

**Distribution  
of barren-ground  
caribou harvest  
in northcentral  
Canada**

**by G. R. Parker**

**Occasional Paper  
Number 15**

**Canadian  
Wildlife Service**



Environment Canada  
Wildlife Service

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# **Distribution of barren-ground caribou harvest in northcentral Canada from ear-tag returns**

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## Acknowledgements

The barren-ground caribou tagging program in the Northwest Territories was a joint effort of the Northwest Territories Game Management Service, the game branches of Manitoba and Saskatchewan, the Indian-Eskimo Economic Development Branch of the Department of Indian and Northern Affairs, and the Canadian Wildlife Service.

The program was begun by D. Thomas in 1960 and carried on by R. A. Ruttan from 1962 through 1965. J. P. Kelsall, of the CWS Western Region, organized and analysed ear-tag returns from 1960 through 1965. The enthusiasm maintained by Dr. Kelsall ensured the continued success of the program.

Individuals who contributed to the success of the program by turning in recovered ear-tags include F. W. Terry, T. Jonasson, R. S. Isbister, R. A. Duncan, F. Riddle, E. Land and the late W. Thom.

## Abstract

A total of 6,857 barren-ground caribou was ear-tagged in the Northwest Territories from 1960 to 1967. Total recovery rates for the populations that calve at Beverly Lake and Bathurst Inlet were 7.2 and 4.4 per cent respectively. The difference in recovery rates suggests hunting pressure on the Beverly Lake Population is significantly greater than on the Bathurst Inlet Population. A significantly greater mortality of males from hunting is evident from a male:female relative recovery rate of 1.25. The average interval between tagging and shooting was 1.7 years and the greatest interval was 7.3 years. Approximately two-thirds of the tag recoveries were from the Northwest Territories and one-third from the Province of Saskatchewan. Indian hunters have returned a much greater number of tags than Eskimo hunters. Tags returned by Indians were usually winter recoveries within the taiga while most of those returned by

Eskimos were summer recoveries north of the treeline. Application of the Lincoln Index produced varying annual population estimates for the Beverly Population but the mean was similar to results from aerial surveys in 1967, i.e., about 150,000 caribou. The recovery of tagged caribou together, several years after tagging, suggests long-term social bonds, particularly between adult males. Populations of barren-ground caribou on mainland Canada have well-defined range limits but adjacent populations appear to exchange approximately 5 caribou per 1,000 annually.

## Résumé

De 1960 à 1967, 6,857 caribous des toundras en tout ont fait l'objet d'un étiquetage à l'oreille, dans les Territoires du Nord-Ouest. Les pourcentages globaux de récupération en ce qui a trait aux populations qui mettent bas au lac Beverly et à l'inlet Bathurst ont été de 7.2% et de 4.4% respectivement. La différence entre ces deux taux porte à croire que la chasse a été nettement plus intensive dans le cas de la population du lac Beverly que dans celui de la population de l'inlet Bathurst. La mortalité chez les mâles, attribuable à la chasse, est de beaucoup supérieure à celle des femelles, comme le démontre le rapport mâle/femelle de 1.25, établi d'après les étiquettes récupérées. Il s'est écoulé en moyenne 1.7 an entre le moment où un animal s'est fait étiqueter et celui où il s'est fait abattre et l'intervalle le plus long a été de 7.3 ans. Environ les deux tiers des étiquettes récupérées l'ont été dans les Territoires du Nord-Ouest et le tiers, en Saskatchewan. Les chasseurs indiens ont retourné beaucoup plus d'étiquettes que ne l'ont fait les chasseurs esquimaux. D'ordinaire, les étiquettes retournées par les Indiens provenaient d'animaux récupérés dans la taïga alors que la plupart de celles que les Esquimaux ont envoyées avaient été retrouvées au nord de la limite de végétation arborescente. L'application

de l'indice de Lincoln a donné des nombres estimatifs variés concernant l'importance annuelle de la population du lac Beverly, mais la moyenne est restée semblable à celle qui avait été établie d'après les résultats des dénombrements aériens de 1967, soit environ 150,000 caribous. La récupération, plusieurs années après le marquage, d'étiquettes sur des caribous rassemblés suggère des liens sociaux de longue durée, surtout chez les adultes mâles. Les populations de caribous des toundras qui vivent sur la terre ferme du Canada ont des territoires bien délimités, mais les hardes voisines s'échangent, semble-t-il, environ cinq caribous pour mille, par année.

### Абстракт

За 1960-67 годы были сделаны пометки на ушах 6.857 тундровых карибу, телившихся в районах Беверли-Лейк и Бэтхерст-Инлет. Из этих карибу 7,2 и 4,4 процента в тех же районах были пойманы снова. Относительная разница в доле добычи заставляет предположить, что охота на популяцию района Беверли-Лейк проводится со значительно большей интенсивностью, чем в районе Бэтхерст-Инлет. Что при этом погибает больше самцов, видно из соотношения количества убитых самцов к убитым самкам. Оно составляет 1,25 : 1. Со времени пометок до убоя протекало в среднем 1,7 года. Наибольший наблюдавшийся интервал был 7,3 года. Примерно две трети возвращенных пометок были получены в Северо-западных территориях, а одна треть — в провинции Саскачеван. Охотники-индейцы вернули больше пометок, чем охотники-

эскимосы. Индейцы добывали пометки большею частью в тайге и зимой, а эскимосы в большинстве случаев летом к северу от границы лесов. Применяя индекс Линкольна, был получен ряд годовых подсчетов популяции Беверли, средний из которых соответствовал результатам, полученным путем воздушной разведки в 1967 году, т. е. около 15.000 карибу. Одновременная добыча карибу, помеченных несколькими годами ранее, указывает на существование долгосрочных стадных связей, в особенности между взрослыми самцами. Население карибу в тундре на канадской части материка пребывает в четко установленных границах, тогда как соседние популяции, по-видимому, проводят обмен в примерно 5 карибу на каждую тысячу голов.

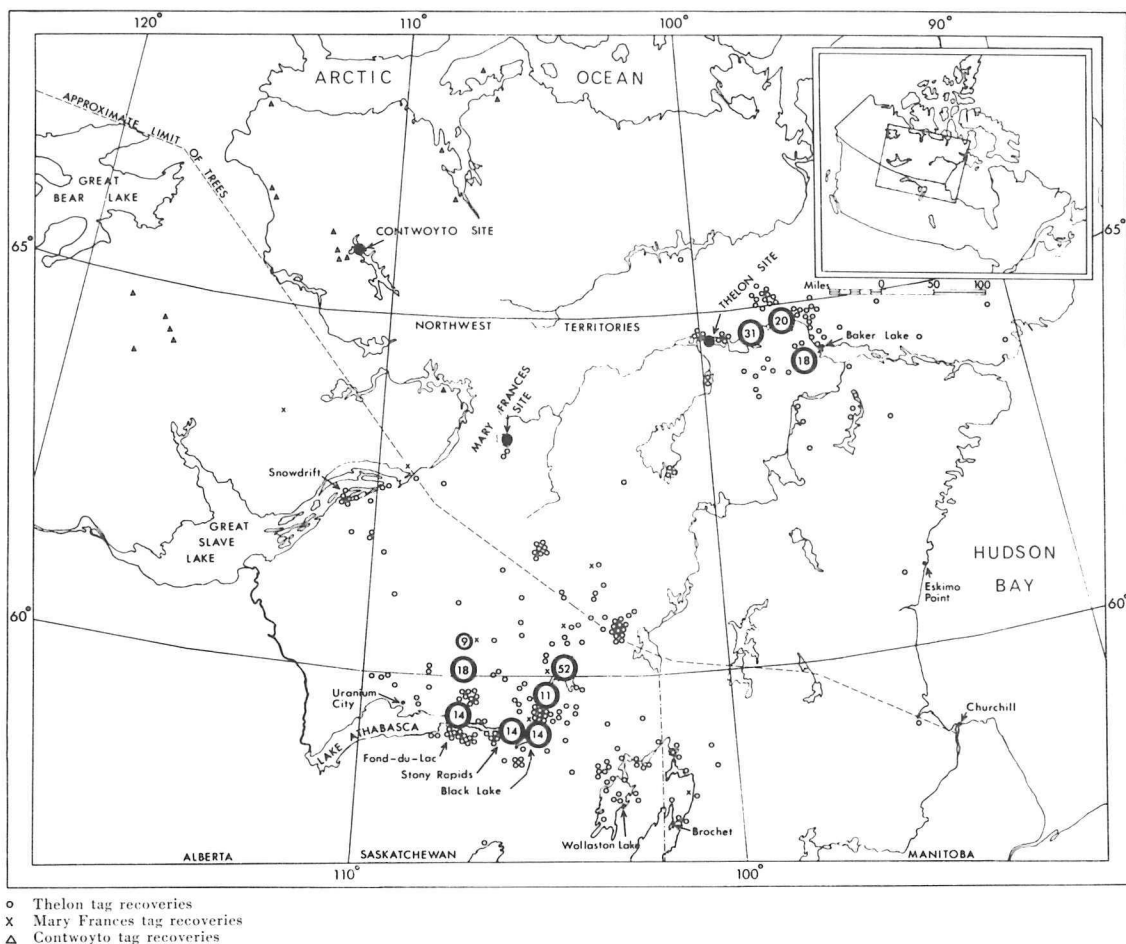
# Introduction

Figure 1. The geographical distribution of ear-tag recoveries (1960 through 1970) for caribou tagged from the Beverly and Bathurst population from 1960 through 1967. Each small symbol = 1 tag return.

Most barren-ground caribou (*Rangifer tarandus groenlandicus*) of northern Canada can be assigned to a particular population, each having defined range limits and a traditional wintering and calving ground. Banfield (1954) first named 16 mainland herds, but many of these were later

found to be segments of individual populations. Thomas (1969) recently identified four populations containing most barren-ground caribou in Canada, excluding the Arctic Islands. These he named Bluenose, Bathurst, Beverly and Kaministiquia, after areas traditionally used for calving.

Figure 1





Aerial surveys from 1948 to 1958 suggested an alarming decrease in the total number of barren-ground caribou throughout their range in northern Canada (Banfield, 1954, 1956; Kelsall, 1957, 1960). In 1958, the Canadian Technical Committee for Caribou Preservation discussed the possibility of marking caribou to assist in obtaining information on their movements and seasonal distribution. Robertson (1961) suggested capturing caribou in the water after he observed Indians spearing caribou at a traditional water crossing at Duck Lake in northern Manitoba. The method proved successful when 112 barren-ground caribou from the Kaminuriak Population were tagged at Duck Lake in September 1959 (Robertson, 1961), and was continued there through 1967. The results of the Duck Lake tagging program from 1959 through 1965 are described by Miller and Robertson (1967).

The Canadian Wildlife Service initiated tagging of the Beverly and Bathurst populations in 1960. The main tagging site for the Beverly Population was a traditional midsummer crossing of the Thelon River ( $64^{\circ} 40' \text{ N } 100^{\circ} \text{ W}$ ) between Beverly and Aberdeen lakes, Northwest Territories, in 1960, 1962, 1963, 1964, 1965 and 1967. A small number from the same population was also tagged in 1960 at another water crossing at Mary Frances Lake ( $63^{\circ} 20' \text{ N } 106^{\circ} 15' \text{ W}$ ). Caribou of the Bathurst Population were tagged at Contwoyto Lake ( $65^{\circ} 50' \text{ N } 111^{\circ} 15' \text{ W}$ ) in 1960, 1964 and 1965. Figure 1 shows the three major tagging sites.

I have used ear-tag recoveries from the CWS program to demonstrate geographical and seasonal distribution of the harvest and to examine the discreteness of local populations and evidence of long-term social bonds. I have also estimated the size of the Beverly Population by the Lincoln Index and the annual mortality rate from tag recoveries received up to July 1970.

The capture method in the Northwest Territories is similar to that first used in 1959 at Duck Lake and described by Bossenmaier (1959), Robertson (1961) and Miller and Robertson (1967). Basically, caribou were captured in the water with the use of canoes and outboard motorboats.

Caribou of the Beverly Population were tagged on the Thelon River during the northerly movement from the calving ground in late June and early July, and at Mary Frances Lake after the northerly movement across the Thelon River had terminated and while the bands were drifting southwest to the treeline in late July. Caribou of the Bathurst Population were tagged as they moved from the calving ground near Bathurst Inlet southward to the taiga.

Ketchum "Visa" aluminium cattle ear-tags<sup>1</sup> were used from 1960 to 1965. A small number of green nylon swivel-tags<sup>2</sup> were used in 1965. The narrower Hasco 6-49 cattle ear-tags<sup>3</sup> were used in 1967. Fabric streamers, ranging in size from  $1\frac{1}{2}'' \times 8''$  to  $\frac{1}{2}'' \times 3''$ , attached to all ear-tags enabled the crew to identify caribou already tagged. The streamers were made from No. 80 Herculite<sup>4</sup> in 1960, 1962 and 1967; and from a vinyl-coated nylon protective fabric<sup>5</sup> in 1963, 1964 and 1965. Ear-tags were gold, yellow, green, blue, red and silver; streamers were grey, yellow, red and green.

<sup>1</sup> Ketchum Manufacturing Sales Ltd., Ottawa, Ontario.

<sup>2</sup> Salt Lake Stamp Co., Salt Lake City, Utah, U.S.A.

<sup>3</sup> National Band and Tag Co., Newport, Kentucky, U.S.A.

<sup>4</sup> Herculite Protective Fabrics, Newark, New Jersey, U.S.A.

<sup>5</sup> Cooley Inc., Pawtucket, Rhode Island, U.S.A.

# Results and discussion

A total of 6,857 barren-ground caribou was tagged in the Northwest Territories from 1960 to 1967 (Appendix 1). The sex and age of 1,550 caribou tagged at the Thelon River site in 1965 were not recorded. Of 5,159 tagged caribou, 30 per cent were adult males, 39 per cent were adult females, 25 per cent were yearlings and 6 per cent were calves. Of the caribou tagged, 6,381 (93 per cent) were tagged at the Thelon River site, 70 (1 per cent) at Mary Frances Lake, and 406 (6 per cent) at Contwoyto Lake.

Mortality at the time of tagging was low: 2 of 52 caribou were accidentally killed in 1960 and 3 of 833 in 1967. Several tag recoveries by Eskimos were from caribou found dead near the tagging site, possibly from injuries not detected at the time of tagging. Several hundred caribou have been tagged in a single day during the height of migration across the Thelon River.

## Recovery rates

The recovery rates of the ear-tagged caribou are shown in Appendix 2. The total recovery rate for the sample tagged from the Beverly Population was 7.2 per cent and from the Bathurst Population 4.4 per cent (Chi-square 4.77, 1 d.f.,  $P < 0.05$ ). Assuming that tagged and untagged animals within each population had equal chances of being shot, the lower recovery rate for the Bathurst Population suggests that hunting pressure was lower than that exerted on the Beverly Population. Effective recoveries include those for which an approximate date (within several weeks) and definite location of recovery were known. Only 4 per cent (22 of 489) of the total returns could not be used when calculating effective recovery rates. All recoveries used in the following analyses were from hunting.

The following results and discussion on recovery and mortality rates will be restricted to the sample from the Thelon River site, as 93

per cent of all caribou tagged and 94 per cent of all returns are from that tagged sample.

Males had a higher recovery rate than females; the male: female relative recovery rate was 1.25 (Chi-square 5.06, 1 d.f.,  $P < 0.05$ ). Direct<sup>6</sup> and indirect recovery rates for sex and age classes are shown in Appendix 3. The direct recovery rate for males in most sex and age classes and tagging years was consistently higher than that for females. This was also true for animals in the second year of life (yearlings), when males and females differ in antler development and body size only slightly, making it difficult for hunters to select males.

Indirect recovery rates for males were more pronounced, primarily—it is believed—because the northern Indian communities have greater access to males than to females during the winter months. A higher annual hunting mortality for males would contribute to a reduced ratio of adult males to females in the Beverly Population (Kelsall, 1968:154). Yearlings showed a slightly higher direct recovery rate than adults and a lower indirect recovery rate. If the yearling mortality rate were higher, then indirect recoveries would be lower. Recovery rates for calves were low because of a high natural mortality of caribou during their first year of life.

The maximum interval between tagging and recovery was 7.3 years. The mean for those returns whose precise recovery date is known was 1.7 years with a standard deviation of 1.5 years.

## Geographical and seasonal distribution of harvest

Most ear-tag recoveries (Fig. 1) were within the normal range limits of their populations as delineated by Banfield (1954) and Kelsall (1968). All recoveries of the sample from the Bathurst

<sup>6</sup> Direct recoveries are those returned within one year of tagging (July 1 through June 30).

Figure 2. Distribution of ear-tag recoveries from the Beverly Population among hunters according to their community

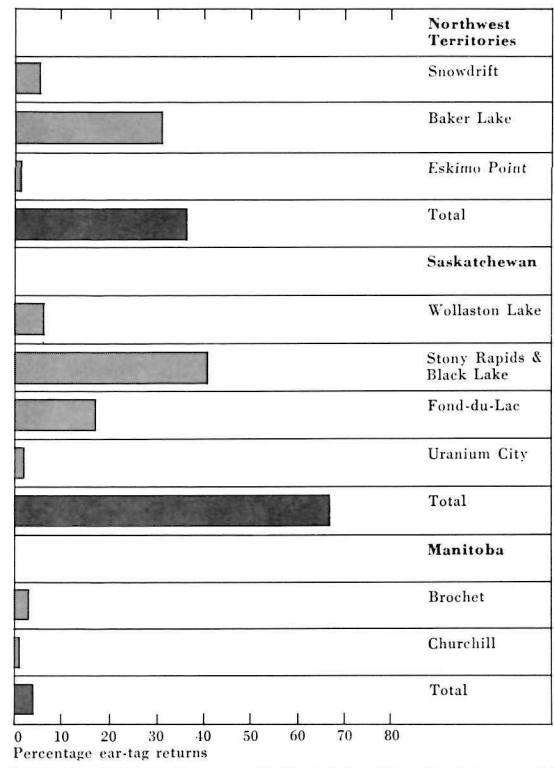
Population were made in the District of Mackenzie, NWT; recoveries from the Beverly Population were made in Mackenzie and Keewatin districts, in Manitoba and in Saskatchewan.

The maximum distance of tag recovery from the Thelon site was 530 miles, and the maximum distance between recoveries of tags applied there was 720 miles. The treeline approximates the line of demarcation between recoveries in winter (October through May) and summer (June through September) and recoveries by Indian and Eskimo hunters. Eighty-five per cent of all usable tag recoveries from the Beverly Population were clustered within a 50-mile radius of Indian and Eskimo settlements or semi-permanent summer and winter camps. The proportions of tags from the Beverly Population recovered by hunters from each settlement are shown in Figure 2. The proportions of tags from the Beverly Population recovered by hunters residing in Manitoba, Saskatchewan and the Northwest Territories, were 2.5, 63.8 and 33.7 per cent respectively, but proportions recovered in Manitoba, Saskatchewan and the Northwest Territories were 2.5, 35.3 and 62.2 per cent respectively. Forty-nine per cent of the tags returned by hunters from the Saskatchewan communities of Fond du Lac, Uranium City, Stony Rapids and Black Lake were recovered within the Northwest Territories.

Indians returned a much larger proportion of tags than Eskimos (Fig. 3). Indians made most indirect recoveries, while Eskimos made most direct recoveries (Fig. 4). The proximity of the Thelon site to a number of Eskimo summer hunting camps accounts for the high proportion of direct recoveries by Eskimos. The Eskimos are abandoning these camps for summer employment at Baker Lake, and direct recoveries after 1964 have consequently dropped sharply.

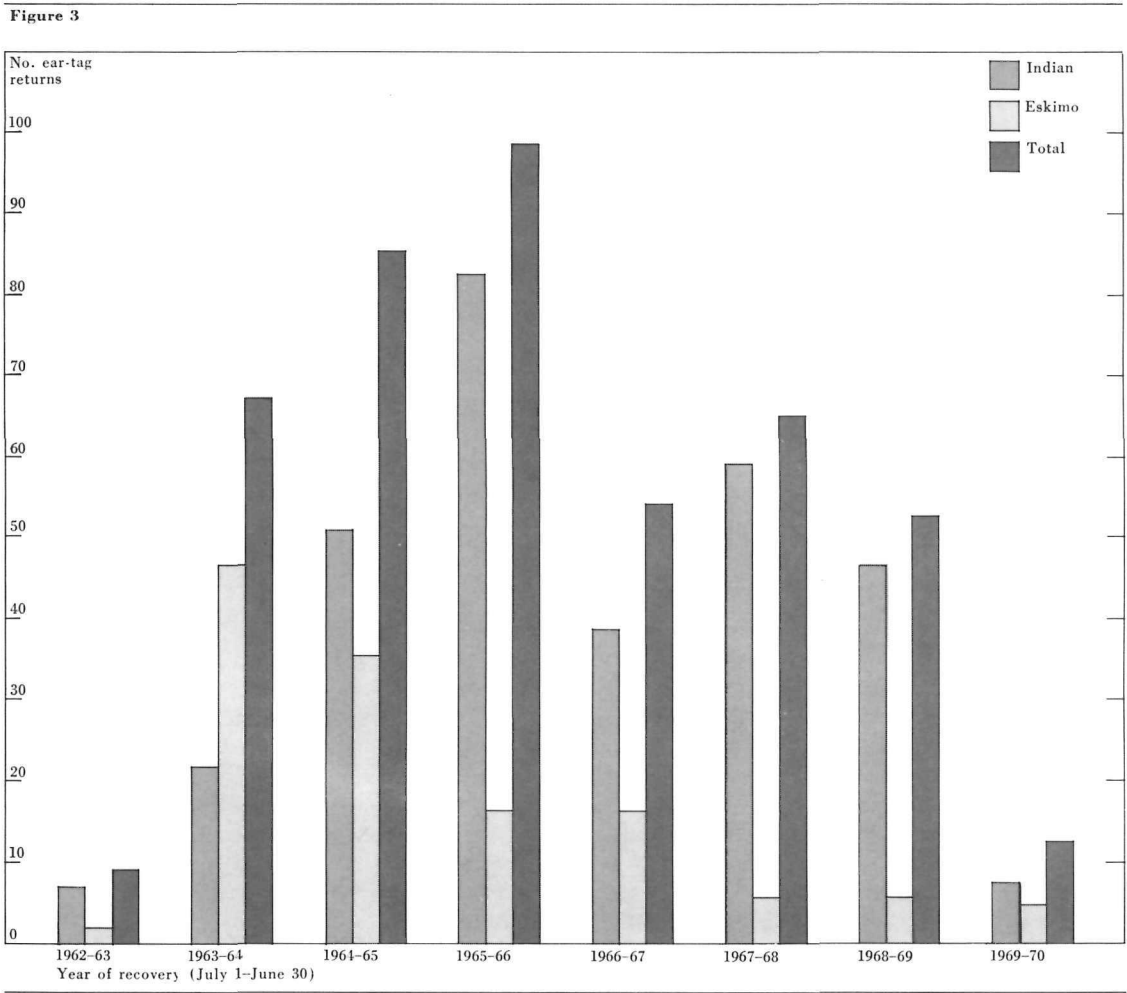
The number of tags returned by Indians and Eskimos for each month is shown in Figure 5.

Figure 2



Returns by Eskimos were generally restricted to the summer months (July through September) while most returns by Indians were made in the winter and spring months (November through May). Few tags were recovered during the caribou calving period in June or the rutting period in October, months of spring thaw and fall freeze-up respectively, when overland travel by hunters is restricted. Returns by Eskimos show that although most caribou migrate south into the taiga in the fall, some remain on the tundra all winter; January and February were the only

Figure 3. The annual number of ear-tag recoveries by Indian and Eskimo hunters from 1962-63 through 1969-70



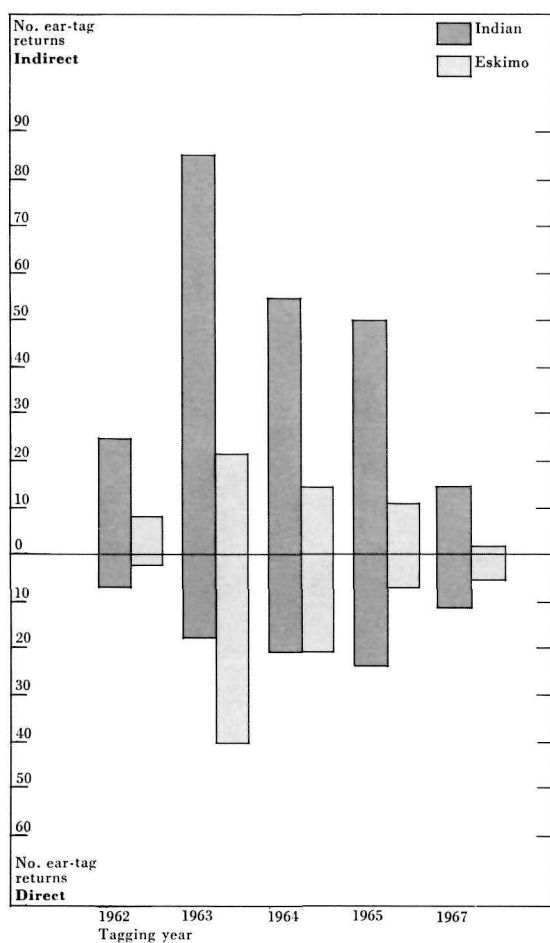
months when no tags were returned. Eight of the nine tagged caribou shot by Eskimos from October through April, and for which sex was recorded at the time of tagging, were males, suggesting that the majority of caribou that winter on the tundra are males.

**Apparent mortality rates from harvest**

Calculated annual mortality rates from ear-tag recoveries are shown in Table 1. Mortality rates are provided only for the first four years following tagging as few tags were returned after that period for the tagging years of 1962 and 1963.

Figure 4. The number of direct and indirect ear-tag recoveries by Indians and Eskimos for the tagging years 1962 through 1967

Figure 4



The high apparent mortality rate for the first year following tagging is a result of the large number of first-year returns in comparison to subsequent years. The large discrepancy between first- and second-year recoveries produces an inflated mortality of 40.1 per cent. As stated

Table 1

A time-specific life table showing calculated annual mortality for caribou, excluding calves, tagged at the Thelon River site for the combined tagging years 1962, 1963 and 1964 (after Hickey 1952)

Year of return (dated from tagging)	Number shot and reported	Number alive at start	Number of deaths	Mortality %
0-1	102	102	41	40.1
1-2	61	61	10	16.3
2-3	51	51	15	29.4
3-4	36	36	16	44.4
4-5	20	20		

elsewhere, Eskimo hunting camps near the Thelon tagging site contributed to selective shooting of tagged animals, greatly increasing first-year recoveries. A second-year mortality of 16.3 per cent, although high, is more in line with the expected. Progressive increases in mortality estimates for the third and fourth years following tagging is believed a result of tag loss from natural wear and accidents.

Given the known average productivity and average first-year calf survival of Canadian mainland barren-ground caribou populations, a population could not maintain itself if the total mortality rate for animals over one year of age exceeded 10 per cent. As the mainland populations have apparently not decreased over the past decade (Thomas, 1969; Parker, 1971), the calculated annual mortality rates must be wrong. The two factors most responsible for the exaggerated mortality rates are probably tag loss and a decline in the annual harvest.

### Population estimate

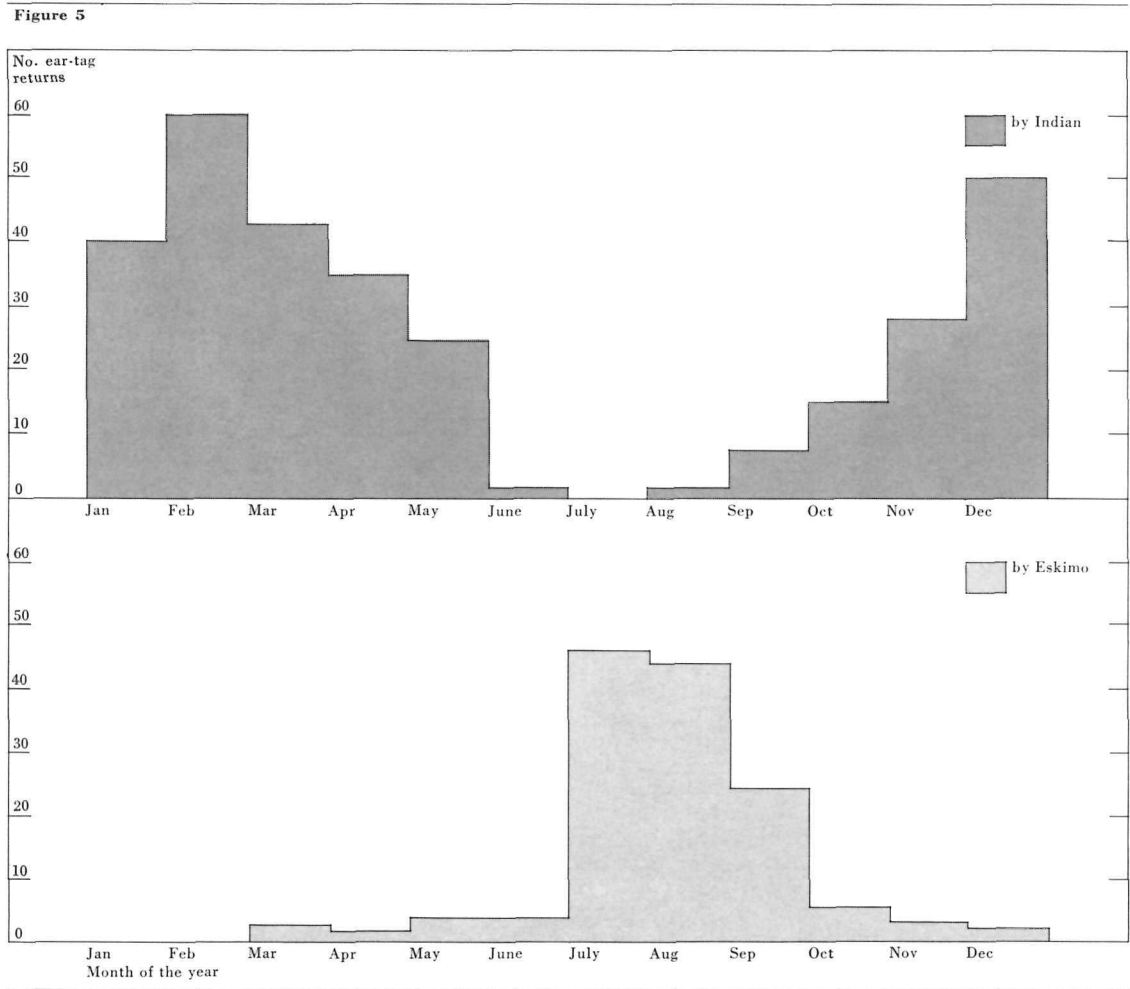
The Lincoln Index is an application of the capture-recapture method of estimating populations (Lincoln, 1930). The assumption is made that marked animals retain their identity, that the capture and marking does not seriously affect the subsequent behaviour of the animal, and that the marked sample's chance for recapture is equal

Figure 5. The number of ear-tag recoveries by Indians and Eskimos, by month, from July 1960 through July 1970

to any other sample of the population (Parr, Gaskell and George, 1968). The formula for calculating population estimates from the Lincoln Index is  $N = nM/x$ .

The greatest source of error in this technique is the procurement of accurate annual kill statis-

tics. Only direct recoveries can be used because annual natural mortality and the recruitment of young animals in subsequent years diminish the proportion of tagged animals in the population. It is also essential that all recovered tags be returned with accurate data on location and



date of kill. Population estimates from returns by Eskimos of Baker Lake are biased because the proximity of the tagging site to their summer hunting camps does not allow random distribution of the tagged sample within the population. Table 2 shows total annual estimates of the Beverly Population, using direct recoveries by Indians. The annual kill estimates were obtained through the Northwest Territories Game Management Service from holders of general hunting licences. Tags returned by Indians of Wollaston Lake, Saskatchewan, were not used, as annual kill data were not available for that community.

The confidence limits for each estimate are based on the formula provided by Overton and Davis (1969). Parr *et al.* (1968) emphasize that when  $x < 10$  the possible values of  $N$  vary by large steps and the standard error is very large. The inflated population estimate and wide range in confidence limits for the 1962–63 sample can be attributed to the small number (4) of direct recoveries. The mean (146,370) of the estimates for 1963–64 through 1967–68 approx-

imates the 1967 aerial survey estimate of 159,000 caribou for the Beverly Population (Thomas, 1969).

### Evidence of long-term social bonds

Barren-ground caribou on mainland northern Canada travel hundreds of miles to and from winter and summer ranges and may occupy a total home range of over 100,000 square miles. Long-term social bonds between individual adults have been assumed to be non-existent because the species is nomadic.

In 13 instances, groups of caribou whose members were tagged at the Thelon site on or near the same date were shot together over 12 months after tagging. These cases suggest the existence of persistent social bonds between barren-ground caribou, particularly between adult males. Group sizes varied from two to four caribou. Four of the 13 groups consisted of two adult males shot more than 3½ years after tagging.

Nine of the 13 bonds were between males. There are several possible explanations for more permanent bonds between adult males than females. Adult female caribou become less tolerant of close association with other adult animals during the late stages of pregnancy and at parturition. At this stage the bond with the calf of the previous year is usually terminated. The period of isolation during parturition is relatively brief in barren-ground caribou, but when combined with the strong maternal bond between the cow and new calf it may be sufficient to discourage long-term bonds with other adults. Males are normally found in small bands and appear to be quite tolerant of one another, except during the short breeding period in October and early November. Most seasonal migrations and movements of adult males are also less rapid than those of adult females and juveniles.

**Table 2**  
Population estimates for the Beverly Population of barren-ground caribou from the Lincoln Index ( $N = nM/x$ ), using direct recoveries by Indians and annual kill data provided by the Northwest Territories Game Management Service

Year (July 1– June 30)	Tagged sample M	Reported kill n	Direct recoveries x	Population estimates N	Confidence* limits 95%
1962–63	618	1833	4	283,198	78,162 836,001
1963–64	1641	1389	16	142,459†	79,777 232,493
1964–65	1692	2210	17	219,960†	125,715 353,365
1965–66	1550	1701	22	119,843†	73,981 181,658
1967–68	830	1368	11	103,221†	50,299 187,347

\*Confidence limits calculated after Overton and Davis (1969) by the formula,

$$N_L = \lambda \text{ (tabular value of } x)$$

$$\text{and } N_U = \lambda \text{ (tabular value of } x)$$

$$\text{where } \lambda = M(n)$$

†1963–68 average = 146,370

### Discreteness of populations

Caribou of the four mainland populations, as defined by Kelsall (1968) and Thomas (1969), occupy a total area of approximately 750,000 square miles but are classified taxonomically as the same subspecies, *Rangifer tarandus groenlandicus* (Banfield, 1961).

Kelsall (1968) suggested extensive shifts of large numbers of caribou from one population into another. Tagging returns have not demonstrated such population shifts within the past decade, but have indicated interchange of caribou between the Beverly and Kaminuriak populations.

The tagging of caribou within the Kaminuriak Population has been reported by Miller and Robertson (1967). From 1960 through 1970 (revising Miller and Robertson's 1967 data to July 1, 1970) 8 of 131 returns (6.1 per cent) from the Kaminuriak tagged sample have been from the normal range of the Beverly Population. During the same period, 20 of the 442 returns (4.5 per cent) of the Beverly tagged sample have been from the normal range of the Kaminuriak Population. This does not include returns from the extreme northeastern portion of Saskatchewan where normal winter range for both populations may occasionally overlap. As all such returns were winter recoveries, the possibility exists that those caribou would have returned to their normal range and not added genetically to the adjacent population. Until there is supporting evidence for this, however, I make the assumption that returns from outside the normal range of a population represent caribou lost from that population. Assuming a constant rate of annual exchange over the past decade, the loss of caribou into the adjacent population has been about 6 and 4 per 1,000 for the Kaminuriak and Beverly populations respectively.

This rate of interchange between adjacent populations contributes to the genetic uniformity

of mainland caribou, with the possibility of slight genotypic variations between the eastern and western extremes of their distribution.



# Conclusions

The tagging of barren-ground caribou at traditional summer water crossings has proven to be an efficient method of marking a large number of animals with minimum cost and effort. Over 1,000 caribou can normally be tagged at the Thelon River site in a period of 2 weeks at a cost varying from \$3.00 to \$5.00 per animal. Mortality during tagging is low, usually less than 1 per cent.

The quality of results depends upon the co-operation of hunters in reporting the recovery of a marked animal and providing the required data with the return. Many caribou hunters are illiterate and although a one dollar reward is paid for each recovered tag, it is believed a number of ear-tag recoveries remain unreported. The precision of data on location and date of kill is also questionable in some instances.

The tagging program has, however, provided otherwise unattainable data on barren-ground caribou populations. Recovery rates show that a greater proportion of males are killed than females, and although deliberate hunter selectivity may be responsible in the adult age groups, it does not explain the greater direct return rate for male yearlings over female yearlings. Male caribou winter farther south than female and juvenile caribou and are therefore more accessible to the Indian communities. Such accessibility may be more important than deliberate selectivity as a contributing factor in the uneven sex ratio in the annual harvest.

Tag returns show that most caribou of the Beverly Population are killed by hunters residing in the Province of Saskatchewan. As this caribou population may annually utilize range in the Northwest Territories and the provinces of Manitoba and Saskatchewan, research and management programs must be formulated through the co-operative efforts of all three wildlife agencies, and the cost of these programs could be shared

according to the extent to which this resource is used by residents within each political jurisdiction. The tagging program provides a guide to such cost sharing.

Tag loss appears to reduce the validity of mortality rates for adult barren-ground caribou calculated from ear-tag returns. Tag loss, the low number of direct recoveries, and the questionable accuracy of annual kill statistics all contribute to considerable variation in annual population estimates based on the Lincoln Index. Such population estimates, however, may be useful in detecting population trends over a number of successive years, combined with periodic aerial inventories.

The tag returns have detected no major population shifts within the past decade, but this does not mean that abnormal movements do not occasionally occur. A continued tagging program would document such movements and provide an answer to questions from the public over caribou reductions in specific areas. The ear-tagging program provides the opportunity to detect population shifts, range extensions, and fluctuations in hunting pressure, and should be considered a long-term, inexpensive monitoring technique for mainland barren-ground caribou populations.

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# Appendices

## Appendix 1

The number and composition of barren-ground caribou ear-tagged in the Northwest Territories, 1960 through 1967

Tagging site	Year tagged	Caribou tagged	Classification of tagged sample					Sex and age unknown
			Adult male	Adult female	Adult sex unknown	Yearling	Calf	
Thelon	1960	50	3	24	1	3	6	13
	1962	618	252	241	0	65	11	49
	1963	1641	654	644	0	273	44	26
	1964	1692	354	538	0	629	153	18
	1965	1550	?	?	?	?	?	1550
	1967	830	219	371	0	218	22	0
Subtotal		6381	1482	1818	1	1188	236	1656
Mary Frances	1960	70	15	35	0	6	5	9
Contwoyto	1960	96	5	31	4	5	23	28
	1964	21	5	0	0	11	5	0
	1965	289	50	120	0	56	63	0
Subtotal		406	60	151	4	72	91	28
Total		6857	1557	2004	5	1266	332	1693

## Appendix 2

Recovery rates for barren-ground caribou ear-tagged in the Northwest Territories, 1960 through 1967

Tagging site	Date of tagging	Recoveries				
		No. tagged	No. used	No. not used	Effective recovery rate %	Total recovery rate %
Thelon	1960	50	2	0	4.0	4.0
	1962	618	40	1	6.4	6.6
	1963	1641	165	9	10.0	10.6
	1964	1692	111	8	6.5	7.0
	1965	1550	92	3	5.9	6.1
	1967	830	32	0	3.8	3.8
Total	1960-67	6381	442	21	6.9	7.2
Mary Frances	1960	70	8	0	11.4	11.4
Contwoyto	1960	96	3	0	3.1	3.1
	1964	21	0	0	0	0
	1965	289	14	1	4.8	5.1
Total	1960-65	406	17	1	4.1	4.4

## Appendix 3

Recovery rates by sex and age for barren-ground caribou tagged at the Thelon River site from 1962 through 1967

Tagging year	Adults				Yearlings				Calves				Total			
	Direct		Indirect		Direct		Indirect		Direct		Indirect		Direct		Indirect	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
1962	1.6	.8	7.5	4.1	0	7.4	2.7	0	0	0	0	0	1.3	1.3	6.7	3.6
1963	3.6	3.4	7.3	5.5	5.9	4.5	7.9	5.1	0	0	9.0	0	3.6	3.5	7.4	5.3
1964	2.8	2.6	3.6	3.9	2.6	1.7	3.5	2.7	1.0	3.1	2.1	3.1	2.5	2.2	3.4	3.3
1967	.9	1.8	3.1	1.3	3.0	.5	3.0	.5	0	0	0	0	1.5	1.7	3.0	1.3
Subtotal	2.6	2.4	5.8	3.9	3.2	2.5	4.3	2.9	.7	1.8	3.1	1.8	2.6	2.4	5.3	3.6
Total	2.5		4.8		2.7		3.5		1.2		2.5		2.5		4.3	

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