

# **FORTY YEARS OF REINDEER HERDING IN THE MACKENZIE DELTA, N.W.T.**

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From: *Polarforschung*, Vol. 45, No. 2, 1975, pp. 129–148.

*Abstract:* Reindeer herding in the Mackenzie Delta area started in March 1935, when a herd of 2,370 animals was delivered to the newly established Reindeer Grazing Reserve. Conceived to supplement the dwindling wildlife resources of the Canadian Arctic and to improve the economic conditions of the native Eskimos, the policy was to keep a government-owned nucleus herd from which additional units could be obtained and put under Eskimo management. Several native-owned herds were set up, but for various reasons they all were returned to the government, the last one in 1964. A new approach was undertaken in 1960; in an attempt to demonstrate the economic feasibility of an Arctic reindeer industry, the project was placed under private management. There were plans to start large-scale reindeer breeding following modern conceptions of reindeer husbandry, but when the reindeer population dropped alarmingly, the Canadian Wildlife Service in 1968 accepted the responsibility for a five-year term. The main task then was to rebuild the herd and to conduct biological as well as management-related studies. In March 1974, the herd was finally sold to a native-owned Reindeer Company. In addition to providing a detailed review of reindeer herding in the Mackenzie Delta area, an attempt is made to evaluate the past economic importance of the project and to assess its potential future development. (The translation is by William Barr, University of Saskatchewan, Saskatoon.)

## *1. Introduction*

The first attempt at introducing a reindeer industry, i.e., the herding of semi-domesticated reindeer (*Rangifer tarandus*), into North America was made in the 1890's in Alaska. In an effort to help the Eskimo, whose existence was threatened by the ruthless exploitation of the stocks of game by American whalers, 1,280 reindeer were purchased in Siberia between 1891 and 1902 and were subsequently distributed over a wide area of coastal Alaska in the form of Eskimo-owned herds. The subsequent eventful history of this enterprise, to which the present 21 herds consisting of 29,000 animals provide eloquent testimony, has frequently been told (Lantis, 1950; Sonnenfeld, 1959; Brady, 1968; Olson, 1969).

The early Canadian attempts in this direction, all of which failed, have also been dealt with elsewhere (Treude, 1966; Scotter, 1972), and hence they need only to be touched upon here. Inspired by the successful development of the reindeer industry in Alaska, Dr. W. Grenfell, a missionary and physician, bought 300 animals in Norway in 1908 and subsequently introduced them to northern Newfoundland under the supervision of several Lapp families who accompanied the reindeer. His initial success stimulated the Canadian Department of the Interior to purchase 50 animals from his herd and to ship them to Fort Smith on the N.W.T.-Alberta border. However, most of these animals died the following summer. Grenfell's attempt also foundered by 1923 because of a lack of suitable herders after the Lapps had returned home and refusal of government support.

Through the urgings of the explorer Dr. V. Stefansson, the Canadian Government set up a Royal Commission in 1919 to study the possibilities of

establishing a reindeer and muskox industry. Before the results of this investigation were published, Stefansson, on his own initiative in 1921, introduced 521 Norwegian reindeer into southern Baffin Island. This attempt also failed because the fodder base turned out to be inadequate for an intensive herding operation and, despite the recruitment of Lapp herders, there was a lack of proper supervision of the animals.

The Royal Commission published its report in 1921, and in contrast to Stefansson, who thought primarily in terms of the establishment of a reindeer industry aimed at the export of meat to southern Canada, it recommended the creation of a number of experimental herds in areas to be selected by scientists. The aims would be: to insure a supply of meat for the Eskimos and Indians, and skins necessary for the production of winter clothing; to create food reserves in the event of mining exploitation in the North; and to lay the groundwork for the possible future establishment of a commercial reindeer industry aimed at the production and export of meat. Apart from Ungava and the west coast of Hudson Bay among others, the coastal zone between Kent Peninsula to the east of Bathurst Inlet and the Alaska-Yukon boundary was identified as a potential reindeer-herding area (Canada, 1972).

Between 1926 and 1928, A. E. Porsild, a Danish scientist who later became chief botanist of the National Museum in Ottawa, conducted thorough field investigations in the area between the Alaska boundary in the west, the Coppermine River in the east, and Great Bear Lake in the south. His survey revealed that the northwestern part of the area alone would be capable of carrying 250,000 animals, while the area north of Great Bear Lake could support a further 300,000 reindeer. On this basis, and on orders from the government, Porsild studied reindeer stocks in Alaska and reconnoitered a route by which a herd might be driven to the Mackenzie Delta. In 1929 the Canadian Government bought 3,400 reindeer from Kotzebue Sound. Late in 1929 the great drive along the coast began. Not until five years later, in March 1935, did the Lapps and Eskimos accompanying the herd reach their destination on the east bank of the Mackenzie River with 2,370 animals.

The present article traces the development of the Mackenzie Delta project during the intervening 40 years, discusses both the setbacks suffered and the results achieved, and assesses the possibilities for future development.

## *2. The Background Situation*

The general development of the reindeer industry in the Mackenzie Delta can be understood only against the background of overall economic changes in the area. The starting point would be the period dominated by commercial whaling: from 1889 onward American whalers wintered regularly off the Delta. The critical aspect in this connection is not so much the fact that the Eskimos participated in whaling, a new activity for them, or that they manned some of the small whaleboats that the whalers brought with them, as that they undertook to supply fresh meat for the crews. After the introduction of the rifle, this hunting activity led to the annihilation, or at least to a significant reduction, of the stocks of game over a wide radius, particularly the stocks of caribou. This can perhaps be better understood when one considers that on Herschel Island alone, during some winters an additional 600 Americans had to be fed (Usher, 1971). From the beginning, the whalers augmented their income by setting traps throughout the winter and also by

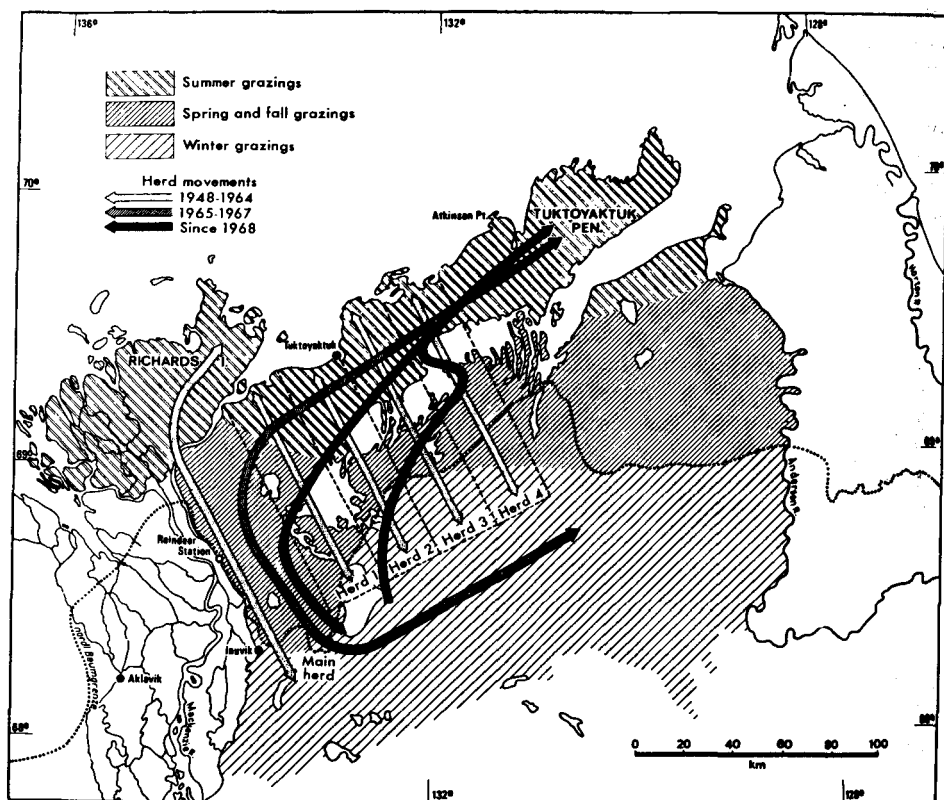


Fig. 1. The Mackenzie Reindeer Grazing Reserve, N.W.T.

encouraging the Eskimos to do so, so that a trade in furs quickly developed, together with a growing dependence on imported goods. As a result, the failure of the whalers to return after the collapse of the whalebone market in 1907 shook the economic base of the Eskimo groups who had come into contact with them. But the establishment of trading posts immediately after this period offered an opportunity for intensifying trapping activities. A number of furbearing species were trapped in the delta, predominantly muskrat, while on the coast it was exclusively Arctic fox. The yield from trapping depended on two factors: the cyclical fluctuations in the stocks of the animals trapped, and movements in world market prices. The 1920's saw a boom in the fur trade and relative prosperity for the Eskimos until, as a result of the world economic depression, the price collapsed.

With the recruiting of Lapp herders, the setting aside of a reindeer reserve of 17,094 km<sup>2</sup> (expanded to 46,361 km<sup>2</sup> in 1952) to the east of the Mackenzie, where all types of hunting, except trapping, were prohibited, and with the establishment of the settlement of Reindeer Depot (later renamed Reindeer Station) for the families of the reindeer herders, the necessary prerequisites were created.

The reserve was delimited in such a way that, in accordance with fodder requirements, it included parts of two vegetation zones: the flat, relatively wet

Arctic tundra in the north, with grasses and sedges, as well as dwarf shrubs and lichen carpets on drier sites was suitable for summer pasture; the forest tundra in the south, with its more pronounced relief and its open park-like woodland with black spruce, white spruce and birch, interspersed with wide level areas colonized only by lichens, provided optimal winter pasture. Only in the extreme southeast does this forest tundra give way to denser boreal evergreen forests. The intermediate transition zone, with low birch and willow scrub, was to serve as intermediate grazing, i.e., as spring grazing (and calving grounds) and as fall grazing (see Fig. 1).

The government's program of development envisaged that a permanent herd of about 4,000 animals would be maintained in the reserve. It was calculated that this main herd would increase annually by 400 calves, which would make it possible to remove 700 to 900 animals regularly every second year, and to hand them over to suitable Eskimos as independent units. At the same time the new herders would be obliged, after an appropriate period, to return to the main herd half of the number originally entrusted to them, so that here, too, there would be animals available for establishing further herds. Furthermore the main herd was to be used to familiarize interested Eskimos with the techniques of reindeer herding, the more expert Lapps acting as teachers. At the same time it was also to be used to supply the meat and skin requirements of the immediate vicinity, to the extent that this was possible without reducing the growth of the herds.

It can no longer be determined with any degree of certainty, whether it was originally planned to entrust the Lapps with complete responsibility for the project. The government appointed as superintendent a Eurocanadian without any previous experience in reindeer herding; apart from direct responsibility for the main herd and for the training program associated with it, he was also to exercise control over the Eskimo-owned herds that were to be set up. He, in turn, was bound by directives that he received from an Interdepartmental Reindeer Committee within the then Department of Mines and Resources in Ottawa, which did not restrict itself simply to issuing general guidelines. This was an aspect that over the years was to have a negative effect.

### *3. The Build-up of Eskimo-Owned Herds*

Within a few years the main herd had increased to the point where, in December 1938, 950 reindeer could be separated and transferred to the Anderson River, outside the reserve. These animals formed Herd 1, under the management of two experienced Eskimo herders, father and son. Herd 2 was established on the Horton River in December 1940 (Table 1). In anticipation of an expansion of the project eastward as far as the Coronation Gulf area, young Eskimos were recruited from that area to be trained by the Lapps as herders in the main herd. But in the summer of 1944 this undertaking, which had begun so promisingly, received a severe setback when the owners of the two newly formed herds drowned in a boating accident. Whatever animals of the two herds could be found were combined and were operated thereafter as the Anderson River Herd, under government control (Fig. 2).

During World War II it was difficult to recruit additional herders because of the high prices being paid for furs, but this situation changed after the war, at least briefly, as fur prices dropped. The Eskimos' interest in reindeer herding rose because they realized that this activity could also afford an opportunity, through the sale of

TABLE 1

Number of Reindeer Separated from and Returned to the Main Herd in Connection with the Establishment of Eskimo-owned Units

Herd	Separated		Returned		Year given up
	Animals	Year	Animals	Year	
No. 1	950	1938	~1,300	1944	1944
No. 2	825	1940			(1950)
No. 1	878	1948	400	1953	
No. 1	1,351	1953	15	1956	1957
No. 2	1,099	1950	549	1954	
No. 3	827	1952	~400	1956	1956
No. 4	1,302	1954	651	1964	1964
	7,032		3,315		

meat, for securing a cash income, with which they could purchase goods to which they had become accustomed.

The procedure for further transfers of Eskimo-owned herds provided that, after a fairly long training period, two Eskimos would together be entrusted with the management of each herd. The contract was set at five years (or could be extended if necessary) and it specified that the new herd would be fully released from

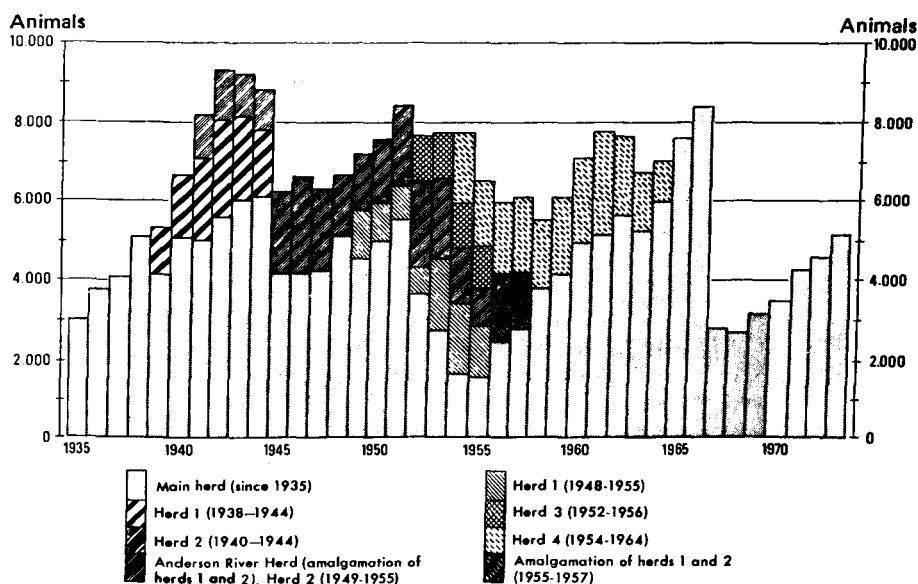


Fig. 2. Number of reindeer in the different herds of the Mackenzie reindeer project during summer roundups, 1935-73.

Source: Reports of Dept. of Indian Affairs and Northern Development, Ottawa.

government ownership only when half the number of animals originally transferred was returned to the main herd after a minimum period of three years. Another stipulation was that the Eskimo-owned herd be well managed. For its part the government assumed the obligation for the maintenance of the two herders during the first year, supplying them with fuel and fishing nets and with assistance in building roundup corrals, and marketing meat not required for their own consumption. The government also bore the total costs for two assistants for a period of two (or, in special circumstances, three) years. The herders were to be permitted to slaughter a small number of animals for the first time during the winter following the establishment of their herd. In light of developments in Alaska, the contract also specified that all sales from a herd required the approval of the government. (In spite of legal regulations, the reindeer in Alaska had been transferred, after 1914, through the Lapp instructors into the hands of Euro-Americans. A new phase thus began: reindeer companies emerged, open herding was introduced, and the grazing areas of the Eskimo-owned herds became intolerably constricted by those of the Euro-Americans. In view of the difficulties that arose from the mixing of herds, many Eskimos abandoned reindeer herding. The general confusion was not ended until 1939 when the government bought out all 40 non-Eskimo herd owners.)

In the Canadian case, Herd 1 was set up in December 1948. But when a gradual decrease in the number of animals occurred in subsequent years, the herd was dissolved in January 1953. The remaining reindeer (about 400 head) were returned to the government; the herd was then augmented to 951 animals and handed over to two other Eskimos as a new Herd 1. In February 1950, Herd 2 was created from the Anderson River Herd, after the latter had been moved back closer to the main herd (cf. Fig. 2). By March 1954 the managers of this herd had returned the number of animals prescribed according to the contract, whereupon, in June 1955, the Minister then in office confirmed their ownership of the herd, for a short time at least. Canada thus had its first truly Eskimo-owned herd. Then, in the summer of 1955, it became apparent that both Herd 1 and Herd 2 had relapsed to a size that made their continued existence questionable. The two herds were amalgamated to enhance efficiency and reduce costs, and thereafter were managed by the owners of Herd 2. In the summer of 1956, one of the owners wanted to give up his partnership, whereupon his partner bought him out; but in the following year the latter also gave up, on grounds of age. A progressive decline in herd size was also a contributing factor. The government bought back the remaining animals. Herd 3 evolved in February 1952; but two years later one of the managers resigned, followed in 1956 by the other; the remains of the herd were returned to the main herd. Herd 4 was formed in March 1954 and survived for 10 years, until personal relations between the two herders, who were from Victoria Island, deteriorated to the point that they decided to dissolve the partnership and to break up the herd. They gave back the prescribed number of animals, sold 390 to the government, and slaughtered 220. Whether even this herd would have survived this long without the constant influence exerted by the superintendent is doubtful. In any event, the formation of herds 5 and 6, envisaged for the spring of 1955, did not occur.

By 1956, the government had recognized that its plan to insure a comprehensive economic base for the Eskimo over wide areas of the Canadian Arctic through the formation of Eskimo-owned herds was doomed to failure, although at this point there existed two small herds apart from the main herd.

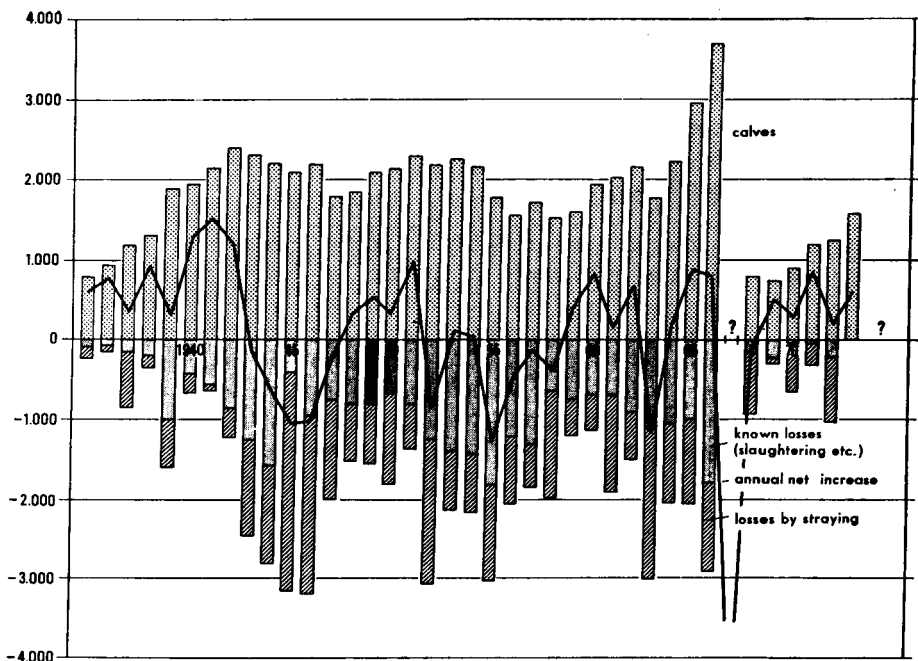


Fig. 3. Herd additions and reductions at year's end, Mackenzie reindeer project, all herds combined, 1935-73.

Sources: Krebs, 1961; Hill, 1967; Nowosad, 1972; Reports of Dept. of Indian Affairs and Northern Development, Ottawa.

In trying to identify causes for this failure, in the first instance, one has to seek an explanation for the drastic reduction in the numbers of reindeer in everyone of the herds taken over by Eskimos, leading in every case, without exception, to the abandonment of the herd. The causes would include inadequate supervision of the herds and associated losses by straying, excessive slaughter of animals, in part the grazing of the herds on unsuitable land, and overgrazing in the vicinity of the settlements, quite apart from losses by illness, predation, and poaching (cf. Fig. 3).

As will be demonstrated later, the number of missing, i.e., strayed, animals over the course of a year corresponded approximately to that of the animals slaughtered. If the number of animals was to be maintained or increased, the losses from straying had to be kept at the lowest possible level since relatively intensive cropping of the herd was necessary to cover the fixed costs associated with herding. Since operating costs (wages of the herd owner and assistants, minor repairs to equipment, etc.) ran at around \$7,000 per year, as was the case for Herd 4 in 1963, then 175 animals would have to be slaughtered, at \$40 per head, to cover these operating costs alone. At least 25 animals would be needed, in addition, for home consumption. If one includes a further 175 reindeer that can be assumed to have strayed, the annual decrease would run at 475 animals at the minimum. With an average calf crop for the period 1938-58 of 28% (Krebs, 1961), the herd size would thus have to be in excess of 1,250 animals to produce the required annual

growth. However, the minimum herd size would have to be 1,500 animals since a considerable number of the animals slaughtered would be cows. This meant that, even at the time of formation, the Eskimo herds were too small, and that the owners of a herd had to give up as soon as the numbers dropped below this critical threshold. In the case of the main herd, these considerations did not apply; since it was more of a demonstration herd, slaughtering could be postponed in the interest of an equable increase in stocks.

Apart from these external difficulties, arising more from technical and economic causes, internal weaknesses in the area of interpersonal relations also contributed to the failure of the concept of an Eskimo-owned herd. The owner-partnerships evolved as a rule from a decision arrived at through government channels and did not reflect the personal preferences of the Eskimos. The old form of cooperation based on the family was ignored in favor of a partnership formed on the basis of the principle of maximum possible efficiency. In most cases, the basis of trust, so necessary for success, was lacking, a circumstance that, combined with uncertainties as to competence in the areas of decision-making and leadership, led to a paralysis of that feeling of satisfaction in the job on the part of those involved, which undoubtedly initially existed.

The intensive or close method of herding introduced into Canada by the Lapps demanded that the herd be kept constantly under observation; a herder circled around it with his herding dog at least once a day. In view of the close proximity of the herds, this labor-intensive form of reindeer herding was unavoidable; yet, despite the demands it made on the herders, it was unable to halt the severe losses by straying. The difficulty and monotony of the work and the comparatively low cash yield allowed reindeer herding to compete only to a limited degree with trapping or with wage labor. As long as there were no compelling reasons, as emerged immediately after World War II, the majority of Eskimos were unwilling to exchange the unfettered traditional life of a hunter or trapper for that of a herdsman or herd owner. The Mackenzie Delta, because of a richness of species, offered particularly favorable conditions for trapping; indeed it is probably the most productive fur-trapping area of the entire Canadian Arctic. It was not without reason that some had warned, from the beginning, against selecting the delta for the experiment since the most prosperous Eskimos lived in that area. The period of the drop in fur prices was followed, in the early fifties, by a building boom associated with the establishment of the DEW Line and the construction of the town of Inuvik. This quickly resulted in the more active Eskimos, who might have become involved in the reindeer industry, being lured elsewhere.

Although an economic transformation affecting the entire region could not be achieved, a cadre of 10–15 Eskimos was nevertheless recruited and became firmly associated with the project. In the case of a relatively small number of Eskimos, it had thus been possible to make conscientious, responsible herders out of Arctic hunters, for whom hunting and trapping still remained ancillary occupations. However, the Eskimo herd owners did not evolve into modern entrepreneurs, intent on maximizing profits, but remained generally constrained by their hereditary modes of thoughts and value systems. Despite its market orientation, the newly introduced reindeer industry was viewed as an extension of traditional economic patterns. In the case of the herd owners, for example, the obligation to give away meat, based on the old system of insurance through reciprocity, still applied, despite the fact that wage employees, with their cash income, were exempt from it. This



circumstance was extremely advantageous in terms of the status of the herd owner, but extremely detrimental to his economic situation.

#### *4. Continuation of the Project on a Contract Basis*

Since 1956 the government in Ottawa had been seeking a solution to the dismal situation already outlined. Several possible courses of action were discussed over the next few years: (1) abandonment of the project, i.e., cease herding the reindeer and let them go off with the caribou herds; (2) transfer of the herds to the Lapps who had stayed in the area, with freedom to proceed according to their own discretion; (3) transfer of responsibility for the project within the structure of government; (4) application of the total energies of the planners within the Department to improvement of the herd management; (5) transfer of herd management for a limited period to experts, with the aim of determining the economic viability of reindeer herding in the Mackenzie Delta.

Since reindeer stocks reached their lowest level in 1958 (cf. Fig. 2), the decision as to future utilization of the reindeer could not be postponed. Despite a recommendation from the Reindeer Advisory Committee to transfer the herd to the Canadian Wildlife Service for a program of reorganization and research with a five-year time limit, the Department accepted an offer from John Teal, Director of the Institute of Northern Agricultural Research in Vermont, and in the fall of 1960 concluded a five-year contract with Teal and with A. J. Oeming, owner of a game farm in Alberta, with the aim of demonstrating the economic viability of reindeer herding. The government conceded that it would continue to cover the support costs that had been paid annually until then, but also secured for itself a share of the income anticipated from the sale of meat; at the same time the herd remained under government ownership. The speed with which Ottawa shifted the burden of responsibility to private individuals led to the contract being signed before the new partners could discuss their partly conflicting ideas as to goals; while Teal intended to pursue a reindeer industry directed toward maximum meat production, Oeming's interest lay more in experiments at interbreeding reindeer and caribou as well as in the supply of animals for his animal export business. The incompatibilities and divergences, in part predicted by experts within the Department, led to Oeming's retraction in June 1961, whereupon Teal attempted unsuccessfully to find a new Canadian partner. The general confusion in Ottawa continued until March 1963 when Oeming secured a two-year contract, again with an assurance of continuation of the annual government subsidy. Oeming then hired Swedish-born S. B. Johansson as a project manager who seemed to have experience of reindeer herding and agreed to reorganize and modernize the project.

When the final Eskimo-owned herd disappeared with the abandonment of Herd 4, the first step was to replace the intensive or close system of herding, which in Johansson's view overtaxed the vegetation cover and led to the animals being constantly disturbed, by an extensive or open system of herding. With this new form of herding, the reindeer would be permitted to graze unrestricted over a wide area; the herders confined their activities to driving the herds during seasonal migrations. Otherwise they patrolled only occasionally around the grazing grounds to turn back straying reindeer and to counter poaching. In an effort to simplify and, at the same time, improve herd management, planes were widely used for the first time. At the same time, a horseshoe-shaped pattern of movement was introduced in place of the previous SE-NW migration. The new pattern was dictated

in part by signs of overgrazing on Richards Island, the traditional summer grazing area of the former main herd (Fig. 1).

Oeming's contract was not renewed in March 1965; his place was taken by Johansson, who during his two years as project manager appeared to have proved his competence. However, his contract ran for only one year at a time, and was renewed for the last time in March 1967. In contrast to his predecessors, he received a fixed salary, i.e., he did not enjoy a percentage interest in the sale of meat, and hence had no personal interest in excessive slaughtering.

In 1964, Johansson had presented a development program which, after some modifications in the herd structure (cows were to make up about 90% of stocks), envisaged a growth of the herd to 30,000 animals within four years; during the same period almost 5,000 animals were to be slaughtered. With Johansson a previously unknown vocabulary made its appearance in government documents: technical ranching terms such as grazing density, optimal slaughter weight, meat production in lbs. per unit of labor input; production costs per lb. of meat, etc. These did not fail to make an impression on the officials in Ottawa. However, what was particularly important for the Department was that the day seemed to be not too distant when the project would not only support itself, but even promised to produce some profit. In a study carried out on the government's behalf (Hill, 1967) Johansson's proposals were modified (the maximum stocks of 30,000 animals would not be reached until after 10 years, but to achieve that level about 65,000 reindeer were to be slaughtered during that 10-year period) and were expanded by the addition of an optimistic market study.

However, all these plans came to naught when, in accordance with its supervisory obligations laid down in the contract, the government insisted on another herd census; the last one, taken in 1962, had indicated stocks of 7,634 animals. Since then the size of the herd had been determined by using projections of empirical values for increases and losses. In March 1967, the reindeer stocks had been estimated at 9,057 animals, but in the fall of that same year an aerial photo survey revealed only 2,756 animals. One can only surmise the reasons for this discrepancy of more than 6,000 animals: the original herd size was probably smaller than estimated, and the number of strayed animals undoubtedly larger. Johansson's contract was not renewed and, in March 1968, the government was faced with the same problems as in 1960.

Once again a range of alternatives was discussed in Ottawa: that the herd be abandoned and hunting permitted; that another, more successful contractor be found; that responsibility for the herd be transferred to the Canadian Wildlife Service, to the Government of the Northwest Territories, or to some other government department; or that the surviving reindeer be slaughtered, the meat sold, and at least the usable equipment salvaged.

For political reasons there could be no question of slaughtering the herd; one would have to reckon with strong protests from the residents of the delta; moreover the territorial government had expressed itself in favor of maintaining the herd. Nor could there be any question of continuing on a contractual basis, involving a private individual, since it was calculated that at least five years would be required to bring the herd back to economically viable size. Since it was believed that the reduction in herd numbers could be attributed to poor management by the contractor, it was

decided in Ottawa that it would be inappropriate to abandon the reindeer industry without having at least made an attempt to emphasize those aspects that had been neglected during the previous 35 years. As of April 1, 1968, the project was therefore transferred to the Canadian Wildlife Service with a mandate to determine conclusively whether a continuation was either reasonable or practicable (the original two-year contract was extended by three years in 1970).

The research plans presented by the Wildlife Service broke down into two groups. The first part, leaning more heavily toward biological investigations, focused on the growth and composition of the herd as well as optimal herd size, on the basis of purely biological aspects. In the second part of the program, directed to herd management, it was intended to bring the herd up to an optimal size, determined by the carrying capacity of the pastures, and to eliminate avoidable sources of loss. To facilitate the investigation, 166 km<sup>2</sup> of land was to be fenced in and part of the herd would be placed in this area for investigation under model conditions. As a complement to the Wildlife Service project, extensive botanical studies were also planned. However, inadequate finances prevented the recruitment of staff and, in combination with an unexpected bureaucratic dispute between the new manager, R. F. Nowosad, and his supervisors in Edmonton, this had the effect of going back to a minimal program that yielded disappointing results and proved inconclusive as evidence.

With the Wildlife Service assuming management of the herd, the settlement of Reindeer Station was abandoned, and the headquarters was moved to the government-owned research laboratory in Inuvik.

The fact that the herd recovered relatively quickly and straying losses were reduced to a tolerable level can be ascribed only to Nowosad's personal influence; instead of the previous eight herders, now only four were available. Nowosad continued to implement the open herding system of his predecessors and even made it more extensive. At the same time, he reduced the degree to which the animals were driven by the herders in spring and fall, and permitted the herd to follow its natural migratory drive to a greater degree; at the same time, he implemented a rotation of winter grazings at the suggestion of the herders. The route of the herd, which diverges from the earlier horseshoe-shaped movement (cf. Fig. 1) resulted from the fact that, on the whole, in springtime the animals travel across the ice of the chain of lakes running through the reserve in a W-E direction, while in fall, when the lakes are still open, they migrate around them. Herding would undoubtedly have been made easier by the use of dogs, but, presumably because their use was associated with the earlier failures, Edmonton had prohibited their use, without consultation with the herders.

In 1971 the discussions in Ottawa as to the future of the reindeer industry were renewed, with consideration of some additional alternatives: the herd was to be driven east so that the reindeer could join the caribou population in the Anderson River area; the restrictions on hunting in the reserve were to be lifted, and an open season on the reindeer declared; regulated hunting, involving even trophy hunters, was to be permitted, under the supervision of the territorial government; all the animals were to be slaughtered, an operation that would have to be extended over a period of three or four years in view of the limited consumption capacity of the local market; the herd was to be kept in its present condition, so that it might be available in case some demand might arise some time in the future;

the herd was to be allowed to grow to 30,000 animals and a profit-making reindeer industry was to be inaugurated along the lines of the plans presented by Johansson; or, finally, the herd was to be offered for sale, with the inhabitants of the delta receiving first refusal.

Parallel with the biological research schemes of the Wildlife Service, investigations were also started in 1970 on the socioeconomic aspects of the reindeer industry; a report was completed in 1972, but was not released. The recommendations, which were made available, called for the sale of the herd to an Eskimo, a suggestion that Ottawa was only too glad to seize. On March 20, 1974, the government sold 5,100 reindeer for \$45,000 to the Canadian Reindeer Company Ltd., a limited liability joint-stock company in Tuktoyaktuk. The president and manager of the company is S. Kangeana, an Eskimo with experience in the reindeer operation. As part of the sales agreement, the company guaranteed that it would maintain minimum stocks of 3,000 animals; if the population dropped below that level, the government would have the opportunity of buying back the animals at a price of no more than \$10 per head. Moreover, in the event of the herd being given up, the government would have first refusal on purchasing it. The company was obliged to carry out annual roundups at government cost to determine the total number of animals, and, until the purchase price had been completely paid off, to provide the government, on request, with up to 1,000 cows at \$10 per head insofar as this was possible, in the view of the zoologists, without affecting the growth of the herd. These animals could then be used by the government to build up further herds as required. The company is advised by a committee that includes a geographer from British Columbia who is the author of the study that provided the impulse for the sale of the herd, and representatives of the federal government, the territorial government, and of the settlements of Tuktoyaktuk and Inuvik.

### *5. The Economic Significance of the Project*

The aim of the original reindeer project started in the Mackenzie Delta in 1935 was to place the crisis-shaken Eskimo economy on a new and secure basis through the establishment of Eskimo-owned herds; for a number of reasons this plan has not been implemented. The government then sought to determine the viability of a reindeer industry directed toward meat production, also unsuccessfully. Despite these failures, the contributions that the project has made in improving the economic situation of the Eskimos should not be overlooked. That contribution has taken two forms: the provision of jobs and the supply of meat to a fairly wide section of the population.

From the start of the operation until 1953, a total of 120 Eskimos received training as herders for periods varying from a few days to several years; by 1975, this number may have increased to about 200. In this connection no account is taken of the large number of Eskimos who have been employed for a short period as temporary helpers during the annual reindeer roundup. In 1953, 21 Eskimos lived exclusively from the reindeer industry, either as herders or herd managers; with their families the total would be 83 persons. In 1963, 70-80 Eskimos at Reindeer Station and a further 19 connected with Herd 4 reported the reindeer operation as being their main livelihood (Abrahamson, 1963). With the change to extensive or open herding, these numbers gradually declined until, during the period when the herd was managed by the Wildlife Service, only four herders were required.

Remuneration to the herders of the main herd was made in the form of money and a meat ration. In the 1930's, the annual salary was \$840 for herders and \$300 for trainees, together with 12 reindeer per man; after the Wildlife Service took over the project, the herders received \$6,800, but, at the same time, the meat allocation was discontinued. The cash incomes of the managers and of the Eskimo herd owners in the 1950's and 1960's ran between \$5,500 and \$7,000 per herd per year; this meant that, with two managers and two herders employed by them, salaries were about \$1,500—1,800 for a manager, and \$900—1,200 for a herder.

On top of these payments, there was a special dispensation in the case of the main herd, a payment of 30—50¢ for every calf that was ear-marked. Not until 1958, when there was a general increase in salaries, were these payments to the herders discontinued.

During the period 1935—57, according to official data, a total of 12,054 reindeer, or 28.6% of the total herd increment, was slaughtered; at an average weight of 55 kg of meat per carcass, 662,970 kg of meat was thus made available to the Eskimo population. A further 6,872 animals (16.3%) fell prey to disease or predators. A total of 13,275 reindeer (31.5%) were recorded as having strayed, i.e., losses by straying exceeded the number slaughtered. In terms of annual average figures, the following picture is revealed: a reduction of 8.2% by slaughtering and 4.1% due to natural losses (disease, predation) compared with 8.9% due to straying. Until 1966 the known losses from slaughtering, disease and predators amounted to 28,263 animals, and the losses due to straying, to 28,846 animals. If one applies the percentage breakdown determined for the period 1935—57, a total of 18,004 animals would thus have been slaughtered up until 1966—a figure that appears entirely realistic—and they would have produced 990,220 kg of meat. When one includes the year 1967, for which no reliable data are available, as well as the period covered by the Wildlife Service's management, the total meat yields for the reindeer project would thus be in excess of 1 million kg.

The weight of the slaughtered reindeer carcasses varies significantly depending on age, sex, and condition of the animals. Herre (1955) has pointed out that total body weights are significantly higher in North American reindeer than those from Eurasia, and that this average weight approaches the maximum weight for Lappish animals. The view, which one encounters frequently in government documents, that the average weight of slaughtered reindeer carcasses has decreased over the years should not be accepted without critical assessment. According to these sources, the weight of old bulls in the early 1940's was around 77 kg and that of cows 60 kg; in 1947 the mean weight of both was recorded as 57 kg; while, since the 1950's, 55 kg per animal has been generally accepted.

There may be two conceivable reasons for this development: first, the intensified slaughtering of young, immature bulls to meet the growing demand for meat; second, the fact that at least during the first few years the strongest bulls were regularly castrated because the Lapps considered them dangerous; as a result, only the weaker, more docile animals were allowed to breed.

Fairly accurate data on the distribution of the meat are available only for the period 1935 to 1955. According to these data, of the 9,083 reindeer slaughtered until 1955, 45% were sold and 34% were consumed in the herding camps. Prior to 1953 a further 20% was distributed to the mission schools and hospitals in Aklavik, and 1% was given away in the form of social welfare to needy Eskimos. For the period

1955-75, it can be estimated that 70% of the yield from the annual kill was available to be marketed.

Until 1952 the meat was sold directly to private individuals, although it never completely met the demand; thereafter a marketing plan was introduced, whereby, apart from sales to the missions in Aklavik, the Hudson's Bay Company with its widely branching network of trading establishments on the Lower Mackenzie became established as the sole wholesale dealer. In 1959 some thought had to be given to introducing buffalo meat in addition, since a bottleneck had developed in the supply of meat from the delta. The following year the cost price rose from 35¢ to 50¢ per lb., and thereby the selling price immediately rose to 65 to 82¢ per lb., depending on the type of meat. This made the purchase of the meat by members of the lowest income groups—and very many Eskimos come into that category—temporarily impossible (Abrahamson, 1963). Irrespective of the location at which slaughtering was carried out, the Eskimo herd managers received a standard price: the meat was flown out and the transport costs were averaged out. As a rule the annual slaughter took place in late November or December when, due to the prevailing low temperatures, the use of freezers was rendered unnecessary; however, summer slaughtering was also carried out quite frequently at the end of the roundups.

Summer slaughtering in early August has the advantage that the skins, especially calf skins, can be used for the production of a wide range of winter clothing and boots, while those resulting from winter slaughtering can at best be used for sleeping robes.

Since the remarkable decline in caribou stocks, there has been a shortage of the skins required for clothing and sleeping robes over wide areas of the Canadian Arctic. To alleviate this need, between 1942 and 1957 the Mackenzie Delta project was able to provide 4,647 skins for shipment to various settlements in the eastern Arctic. Prior to 1942, the skins were left on the carcasses to reduce spoilage during storage in ice cellars in the permafrost.

Reindeer were trained as draft animals in small numbers; in the main herd alone 60-70 geldings were regularly used for moving camp or for hauling firewood. However, for travel, sledge dogs remained indispensable until they were replaced in the 1960's by snowmobiles.

The high rate of loss by straying (it can be assumed that the majority of the animals wandered eastward out of the preserve and joined the local caribou herds) has repeatedly been the cause of concern ever since the start of reindeer herding in the delta. In this connection it can be accepted that inadequate attention by herders is only a partial cause. If one is to believe the reports in the official documents, the majority of the animals disappeared during periods of bad weather in late fall and winter, when orderly herding was not feasible in any case. In 1955 the superintendent suggested the building of fences to halt the losses by straying, at least in part. Then, in 1957, British and Scandinavian reindeer experts also advocated the erection of a fence from Reindeer Depot eastward; moreover, they proposed that it should be introduced simultaneously with open herding, in which the fence was to have played an important role. The cost of 93 km of fence was estimated by the government at \$75,000, i.e., the equivalent value of 1,875 reindeer at \$40 per carcass. Building was in fact started, but then, after only a few kilometers, it was abandoned for some reason; since the fence was built in a valley where it was completely drifted over by snow in winter and thus presented no obstacle to the reindeer, the operation, moreover, was senseless.

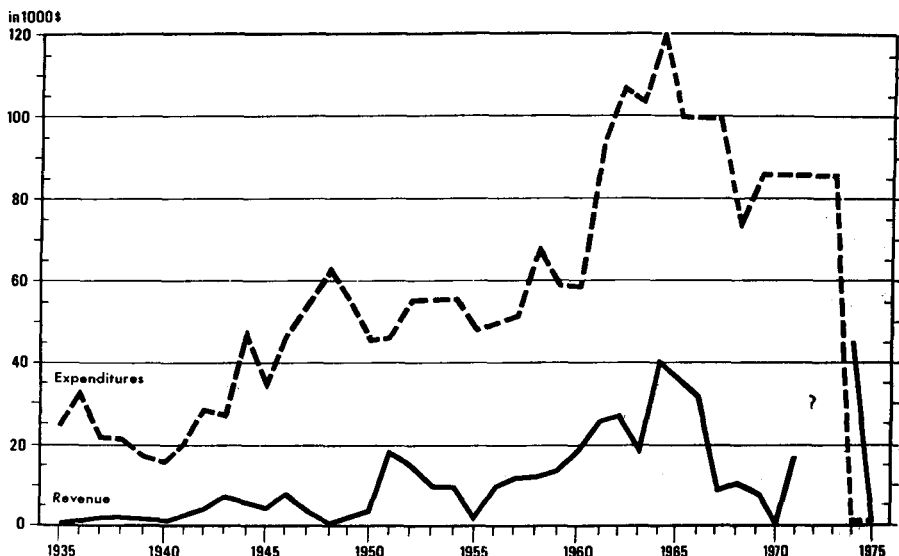


Fig. 4. Government revenues and expenditures, Mackenzie reindeer project, 1935-75.

Sources: Reports of Dept. of Indian Affairs and Northern Development, Ottawa.

From the very beginning the Canadian government must have been aware that at least during its build-up phase, the reindeer project would require significant subsidization. In Fig. 4, the government's income and expenditures are compared; the true preparatory costs, e.g., the amounts spent on terrain reconnaissance, building Reindeer Station, and for the purchase of the first herd, to an amount of \$294,000, are not included. The progress of the project's development is reflected in the expenditures: the establishment of the first Eskimo-owned herds, the repossession of the Anderson River herd and the establishment of further small herds; the payment of high salaries to the contractors and the intensified use of aircraft in herding since 1960; in 1964, in addition, the remnants of Herd 4 had to be repurchased. At the same time, in examining these expenditures, one should not overlook the fact that the settlement of Reindeer Station was also maintained out of these funds, including the supply of electricity and fuel oil. In total, expenditures of \$2.6 million can be set against an income of barely \$0.5 million. If one wants to be malicious, one has to recognize that the true costs of production ran at approximately \$2.60 per kg of meat.

With the sale of the herd in March 1974, the government's financial responsibilities came to an end, apart from the minor costs associated with carrying out the annual roundup which devolved upon the government.

## 6. Outlook

The future development of reindeer herding in the Mackenzie Delta will be determined by three factors: the potential carrying capacity of the available grazings; the absorption capacity of the market; and the number of aggressive people within the personnel of the Reindeer Company Limited.

On the basis of his preliminary researches A. E. Prosild (1929) believed that the potential carrying capacity of the coastal belt between the Alaska boundary and Cape Parry could be set at 250,000 reindeer. Since the present reindeer reserve covers only about one third of that area, it ought to be possible to maintain around 85,000 animals within the reserve (Hill, 1967). E. Porsild (1936) estimated the potential carrying capacity of the reserve (at that time covering 17,094 km<sup>2</sup>) at 25,000 reindeer; in 1965, after it had been expanded to 43,361 km<sup>2</sup>, Johansson argued on the basis of a potential of 30,000 animals, an opinion shared by Scotter (1970), with the stipulation that the entire grazing area be utilized, and that controlled rotation were practiced. According to these recent estimates, the theoretical grazing density, determined on the basis of the annual grazing area required per reindeer, is 0.6 reindeer per km<sup>2</sup>. Thus it differs only slightly from the value determined for the Soviet Union, of 0.7 reindeer per km<sup>2</sup> (Andreyev, 1970). When one considers solely the winter grazings, representing about 40% of the total pasture, one achieves a figure of only 1.6 animals per km<sup>2</sup>, which would then be considerably lower than the values of 7 to 10 reindeer cited by Heile (1966) for northern Finland, and of 10–13 animals per km<sup>2</sup> cited by Shuncke (1969) for parts of Northern Sweden.

Bissett (1967) has already pointed out the danger to winter grazings from forest fires; in 1955 about 2,124 km<sup>2</sup> and in 1962 a further 52 km<sup>2</sup> were destroyed. The intensified encroachment by the expanding stocks of caribou prevents, or at least complicates, the inclusion of the eastern half of winter grazings in the controlled pattern of grazing. Added to this is the fact that at present Richards Island is not available as a summer grazing area, because the island is heavily overgrazed and because the few untouched areas are occupied by oil and gas exploration activities (Nowosad, 1972). In view of these restrictions it is absolutely essential that the potential carrying capacity be determined anew.

In the only market analysis presented so far, based on a herd size of 30,000 animals, Hill (1967) distinguished three market regions, where transport factors permitted an export potential. The first region included, apart from the delta area, the Great Slave Lake area and the settlements along the Mackenzie; in Region 2 he would include the remaining parts of the Northwest Territories; and in Region 3 the Yukon Territory, all the provinces, and the foreign export market. However, export to this latter market would be possible only after the erection of a slaughterhouse meeting strict government regulations, in order to acquire a "Canada Approved" label. For the year 1967, Hill calculated on the basis of a given market potential of 140,843 kg per year, of which two-thirds would derive from the core area. Within this Region 1, the Delta, with a population of 5,000 people and an annual meat consumption of 30 lbs. (13.6 kg) per capita, would alone consume 68,040 kg. By 1977 he estimated a possible increase for all three regions, to a minimum of 209,000 kg, and to a maximum, assuming greater per capita consumption of 465,000 kg.

Using the per capita consumption figure determined by Hill for 1967, and taking into consideration the most recent population figures for the core area (1975), one arrives at a potential demand of 114,000 kg of meat, or 2,073 reindeer; of this demand 72,422 kg, or 1,317 animals would originate in the delta. In this connection meat sales to exploration companies active in the surrounding area are not considered. Of course this determination of the demand assumes that reindeer meat not only can compete on the local market with imported beef, but as far as possible would be offered at a cheaper price. Since the average price for beef at present is about \$1.00 per lb., the wholesale price for reindeer meat to the retailer would have to be in the area of



TABLE 2

## Herd Growth and Operations Model

Year	Initial herd size		Calves		Natural losses		Losses by straying		Slaughtered		Year-end herd size
	M	F	M	F	M	F	M	F	M	F	
1973	3,480	3,193	1,305	1,305	609	550	418	395	—	400	6,911
1974	3,758	3,153	1,414	1,414	658	598	451	397	—	700	6,935
1975	4,063	2,872	1,524	1,524	711	592	488	380	—	700	7,112
1976	4,388	2,724	1,646	1,646	768	601	527	377	100	600	7,431
1977	4,639	2,792	1,740	1,740	812	627	557	390	200	800	7,525
1978	4,810	2,715	1,840	1,840	842	633	577	389	300	700	7,764
			18,938		8,001		5,346		4,500		

Source: Reports of the Department of Indian Affairs and Northern Development, Ottawa.

50–60¢ per lb. to give the retailer an adequate margin to cover transport and processing costs (the meat is bought from the herd owners in complete carcasses) as well as a profit margin. Apart from this, a year-round supply of reindeer meat must be assured.

One can work from the assumption that the four herders and the manager of the Reindeer Company are in a position to operate a larger herd, and to slaughter 1,300 reindeer per year. This should be an adequate number to cover the demand in the Mackenzie Delta. For reasons of minimizing fixed costs, the number of herders will have to remain limited to four, and yet the major part of the fixed costs will still consist of wages. The 1973–78 growth model that was conceived prior to the sale of the herd (Table 2) would permit the culling of around 1,300 animals in the sixth year, and thereby at the same time would result in a final herd size of around 7,500 reindeer. A herd of this size can be handled by two herders at a time, in rotation, using the open or extensive herding method. A 10% loss from straying, which is inevitable with this method, has been built into this model. Moreover it was also assumed that 75% of reindeer cows will drop calves annually, and that 20% of those calves will not survive their first year. Losses due to natural causes were taken to be 10% of the adult population annually. Total values were based on empirical values, deliberately chosen as being relatively low. A planned reindeer operation, with controlled breeding, ideal herd composition (90% females: 10% males) and with slaughtering timed to coincide with optimal meat quality can certainly not be practiced under present circumstances, and hence the herd's optimal productive yield, with constant fixed costs, cannot be achieved.

It is futile to put forward hypotheses as to the future development of reindeer herding in the Mackenzie Delta. Time will tell whether the new Eskimo herd owners are capable of managing the project successfully. The only sure thing seems to be that for the foreseeable future reindeer herding in Canada will be restricted to a limited local area, and will not be in a position to make a significant contribution toward meeting the general demand for meat, within the framework of a large-scale, economically effective delivery system, by means of the exploitation of previously

little-utilized or unutilized areas. In view of the developments that reindeer herding has experienced thus far, Sapper's (1931) forecast must be called in question, at least in the case of Canada: according to him the reindeer "will probably make a substantial contribution in the future to the sustenance of mankind."

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