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Caribou calving. [Ottawa?] 1953.

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1. Caribou - Reproduction. I Title.

CARIBOU CALVING

1953.

By;
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CANADIAN CALVING Released 1956

The process of caribou calving is still little understood and recorded but a considerable amount of observational and descriptive information has been added since the 1950 report. Since most of the material is purely descriptive it is presented in narrative style and as completely as possible. The account covers that period from a few weeks prior to parturition to the time when most calves are a month old.

The material is based largely on the field notes and reports of three Canadian Wildlife Service field parties. In 1949, A.H. Lawrie and D. Peterson attempted observation of calving from a base camp at Beverly Lake, Keewatin District, on the lower Thelon River. While actual calving was not observed, the men were probably much closer to seeing it than they believed at the time, if the dates for calving established by later field parties are in any way constant. Accompanied in 1950 by E.H. McEwen, and in 1951 by H.G. Perret, the author attempted, and at length succeeded, in observing calving on ranges off the western shores of Bathurst Inlet in Coronation Gulf.

Poor travelling conditions have been the greatest obstacle in conducting calving studies. All observers have found that, at the time of the year when most calves appear to be dropped, ice is generally not safe for aircraft landing on skis and there is not enough open water in calving country for aircraft operating on pontoons. The country seems to be less hospitable than at any other time of the year. Temperatures are mostly not far above freezing; rivers, creeks, and potholes are overflowing with water from the run-off and often covered by deceptively safe-looking snow; heavy rains, mists and wet snow storms, accompanied by winds up to gale strength, are frequent. Travel by any of the usual northern methods, except on foot, is not practicable. Travel on foot is most laborious, at least in the areas so far investigated, and 15 miles a day with a light pack must be considered good travelling. Pack dogs would doubtless be helpful but they may hinder close and undisturbed observation of caribou.

The exact time when calves are dropped was not known, and this was a further complication. Dates ranging from early May to late June have been given by various persons - all upon some more or less factual basis. Banfield, for purposes of convenience, considered June 1 as the major calving date in his report. June 1 may yet prove to be a good average date but subsequent data points strongly to a later date - June 15 to 20 - in the north-central mainland. There is no doubt that in some years, and in some places there is great variation in the dates of parturition. Barren-ground trappers stated that in some years calves may be dropped as early as the last few days in April. There are equally reliable reports of calves being dropped up to the first week in July. No doubt that these variations occur but we have as yet no way of telling how frequently, or what proportion of the caribou are affected. Present evidence indicates that calves are normally dropped within a two or three week period in the month of June.

Movements during the Calving Period

It might be well to outline first the general movements of the caribou herds during the calving period. The movements observed during the continuing study follow exactly the pattern described by Lawrie. As spring migration proceeds there is a marked tendency for cows, particularly pregnant ones, to move to the front. At the same time adult bulls begin to lag behind. These tendencies are progressive. In some herds they may not be marked until spring migration is well under way in April; in other herds, or in other years, some segregation may be apparent on the wintering grounds before actual migration starts. Lawrie has recorded instances where the adult bulls actually arrived at the calving areas well behind the cows, with a time interval between the last marked movement of cows and the first marked movement of bulls. This seems to be a general and usual occurrence. Observations at Bathurst Inlet in 1950, however, showed much less marked segregation, with adult bulls actually mixed with the first cows, although most of them were in the rear. In 1951 segregation at Bathurst Inlet was marked. During mid-June on the calving area only three adult bulls were seen among more than 5,000 caribou. In this case it seemed likely that the bulls had remained on the east side of Bathurst Inlet while the cows moved to the west side to have their calves. It may be pointed out that, even where segregation of adult cows and bulls is nearly complete,

segregation of younger animals is not marked. One- and two-year-old animals of both sexes may be found with either cows or bulls. Bulls more than one year of age tend to remain with the adult bulls. Non-breeding cows also appear to remain with the adult bulls for the most part.

The movement of cows is rapid just prior to calving and if not heading for a specific area they certainly appear to be doing so. The first cows across Bathurst Inlet in the spring of 1950 moved into the high country to the west at a leisurely pace, stopping frequently to feed and spreading out and resting for short periods in good feeding areas. As the movement of the cows progressed it accelerated. The bulls and non-breeding animals continued to move leisurely, and many, in fact, remained in the superior ranges close to the coast throughout the calving period. The cows, however, became more and more hurried. The last ones to cross the ice, during the third week in June, scarcely paused before moving into the hills. Exactly the same behaviour was noted in 1951, although observations were not started as early as during the previous year. On the arrival date, on June 2, some adult cows were still moving leisurely into the hills, feeding as they went. The last caribou to go through a week later, just before the field party moved into the hills, went through the area with scarcely a pause - some actually running for considerable distances at times.

In the calving areas the caribou appear to scatter widely and movement slows markedly. From June 12 to 20, among calving animals in 1951, very few groups that numbered over 100 animals were seen and groups of 20 or less were the rule. Directional movement appeared to be lost, except that topographical features were followed during feeding. There is some evidence to show that the first cows to arrive on the calving grounds include those which first drop their calves and that later ones are not as advanced in pregnancy. In 1950, McEwen and the author were probably within less than ten miles of calving caribou on a number of occasions and had pregnant caribou under almost daily observation, in progressively reduced numbers, from late May until June 27. This coincides with the calving dates established the following year, yet not a single new-born calf was seen. During the following year all pregnant females with a single exception, disappeared into the hills before dropping their calves although some

females are still moving to the calving area in late June after the majority of calves had been dropped.

During the later stages of calving the animals start to bunch up again - possibly aided by an increase in movement along topographical lines of least resistance. By July 2, groups may include at least 1,000 animals and, by July 14, groups of up to 10,000 are usual. At this time, or shortly before, they may, or may not mingle again with the bulls. Among Bathurst animals in 1951, bulls were not present on July 2 at least, and if they actually remained, as suspected, on the east coast of the Inlet they may have remained separate from the cows all summer. A herd of upwards of 1,000 bulls was seen on July 2 some 90 miles southwest of the nearest cows. In mid-July 1950, on the other hand, herds numbering in the thousands of animals each, were seen to include animals of all sexes and ages.

The Calving Grounds

Banfield concluded that there are no special calving grounds and that calves are dropped where ever the cows happen to be at the appropriate season. The continuing study bears this out with, however, certain qualifications discussed below.

The author has been much interested in the long history of caribou abundance at Bathurst Inlet just prior to calving time. Discussions with Hudson's Bay Company employees and Catholic missionaries, some of whom have kept records in diary form, have disclosed that caribou appear in migration across the Inlet annually, or almost annually, just prior to calving time. In some years the movement is as early as April but most often it is in May and early June. This history can be traced back with scarcely a break for a score of years.

Even longer ago than that, in 1926, W.H.B. Hoare described caribou movements at the south end of the Inlet. In that year a large migration came out of the hills to the west, crossed the ice, and proceeded up the valley of Western River toward Back River. He noted bulls remaining on the coast with a diminishing percentage of cows until mid-June and cows with calves coming out to the coast in early July. He thought that calves were dropped in the rugged country between Western River and Back River. The migration of 1951 was much like that observed by Hoare, and his observations of the summer movement of cows and bulls were similar to those of 1950 and 1951.

The historical records indicate one thing clearly. The caribou move into the high, rugged country away from the coast to drop their calves regardless of the precise direction of migration across Bathurst Inlet. In many years they must get barely out of sight of the coast, as shown by the closeness of the dates when the last cows disappear inland and when they return with calves. The fact that the date when cows and young calves show up on the coast is almost always in early July and sometimes in late June, is particularly indicative. In spite of this, only one known instance of parturition has been recorded in coastal areas. This was a single cow which had her calf, apparently during the ice crossing of the Inlet in 1951. It has been mentioned previously that the cows show increasing haste to get away from the coast and into the interior as the time of parturition draws closer.

In cannot be stated that the Bathurst Inlet caribou use precisely the same calving areas annually. Typical high, rugged country extends for nearly 120 miles north and south on both sides of the Inlet and the caribou very often enter it on a comparatively narrow front. In some years there are migrations both from east and from the west and in others the recorded movements have been in one direction only. It does seem safe to say, however, that essentially the same type of country is used on an annual, or nearly annual, basis and that certain specific sections of the country almost certainly have a nearly annual use at calving time. It seems doubtful if this could "just happen" each year at the appropriate season.

A brief description of the topography of the calving areas investigated may be in order. While ground observations were carried out only in a small area extensive aerial reconnaissances indicate that the observations are equally applicable to the rest of the country.

The Bathurst Inlet topography can only be described as rugged. From aircraft altimeter readings on a number of trips it has been checked as ranging from sea level to slightly above 2,000 feet. Well inland, the country appears to have a rather uniform level, but this is deceptive. While the mean level is probably about 1,800 feet some 30 miles southwest of Burnside Harbour, there is a range of elevation from 1,000 feet on the large rivers to 2,000 feet on the highest hills. The country to the east of the Inlet appears to have a somewhat lower mean elevation. Even the most level inland country is broken by numerous ridges which usually run northeast to southwest and which rise 100 to 200 feet.

All this country has been subject to violent geological action. Exposed rocks are various types of sandstones and conglomerates in places, and there are large areas of igneous intrusion and overflow. The present imperfect geological maps indicate Proterozoic age for much of the country. Glacial action is most evident on all the higher ridges and obviously glaciation was followed by a period of rather rapid emergence from the sea. A clearly defined series of raised beaches occurs between the present sea level and an elevation of about 1,500 feet.

The presence of numerous ridges and outcroppings of hard rock give the country a most involved drainage. Small rivers are particularly tortuous, twisting from lake to lake. Most of them have little water during the summer months. Bodies of water are numerous and range in size from the smallest of potholes to lakes more than 20 miles long and several miles wide. Only a few of the largest lakes are shown on the best available map sheets.

The country rises quite abruptly from the coast in most places, although on the west side of the inlet, and in the Kent Peninsula area, there are some miles of gently rising plains and hills before the 1,500 foot level is reached. These plains are particularly well vegetated and heavily utilized by a great number of caribou just prior to, and just after, calving. Calving caribou were not found below 1,200 to 1,500 feet and the calving area appeared to be well defined topographically, if not in any other way.

It is interesting to note that other large groups of caribou have calving grounds in country remarkably similar to that of Bathurst Inlet. There is ample evidence that caribou frequently use country between Dubawnt Lake and Beverly and Aberdeen Lakes as well as/north of both the two last-named. The animals seem to appear on the extensive plains near the water prior to and after calving but to have their calves in the rugged country away from the water. A similar area is the rugged country west and northwest of the northwest tip of Contwoyto Lake, which seems to be used frequently, probably by the Radium herd. Altitudes in both these areas range to at least 1,000 feet. In the western Arctic, at Chulotuk, caribou are seen almost annually on the coast in good numbers prior to calving, and in smaller numbers after calving much as at Bathurst Inlet. There, too, calving takes place back from the coast in rough country rising to at least 1,000 feet.

No attempt can be made here to define a specific type of country invariably used by caribou for calving. Present information is far too limited and there are numerous exceptions. It does seem more than coincidental, however, that widely separated herds use types of terrain that have a number of important common characteristics. It is hoped that continuing studies will permit a great deal more to be said about this matter.

Limited range studies, dealing with vegetation, were conducted in the Bathurst Inlet calving area. These will be discussed in the general section dealing with range studies.

Caribou Calves

A physical description of caribou calves is hardly necessary. Excellent descriptions are given by Banfield and Murie. Observations at Bathurst Inlet did not show quite as wide a variety of coloration as Murie reports. Rather there seemed to be two fairly distinct colorations with limited intergradation between them. The reddish-brown colour referred to by both the above authors was common, but almost equally so was a light chocolate brown phase. The only additional data in relation to physical description to be presented are measurements of young calves. The measurements are standard mammalogical ones but it should be noted that the shoulder measurements were taken from the tip of the extended front hoof to the dorsal apex of the scapula. This seems to be an easier and more exact measurement than one extending to the top of the back, when dealing with animals in all stages of death and decomposition. The ages of foetal caribou are calculated with the date of conception arbitrarily set at October 22, the mid-point in sexual activity during the rut as recorded by Lawrie. The ages of post-parturition calves are calculated as if birth occurred on June 25. It will be appreciated that both these dates may be subject to revision in future but they appear to be the best average possible at present.

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It is interesting to note that even the youngest of new-born calves have fully erupted incisor and incisiform canine teeth, and that in all cases examined to date the premolars have been one-eighth to one-quarter of an inch above the gum line. The calves are therefore equipped to start eating solid foods at the time of birth.

No evidence of twinning in barren-ground caribou has been seen either on the calving grounds or in a number of autopsies of pregnant females.

Behaviour of Calves

Tendency to Get Lost

The process of parturition appears to be relatively simple, at least if the single instance observed from beginning to end is typical. On June 13, 1951, a small group of caribou were watched as they filed over hill and commenced to scatter and feed on a sedge plain with up to 400 other caribou which were there before them. At about 1.30 p.m., a cow, one of the last caribou to come in sight, lay down at the edge of the plain. Until then it had been moving most leisurely and stopping frequently. When, at 2.00 p.m., it stood up again, it was clearly evident that a calf had been born. At a vantage point somewhat over a quarter of a mile away the observers had suspected that she was in labor because she had not grazed immediately on reaching the sedge plain with her companions and because she had lain down for so long a period that the other animals had drifted 300 yards or more from her. No other evidence of labor was noted although the animal was watched intently with high power binoculars.

From 2.00 to 2.30 p.m. the cow repeatedly stood up and lay down as if uncomfortable. The calf usually got up and lay down with her, appearing a little steadier each time it got to its feet. At 2.30 the animals were approached and the calf was ear-tagged. The calf was so persistent in following that it was necessary to roll it on its side behind a boulder and then dash off on the run to get away from it. The cow dashed about in great alarm on first being approached, dropping the placenta in doing so, but it soon disappeared into the hills. The observers repaired to a rocky hillside where they could watch without being seen.

The subsequent search of the cow for her calf was most dramatic and kept both observers biting their nails in anxiety. At 3.00 p.m. the cow returned, obviously having run in a great semicircle, and approached in a direction opposite to that of departure.

stopped within 50 feet of the calf, which was only a short distance from where she had left it, for about two minutes and then without doing any searching turned and trotted away down the hill. By 3.15 she had made a semicircle to a lake half a mile away and had returned to the exact spot where she had last seen the calf. The calf remained still throughout. The cow grazed briefly then stood perfectly still for about ten minutes, moving only her head and neck to look about and grunting occasionally in the manner of all cow caribou when searching for lost calves, and then started to graze again. At 3.25, when, from all appearances, she had lost interest in the search and was starting to follow the other caribou, which were now moving off, she found the calf apparently quite by accident through the process of nearly tripping over it. She got the calf to its feet immediately and started it off as fast as it could be made to go. When last seen the calf was climbing out of a creek some miles away and, up to that time (4.30 p.m.) it had been allowed to suckle only twice, both times briefly.

The above story is told in detail because it illustrates the great possibility of calves being lost from their parents at early ages. The cow returned exactly to the spot where she had last seen her calf but showed no imagination and little initiative in looking for it. If the calf had been 100 yards from where it was last seen she could never have found it. An older calf will stand up and aid discovery by grunting and walking about. The fact that it will walk about, however, and follow other moving animals - even a man - tends to remove it from the cow's scope of search. A young calf temporarily abandoned by its cow near Burnside Harbour was never found by the cow although she returned an hour or so after leaving and searched for some time in the area where it still was located. The calf was found, partially eaten by a fox or wolf, some days later. In another case, after an unsuccessful attempt to catch a young calf for tagging had been made, the cow moved off with other caribou and was last seen still going directly away at some miles distance. The calf, when last seen, was going off by itself in a directly opposite direction, and although it was grunting lustily the chances of the cow findin; it again seemed remote, even if she did return with all haste.

Precocity

The precocity of caribou calves is truly amazing - particularly to a person who has had some experience with the more sedentary young of other ungulates. A few minutes after birth a calf may stand up voluntarily. At the age of 30 minutes it is capable of walking slowly on still unsteady legs and does not appear to be particularly discouraged when it falls down. Within an hour and a half it can be forced, under pressure by the female, to run, walk and hop several miles - falling over only the largest of obstacles - and can wade an icy stream at the end of this. The hopping gait is often resorted to by very young calves when they are attempting maximum speed. They use it like a large rabbit or a mule deer, although they do not give the impression of vertical "bounce" exhibited by the latter.

It is difficult to say at what age a calf caribou can outrun a man, but it is thought to be considerably less than 24 hours. Only two calves, both less than four hours old were captured, out of a good many hundred calves seen. It is possible that if a man were willing to chase a calf persistently for several miles he might wear it down to the catching stage even if it were a day or two old. As a rule, however, a calf of that age will be started away by its cow at the approach of a man still a good many hundred yards away. On one occasion a startled cow raced away for some distance leaving a calf so young that its umbilical cord was still trailing. This calf showed great ingenuity in eluding pursuit. It would permit approach to within 20 feet or so and then race away, stopping when pursuit stopped, and sometimes walking back a short distance to make sure that neither observer was its mother. It was not caught.

It is noticeable that a cow, when travelling in a herd adjusts her speed to that of the calf, during its first few weeks of life. Even when travelling away from supposed danger, the speed is usually not above a slow walk unless the danger is obviously very near at hand. When danger is apparent, however, cows force their young to travel at greater speed. They trot along in front until the calf is well behind. Then they wait until it has nearly caught up and trot off again. On several occasions, when calves fell and stayed down, had difficulty with some obstacle, or were just tired, cows were seen to stand in front of them and beckon with their heads exactly as a human might do when silence and speed are imperative.

If cows are taken suddenly unaware, or if pursuit is close, they readily abandon their calves. On two occasions they dashed about an approaching observer, as if to distract attention from the calf and invite pursuit to themselves, before disappearing. On other occasions they fled at once and abandoned the calves entirely.

By the time the calves are a few weeks old, in mid-July, the cows have become much less solicitious for their calves. When danger is suspected the herds race off across the tundra with the calves scattered behind to catch up as best they can. If no real danger materializes, individual cows frequently come back to or wait for calves, but not invariably.

Caribou calves seem to be natural swimmers. When no more than twelve hours old a calf will plunge fearlessly off an ice shelf and swim easily. When only a few days old a calf can keep up with its parent in a swim of more than 150 yards in a moderate current. Their only real difficulty seems to be to keep their heads above water when waves are running. This will be mentioned later in the discussion of mortality.

Grazing

Calves are pretty well equipped to start grazing at birth. The author has been continuously amazed how little evidence of suckling he has been during his association with the animals. There is a marked contrast between caribou and reindeer in this respect, even though the two animals are very closely related. In late July 1952, at reindeer roundups in the Mackenzie Delta calves were seen to be grazing extensively but there was still much evidence of suckling. Calves would frequently suckle for some time, occasionally bunting the udder of the female so vigorously that her hindquarters would be nearly lifted off the ground. At that time the reindeer calves were almost three months old. In September, 1952, caribou, including hundreds of calves, were watched at close ranges for a period of nearly two weeks. These calves also averaged about three months of age. Not one calf was seen to suckle, although autopsies on two calves showed that both were still taking some milk. From July 18 to 30, 1950, Newson and the author had a herd of more than 1,000 caribou, including several hundred calves, under very close observation. At that time the majority of the calves were not more than a month old. If there had been much suckling at that time it should have been possible to see least a few calves suckling;

in a herd of that size at almost any time. Not one calf was observed to suckle; all were feeding on vegetation exactly as the older animals were doing. Some periods of continuous observation on specific groups of animals of this herd were well over two hours in length and observation was at very close ranges.

In 1951 the first observation of grazing calves was made on June 13. At that time less than half the pregnant cows in the area had dropped their calves. From then until departure from the calving area on June 21, calves were seen to graze oftener than they were seen to suckle. Exactly how old a calf is before it starts to graze could not be determined, but they certainly must be able to do so by the time they are a week old and they may do so even younger. Some calves seen to graze had every appearance of being only a day or two old.

One typical example might be mentioned in illustration. On June 20 a group of 68 animals, including ten calves of various ages, as well as pregnant females which had not yet calved, were watched for approximately a half hour at very close range. The animals were feeding quietly and resting during all this period. Only one calf was seen to suckle and this one was so young that it was still uncertain of its footing at all times. All the calves, including the one that suckled, were seen to make some attempt at grazing. In some instances they would walk with heads lowered, grazing exactly as their parents did, for brief periods. In other instances they grazed from a lying position, chewing tentatively at whatever vegetation was nearest at hand.

It seems that caribou calves become accustomed to, and probably dependent upon, grazing during their very first weeks. It does not, however, appear wise to say that they always become independent of suckling at that age. The observational data indicates only that suckling is most infrequent in calves over three weeks old; that grazing is the most frequently observed method of taking nourishment even on a calving area at the time of maximum parturition; and that some calves at least will take milk up to, and perhaps after, the age of three months.

Behavior of animals associated with calving

The behavior of females and other associated classes of caribou at calving time shows a few features not evident at other periods. Most prominent among these are various kinds of segregation, some of which have already been mentioned briefly.

There is no doubt that there is some segregation of various classes of caribou on the calving grounds. However, the segregation is always far from complete and it appears to be based partly on sex and partly on age.

Mature bulls were the only class of animals almost entirely lacking from the calving areas investigated. Only three of them were seen among thousands of caribou noted during a twelve- day trip to calving grounds in 1951. When seen, they were with small groups of younger bulls. It seems very likely that in other years, or in other areas, bull segregation may not be nearly as well marked. All other age and sex classes were well represented on the calving grounds. A good number of younger animals of both sexes, and older bulls, remained in coastal areas during the calving period, as during the previous year. In 1950, however, there were far more older bulls seen on the coast - fully as many, in fact, as there might be expected to be in the herd - whereas in 1951 it appeared that the majority of these animals must have remained farther behind along the line of migration or gone through before the rest. The latter is possible since good numbers of adult bulls were reported among the first animals to go through Burnside Harbour in early May. However, the bulls seen at Burnside Harbour may have been associated with the caribou migrating eastward rather than with the ones among which observations were made.

On the calving grounds caribou were mostly separated into small herds varying greatly in size and composition. Herds of from ten to 80 animals were the rule, although smaller herds were seen frequently and two herds numbered about 400 and 600 respectively. Generally one-third to one-half of the animals in a given herd would be cows and their calves. Cows which had not yet had their calves would, of course, make up an increasingly smaller percentage as the season advanced. The rest, and frequently the majority, were younger one- and two-year-old animals of both sexes. Because of the diffulty of sexing younger animals at this season, comparative figures for young males and females cannot be given, but the ratio of females to males appeared to be about three to one.

A sort of local segregation was frequently noted - a segregation of the adult females, particularly those with calves, from the younger animals, under certain circumstances. When approached by one or both observers, a typical herd almost invariably reacted in the same way. At the first sign of approach the cows with calves, and most or all of these in advanced pregnancy, would start moving rapidly away. They generally continued to do so without stopping until they were out of sight. The younger, non-breeding animals, and occasionally one or two of the pregnant cows, reacted in typical caribou fashion, sometimes approaching the observers to within 100 yards for a better look; sometimes cutting back and forth in front of the line of movement to get the wind; sometimes circling to the rear, and generally showing great curiousity. This served admirably as a distraction behind which the cows would withdraw their calves from real or supposed danger.

The direct, uninterrupted withdrawal of the cows with calves from such herds is most unusual behavior for caribou. In late May and early June, just prior to their arrival on the calving areas, the cows do not react in this manner. In fact, groups of caribou on open tundra are about as easy to approach closely at that time as they are at any season. There is often so much hesitation and delay before flight among caribou in late May that a man, simply by a combination of eccentric action and swift running, and without any stealth or use of cover, can get into position to spear caribou. Even in late summer when many animals are most wary, and it is often difficult to get within rifle shot of them, herds in flight will pause frequently to look back, back-track, or circle well out of range to get the wind.

There does not appear to be any real basis for the belief, frequently expressed, that the cows, prior to calving, attempt to find solitude and seclusion. When a cow is about to give birth she lies down. The period of labor appears to be relatively short and following this the cow and calf will remain relatively quiet in one spot for at least two or three hours. By the time they are ready to travel, the herd of which the cow was a member will almost invariably have moved on, sometimes for many miles, and she will be alone. It appears reasonably certain that the majority of cows with calves rejoin the herd as soon as possible after the calf is well enough able to follow. Cows with calves no more than two or three hours old and still trailing the umbilical cord, were seen to walk considerable distances to rejoin their herds.

No instances where cows with calves attempted to enforce segregation were seen. If the majority of a herd were feeding and the calves lying down resting, there was not the slightest evidence of agitation if other animals came between a calf and its mother. Reindeer, on occasion, will show jealousy for their calves towards other animals.

It is interesting to note that, despite frequent Indian statements to the contrary, there was no evidence that yearling animals attempted to run with their mothers after a new fawn had been born. Yearling animals appeared to associate themselves for the most part with the two-year-olds.

Calf Mortality Factors

It is believed that early calf mortality is of the greatest importance to the barren-ground caribou herds. For reasons as yet largely unknown some seasons are good calf years and some are bad. Most of the major calf counts, particularly during the continuing caribou study, were made during the winter when the caribou were easily accessible, and readily observable from the air. However, enough spot counts have been made in the summer to indicate that the rate of calf survival is usually indicated within a month or even less of calving. To show how the calf percentages vary the following table has been constructed from calf counts obtained by various observers since the commencement of the caribou study.

Table to be inserted.

It can be seen from the above table that each year variations in calf percentages are generally shown in a number of caribou herds simultaneously. Thus calf percentages in four different herds range from 4.8 per cent to 9.0 per cent in 1950-51, from 15.0 per cent to 21.1 per cent in 1949-50, and from 8.1 per cent to 14.1 per cent in 1951-52. In 1952-53 the calf crop was better than in any of the previous three years and the range was from to in four different herds.

From limited field observations, and from many verbal reports of prospectors and trappers, it is believed that it is usually clear whether there will be a "good" or a "bad" calf crop very soon after the calves are born and certainly by late July or early August. There can be little doubt that, although there is a varying amount of calf mortality during the whole year following birth, very early mortality has the greatest significance. In each year the trend has been the same in all herds and this seems to indicate that some major and widespread controlling factor or factors, varying from year to year, must be operative in calf mortality.

At present there is no positive evidence to indicate what these factors are, but by a process of elimination it may be possible to identify some of them and the means of attacking them.

Non-fertilization of significant numbers of females of breeding age, and a pre-parturition disease such as contagious abortion, do not appear to be likely possibilities, although they cannot, of course, be ruled out entirely. If difficulty arose at the time of fertilization, for instance if, for some reason, sufficient bulls did not contact the cows at the proper season to effect maximum fertilization, it seems unthinkable that all herds should be so affected in a single year. No herds seem to suffer from a shortage of breeding bulls; all have far more breeding bulls than is considered desirable for maximum fertilizatim in a herd of reindeer. There has been no evidence of pre-parturition diseases, or of pathological conditions which might lead to calf mortality while the calves are still in the foetal stage. Here again it seems unlikely that all herds would be similarly affected in a single year, or that some evidence would not have been noted on winter ranges. Limited first hand observation, and extensive interrogation of hunters and trappers, seems to indicate that it is unusual to find breeding cows which are not carrying calves during the winter months.

Observation of large numbers of cows immediately before, during, and after calving showed very few animals of breeding age which were not lactating.

It is believed that the major calf mortality, particularly during 1950 and 1951 when the calf crops were not good, occurred on the calving areas during and shortly after parturition. There is certainly a substantial calf mortality at times on and near the calving grounds, as shown by the fact that six dead calves were discovered during work in the Bathurst Inlet area in 1951. Dead calves are inconspicuous and are noticed only from close by. During the period in which the six dead calves were located, about 300 living calves were seen at reasonably close range (500 yards or less) and many more at greater distances. A calf loss of no less than 2 per cent and probably far more is indicated.

In casting about for factors which might influence calf survival varying widely on an annual basis over a wide area at birth, or shortly after, only tow appear likely. These are adverse weather and insect infestations. The latter probably depends on the former in regard to degree of infestation.and dates at which the insects appear. Insects certainly are dependent on weather as regards the influence they exert on large mammals, during a bad infestation.

Weather

The month of June and early July usually appear to be pleasant periods on the barrens. Plants begin their period of heavy flowering, small birds - passerines in particular - are at their nesting peak, and caribou are bringing forth their young. Overcast weather, precipitation, and winds are frequent but are seldom sufficiently severe to dampen the joys of rising temperatures and continuous sunlight. Persons who have not been privileged to experience a complete "break-up" period on the barrens can scarcely comprehend the full impact on the country of the new life and vigour which appears on every hand. Possibly it is reflected best in the Eskimo children who roam continuously, in perfect happiness, until sheer exhaustion forces them to sleep. From the time when most of the snow has left the ground, usually in late May, until the blackflies and mosquitoes become a nuisance, usually in early July in high latitudes, the barrens are a splendid place to be.

The author has spent two "break-up" periods in the barrens -- scarcely sufficient time to acquire a broad general experience. Both those years, in

One locations chosen at least, were "poor" caribou years. This experience, plus innumerable conversations with much more knowledgeable persons, and some reference to the scanty meteorological records available, will be used as the basis of the following opinions on the influence of weather on caribou calving.

In 1950 at Bathurst Inlet the process of caribou calving was not actually seen, although it was later determined that the main base was less than 20 miles from a fairly large number of calving animals. When the significant calf counts were secured from a well balanced herd of over 4,000 animals it was astonishing to learn that only about 9 per cent were calves. Subsequent calf counts, on this and other study herds during the following winter, failed to disclose any herd with a greater percentage of calves.

In 1951, again at Bathurst Inlet, the calf count was not as successful. Only a few more than 300 animals were successfully segregated between the time when they first came out of the hills after calving and when it was necessary to leave the area. However, the percentage was again low - 11.5 per cent - and subsequent counts during the winter gave figures only slightly greater. In contrast to these two "poor" caribou years the 1952-53 season looks phenomenal. Unfortunately no early calf counts were made during 1952-53 but winter counts on all study herds never gave less than 20 per cent and in some cases gave as high as 30 per cent. It is truly regrettable that observers were not on or near the calving grounds during the spring of 1952 to collect comparative data.

In suggesting reasons for the low calf percentages in the post-calving counts of 1950 and 1951, there is no recourse but to refer to the weather. It cannot be said with certainty, of course, that the many adult cows which showed up following the calving period without calves were not barren to start with but it does not appear likely that they were. The number of barren cows on the part of the calving grounds actually covered in 1951 was negligible and very few cows observed at close hand in 1950 appeared to be in a non-lactating condition. In addition, the relatively large number of dead calves found on the calving area in 1951 indicates a heavy mortality shortly after birth. It is significant that no apparent physical reason for death could be found in any but one of the dead calves discovered and that all were found following a particularly severe period of rough weather.

A few quotations from the field notes of June 15 to 17, written when among calving caribou, will best serve to illustrate the conditions encountered.

"June 15. Bad weather started in the early evening. At 9.00 p.m. temperature was 39°F., wind northeast, low heavy cloud and mist.

"June 16. One hell of a day!! 32° to 32°F. Very high wind - gale strength - driving rain, hail and snow. Started very early in a.m. Reinforced the tent twice and built a 4g foot stone wall around the windiest side and corner. Snow continued all day and at 10.30 a.m. it was blowing, if anything, harder than ever and still about 32°F. Drifts over a foot deep in some places. The wind reached a climax about midnight and brought freezing rain with it. A miracle the tent didn't blow down.

"June 17. Still blowing and alternating wet snow with wetter snow. Temp. remains 32° - 33°F. Wind not nearly so strong at 2.00 p.m. Later walked to the top of the hill - 150 yards - and couldn't see the tent from there (because of the blowing snow). Temperature remained constant but snow and rain stopped and changed to a heavy mist in evening.

"June 18. Wind has dropped although still high gusts (estimated to 35-40 m.p.h.). Heavy mists or occasional rain or snow continue. Temp. at 11.30 a.m., 36°F.; temp. at 11.00 p.m., 33°F.

"June 19. Very windy and drifting low cloud with wet snow but the occasional sun spot. Temp. 34° at 8.30 a.m. The weather improved during the day. Clouds lifted several thousand feet and by 12.00 p.m. the wind was N.E. and light and the temperature was 34°F."

During the three days, June 16 to 18, it was quite impossible to travel. A man working outside became soaked through within minutes even when the precipitation was only mist. Visibility was seldom over 150 yards and frequently less. On June 20 the morning weather was still bad but it was necessary to move on because food and gasoline for cooking were exhausted. During the day a waist-deep river had to be crossed in the driving snow - an experience that the author, at least, will be long forgetting. Calf caribou had been exposed to these conditions for a full three days. They must have been continuously soaked by the precipitation. Adults were all drifting rapidly before the wind, crossing any water they came to, and tired young calves must

almost certainly have been drowned in numbers at water crossings or separated from their parents.

On June 25 and 26, there were two more days of similar weather. At that time the observers had left the calving grounds and were at the base camp at sea level. The conditions experienced there were not nearly as severe as they must have been among the high inland hills, but they were still very severe.

During the work in 1950 as severe conditions were not experienced at the camp at sea level where the wind was much more moderate and precipitation much less than in 1951. Time after time days would go by when the cloud layer would be no more than 1,000 to 1,500 feet above sea level, which means that the higher (1,500 feet) calving area was subjected to continuous fog and wet mist. On the three days in 1951 when rough weather was experienced on the calving grounds, conditions at Burnside Harbour, at sea level and only 30 miles away, were much better. While there was continuous precipitation on the calving grounds snow and rain flurries were only occasional and none of the heavy mist, the most penetrating of all precipitation, occurred at the coast.

An examination of a number of detailed weather records for the caribou calving period has been made. These include records from two years (1948 and 1949) kept by Lawrie while with the initial caribou survey, from two years (1950 and 1951) kept by the author, and from random but useful notes kept in diary form by traders, missionaries, and prospectors.

The period of heaviest calving, the most critical survival period for very young calves, has been considered to be June 10 to June 29, although these dates may be much more variable than is generally believed. In this 20-day period the number of days on which below freezing temperatures were recorded was most variable. In 1950 temperatures of 32°F. or lower were noted on 16 days; in 1951, on only 3 days. Precipitation was also most variable. In 1949 Lawrie recorded precipitation on 13 days; in 1948, on only five days. In both 1950 and 1951 there was precipitation on 10 of the 20 days but there were undoubtedly a number of days in both years when there was precipitation on the higher calving areas and not on the coast. On some days in both years the cloud layer was actually below the tops of the inland hills and yet no precipitation occurred on the coast, although rain and snow could be seen descending farther inland at higher altitudes.

Weather records were also examined for records of high winds. In 1948, Lawrie encountered only two days with a wind force as strong as 32 to 38 miles per hour. For the most part it was calm to moderate, 13 to 18 miles per hour. In 1949 the wind was fresh, 19 to 31 miles per hour, on only two days and on the rest of the days it varied between gentle and moderate at 8 to 18 miles per hour. In 1950 and 1951 at Bathurst Inlet the records were not kept as accurately, but high winds were much more prevalent. In 1950, winds were high enough to be classed as fresh, 19 to 31 miles per hour, or more, on 17 of the 20 days. Only two calm days were recorded. On atleast one day the wind was of gale force, 39 to 63 miles per hour, and probably winds of gale force prevailed in the high adjacent country on a number of other days. In 1951 winds on the coast were recorded as high as fresh, 19 to 31 miles per hour, on eight days and, on at least three of these winds attained gale force, 39 to 63 miles per hour, and were possibly even stronger on the nearly calving grounds. Through comparison of weather notes kept simultaneously on the coast and on the higher inland country the conclusion was reached that the latter has much more severe weather even though only a few miles distant. Precipitation and wind velocities were much greater inland.

Relative humidity figures would also be of considerable interest but are not available except for 1948 when Lawrie got readings that averaged less than 10 during the period in question. A few random readings in the Bathurst area did not at any time go over 64 despite proximity to the coast and frequent precipitation.

The weather records and the conclusions to be drawn from them are inconclusive but one thing is clear. In 1949 and 1948, there was no time during the 20 critical days when high winds, temperatures of freezing or lower, and significant precipitation were simultaneous except possibly for very short periods. During those two years the calf crop was apparently adequate. In 1950 and 1951 there were a number of days, and in fact successive days, when all three weather extremes were encountered simultaneously.

The development of a theory to account for mortality due to weather is difficult because of weather records available from specific calving areas are inadequate. Such long term records as have been kept in the high Arctic are little help since they are taken either from areas far from calving

grounds or from coastal areas. The work is made even more difficult by the complete unavailability of literature or library facilities. In spite of this the following theories are proposed.

It seems likely that there is a "chilling point" at which the bodily functions of caribou are so impaired that life can hardly be continued. In a new-born calf caribou the chilling point must be reached under much less severe conditions than for adults. Air moisture (relative humidity), air temperature, precipitation, and wind velocity must be the crucial factors, other than those inherent in the caribou. Variable air moisture would act to hasten or retard the evaporation of water from the bodies of the caribou. The higher the moisture content of the air the slower would be the evaporation and the more prolonged the cooling effect of such evaporation. With a low moisture content, evaporation would be progressively faster and the cooling effect would also be faster. Air temperature would act in governing the rate of evaporation: the higher the temperature, the faster the evaporation rate. Wind speed would also affect evaporation, the rate of the latter increasing with an increase in the former. Precipitation would serve as a wetting agent to keep abnormal evaporation and cooling in progress. It is considered that with a number of combinations of these four factors would be found points at which life would be difficult or impossible for young caribou.

It seems likely that the crucial conditions are high wind velocities, low air moisture content, temperatures low but not necessarily below freezing, and continuous or frequent precipitation. Very likely there are an infinite number of factor combinations which would achieve the same end: the lowering of body temperature until life is difficult or impossible to retain. Possibly even extreme low temperatures with wind might prove lethal, although extreme low temperatures are not frequent during the calving period and are usually associated with calm, clear weather.

It is believed that during the calving period in 1950 and 1951 climatic conditions were such that a large number, probably more than 50 per cent of the young caribou perished shortly after birth due to what might best be termed "exposure"; if not killed outright by the weather their funtions were so impaired that they could not keep up with and lost their parents, drowned at water crossings

which they could normally swim with ease, or fell an unusually easy prey to predators. Despite the ruggedness of the calving grounds there is no adequate cover to protect young calves from adverse climatic conditions, except shelter from the wind. Even in the highest winds, however, caribou lie beside rocks or protecting hills only seldom and for short periods. Winds usually make the animals nervous and keep them on the move at greater speeds and for longer periods than normal. This would cause young calves to be thoroughly fatigued and make them much more susceptible to a " chilling point" and its effects.

Parasites

Insect infestations cannot often affect very young calves seriously. In the higher latitudes at least blackfly and mosquito populations do not become unduly dense and troublesome until July, one to three weeks after most calves are born. It is believed, however, that under conditions ideal for the insects they might cause, at least indirectly, a substantial calf mortality. This would be mostly brought about through fatigue and malnutrition.

It is difficult for one who has never seen it to understand how caribou can travel so far, fast, and continuously without falling from utter exhaustion, when the flies are really bad. Herds are on the move night and day unless the nights are cool enough to discourage the insects. Even when they stop to feed, motion usually proceeds at a slow walk. They seldom lie down for more than a few seconds at a time. All-out running is frequent, particularly when lake margins and swamps are being traversed. Relief and rest are secured only when they can get to an exposed and windy hilltop and even not even then if there is no wind. The author and various assistants have seen individual caribou driven so frantic by blackflies and mosquitoes that they galloped from a herd, ran without reason over the country, and performed most of the strenuous contortions of a bucking horse at a rodeo. It seems reasonable to assume that calves so young that they are only just learning to eat properly, would get far less than the desirable amount of food and milk under such conditions. Even the healthiest adult animals become gaunt and worn and the constant movement must be much more fatiguing to calves than to adults.

Field men of the caribou study have not seen caribou deaths attributed wholly or largely to insect infestations. They have, however, seen the

animals so troubled with insects that the possibility seemed real. During the summer of 1949 - only a few days after a Canadian Wildlife Service field party left Bathurst Inlet - natives began finding many dead caribou, including many calves, in the coastal marshes. Some of these animals appeared to have nothing wrong with them except swollen, sometimes bloody, eye and nose openings. Others had broken front or hind limbs or greatly swollen and infected leg joints. The Eskimos salvaged quite a number of these caribou and used them for dog food throughout the summer; some even found enough caribou to carry them well on to the next winter. Both the white residents at Burnside Harbour and the Eskimos firmly believed that insect infestations were the prime cause of this mortality. Eskimos actually described seeing caribou dash about in such frenzy that they broke limbs and animals so utterly exhausted that they could scarcely stand. The actual facts cannot of course, be fully ascertained through interrogation, but it appears that the natives are at least partly right. Even if some unknown and unsuspected disease were involved, fly infestations would certainly aggravate it by causing fatigue and malnutrition.

It should be emphasised that fly infestations cannot cause caribou mortality every year, and in some of the drier sections of the summer range may never cause it. Probably it takes an unusually wet summer with unusually little wind, to create conditions severe enough. Even when flies are very bad indeed there is usually enough wind to give fairly long periods of relief at intervals.

Except for what has been stated, little is yet known about calf mortality among caribou. As with most other game mammals, it may be inferred that the calves are more prone to mortality than the adults, during the first year of life. Winter kill, brought about through malnutrition and fatigue, is more apt to affect calves than other age and sex groups. They are probably more subject to death through predation and from certain parasites than the adults. The only tapeworm infection found during the continuing study that appeared likely to have proved lethal, was in a three-month old calf. In this animal the small intestines were so choked with worms that they were white due to food dilution in the lower end. It was considered that this animal would probably not have survived the winter.

Predation

Surprisingly little evidence of predation was noted during the trip through part of the interior calving grounds in 1951. Only one barren-ground grizzly bear and the tracks of a second and one adult wolf and the tracks of two others, were seen. It is assumed that the tracks belonged to different animals since they were seen in different localities.

Minor predators which have no direct effect on living caribou, such as owls, hawks, and falcons were relatively abundant. No eagles were seen.

The smallness of the number of wolves seen came as a distinct surprise. Prior to the inland trip wolves had been seen quite regularly on the coast. In the course of the first short walk made after establishing base camp, three wolves were seen. Four wolves were shot on the coast during the month spent there. During the field work at Bathurst Inlet in 1950, wolves were seen on the coast almost daily through late May and the first half of June. During the latter part of June and July, 1950, almost no wolves were seen on the coast and they were thought to be confining their activities to the high dry, and relatively insect-free interior. During August they were again fairly abundant on the coast.

During the calving period adult wolves are, it is true, confined to their denning areas. However, the wolf's radius of movement from its den must be quite large. It is known that wolves at Bathurst in 1950 were hunting 20 miles from their den and possibly more. It is thought that wolves denning along the coastal areas still find the calving grounds within their hunting radius, particularly after the spring run-off subsides. No evidence of wolf-killed calf caribou was seen, but one recently killed female caribou was noted. Possibly wolves may account for some calf mortality indirectly. If wolves scared female caribou away from their calves at too early an age some of the calves would not be reclaimed by their mothers.

The barren-ground grizzly which was encountered was resting by a river bank. From its actions, Perret, who had had some experience with grizzlies, did not believe that it was fishing. Upon catching the human scent this animal ran off at a surprising speed. It followed a straight line until well out of sight, crossing in the course of its flight a fairly large river and a lake in which it had to swim from ice to shore. From its speed, there is no doubt that a grizzly could catch young caribou if it wished. Droppings found

in connection with a freshset of grizzly tracks contained bones and tendons from young caribou.

The general impression received on the calving area was that predation was not heavy. Certainly there was no apparent concentration of major predators in the area investigated. The condition of the country at that period would decidedly favor caribou if they were pursued by wolves. While wolves can and will swim efficiently if pressed, they do not appear to like to enter water. The one wolf noted in the calving country was watched for nearly two hours while it trotted from place to place on lake ice trying to find a place to get ashore without getting wet. At almost any point in that calving area, caribou would have to run only a short distance to escape into water. As mentioned elsewhere in this report, caribou calves can begin to swim a few hours after birth and, on one occasion, at least, a female was seen to lead a very young calf across a water-way to escape from danger.

It is believed, however, that some calving areas must have a much denser wolf population then observed so far, and it is hoped that such areas may be located in subsequent investigations if they exist.

Straying

In only one case of calf mortality found on the calving grounds was the cause of death apparent. In this instance birth had been incomplete. The calf had wedged between the pelvic bones of the female, which had suffered haemorrhage and died. In all other cases the dead calves appeared to have been normal and healthy. In most cases, at least part of the viscera had been removed through a hole in the side or in the anal area - the work of small mammals or large birds - but this appeared to have been done after death.

The author believes that calf mortality is often the result of separation from the female at too early an age. Bad weather, insect infestations or action by predators would certainly act to aggravate the bad results of separation. A cow can be frightened away from its calf easily, as observed in three instances. She may return later to look for it with considerable persistence but could easily fail to find it if the calf was very young and was removed more than 50 yards from where it was left. In one instance, which has been described, a cow took a considerable period to locate a calf that stayed no more than 20 or 30 yards of where she had left it. It was found, that a calf about 12 hours old could not differentiate between its mother and the

observer, either by sight or by the typical grunting noise, at ranges of more than 30 yards even when the noise was answered in a most untypical manner. A calf of this age, or older, could wander so far in a very short time that its mother would not find it.

From observation and discussion with experienced persons it has been concluded that caribou very seldom, if ever, deliberately hide, or cache their calves when danger threatens as most other ungulates do. As a result they are not accustomed to having to search for them. Caribou will leave their calves but usually only after a hard chase which the calf is obviously not able to maintain or in case the danger threatens unexpectedly and from very close at hand. In either event the calf is not usually hidden in the true sense of the word. Usually it merely lies down and stays perfectly still. A predator, or man, may have great difficulty finding such a calf, but only if he does not see it at the moment when it lies down. A number of observers have reported calves they did not see but knew were present through the actions of the females. Even some old residents maintain that caribou hide their calves, and believe that they have seen cows that had hidden calves, even though they never found the calves. The author and McEwen had precisely this feeling during the 1950 investigations at Bathurst Inlet. A number of female caribou that acted as if they might have calves hidden nearby were observed. It was concluded in each case, after much watching and searching that there was no calf hidden. Male and yearling caribou sometimes acted in exactly the same way, and the behaviour was considered to be merely another of the variable manifestations of caribou curiosity. These conclusions appear to be completely justified in the light of the 1951 investigations. If a caribou does happen to "hide" its calf an observer will almost certainly see the calf long before it is "hidden".

A number of things that might bring about a separation of mothers and calves and result in the ultimate death of the latter can happen on the calving grounds. One of the worst would be the sudden dash of a large predator into the herd. The resulting panic would scatter caribou, especially the ones pursued, over a wide area. A herd can scatter and run beyond the speed of young calves for no apparent reason, as many observers have noted on many occasions. Close-knit, moving herds will sometimes start into a wild gallop,

leaving calves and weaklings scattered behind like chaff, to catch up as best they can when the herd slows down. Mothers which lose calves in such a rush will generally return to look for them but sometimes too long a time interval elapses or too great a distance intervenes.

Drowning

Calf loss through drowning can be heavier than is generally indicated in literature and verbal statements. On August 11, 1951, a field party were camped at the central narrows on Aberdeen Lake. The narrows are two to five miles wide and about 4½ miles long. A number of dead caribou were found over a ten-mile stretch of narrows and lake shore on the north side, where, apparently they had been deposited by a high wind. Examination of one mile of shoreline resulted in the discovery of the following dead caribou.

Class of animal	Number dead	% of dead animals
Adult male	3	6.7
Adult female	3	6.7
Two-year-old	2	4.4
Yearling female	3	6.7
Male calf	8	17.8)
Female calf	2	4.4) 75.5
Calf, sex unknown	24	53.3)
Total	45	100.00

Many of the dead calves could not be sexed because of decomposition the effect of fly blowing, and weathering. Many were nothing but dry skin and bone. It was estimated that these animals must have drowned about the first or second week in July when most calves are less than a month old.

It was not possible to examine both shores because of high winds and the necessity of continuing the journey, but it is estimated that the ten-mile stretch of lake and narrows where the dead animals were deposited on the north shore had at least 400 to 450 carcasses. This in itself constituted a large caribou loss, of which calves made up by far the greatest percentage. In theory there was a 100 per cent calf loss from a herd of 1,500 animals or a 10 per cent calf loss from a herd of 15,000 animals.

It is suspected that the narrows were too wide for the calves to swim with ease and the presence of older dead animals that had been in apparent good health indicated that a high wind probably increased the damage. A violent wind could easily arise during a swim of this distance. Fortunately such great losses through drowning are not often reported.

The sex ratio at birth in caribou, as in practically all other animals, is probably about 50:50. Since adult males are generally much less numerous in a herd than adult females there is probably an early differential mortality. Of 15 calf caribou under one month in age, found dead during the continuing study and examined for sex, nine were male and six female. Of two live calves examined one was male and the other female. The data are too few, as yet, to be significant.

Summary

1. Caribou calving investigations are difficult because calving occurs during break-up when travel is most difficult and laborious.

2. Migration prior to calving leads to partial or complete segregation of adult males from adult females, with the former lagging behind along the path of movement.

3. Cows scatter widely in small groups and marked directional movement ceases during calving. Following calving, the groups increase in size, mingle with the bulls again, and travel extensively during the summer.

4. Investigated calving areas were rugged, with many small lakes and rivers, and were well back from sea coasts or large bodies of water at altitudes of 1,000 feet or more. A number of major herds are known to use, more or less regularly, terrain which can be so described.

5. Female caribou do not seek seclusion when about to give birth and they travel with other caribou as soon as the calf is able to follow.

6. Newborn calf caribou have fully erupted incisor and incisiform canine teeth and premolars protruding 1/8 to $\frac{1}{4}$ inch above the gum line and start eating vegetation very shortly after birth - probably within a few days.

7. Calf caribou are very precocious: they can stand up voluntarily when only a few minutes old and walk, run, and hop several miles when less than two hours old. They may outrun a man when less than a day old. They swim instinctively and fearlessly.

8. Cows generally favor calves in travelling but can readily be frightened into leaving them by a hard chase in which the calf lags or by being taken unaware close at hand. They do not hide their calves from danger unless the calf is unable to keep up, and they may, or may not, try to create a distraction to save their calves.

9. Cows with young calves do not show their usual curiosity in time of real or supposed danger but retreat immediately and steadily.

10. No instances of twinning have yet been found in barren-ground caribou.

11. Unusually low calf numbers in a given year are usually evident shortly after calving and it is thought that mortality at and shortly after parturition has great significance in some years.

12. Presently inadequate evidence leads to the belief that severe weather and heavy insect infestations during and after calving may cause exceptionally heavy calf mortality at times. Both could act directly or indirectly to cause mortality by bringing about separation from the female at too early an age, by over-fatigue, by malnutrition, by drowning and by predation.

13. Predation was not heavy on the calving grounds investigated.

14. Many aspects of early calf mortality remain to be investigated.

TITLE

DATE LOANED	BORROWER'S NAME