered cows trailing muley calves. In 1981, 5.1% of the adult cows were antlerless and 5.7% in 1982. In the Kaminuriak herd, 3.0% of the female caribou collected by the Canadian Wildlife Service between 1966-1968 were antlerless (F.L. Miller pers. comm. 1982). Only in Newfoundland are there herds with a substantial proportion of antlerless cows; 55% in the Interior herd, 81% in the Avalon Peninsula herd and 39% of the Humber herd were antlerless (Bergerud 1976). Other than Bergerud (1976), I could find no other published descriptions of genetically antlerless caribou cows. In 1981 an antlerless bull ("hummel") was observed at a distance of about 100 m at Tite Lake. He had no visible pedestals, a white mane about 15 cm long without dark brown flank markings; the penis was visible and no vulval patch was observed. Bergerud (1976) comments on the rarity of hummels of which he observed two at Mount Albert, Quebec.

The difficulty of distinguishing the presence or absence of small antler pedestals on the calves led to my reluctance to describe a calf as antlerless in most cases, and it is not always possible then to identify the relationships of antlerless calves to antlered or antlerless cows. Antlerless cows with either

antlered or antlerless calves were observed; in 1981 three antlerless cows were positively associated with antlerless calves. In 1982 we paid more attention to looking at the calf of an antlerless cow; 18 antlerless cows were followed by 16 antlerless and 2 antlered calves. Bergerud (1976) however, noted that many cows did not acquire visible antlers until their third summer in Newfoundland.

In 1981 and 1982, muskrat (Ondatra zibethicus) pushups on the Dubawnt River had been kicked open and the green sedge scattered and probably fed on. Caribou tended to track to and around isolated boulders on lake edges possibly investigating them as potential muskrat pushups. The use by caribou of muskrat pushups has been recorded from the Peace-Athabasca Delta, the Mackenzie River Delta and Alaska (Banfield 1954, Kelsall 1970).

The monitoring of movements was not a major objective, but my subjective impressions are mostly in agreement with Wilke (1958) and Decker (1978) who described the tendency of fall migrating caribou to follow drainage and lake systems. In 1981 and 1982 I particularly noted the heavy use of the Dubawnt River and Thoa River drainages as routes. Unlike Wilke (1958), I did not have an impression of caribou turning from major burns. Caribou in 1982 followed the Thoa River through a major 1979 burn west of Delight Lake and many caribou travelled through 1979 burns west of Manchester Lake.

RECOMMENDATIONS

1) The most efficient timing of fall composition counts is when large groups are migrating on the large lakes, i.e. after freeze-up. Prior to freeze-up, the caribou are in small groups in the bush, on muskeg or small ponds, and are quickly concealed by trees when attempts are made to classify them in those situations. Additionally, those small areas are usually not suitable to land a helicopter in. Counts in those situations also could be biased as cows with calves are the most responsive and rapidly leave an open area for cover. Delaying the composition counts until after freeze-up when the caribou are travelling on the large lakes would also lessen the possibilities of causing injuries through panicking caribou on glare or thin ice. Caribou on thin or glare ice were particularly responsive to the helicopter and we avoided aerial segregations under those circumstances. If composition counts are delayed until after freeze-up, caribou are more likely to be in larger groups and aerial segregations are then unnecessary.

2) Consideration should be given to using a four-bladed small helicopter, such as a Hughes 300, rather than the two-bladed Bell 206B. The Hughes 300 is only a two person machine but is relatvely inexpensive (similar to a Cessna 185 in price), has low fuel consumption, 480 km range and can be equipped with floats (one observer with a tape recorder is sufficient).

ACKNOWLEDGEMENTS

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Appendix A. Notes on caribou carcasses found during fall composition counts on the Beverly herd, 1981 and 1982.

Carcasses Located in 1981

Location:	Mansfield Lake area
Age class:	Calf
Sex:	Male
Cause of death:	Probably wolf kill
Carcass condition:	Carcass was intact lying on its right flank. One raven present; carcass was scavenged with a small hole pecked in the anal area and in the flank and the left eye was missing. The throat was lacerated and had puncture wounds. There had been snow falling in the previous 12 hours and no tracks were visible around the carcass. The calf had approximately 20 cm of spike antlers with tattered velvet, no warbles and a trace of back fat. The carcass lay on a small lake about 1 m from the bush at the edge.

Location:	Labyrinth Lake area
Age class:	Calf
Sex:	Unknown
Cause of death:	Possibly wolf kill

Carcass condition: Scattered remains of a calf carcass. Only one mandible, skin pieces, four disarticulated limbs which were fractured at the upper limb bone and bone fragments remained in the middle of a small lake. The stringy appearance of the meat suggested extensive avian scavenging.

Location: Glass Lake

Age class: Calf

Sex: Unknown

Cause of death: Probably wolf kill

Carcass condition: Carcass was intact but the abdomen was opened and the viscera removed; the throat was perforated and lacerated and the tongue removed; the frontal and nasal areas of the head were crushed. Wolf tracks were visible around the carcass and six ravens were present. The carcass was approximately 10 km from the edge of the bush on the lake.

Carcasses Located in 1982

Location: Alcantara Lake

Age class: 4-5 years (estimated from tooth wear)

Sex: Female

Cause of death: Probably wolf kill

Carcass condition:	Carcass intact but muscle masses from hind quarters and back and viscera removed. Throat was lacerated and torn, the tongue and cheek muscle were also removed. The carcass was just off a point of land on the lake and broken pieces of branches suggested a struggle. There were five ravens, a mature bald eagle and fox tracks around the carcass.
Location:	Thoa River
Age class:	Calf
Sex:	Unknown
Cause of death:	Probably wolf kill
Carcass condition:	Carcass intact but muscle masses from hind-quarters and all viscera removed. Throat opened and tongue and thyroid removed; heels of mandibles severed. The calf, had which 20 cm of velvet covered spikes, lay on the ice in the middle of the river. Ten ravens were present.
Location:	Thoa River
Age class:	9-10 years (estimated from tooth wear)
Sex:	Female
Cause of death:	Probably wolf kill

Carcass condition: Carcass intact but muscle masses from hind quarters, shoulders and ribs removed. The rib cage was intact with stringy fragments of tissue adhering which is suggestive of avian scavenging. The throat was opened; the tongue and thyroid removed and the heel of the mandibles severed. The cow had long straight antlers and lay on shore about 5 m from a boulder strewn edge of the river.

Location: Porter Lake

Age class: 5-6 years (estimated from tooth wear)

Sex: Female

Cause of death: Probably wolf kill

Carcass condition: The intact carcass lay on the lake ice at the base of a boulder strewn slope. The muscle from the hindquarter and viscera were removed. The throat was opened with the tongue and thyroid removed and the heels of the mandibles were severed. The cow had long straight antlers with one basal tine. The femoral marrow fat was pink-white.