DEPARTMENT OF

NORTHERN AFFAIRS AND NATIONAL RESOURCES

NATIONAL PARKS BRANCH
CANADIAN WILDLIFE SERVICE

CARIBOU INVESTIGATIONS IN KEEWATIN AND MANITOBA, AUGUST 15 to OCTOBER 15, 1956.

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INTRODUCTION

The following report deals with barren-ground caribou investigations in southern Keewatin and northern Manitoba. The investigations were conducted from Fort Churchill, Manitoba from August 15 to October 15, 1956.

They were designed to gather basic management data and biological knowledge concerning the three major eastern Arctic mainland caribou herds (Churchill, Duck Lake, and Brochet herds). In addition, the information provided by the survey was expected to be of direct value in the proposed 18-month barren-ground caribou investigation.

The three primary objectives of the survey were as follows:

(1) In view of the operational difficulties arising from unfavourable weather experienced during the 1955 spring aerial caribou survey (Loughrey, 1955), it was considered advisable to explore the possibility of conducting aerial surveys at other times of the year. The feasibility of conducting late summer or early autumn aerial censuses was to be tested. Weather conditions were to be observed to see how they affected the operational phase of survey flying at that time of year. The movements and distribution of the caribou herds were to be documented to determine the most favourable times and locations for conducting aerial censuses.

(2) To obtain caribou herd segregation data, especially to determine the annual calf crop accurately for the three major herds. Those data were considered important in establishing over-winter calf mortality by comparison with similar data to be gathered in the spring of 1957. In view of the very low calf crops determined by Kelsall (1956), it was decided that work relating to this objective should receive first priority.

It was proposed to compare the accuracy of the standard techniques for obtaining segregation data. This could be done while investigating the calf crop. In addition, efforts were to be made to determine the best technique for obtaining aerial photographs for segregation purposes, in order that a standard photographic technique might be adopted.

(3) To investigate reports of excessive late summer and autumn kills of caribou by the northern Indians and Eskimos in the study area.

It was considered that the following might be done incidentally: (1) a qualitative inspection of the winter and summer ranges of the caribou herds (11) an attempt to locate the calving grounds of one or two of the eastern herds; (111) a census of public opinion on, and an assessment of, the effectiveness of the caribou conservation program, especially the recently-initiated predator control program in southern Keewatin.

ITINERARY

The writer arrived in Churchill on August 14, 1956. Survey flights were commenced on August 27 and terminated on October 11. The itinerary, dates, routes, and mileages of survey flights are shown in Table 1. Flight tracks of survey flights are depicted on Map 1. A total of 4,788 miles was flown during the course of the investigation.

Table 1 - Itinerary for the Keewatin-Manitoba Caribou Investigation, August 27 to October 11, 1956.

Date 1956	Flight Route	Air Miles
August 27	Churchill - Duck L. - Padlei - Baker L.	492
" 28	Baker L. - Thelon Sanctuary - Baker L.	516
" 29	Baker L. - Churchill	424
Sept. 18	Churchill - Duck L.	140
" 19	Duck L. - Nueltin L. (south)	180
" 21	Nueltin L. - Kasmere L. - Fort Hall L.- Brochet	190
" 22	Brochet - Lynn L. - The Pas	300
" 25	The Pas - Fort Churchill	450
" 30	Churchill - Eskimo Point (via Camp L.)	320
Oct. 2	Eskimo Point - Churchill	180
" 4	Churchill - Eskimo Point - aerial census- Eskimo Point	500
" 5	Eskimo Point - Padlei - Nueltin L. (north) - Churchill	512
" 11	Churchill - Nueltin L. (north) - Churchill	584
		4,788

NARRATIVE

Upon arrival at Churchill I questioned civilian and military pilots concerning the distribution and movements of caribou in Keewatin District. Reports from all sources indicated that no large concentrations had been observed during the months of June, July, and early August. Most reports stressed the fact that very few caribou had been sighted.

The August flights were planned to cover a large part of southern Keewatin and the eastern part of the Thelon Sanctuary. Landings were made at Duck Lake, Padlei and Baker Lake to gather data relative to caribou distribution and utilization. A coastal fog in the Eskimo Point region prevented landing at that settlement on the return flight.

During the following week local pilots reported no sightings of caribou. It was decided to postpone further flights until the completion of a survey in northern Manitoba.

At the invitation of the Manitoba Game Branch I accompanied their survey flight across the northern portion of that province. The Manitoba Government aircraft, with Mr. Robertson, Chief Enforcement and Predator Control Officer, as observer and Mr. Baldwin as pilot landed at Churchill on September 17. The following day we flew in it to Duck Lake. Two days were spent in that vicinity and a caribou crossing where the local Chipweyan Indians had made a large kill the previous September was inspected. Small bands of migrating caribou were also observed and segregation data were gathered. Before proceeding to Nueltin Lake we undertook an aerial reconnaissance of the Duck Lake region. A camp was established at the south end of Nueltin Lake, just across from the rapids where the Thlewiaza River drains from Nahili Lake. Two days were spent patrolling the area adjacent to the camp. Another caribou crossing where the Chipweyans were reported to have made a large kill of caribou was inspected. After leaving Nueltin Lake the party proceeded to Brochet, landing on the way at Kasmere and Fort Hall Lakes, where further patrols on foot and by boat were conducted. The flight continued from Brochet to The Pas, via Lynn Lake.

Shortly after the return to Churchill, reports from local bush pilots indicated that caribou in considerable numbers were showing up along the Hudson Bay coast north of Churchill and inland from Eskimo Point. Acting on this information an initial flight was executed on October 2. Aerial, ground and photographic coverage as extensive as weather and finances permitted was obtained on two herds encountered. Aerial calf counts were made on

a herd between the Knife River and the Thlewiaza River. Extensive photographic coverage of a concentration at the McConnell River was obtained. A landing was made to obtain ground segregation of elements of that herd and the area of movement for the main herd was determined. By October 4 this large herd had reached the coast near Eskimo Point and offered an unique opportunity to conduct a carefully controlled aerial census, which was taken on that date. Landings were made to obtain additional ground segregation data. A flight planned for October 5 from Padlei to Ennadai Lake had to abandoned because of unfavourable weather encountered at the north end of Nueltin Lake. On the 11th a flight was made from Churchill to the north end of Nueltin Lake and extensive aerial photographic coverage of a herd of several thousand animals was obtained.

Due to the freezing of the lake used for the float plane base at Churchill, further flights had to be cancelled and field work terminated.

METHODS

Standard techniques were employed for studying the following aspects of caribou biology: distribution, movements, behaviour, and mortality. The techniques have been described previously by biologists of this Service and are identified only when referred to in this report. New techniques or modifications of standard techniques are discussed below.

Aerial Census Techniques

Only one aerial census, that of the Churchill herd, was taken for the purpose of obtaining a herd population estimate. In that census, use was made of the standard techniques described by Banfield et al, (1955) with several modifications. From flights made the previous week it was known that the herd occupied a large area, estimated at 500 to 1,000 square miles. It was decided that an attempt to delimit the herd boundaries accurately by flying the perimeter of the area of occupation would be too expensive and time-consuming. Parellel transects were flown at right angles to the direction of movement of the animals, which were moving slowly towards the coast. The area occupied by the herd was later determined by analysis of the transect data and plotted on an eight miles to the inch map sheet. The initial transects were flown at intervals of five miles, and over a coastal concentration of animals the transect interval was reduced to two miles. Data were recorded on a standard form on a clipboard. The transects for the census are depicted on Map 1. A Norseman aircraft was used in all the 1956 surveys; the observer sat in the co-pilot's seat

and angles of sight were marked on the strut of the aircraft with black electrical tape.

Herd Segregation Data:

To obtain sufficient data to permit expressing the number of calves in a herd as a per cent of the total number of animals, it was considered desirable to segregate on the ground at least 500, preferably 1,000, caribou. It was believed that best results would be obtained if these segregations were made as close as possible to the rutting period, since at that time the caribou herds are considered to be most heterogeneous. Before landing to obtain ground segregation counts, the area around the herd was reconnoitred and a location was selected where several hundred animals were feeding or migrating near a lake suitable for landing. After the landing, the caribou were approached upwind or crosswind. A station was selected which afforded cover, and passing bands of caribou were segregated with the aid of binoculars and recorded on a tally sheet. By such methods it was usually possible to segregate several hundred animals in one or two hours.

Aerial segregations of caribou herds were obtained by flying at low altitudes over scattered bands or groups. These flights were made at an altitude of 300 to 500 feet above the ground. The aircraft could be flown for short periods at 75 m.p.h., by maintaining a slight degree of flap and reducing airspeed. It was found by experience that it was difficult to count the calves in bands of 30 or more, especially when they were bunched together. When a recount was necessary the pilot circled the band. Records were kept on a tally sheet.

Calf percentages were also obtained by examining aerial photographs under a binocular microscope. The photographs were taken with a standard K-20 aerial camera, with shutter speeds of 1/250 or 1/500 of a second. Aperture settings were determined by the use of a light meter. The optimum altitude for taking aerial photographs for segregation purposes was checked by making duplicate "runs" at heights of 75 feet, 150 feet, and 300 feet above the ground. The optimum angle from the vertical for orientating the camera was checked by taking two series of photographs, one at 40° and the other at 60° from the vertical.

DISTRIBUTION, MOVEMENTS AND NUMBERS

The actual period during which observations of caribou herd movements in southern Keewatin were made covered only six weeks from the end of August to the middle of October. On the basis of the information secured and additional information obtained from bush pilots and local residents throughout the area it was possible to obtain a

fairly good documentation of the mid-summer migration of the two eastern herds. No details were available concerning the Brochet herd as it was not contacted and there are few reliable observers in that area.

A population estimate based on transect data was obtained for the Churchill herd. The summer ranges and calving grounds of the two eastern herds could be established only by inference since no flights were made over those areas.

Churchill Herd:

The mid-summer migration routes and area of concentration before the rut of the Churchill herd are depicted in Map 2.

The Churchill herd commenced its southerly mid-summer migration from its summer range in the vicinity of Kaminuriak Lake to Kaminak Lake and northeast toward Rankin Inlet. Tracks indicated that the main movement had followed the east shore of Maguse Lake. A large concentration was reported in the vicinity of Camp Lake on September 26. That herd was contacted during the flight on September 30. A dense concentration of 3,000 to 4,000 (based on estimates and K-20 photographs) was noted on the south side of the McConnell River 10 miles southeast of Camp Lake. On the same date smaller numbers of caribou were noted moving into the Camp Lake vicinity from the northwest. The main concentration at that time was moving steadily east between Camp Lake and Eskimo Point. The animals at the head of the movement had reached to within 20 miles of the coast. They were travelling in bands numbering up to several hundred along the parallel sandy ridges between the numerous small lakes.

On October 4, when that herd was again contacted, the advance elements had reached the coast near Eskimo Point and were spreading north to the Maguse River. Scattered bands were still moving in from the Camp Lake district to the west and from the McConnell River to the southwest. The migration momentum appeared to have been expended when the animals reached the coast, as most of them were resting or grazing and their movements appeared haphazard. At the time it seemed probable that they would move on, probably to the north, at a slower pace.

As previously mentioned, a census of this herd was taken on October 4. The transects are shown on Map 1. Survey data on which population estimates were based are provided in Table II.

A total of 226 linear transect miles was flown, during which 3,692 caribou were recorded in the sample areas A and B of 60.1 square miles. On the basis of 12.7 per cent coverage of the major concentration (Area A), an index of 91.5 caribou per square mile was calculated for 32.6 of the 256 square miles. On this basis a total of 23,400 animals is estimated for Area A. From Table II the exceedingly high concentration of caribou per square mile in that area can be seen (up to 175.5).

On the basis of a 4.5 per cent coverage of Area B (608 square miles) an index of 19.4 caribou per square mile was calculated, giving a total of 11,800 animals for that area.

The total number of animals involved in the movement, then, was estimated at 35,200. This is exactly (too exactly!) the same as the estimate of 35,200 for this herd from the 1955 re-survey, (Loughrey, 1955).

Table II - Survey Data for the Calculation of the Churchill Caribou Herd Population

Transect No.	Transect Length (Miles)	Transect Width (Miles)	Area (Square Miles)	No. of Caribou Seen	No. of Caribou per Square Mile	Altitude Above Ground Level (Feet)
Area "A"						
6	12	.165	2.0	21	10.5	400
7	17	.187	3.2	561	175.5	450
8	17	.384	6.5	970	149.0	400
9	16	.384	6.2	333	54.2	400
10	16	.384	6.2	955	155.2	400
11	17	.384	6.5	298	45.8	400
12	12	.165	2.0	19	9.5	400
Summary Area A	107		32.6	3157	91.5	
Area "B"						
1	34	.336	11.4	226	19.8	350
2	28	.165	4.6	293	63.8	400
3	17	.165	2.8	0	0.0	400
4	10	.187	1.9	0	0.0	450
5	30	.226	6.8	16	2.4	550
Summary Area B	119		27.5	535	19.4	

Duck Lake Herd:

The mid-summer migration route and the area occupied by the Duck Lake caribou herd before the rut is depicted on Map 2. This herd appeared to have summered in the vicinity of the Kazan River north of Yathkyed Lake. The southward summer migration passed around the east shore of Yathkyed Lake in early August and reached Padlei by the 15th of that month. The advance elements of the herd reached Duck Lake by August 18, apparently having passed around the east shore of the Henik lakes and crossed the Thlewiaza River in the vicinity of Edehon Lake. At Duck Lake the migration deviated from the normal pattern. Instead of swinging back through Duck Lake and crossing that lake at the narrows as they usually do, the main body of the herd penetrated the taiga to a point near the headwaters of the Knife River. It then turned towards the coast and moved northeast to the mouth of the Seal River. It spread northward along the coast to the Thlewiaza River. During the first week in October it was spread out for 100 miles along the coast and up to 20 miles inland. At that time large numbers of animals were noted grazing along the ridges and shores of the coastal sloughs from Hubbard Point north to Nunnalla.

No estimate of the number of caribou occupying the coastal plain was attempted, as the aerial survey was devoted to obtaining segregation data. From the impressions received, I would estimate that there were at least 20,000 caribou in this herd.

An inspection of the caribou crossings at Duck Lake on September 18 indicated that only a few hundred animals had crossed the narrows at the south end of that lake. This is the location where for many years the Chipweyan Indians have made their largest kills. At the time of our visit some 500 animals were observed along the west and north shores of the lake. The movement at that time appeared to be in a general northeasterly direction with crossings being made at the north end of Duck Lake and over the narrow river that joins that lake with Nejanilini Lake. From the inspection of the tracks and the number of animals sighted in that vicinity, it seems likely that only a few hundred animals (1,000 to 3,000) made the traditional mid-September crossing at Duck Lake.

On October 11, tracks indicating that a fairly large number of caribou had ascended the Thlewiaza River were noted between Edehon and Sealhole Lakes. Elements of the same herd were contacted on the same date on the shore of Nueltin Lake some 10 miles west of Sealhole Lake. The movement still appeared to be in a northwesterly direction, but at the time of observation most of the animals were closely bunched together around the shore of a small lake. Aerial photography indicated a total of 3,500 animals in this herd.

Unfavourable weather conditions made it impossible to proceed farther west to ascertain whether other herds existed. On the basis of existing information it was not possible to clearly assign the herd seen to either the Duck Lake herd or the Brochet herd.

Brochet Herd

Little information is available concerning the movements of this herd. After several unsuccessful attempts to reach and survey the Ennadai Lake area during early October that project had to be abandoned because the lakes in the area had frozen. Mr. Kerr, the Northern Service Officer from Churchill, visited Ennadai in mid-September and reported that the local Eskimos were obtaining caribou from a herd moving southward through that area. The general direction of movement only, is shown on Map 2.

Eastern Thelon River Herds

Observations were made on the caribou in the eastern portion of the Thelon Game Sanctuary on flights made from Baker Lake in late August. At that time a small movement of caribou eastward along the north shore of Aberdeen Lake was noted. At the big bend of the Thelon River the extent of recently churned up tundra along the shores on both sides of the river indicated that a herd of several thousand had crossed that river. They appeared to have come from the northeast and were moving in a southwesterly direction. At the time of the survey flight there were still a few stragglers on the north side of the river as far east as Beverly Lake.

No estimate of the numbers involved in either of these movements is possible. The general direction of their mid-summer migration is depicted in Map 2.

HERD SEGREGATION

Annual Increment

The annual increment, the number of calves of the year expressed as a percentage of the total number of caribou, was obtained by the age segregation of several eastern herds. The results of the segregations are presented in Table III.

Table III - Annual Increment in Keewatin Caribou Herds

Herd	Date	Method	Animals Total Segregated	Total Calves	Per cent Calves
Duck L.	Sept. 18	Ground	130	8	6.1
"	" 19	"	225	18	8.0
"	" 30	Aerial	266	35	13.2
"	Oct. 5	"	453	30	6.6
"	Sept./Oct.	Summary	1,074	91	8.5

Table III - Annual Increment in Keewatin Caribou Herds (Continued)

Herd	Date	Method	Animals Total Segregated	Total Calves	Per cent Calves
Churchill	Sept. 30	Ground	477	18	3.8
"	Oct. 4	"	570	36	6.3
"	Sept. 30	Aerial	179	23	12.8
"	Oct. 5	"	1,036	89	8.6
"	Sept. 30	Photographic	1,484	114	7.7
"	Summary		3,746	230	7.5
Nueltin L.	Oct. 11	Photographic	1,956	112	5.7
Total Summary			6,776	483	7.2

The calf percentage for the year for the caribou herds in southern Keewatin District, based on the segregation of 6,776 animals, must be accepted as representing the 1956 calf crop for those herds at the time of the survey. In view of the determination in other studies of a possible annual increment of 21.6 per cent (Banfield, 1954), the 7.2 per cent determined from the present investigation is alarmingly low.

Either or both of two reasons may have been significant in causing a low calf crop in 1956, a low rate of fecundity in the cows and a high rate of calf mortality from the date of birth to the time of investigation. On the basis of the present information it is not possible to attribute the reproductive failure to either reason for cause or to determine and assess the operative factors. To do so would require a detailed study of all the reproductive phases of the caribou, the associated weather phenomena, the effect of predation, and possibly other factors as yet unrecognized.

Table IV. Average Mean Daily Temperatures at Churchill and Chesterfield Inlet for the Period May Through August, 1956, compared with Long-Term Averages.

	May	June	July	August
Chesterfield Inlet: 1956	12.8	35.0	48.4	45.7
11 year average	21.0	37.0	49.0	47.0
Churchill: 1956	22.0	41.1	56.2	52.8
18 year average	30.0	43.0	54.0	52.0

From Table IV it can be seen that for both Churchill and Chesterfield Inlet the months of May and June, 1956, were colder than average, especially May. It does not seem advisable to attempt to interpret the significance of these meteorological data without considering other physical phenomena such as wind velocity, daily temperatures, humidity (perhaps best called wind chill) and herd movements, snow depths and local breakup conditions. For the present I should like to suggest that the colder than normal weather at the time of calving, may have been an important factor in calf mortality, for the eastern herds in the spring of 1956.

In view of the large number of animals segregated for the Churchill and Duck Lake herds it is imperative that comparable segregation data for the same herds be obtained in the spring of 1957. It may then be possible to assess the over-winter calf mortality.

From Table III it may be noted that the calf crop averages of the Duck Lake and Churchill herds (8.5 per cent and 7.5 per cent respectively) are quite similar. It could be expected that two herds occupying similar, adjacent summer and winter ranges and performing similar migrations would be subject to similar calf mortality factors.

The calf percentage obtained for the herd at Nueltin Lake (5.7 per cent) is of less value for purposes of comparison with 1957 data, as it was not possible to ascertain whether the caribou belonged to the Duck Lake or Brochet caribou herds.

Comparison of Ground, Aerial, and Photographic Segregation Methods

As mentioned in the introduction one objective of the investigation was to compare the validity of the standard techniques for obtaining annual increment data. The increment data resulting from the various segregation methods is shown in Table V for the Churchill and Duck Lake herds. All three methods were used in segregating the Churchill herd. For the Duck Lake herd, photographic segregations were not possible as there were no large concentrations.

Table V - Comparison of Calf Segregation Techniques

Herd	Technique	Total Animals Segregated	Total Calves	Per cent Calves
Churchill	Ground	1047	54	5.2
Churchill	Aerial	1215	112	9.2
Churchill	Photographic	1484	114	7.7
Duck L.	Ground	355	26	7.3
Duck L.	Aerial	719	65	9.1

We may assume that the photographic method is the most accurate of the three. From Table V it can be seen that the ground segregation percentage for the Churchill herd is 2.5 per cent lower than the photographic, while the aerial segregation percentage is 1.5 per cent higher. The ground segregation percentage for the Duck Lake herd is lower by 1.8 per cent than the aerial, and that indicates the same general conclusion. Apparently ground segregation percentages are lower than the actual calf crop and aerial segregation percentages are higher.

The following explanation is offered to account for the apparent error.

It was noted that each herd was composed of units varying in number and sex composition. In most cases the lone individuals were mature bulls. The small groups of from 2 to 9 consisted chiefly of cows with calves and occasionally yearlings. The larger bands, from 10 to several hundred, were usually composed of a varied mixture of cows, calves, yearlings, and bulls.

When making ground segregations of caribou the general practice is to concentrate on bands in migration, especially if they are passing in single file. This allows the observer to accumulate data rapidly. Scattered individuals and small groups of caribou are not apt to be observed and recorded in ground segregations. Conversely when making aerial segregations, the aircraft goes so fast that it is difficult to distinguish calves in bands of more than 20, particularly if the animals are closely bunched. Unconsciously the observer selects for segregation individuals and scattered small groups. Thus, the ground segregations are based on a proportionately high percentage of bands and aerial segregations on a proportionately high percentage of individuals and small groups.

If the above assumptions and observations are valid, the reason for the apparent discrepencies resulting from these two types of segregations becomes apparent. In relation to the actual composition of a large herd the ground segregations contain a proportionately low percentage of calves while the reverse is true for the aerial segregations.

As a further check, similar data should be gathered for other herds and preferably by other observers. If their findings confirm the above hypothesis observers may be able to minimize their errors by attempting to base ground and aerial segregations on samples reflecting the actual composition of the herd as closely as possible.

Aerial Photographic Techniques

As discussed in the section on Methods aerial photographs primarily for segregation purposes were taken with a hand-held, Fairchild K-20 aerial camera. Several series of photographs were taken at various altitudes and at several positions of inclination from the vertical in order to determine the optimum conditions. A quantitative evaluation of the results so obtained was not possible. However, examination of the series of photographs under a binocular microscope to obtain segregation data, indicated the conditions most favourable for that type of work. The photographs most suitable for segregation purposes were those taken at the altitude of 150 feet above the ground. The animals are larger in photographs taken at lower altitudes but they are more apt to be blurred; and, because the camera must be held at an oblique angle, the calves, especially those partly hidden by cows may occasionally be obscured. Photographs taken at an angle of about 40° from the vertical were more useful than those taken at more oblique angles, since the individuals in the latter were often too small for age determination.

Thus, the most satisfactory results for aerial photographic segregation of caribou herds were obtained by taking the photographs at altitudes of 150 to 200 feet above the ground (up to 300 feet if there is a solid snow cover), with the camera held at an angle of 40 to 50 degrees from the vertical, preferably pointed slightly forward. For the purposes of standarizing techniques it would be of value if other observers would record and discuss their findings and preferences.

THE RUT

The caribou rutting season commences about October 15 (Banfield, 1954) at a time when travel by float or ski equipped aircraft is impossible, and extensive ground travel is hazardous. The following observations made during the immediately before the onset of the rut are recorded, as they may be of some value.

As noted in the section on Distribution, both Churchill and Duck Lake herds were on the coastal barrens between the Churchill and Maguse Rivers (see Map 2). It is very probable that the rutting season (from October 15 to November 15) was passed on or near those areas. Observations made during the two weeks before the rut indicated that the bands consisted of a mixture of cows, calves, yearlings and bulls. Certainly in the two herds under observation there were enough bulls among the cows for successful breeding. In very few instances was a band of cows noted without one or more mature bulls in close attendance. The above observation is considered important. It has been suggested as a possible reason for reproductive failure of the caribou herds in recent years, that the cows and bulls were separated at the time of the rut and that there was no opportunity for successful breeding. That the breeding bulls mixed with cows just before the breeding season is not a definite refutation of the above speculation. However, if a low calf crop is recorded next summer, in the Churchill and Duck Lake herds, the failure of the cows and bulls to meet during the rut should not be considered responsible.

By the third week in September two-thirds of the mature bulls had completely shed the velvet from their antlers. The remainder were in various stages of shedding, with the velvet hanging in long strips. On September 19, while observing caribou at the north end of Duck Lake, I saw two bulls which had been slowly grazing toward each other, make a few quick passes at each other with their antlers before turning aside. On the same date Mr. Robertson observed a bull make an unsuccessful attempt to mount a cow. I observed a more prolonged sparring contest between two bulls on October 4. This occurred inland from Eskimo Point in the vicinity of Camp Lake. I was obtaining segregation data on bands of passing caribou when I heard the sound of antlers clashing. By climbing a slight knoll behind me I

was able to observe through my binoculars the two combatants on a hillside about one-half mile distant. In that case the two bulls "squared off", lowered their heads with the antlers extended, and advanced slowly towards each other. Their antlers met with a clash and they then engaged in a shoving contest with the uphill animal at a distinct advantage. The lower animal withdrew by stepping to one side. The pattern of contest was repeated about twice before they each wandered away. The sparring observed was far from spirited and the contest appeared to be merely preliminary. Other caribou of various ages and sexes grazing or moving about on the hillside paid no attention to the contestents. No cow was noted in the immediate vicinity of the bulls. Lawrie (1950), in his description of the rut, records that the first sparring and clashing of antlers between bulls in the Nueltin Lake region occurred on October 12.

By October 4 all the mature bulls appeared to have shed their velvet, although some had lost it just recently, judging from the blood-smeared tips of their antlers.

Several antlerless cows were noted during early October. All were fat and in excellent condition. Sam Voisey of Eskimo Point informed me that the local Eskimos were aware of this condition and made special efforts to kill the fat antlerless cows. I suspect that they were barren or had lost their calves soon after birth. It is likely that failure to lactate, after the loss of a calf delays antler shedding and retards the growth of new antlers. This condition should be investigated; if it were found that the antlerless cows were those that had lost their calves at birth, a large percentage of those animals in the fall migration could be taken as indicating a heavy calf mortality during the previous period of calving.

BEHAVIOUR

An interesting group behaviour pattern was noted during this investigation. I was observing from concealment a band of about 70 caribou as they passed single file in front of me at a distance of about 100 yards. When the last half dozen were opposite, I stood upright in plain view of the animals. As soon as they sighted me they took off at a full gallop. When overtaken, the animals in front of them in turn joined the flight, without looking behind. Eventually the whole band moved off at a full gallop for about a half mile before resuming their walking gait.

The interesting part of this flight or escape pattern was the response of the entire band as a unit to the action of a small number. In most instances I have observed that caribou in a band seldom reacted as a unit, but rather as individuals or as a number of units. When a band of caribou is disturbed, several animals usually run in headlong flight. Others close

to them may only trot nervously to one side, and those at a distance continue to graze or look on with seeming indifference.

MORTALITY AND DEBILITATING FACTORS

Predation

In the course of this investigation a record was kept of all wolves observed on survey flights, as well as the frequency of wolf signs on ground patrols. Information concerning wolves was obtained also by interviews at the various settlements. The number of wolves seen on survey flights over the tundra and tree-line area north of a line between Churchill and Brochet is shown in Table VI.

Table VI - Wolf Observations for Aerial Surveys over Tundra and Tree-line Regions

Date	No. of Wolves	No. of Linear Miles of Survey	Linear miles per wolf
April 4 to June 8, 1955.	32	11,225	351
Aug. 27 to Oct. 11, 1956.	11	4,038	367

The number of linear miles per wolf is given in the above table as an index of frequency. The corresponding figure from the 1955 spring caribou resurvey is included for comparison. Despite the difference in season and probably in visibility, the indices ~~of wolf~~ for the two years are remarkably similar. However, conclusions concerning wolf population trends do not seem warranted until further data have been accumulated.

Observations of wolf signs (droppings and tracks) were made on all ground patrols. At Duck Lake and southern Nueltin Lake the signs indicated the wolves were plentiful in the area, although there were no indications of large packs. I was particularly surprised by the numerous recent wolf signs in the Nueltin Lake region where there were no caribou in the immediate vicinity or indication that caribou had recently passed through the area. Wolf signs were less frequent in the country west of Nueltin Lake towards Brochet. This suggests that the local wolf populations are being brought under control by the Manitoba Game Branch predator control program.

Mr. H. Voisey of Padlei informed me that in addition to the five wolves taken on poison sets, 25 were traded at that post during the previous winter and spring. He stated that wolves still appear to be abundant in that district. Constable Gallaher, R.C.M. Police, Eskimo Point detachment, estimated that in addition to the wolves recorded from the predator control program in that area, 40 probably had been killed by the poison. He claimed that they had either been snowed under or had wandered some distance from the poison sites. Some poisoned wolves were brought into the detachment by the local Eskimos. Sam Voisey of the settlement informed me he believed there were fewer wolves than usual in the vicinity during the summer. He stated that no pups had been brought in by the Eskimos during the summer.

The above observations imply that the predator control program should be continued in the Duck Lake, Nueltin Lake area and also in the Eskimo Point coastal region. It should be intensified in the Padlei region and specially intensified in any areas where large numbers of caribou winter this year.

Since few observations of wolves hunting caribou have been recorded in the literature, the following is included for record purposes. On September 19, Mr. Robertson and myself were observing caribou at the north end of Duck Lake, Manitoba. We were lying concealed behind some stunted tamarack trees on a hillside, watching a band of caribou on the opposite side of a small slough about one-half mile distant. The caribou were proceeding towards a narrow swampy isthmus of land bounded by the slough and a large lake. As they approached the crossing they appeared to become nervous. After making several false starts they reversed and galloped back along the far shore of the slough, apparently intending to make the crossing at that end. As we were downwind and well concealed I was unable to account for the sudden "spooking" of the caribou. A few seconds later a large black wolf came running over the hillside almost directly towards Robertson. It saw him at about 50 yards and turned away. It ran uphill, passing about 75 yards from me. From the actions of this wolf we concluded that, like ourselves, it had been lying in concealment at the edge of the swamp, waiting for the caribou to cross the isthmus. It probably hoped to surprise them in the cover afforded by some stunted spruce in the swamp. When the caribou reversed direction the wolf apparently attempted to reach the far side of the slough before the caribou did. When it saw us it abandoned its plan.

Diseases, Parasites, and Accidents:

Of 1,402 caribou observed closely during ground segregation work, only three, all cows, were noted to be visibly crippled. This gives an incidence of 0.2 per cent

crippled animals in the herds, a percentage significantly lower than that recorded by Crisler (1956) for a herd of 397 animals (1.8 per cent cripples).

Mr. Sam Voisey of Eskimo Point informed me that during the summers 1954 and 1955 a considerable number of animals with scabby tongues and pus-infected feet had appeared near Term Point. The symptoms fit for actinomycosis and joint ill, respectively. No opportunity was available during the investigation for conducting autopsies.

Utilization

The total number of barren-ground caribou taken in northern Manitoba for human utilization during the winter of 1955-56 has been estimated at approximately 9,000. These data were obtained by the Manitoba Game Branch personnel and are shown in Table VII.

Table VII - Caribou Utilization in Northern Manitoba

Area	Number of Caribou Killed
York - Shamattawa	158
Split Lake	1,230
Oxford House	1
Limestone	50
Churchill	60
Nelson House	31
South Indian	415
Pukatawagan	12
Brochet	3,548
Duck Lake	2,000
North River	1,500
Total	9,005

Little data concerning caribou utilization for the fall and winter period of 1955-56 are available for the Keewatin area, due to the absence of field personnel. Information relating to the utilization of caribou from spring to autumn, 1956, was gathered during the present investigation and is discussed in this section. However, since many of the hunters were still "on the land" at the time of the survey complete data are lacking for most of the settlements.

Duck Lake, Manitoba

Mr. Horace Flett of the Hudson's Bay Company, Duck Lake, informed me that the total spring kill by the 16 Chipweyan hunters of that settlement was approximately 225 animals. The mid-summer migration of the Duck Lake caribou came through the area from August 18 to 21. At that time the hunters took an estimated 175 animals all for their skins, for clothing. The people at the settlement were moved to Churchill on the 20th and 21st of that month and so had no opportunity to dry or smoke the meat. After a brief sojourn at Churchill they moved 25 miles northwest to the North Knife River. During October they hunted caribou on the coastal plains north of the river. I flew over that area on October 11 and noted several carcasses marked with spruce poles and cloth flags.

Although these people will undoubtedly continue to kill large numbers of caribou at their present location it is doubtful if they will be able to make the excessive "slaughters" possible at the unique caribou crossing near their former camp on Duck Lake.

Nueltin Lake and Brochet, Manitoba.

No quantitative data for the number of caribou taken during the summer and early autumn by the Indians in this area are available. However, the indications, at the time I visited the area, were that very few had been taken. There were two reasons for the small autumn kill: first, the caribou did not come south in September into the south Nueltin Lake and Cochrane River district; and second, many of the Indians were late in moving out to their trapping grounds.

Mr. Robertson and I inspected the crossing at south Nueltin Lake where during the previous autumn, the Indians had made a kill of about 500 animals (determined from the abundance of skulls and carcasses at the crossing). This year the caribou did not reach that area nor were there any hunters at the Chipweyan winter camp located about a mile from the crossing. Mr. J. Cumines of Brochet stated that more local Chipweyan hunters were becoming interested in commercial fishing on Reindeer Lake. If the trend continues, it should have favourable results in the future.

The Indians will have less time for their autumn hunting, and when they have acquired the necessary equipment and skill they may be easier to persuade to put up coarse fish for dog-food.

Padlei, Keewatin

The inland Padlermiuts are very dependent upon caribou in their primitive economy. Unfortunately precise utilization data are difficult to obtain. According to Mr. Voisey the caribou came north through the Padlei district, and were heading for Yathkyed Lake on July 3. At that time the natives hunted for fresh meat for themselves and their dogs. In late July, August, and September they moved out on the land to favoured localities where caribou traditionally reappear on their southward mid-summer migrations. This is the time when the largest kills are made by those people. The caribou seldom return as far north as Padlei on their northward movement in September and October.

On August 27 I flew over an Eskimo hunting camp located on the eastern shore of the bay at the end of the Tyrrell Arm of Yathkyed Lake. This appeared to be an excellent location, as the caribou migrating southeast along the east shore of Yathkyed Lake funneled through a valley at the head of the bay (Map 2). The camp, which consisted of one canvas and three conical caribou skin tents, was situated on a low ridge affording an excellent view of the adjacent terrain. At the time of the flight only a small quantity of meat appeared to be stored near the tents.

On October 11, Mr. Voisey informed me that he had received some 300 caribou skins for trade during August and September. He stated that 600 skins is the average number traded during that period.

Baker Lake:

The last reports from Baker Lake which I received on October 4 indicated that no caribou had passed close to that settlement during the late summer and autumn migration. It seems likely that the autumn kill for that settlement was negligible.

On August 28 I visited a camp of Baker Lake Eskimos located on the north shore of Aberdeen Lake opposite the narrows at the middle of the lake. In that camp of three canvas tents were four men, four women, six children, and four dogs. The hunters from the camp were obtaining caribou from bands moving east along a broad valley on the north shore of the lake. At the time of the visit they had obtained about 75 skins for clothing, nearly one-third of which were calf skins for children's clothing and underclothing. The hides were stretched and pegged with the skin side up on the ground near the tents. Several dozen rib baskets and tenderloins

were exposed for sun drying, along with bundles of back sinew.

The Eskimos appeared to be self-reliant and healthy.

Eskimo Point, Keewatin

Since most of the Eskimos from this settlement were on the land hunting caribou during the period I visited that post, no precise data concerning their autumn utilization of caribou could be obtained. The migration of caribou from the interior to the coast near the settlement in early October was heavy, and it seems likely that the Eskimos killed several thousand animals from that herd.

As previously stated the Churchill herd was estimated at 35,200 animals and had a calf crop of 7.5 per cent or approximately 2,640 calves. Utilization data for this settlement gathered during previous years (Loughrey, 1955) indicated annual kills as high as 5,000 animals. These figures speak for themselves and require no emphasis. It will be very important to obtain accurate utilization data from this settlement for the 1956-57 period.

Ennadai Lake, Keewatin:

I was unable to visit this settlement during the present investigation. According to Mr. Kerr, the Northern Service Officer at Churchill, the Eskimos of the settlement commenced to get caribou in late August. He estimated the take would amount to 100 to 200 animals. Some of the caribou were cached.

Discussion:

Except for Baker Lake where there appeared to have been less than the normal kill of caribou for the second consecutive year, the Eskimo utilization in Keewatin during the mid-summer migration was probably about average (Loughrey, 1955). In northern Manitoba including Duck Lake and Brochet the utilization of caribou by the northern Indians during the autumn migration was considerably less than normal.

The total number of caribou which inhabit Keewatin District and northern Manitoba was estimated to be approximately 169,000 animals (1955 resurvey data). If the average calf crop for all herds in this area was 7.2 per cent, the annual increment for the total population was about 12,200 calves. In my 1955 report I estimated that the total utilization by Indians and Eskimos in those areas was in the neighbourhood of 30,000 animals, exclusive of cripples. If the 1956-57 utilization approaches this figure, the losses due to utilization alone will exceed the annual increment

by 17,800 or 10.6 per cent of the total population. This does not take into account losses due to other factors such as predation, accidents, and diseases. Further, it must be remembered that the increment figure used in the above calculation was based on the autumn calf crop, without allowance for the overwinter calf mortality.

It becomes increasingly apparent with each investigation that if the principles of herd and district management proposed in my report of July, 1955, are not practiced, no amount of research into basic biology and ecology will deter the inevitable decline of the mainland caribou population.

RANGE CONDITIONS

During the course of the present investigation incidental observations concerning the condition of the caribou winter and summer ranges were made in northern Manitoba and southern Keewatin.

Winter Range:

A cursory inspection of the winter range was made during ground patrols in the vicinity of Duck Lake, Nejanilini, Kasmere, and Fort Hall lakes. Particular attention was paid to the extent of lichen growth, especially the fruticose lichens of the genera Cladonia and Cetraria. It has been shown that caribou display a distinct preference for these lichens as a winter food (Loughrey, 1952).

The Duck Lake-Nejanilini Lake area does not lie within the normal caribou winter range in northern Manitoba, but it is of interest because for many years heavy migrations of caribou have passed through the area in spring, summer, and autumn. Although this region lies well within the tree-line, the tree cover is not continuous and is restricted to drainage systems and low sheltered areas. A broad esker runs the length of Duck Lake, almost parallel to the west shore. At its northeastern extremity it forms the west bank of the river which connects Nejanilini and Duck Lakes. Grasses, forbs, willows, and stunted spruce and tamarack grow luxuriantly around the shores of the lakes and in places of low relief and poor drainage. As conditions become more xeric, through the combined effects of increased drainage and exposure to the wind, on such locations as the sides and tops of eskers and moraines, the tree growth becomes more stunted and disjunct and lichens and mosses predominate as ground cover. In locations such as those at Duck Lake the fruticose lichens, although forming a fairly continuous carpet, were very shallow. The lichen growth seldom exceeded an inch and a half in depth and often was less than an inch. It appeared to have been grazed heavily by caribou.

The country between Duck Lake and southern Nueltin Lake is characterized by a tree cover of spruce and tamarack which increases from east to west in density and size of trees. Poplar, birch and jack pine become increasingly frequent and long, sinuous sand eskers orientated in a north northwest - south southeast direction predominate. Ground patrols made between Nueltin and Nahili lakes and Fort Hall and Kasmere lakes revealed similar ground cover. The former region lies north of, and the latter region within, the limit of normal winter range for caribou in northwestern Manitoba. Those areas are characterized by open parklike stands of jack pine which predominate on the sides of the rolling sandy eskers. In those areas, particularly in the Fort Hall region, the ground cover of fruticose lichens seldom exceeded an inch in depth. That condition appeared to be the result of grazing by caribou herds. There was little evidence that the lichens were being destroyed by trampling by the herds except along the barren, well-marked trails.

The above observations suggest the possibility of overgrazing of lichens in the areas inspected. However, it should be noted that the observations were limited to the northern fringe of the normal caribou winter range in Manitoba and the conditions there may not be characteristic of the whole winter range. An excellent discussion of the caribou - lichen co-action is provided by Leopold and Darling (1953, pp. 53-59). These authors state that during the winter the lichens supply the necessary nutrients for subsistence and successful reproduction of caribou. In view of the alarming decrease in the size of caribou calf crops in recent years in the study area and the indications of overgrazing noted, it seems advisable to undertake an intensive, quantitative investigation of the caribou winter range. Such a study should stress the determination of the nutritive value of the range, its carrying capacity, and its rate of regeneration. Particularly valuable results might be obtained by the use of exclosures (Kelsall, 1955). The possibility of using "natural exclosures" such as islands surrounded by open water during the winter should be considered.

Summer Range

Ground observations on the summer caribou ranges in Keewatin were very limited. It was noted in the section on Distribution that the two eastern herds moved out to the coastal plains of Hudson Bay just before the rutting season. Ground observations indicated that they were then feeding extensively on the very luxuriant lichen growth which characterizes the Hudson Bay coastal lowlands. Again the need for a detailed study of range conditions is indicated.

Calving Grounds

The range, where both the Churchill and Duck Lake caribou herds normally summer and where the females usually

drop their calves, is outlined on Map 1. This area lies east of the Kazan River drainage from the southeast corner of Yathkyed Lake to Kaminak Lake and in the region surrounding Kaminuriak Lake. Reports from resident civilian and military pilots indicate that caribou are usually found in considerable numbers in the area in late June and July. In some years, however, the two herds or elements of them may continue northwards to cross the east end of Baker Lake at the islands. They then turn west along the north shore of that lake and summer in the area either north or south of Aberdeen Lake.

During the present investigation I was not able to visit those areas during the early summer to confirm the above observations. It is suggested that further study of the summer movements, possibly in conjunction with a marking program, is required for those herds.

CARIBOU CONSERVATION

During the present investigation an attempt was made to assess the present status of caribou conservation in the study area. This subject is discussed below under several headings.

Predator Control:

During the winter of 1955-56 an experimental predator control program was initiated on the barrens of southern Keewatin and extended into the taiga areas of southwestern Keewatin. A report on the initial part of the program has been submitted by Flook and Novakowski (1956) and on the extended program by Robertson (1956). From a biological point of view there is little doubt that such programs can be successful in controlling wolf populations.

Public support of programs of predator control is important. To assess the public reaction to the above programs, I questioned residents in the settlements of Eskimo Point and Padlei. None of the persons interviewed had any complaints concerning the program initiated in those regions. Without exception they considered that it was a success. They expressed themselves as being most anxious that wolf control should be continued. They appeared to believe that effective predator control would result in less caribou being taken by wolves and fewer foxes being destroyed in the traps by wolves.

Range Management and Protection

Most of the winter range of the Keewatin-Manitoba caribou herds are in the Province of Manitoba and its protection from forest fire is a provincial responsibility. The importance of forest fire protection for this winter range was stressed previously (Loughrey, 1955).

To date lack of knowledge concerning management of the caribou ranges has been a handicap in initiating a program of range protection. The addition of a qualified range biologist to the staff of this Service should correct this situation.

Education

A beginning was made this year in the distribution of specially prepared conservation information to the Eskimos. This material was published in the form of a Departmental pamphlet printed in Eskimo syllabics, script, and English, entitled Tuktut. I questioned white and Eskimo residents in several Keewatin settlements concerning the Eskimo reaction to the pamphlet. The people interviewed indicated that the Eskimo response varied from favourable acceptance to indifference. None of the Eskimos indicated that they found the material patronizing. The distribution of the pamphlet was, I believe, a valuable step in Eskimo conservation education. However, if the program of conservation education is to succeed it will be necessary to follow up the initial information with additional material. A wildlife conservation column could be profitably added to the monthly Eskimo bulletin.

A pamphlet similar to the one described above, but with a somewhat more sophisticated approach, should be published and distributed to the northern Indians.

I was surprised at the concern shown by many of the residents in various settlements with regard to the disappearance of the caribou. It no longer seems necessary to convince these people, including the Eskimos (except the Eskimo Point people) of the recent and significant decline in numbers of the caribou herds.

The contribution of the R.C.M. Police, Northern Service Officers, traders and missionaries in promulgating conservation information to the Indians and Eskimos should not be overlooked. All these people appear to be sincere in their desire to curtail excessive utilization and wanton wastage of the caribou by the natives. One of their greatest handicaps is a lack of suitable information. One R.C.M. Police constable informed me that he had assembled the local Eskimo hunters and through an interpreter had discussed Banfield's 1954 publication. The same constable asked me if it would be possible to receive reports of recent wildlife investigations conducted in the Eastern Arctic. The services of men like Lewis Voisey (now working for Mr. Kerr at Churchill), who know the country and the language, will be invaluable in any conservation program.

Utilization Data

The gathering of accurate caribou utilization data from the Indians and the Eskimos has not kept pace with our knowledge of other basic management data such as herd size and annual increment. An initial step in the direction of gathering utilization data has been made this year with the preparation and distribution of a calendar to the Eskimos for recording their take of various species of wildlife. A continuation and intensification of efforts relative to this phase of conservation is required. Specific recommendations were included in my 1955 report.

Legislation and Enforcement:

It has been shown that in some instances present regulations concerning caribou conservation in the Northwest Territories and the provinces are outdated. An alternative programme of herd or regional management on a priority basis has been proposed (Loughrey, op. cit).

As a result of interviews with R.C.M. Police constables and provincial enforcement officers, and from my own experience with Keewatin Eskimos, I am convinced that natives who persist in wasting wildlife resources in spite of warnings should be prosecuted. An example of flagrant waste of caribou meat by an Eskimo Point Eskimo was brought to the attention of this Department by the R.C.M. Police. The proposed prosecution was supported by a member of this Service familiar with the case. The charge was dropped on recommendation from this Department. Surely legislation, even outdated legislation, without enforcement, is pointless.

The matter of feeding caribou meat to dogs remains one of the largest problems in the Eastern Arctic. Little progress has been made. I discussed the possibility of starting a white whale fishery for dog food with Mr. S. Voisey of Eskimo Point. It was considered that, with proper equipment and supervision, the Eskimos of that settlement could take white whales at the estuaries of the McConnell and Thlewiaza rivers.

Large numbers of caribou hides are still required for winter clothing by the Eskimos and northern Indians. Most of these hides are taken during August and early September at a time when it is difficult to preserve or transport the meat. The possibility of setting up a local tannery to be operated by the natives under supervision should be explored. The advantage of the tanned skins is that they outwear raw skins by many years.

SUMMARY

From August 15, 1956 to October 15, 1956, an investigation was conducted of the three major caribou herds in northern Manitoba and southern Keewatin District. The mid-summer movements of the Churchill, Duck Lake, and Brochet herds are traced from their summer ranges to the ranges occupied just before the rutting season. An aerial census was taken of the Churchill herd on the coastal barrens near Eskimo Point. Transect data from this survey are used to calculate a herd population of 35,200 animals. No population estimates were obtained for the other herds.

Annual increment data were gathered by means of segregation counts based on ground, aerial and photographic records. An average calf crop of 7.2 per cent was obtained from the segregation of 6,776 animals. The calf crops for the Churchill, Duck Lake, and Nueltin Lake caribou herds were 7.5, 8.5, and 5.7 per cent, respectively. Meteorological data for Chesterfield Inlet and Churchill indicated that May and June were colder than normal. It is suggested that the cold spring temperatures might have been a factor increasing calf mortality during the calving period.

A comparison is made of the three segregation techniques. It is assumed that aerial photographic method yields the most accurate results. The biases introduced into samples based on ground and aerial calf segregation resulting in calf percentages lower for the former and higher for the latter than for those based on the photographic method, are discussed.

In aerial photography, the most satisfactory calf segregations were obtained from photographs taken at altitudes of 150 to 200 feet above the ground, with the camera held at an angle of 40 to 50 degrees from the vertical.

The physical condition of the animals and the mingling of the sexes in the caribou herds prior to the rut are described. Observations concerning caribou group behaviour and wolf predation are recorded.

Wolf occurrence based on aerial and ground observations in the survey area is described. Wolves were still fairly numerous in the Duck Lake-Nueltin Lake area, but less common in the Nueltin-Brochet region.

No occurrence of diseases or accidents afflicting large numbers of caribou was noted.

Utilization data for the summer and autumn of 1956 were incomplete, but there were indications that the caribou utilization would be less than normal by the

northern Indians and about average by the Eskimos. It is estimated that the losses due to human utilization alone exceed the annual increment by 17,800 or 10.6 per cent of the total population of caribou in the study area.

Cursory range observations suggested that the northern parts of the caribou winter ranges in northwestern Manitoba may be overgrazed.

The recent developments in the conservation program and an assessment of its success in the study area are presented. A review of the predator control program in Keewatin District indicates the necessity of continuing the program and intensifying it locally.

RECOMMENDATIONS

The following recommendations and discussion are concerned directly with caribou conservation and management. Recommendations for gathering more basic information concerning caribou biology and ecology are not made in this report as they are more properly considered under the basic research programs.

Caribou conservation and management may be considered under four major categories: the gathering of basic management data; the analysis of human utilization of caribou and methods for the reduction of the kill; the control of predators; and the protection and management of the caribou environment or ranges. The background and basic considerations have been outlined and developed in my 1955 report. The general and specific recommendations presented here have arisen as a result of the present investigation or are included to support previous recommendations.

Gathering Management Data

The essential data required for regional or herd management of caribou are:

(1) herd or regional population estimates;

(11) annual increment for each herd; and

(111) annual decrement for each herd.

Human utilization is the most important cause of decrement but losses to predators, diseases, accidents and old age are also important. These latter factors can only be estimated for the present, but it is not essential for the initial management program to have full information on them.

Population data.- Of the three major herds in Keewatin-Manitoba, we have good population estimates for the Churchill herd for 1955 and 1956. The Duck Lake and Brochet herds, overlapped when the survey was taken during the spring migration of 1955 and have to be considered on a regional basis. The following recommendations are presented on the basis of the present investigation.

(1) It is recommended that herd population estimates be obtained for the Duck Lake and Brochet herds. Censuses should be taken during the period from October 15 to November 15 when the herds are most likely to be concentrated on the barrens north of tree-line. The sexes are intermingled then and, the ground is snow covered and suitable for tracking and photography.

(2) It is recommended that a C.47, twin-engined aircraft or an aircraft of similar design be used for the censuses. This type of aircraft charters at $247 per hour and cruises at 150 m.p.h. compared with $105 per hour ($120 in zones north of Churchill) and a cruising speed of 100 m.p.h. for a Norseman. The recommendation is based mainly on the experience gained in the 1955 re-survey. When operating in an area of roughly 100,000 square miles, with few refueling stations and only one base of operations, it was found that more satisfactory results could be obtained with the larger aircraft. Unfavourable weather prevails in the coastal Hudson Bay region in spring and autumn and may not permit flying for several consecutive days. It was found desirable to complete a census in as short time as possible to prevent overlap caused by the movement of the migrating animals. Using two observers in a twin-engine aircraft, census transects equivalent to 1,200 square miles can be covered in a single day. It is difficult to cover more than half as much with a single-engine aircraft.

(3) It is recommended that "saturation" censuses be taken when conditions and finances permit, with a coverage of 50 to 75 per cent of the occupied area rather than the usual 10 to 20 per cent. Observations by other field parties, especially those of the U.S. Fish and Wildlife Service working with caribou in Alaska, have indicated that herd estimates based on the results of 20 per cent coverage are often much less than those of total or near total coverage estimates.

Annual increment.- (1) It is recommended that annual increment data, based on aerial, ground, and photographic segregations, be obtained during September and October. These data can be obtained in a Norseman aircraft with landings for ground checks. At that time of year the herds are on the barrens and the sexes are interspersed. In addition, increment data gathered at that time are most

useful for determining the optimum harvest in the winter hunting season. Flights made in connection with the operation would enable the observer to trace herd movements and distribution for the subsequent censuses in larger aircraft.

Up to now it has been expedient to gather annual increment data in the late winter or spring at the time of the herd censuses. Recently both Kelsall and myself have found that it is not possible to gather both census and increment data in the same survey since either kind of work tends to occupy the observer fully. It has also been found (Kelsall, 1956) that where selective kills for either calves or adults are sustained by small herds (up to 5,000) during the winter, disparate annual increment results are obtained. At that time of the year, the cows and calves are usually well in advance of the bulls on migration, and the herds are not truly representative in composition. Finally, the increment data obtained in late winter or spring is of little value for herd management, since the period of greatest utilization is over.

Annual Decrement.- (1) It is recommended that a calf survey be taken in May 1957, for the purpose of estimating the overwinter calf mortality sustained by the Keewatin-Manitoba caribou herds. The sum of $3,000 would be adequate to provide approximately 30 hours of Norseman flying out of Churchill for that purpose.

We may expect the overwinter calf mortality to vary from year to year and from herd to herd. The decrement sustained by individual herds and by the herds in general should be established, the data should be gathered on a continuing basis for several winters in conjunction with the autumn calf increment data. As a result of the present investigation, data on the calf crop, in herds of nearly 7,000 animals, are available. If comparable data are obtained from the segregation of several thousand animals from the same herds in the spring of 1957, a record of the overwinter calf mortality will be available for the first time.

(2) It is recommended that the Manitoba Game Branch be requested to gather winter (January to March) calf percentages based on the segregations of 500 or preferably 1,000 animals for each of the various herds. These data would be useful in establishing the critical times of calf mortality.

(3) It is recommended that steps be taken to improve the methods of gathering human utilization data. The type of information required was discussed in my 1955 report. Perhaps the first step should be to convene a meeting of the representatives of this Service with members

of the Northern Administration and Lands Branch and the R.C.M. Police to discuss the need and means of obtaining information. The Manitoba Game Branch officials should be apprised of the outcome so that they can standardize the information they get on the utilization of caribou by the residents of their province. The initial representation might be discussed at the meeting of the Technical committee at Yellowknife in February.

(4) It is recommended that predation diseases, and accidents be given particular attention in the research program.

Human Utilization

It has been established unequivocally during the various investigations that the human utilization of the caribou stocks must be reduced if the resource is to be managed on a sustained yield basis. The need for gathering more detailed utilization data has been presented in the previous section.

(1) It is recommended that the conservation education program for the Eskimos be continued. The general reaction to the Departmental pamphlet Tuktut was favourable. Monthly articles of an unsophisticated nature on the need for conservation and its basic precepts should be carried in the Department's Eskimo bulletin. They should treat of the various game species including caribou.

(2) It is recommended that the Northern Administration and Lands Branch consider organizing conservation talks at meetings of Eskimo hunters in various eastern Arctic settlements. These talks should be given from specially prepared texts and delivered by Northern Service Officers or R.C.M. Police personnel through an interpreter familiarized with the topic matter. A man such as Lewis Voisey, now working for Mr. Kerr in Churchill, would be most suitable. This Service should be prepared to assist in preparing the scripts for the conservation talks.

The Eskimos must be taught the basic principles of wildlife population dynamics. The necessity for wise utilization and management, and the methods required, must be explained to them. When their sympathy with the conservation program has been aroused, they should be kept up to date with recent developments. Herd sizes, calf crops, fox cycles, and information of a similar nature should be passed on to them to foster a feeling of participation and group responsibility in the management of their game resources. This consideration and approach is most important.

(3) It is recommended that this Service be prepared to circulate copies of reports on wildlife investigations, such as the present one, to the R.C.M. Police and

Northern Service Officers in the various settlements covered by the reports. Comments on the reports should be invited. If it is not possible to circulate complete reports, mimeographed abstracts should be prepared for distribution to the above agencies.

(4) It is recommended that the present game laws be revised to provide the framework for regional and herd management under the guidance of a suitable resolutions steering committee.

(5) It is recommended that legislation be prepared to make it a punishable crime to waste wildlife resources by such things as feeding caribou meat to dogs in settlements in the eastern Arctic. Along with this, it is recommended that in clear-cut cases where a native has wantonly wasted resources, prosecution should be initiated on recommendation by a Northern Service Officer, R.C.M. Police officer or Canadian Wildlife Service representative. Convicted violators should be punished by imprisonment or fine or both. If we are attempting to integrate these people in our culture and economy, surely it is remiss not to enforce laws intended for their welfare. It is suggested that a few examples of punishment for violations understood to be morally wrong by the miscreant as well as his white and Eskimo neighbours, would save more caribou than many conservation talks and pamphlets.

(6) It is recommended that every effort be made to reduce the amount of caribou meat fed to dogs in order to reduce human utilization of the caribou stocks especially in areas where other resources are available. The possibility of operating a white whale fishery at Eskimo Point should be investigated. Eskimos supervised by such men as Lewis or Johnny Voisey (the most successful whale catcher at Churchill) and supplied with proper equipment including 22-foot freighter canoes with 15- or 25-horse power outboard motors, could be established in camps at the delta of the McConnell and Thlewiaza rivers during the whaling season. It is further suggested that the Indian Affairs Branch be requested to encourage in every way possible the trend towards fishing by the Chipweyan hunters at Reindeer Lake and in northwestern Manitoba. The people that were moved from Duck Lake to the North Knife River might be guided into a fishing enterprise.

(7) It is recommended that the Northern Administration and Lands Branch investigate the possibility of establishing local tanning enterprises at the settlements where large numbers of caribou skins are taken. These posts include Baker Lake, Eskimo Point, and Padlei. Winter clothing made from tanned caribou skins would outlast the clothing in present use. Consideration might be given to apprenticing natives, who due to illness or disability are unable to lead active lives, to a commercial tannery in Winnipeg or elsewhere.

The tanning industry might be placed under the purview of a Northern Service Officer experienced or interested in the subject.

Predation

(1) It is recommended that the predator control program initiated in the Eskimo Point-Tavanni region last year be continued in those coastal areas in accordance with the specific recommendation concerning procedures by Flook and Novakowski (1956).

(2) It is recommended that the predator control program be intensified in the Padlei region, especially if large concentrations of wolves are reported there this winter.

(3) It is recommended that Canadian Wildlife Service co-operation with the Manitoba Game Branch be continued to intensify the predator control program in the taiga region along the Manitoba-Keewatin boundary, especially in the Duck Lake and Nueltin Lake districts.

(4) It is recommended that special funds and time be devoted to putting in additional baits in areas where large numbers of caribou winter this year.

(5) It is recommended that the praticability of controlling wolves by shooting them from a light aircraft be investigated. This experiment should be conducted within a radius of 100 miles of Churchill, Manitoba. In the spring packs of tundra wolves are often observed in association with migrating bands of caribou on the barrens near that base. During that period it may be possible to kill enough wolves within the radius suggested to justify the expense of a light aircraft charter.

Range Studies

(1) It is recommended that a competent range biologist commence studies, using the Beckel airphoto range interpretation, of the winter, summer, and migration ranges of the eastern caribou herds. The primary objectives should be to determine the carrying capacities, the extent of utilization of the ranges by the caribou, and the nutritional values of the ranges at various seasons.

(2) It is recommended that representations be made to the Manitoba Department of Mines and Natural Resources that they commence a survey of the forested regions in the caribou winter ranges of their province. The burns should be located and mapped, acreage destroyed and the types and ages of burns assessed, and the timber, mineral, and wildlife resources evaluated. A priority rating system of forest fire

protection of those ranges could be inaugurated.

Herd Management

The following is a discussion of various aspects of herd management, with a suggested provisional program for the management of the Churchill caribou herd. There are now enough data available for this herd to provide a basis for management. More useful data can be obtained in the course of continued investigations, through marking projects, calving studies and studies of the decimating factors and the carrying capacity of the range. The Duck Lake and Brochet herds will have to be managed on a regional basis until the exact sizes of those herds are established and the amount of interchange determined.

For the Churchill herd a relatively accurate population estimate of 35,200 animals has been obtained. The autumn increment in 1956 was 7.5 per cent or 2,640 animals. Utilization of this herd by the Eskimo Point and Tavanni Eskimos, including a few taken by the Chesterfield Inlet natives, amounts to approximately 5,200 animals per year when the herd is available, as it has been for the past three winters. The herd is also utilized by Indians in the Manitoba registered trapline areas of North River, Churchill, York-Shamattawa, and Limestone. The two-year kill average (1954-55) for these areas is 1,600 animals. The total Eskimo and Indian utilization, then, amounts to 6,800 not including mortally wounded animals that were not recovered.

If the Churchill herd is to be managed on a sustained yield basis, the human utilization of this herd for the winter and spring of 1956-57 must not exceed 5 per cent or 1,760. This is an arbitrary figure based on the low calf crop and allowance must be made for losses due to winter calf mortality, predation, diseases, and accidents. Decision on the number of animals alloted per settlement would have to be reached in joint agreement between this Department, the Indian Affairs Branch, and the Manitoba Department of Mines and Natural Resources.

It would not be realistic to expect that steps could be taken this year (1956-57) to reduce and keep human utilization of this herd within the above quota. Positive steps, however, can and must be taken as soon as possible. Two or three years may be necessary before a successful herd management program can be established.

It is recommended that officers of this Department consider the following factors and weigh the merits of the proposals in the following provisional program.

It has been shown in the preceding paragraphs that the utilization of the Churchill herd is too great (19.3 per cent of the herd). Curtailment of human utilization is one of the most direct steps that can be taken to bring decrement into balance with increment. It has also been estimated in previous reports (Loughrey, 1955) that 50 per cent of the caribou taken by the Eskimos in the southern Keewatin mainland settlements are used solely for dog food. In the Eskimo Point region the total annual consumption of caribou by dogs may amount to 2,500 animals. The most expedient step in reducing utilization appears to be to curtail the number of caribou fed to dogs. If this is done some alternative source of dog food must be provided, since dogs are still important in the hunting and trapping economy of the natives. The possibility of initiating a white whale fishery has been discussed above. In addition, the reason for change must be explained to local residents, both white and Eskimo, since these people have over-utilized the herd but have not experienced a scarcity of caribou. The following program or some modification of it is proposed.

It is estimated that approximately 400 dogs are owned by about 100 hunters of the Eskimo Point and Tavanni region. Each dog takes approximately three pounds of caribou meat every day for nine months of the year ($400 \times 3 \times 270 = \frac{324{,}000 \text{ lbs.}}{150 \text{ (av. dressed wt.)}} = 2{,}160$ caribou annually, a confirmation of the 2,500 estimate above). The same food value to be derived from whale meat at one pound per day for the same period would be 108,000 pounds. The average dressed weight of a white whale is estimated at 500 lbs. Thus roughly 200 whales would be required to satisfy the demand for dog food. The whales could also be expected to provide a considerable amount of blubber and oil for human consumption or possibly for export and sale. A local whale-catching enterprise, could not reasonably be expected to provide enough meat during the first few seasons, until experience in operation was gained.

As an interim transitional stage, it is suggested that whale meat may be obtainable from the Adanac Company at Churchill. At 8 cents per pound in 50-pound boxes frozen, the total cost of 108,000 pounds would amount to about $9,000 including handling. The meat could be refrigerated in Churchill and shipped on one of the late ships to Eskimo Point in September. Special cold pits could be constructed at that point for storage. During subsequent years, as the local catch of whales increased, the storage facilities developed for the imported meat could be taken over for the local product. It is perhaps pertinent to note that the Adanac Company has a quota of 800 whales, but rarely takes more than 500. A larger catch is said to be anticipated for 1957. The meat now processed by the Adanac Company is purchased chiefly by mink ranchers in Manitoba.

Experiments with netting whales instead of harpooning them might be considered. It is also suggested that the dogs' diet might be supplemented by adding some commercial dog food such as Miracle or corn meal with beef tallow. Tallow is not required if whale fat is available.

There can be little doubt that an active program for conserving mainland barren-ground caribou herds is required. The recommendations and management program proposed in this report are not intended as a panacea for the caribou problem. Both administrative and technical difficulties can be anticipated. However, it is hoped that the comments arising from this report may form the basis for constructive modifications of the proposals.

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Caribou
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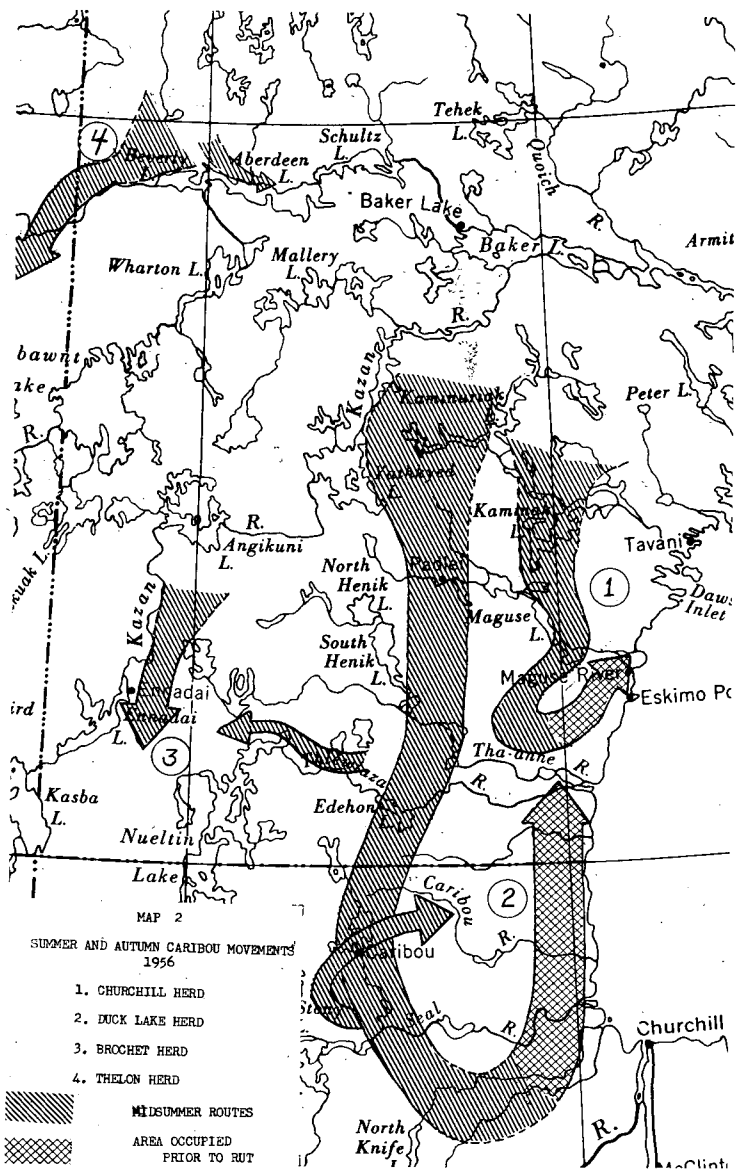
Keewatin and Manitoba
August 15 to October



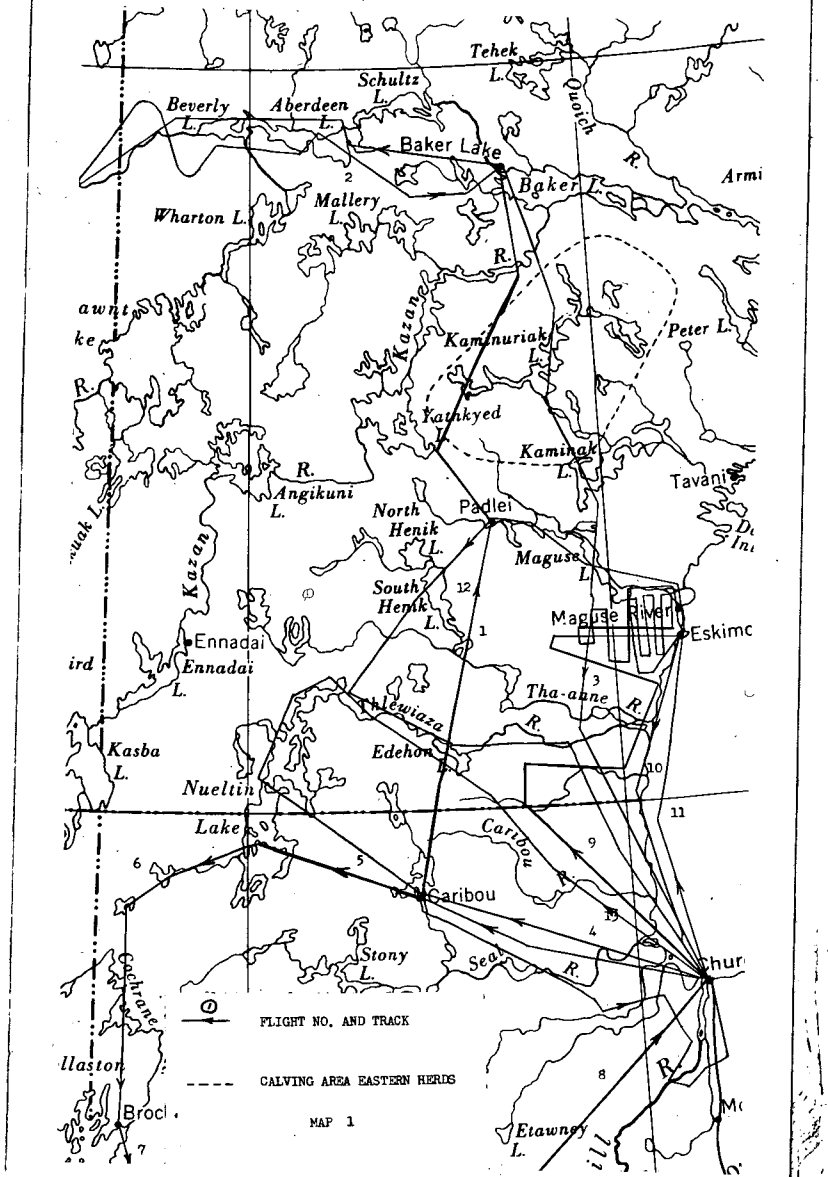
MAP 2

SUMMER AND AUTUMN CARIBOU MOVEMENTS 1956

1. CHURCHILL HERD
2. DUCK LAKE HERD
3. BROCHET HERD
4. THELON HERD

MIDSUMMER ROUTES

AREA OCCUPIED PRIOR TO RUT



FLIGHT NO. AND TRACK

CALVING AREA EASTERN HERDS

MAP 1