

History of Moose in Northern Alaska and Adjacent Regions

JOHN W. COADY

Alaska Department of Fish and Game, 1300 College Road, Fairbanks, Alaska 99701

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Moose (*Alces alces*) have occurred in northern Alaska since the late 1800s. Before the 1920s most Moose were probably immigrants from more southern latitudes. Breeding populations became established during the 1920s in the eastern portion of the region, and during the 1950s and 1960s in the western portion. Weather, habitat, and predation were probably not limiting factors to Moose in northern Alaska during the late 1800s and early 1900s. Temporary cessation of most hunting in northern Alaska and growth of Moose populations south of the region by 1920 were probably the most important factors promoting dispersal to, and increase in Moose numbers in, northern Alaska.

Key Words: Moose, *Alces alces*, northern Alaska, historical account.

Moose (*Alces alces*) are holarctic in distribution (Rausch 1963), having emigrated from Siberia across the Bering land bridge to unglaciated refugia in Alaska during the early Rancholabrean Age (Illinoian glaciation) (Pewé and Hopkins 1967). Both the pollen record (Colinvaux 1964) and the boreal nature of mammals dispersing across the Bering land bridge (Repenning 1967) suggest that tundra and open steppe conditions have prevailed in the Bering Strait region since the interglacial interval preceding the Illinoian glaciation. From the high proportion of grazing mammals found in large-mammal fossil communities, Guthrie (1968) concluded that interior Alaska was primarily a grassland during the late Pleistocene. Browsing mammals were very scarce in the fossil record, and Moose comprised less than 1% of remains at most sites.

Peterson (1955) suggested that Moose persisted during late Pleistocene glaciations in major refugia in central Alaska and in several areas in the northern continental United States. During glacial advances Moose habitat in Alaska was probably marginal, and Moose occurred in relatively low numbers. Post-glacial warming trends between 10 000 and 8000 BP (before present) and again between 6000 and 3000 BP, however, resulted in growth and expansion of forests in Alaska (McCulloch 1967), and therefore in favorable habitats for browsers such as Moose. Post-glacial emigration of Moose occurred from the central Alaska refugia into other areas of Alaska and western Canada (Peterson 1955; Kelsall and Telfer 1974).

The purpose of this paper is to review the record of recent dispersal of Moose into northern Alaska and adjacent regions, and to examine factors that may have influenced the distribution and abundance of Moose in this region before 1970.

Study Area

Northern Alaska is considered here as that portion of Alaska from the crest of the Brooks Range north to the Arctic Ocean (Figure 1). The region is divided into three physiographic provinces (Wahrhaftig 1965). The Brooks Range province consists of rugged mountains from 1200-1500 m elevation in the west to 2100-2400 m elevation in the east. Numerous passes 600-1500 m elevation occur through the mountains. The arctic foothills province consists of rolling plateaus and low hills, and ranges in elevation from 1000 m in the south to 200 m in the north. The province is crossed by north-flowing braided rivers originating in the Brooks Range, of which the Colville River is the longest. The arctic coastal plain province is an area of little relief, gradually declining from a maximum of 200 m elevation in the south to sea level in the north. Continuous permafrost results in poor surface drainage and numerous shallow lakes and extensive areas of saturated soil.

Winters are long, cold, and dry and summers are short, cool, and moist throughout most of northern Alaska. The range of mean minimum to maximum temperatures during July, the warmest month, is 1° to 11°C on the coast and 5° to 17°C inland, while during February, the coldest month, these values range from -32° to -16°C along the coast and -37° to -22°C inland. Winter temperatures below -50°C have been recorded at Umiat on the central Colville River. Mean annual precipitation ranges from 12 cm along the coast to 50 cm in the Brooks Range; total snowfall is 50-75 cm along the coast and 200-250 cm in the mountains. Snow accumulates from September to May, except at higher elevations in the Brooks Range where it may persist during most of the year.

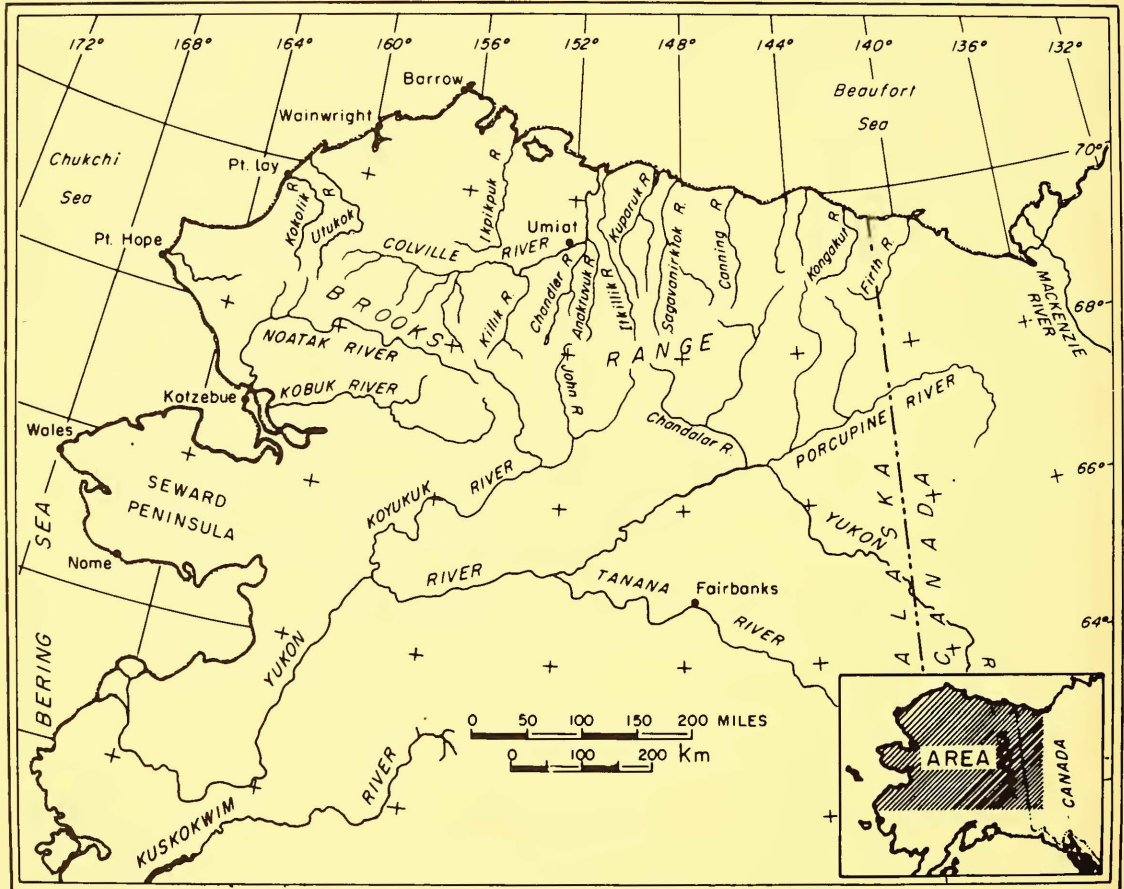


FIGURE 1. Map of northern Alaska. The major study area is that portion of Alaska north of the Brooks Range.

Distribution and Abundance of Moose

I am aware of only one reference to the occurrence of Moose in northern Alaska before 1800. Hall (1973) listed five sites in northern and northwestern Alaska where bones of Moose dated between 980 and 180 BP were found. Hall reasoned that presence of skeletal remains at these sites was due to the natural occurrence of Moose in these areas, and not to trade of Moose meat from more southern areas. I agree with Hall, but add that the paucity of evidence at archaeological sites suggests that Moose were perhaps only occasional immigrants, and that these northern areas were not included in the distributional or breeding range of the species.

Evidence of Moose in northern Alaska and adjacent areas during the 1800s is limited. A Moose was killed in 1825 near the mouth of the Mackenzie River in Canada (Kelsall 1972) and Moose were present in

1861 near Fort Anderson on the Anderson River in Canada (Barry 1961). The Nunamiut Inuit in Alaska did not see Moose north of the Brooks Range before 1870 or 1880 (Gubser 1965); however, between 1880 and 1900 they killed an occasional Moose on the Colville River. Preble (1908) reported that Moose occurred throughout the Mackenzie region as far north as treeline.

The scarcity of Moose in northern Alaska during the 1800s and early 1900s is also apparent from accounts of early explorers in the region. The 1885–1886 Point Barrow expedition of W. L. Howard (no date) did not report seeing Moose on the Kobuk, Noatak, and Colville rivers. Other travelers during the late 1800s saw no evidence of Moose along the Arctic coast or on the Kobuk, Noatak, or Colville rivers (Healy 1887; Nelson and True 1887; Murdock 1898; Stoney 1900). Mendenhall (1902), Smith (1913), and

Giddings (1952), however, reported that a few Moose were known from the upper Kobuk River valley in the 1880s. Leffingwell (1919) did not find Moose in the Canning River region, although he noted that hunting by natives with guns caused Caribou (*Rangifer tarandus*) and Dall Sheep (*Ovis dalli*) numbers to decrease. Murie (1923) quoted an Inuk as saying that a few Moose were found on the north side of the central Brooks Range, although Bailey and Hendee (1926) did not see Moose on an expedition to Wainwright and Point Barrow, even though they travelled inland from Wainwright. Moose were found as far north as the Firth River in 1909 (Nesham 1927). During 1927–1928 and 1930–1935 Moose were rare on the Mackenzie River delta, although in December 1931 a Moose was killed near the Arctic coast a short distance west of the Alaska-Canada boundary (Porsild 1945). Stefansson (1924) reported that Moose were occasionally seen north of timberline along the Mackenzie River and that residents thought that they were both increasing in numbers and expanding their range northward.

Several observations of Moose by Inuit in northern Alaska during the early 1900s are recorded by Bee and Hall (1956). For example, tracks of a Moose were seen in 1924 at Ocean Point near the mouth of the Colville River, some were shot on the Sagavanirktok River in 1929 and near the mouth of the Kuparuk River in 1931. Other Moose were seen near the mouth of the Colville River in 1935, and on the Sagavanirktok River in 1936 and the Killik River in 1945. A Moose was killed at Cape Prince of Wales on the Seward Peninsula in September 1948 (Brooks 1953).

By the early 1950s Moose were common in many areas of northern Alaska. Glaser (1950) counted 34 Moose on the Anaktuvuk River and 109 Moose on the Colville River between Umiat and the mouth of the Killik River in late winter 1950. Several other observations of increasing Moose numbers on the Colville, Chandler, and Anaktuvuk rivers were made between 1950 and 1955 (Bee and Hall 1956; Reed 1956). Observations of abundant Moose in northern Alaska during the 1950s, however, were primarily limited to the eastern half of the region. Bee and Hall (1956) reported record stations for Moose along the Colville River only as far west as Awana River and for rivers east of the Colville River. They also quoted a surveyor as stating that he saw no Moose in 2600 km² of the upper Colville drainage which he surveyed in summer 1950. Glaser (1950) saw no Moose on the Colville River west of the mouth of the Etivluk River in 1950.

By the late 1950s and early 1960s Moose were becoming more abundant in western and northern coastal Alaska. Pruitt (1962, 1966) noted that Moose were observed in northwestern Alaska at Cape Thompson in 1959, Kivalina in 1960, and Point Lay

and the upper Colville River at about this time. He also stated that Moose were regular inhabitants of the lower Noatak River. Dean (1964) found that Moose were sparse, but distributed throughout the Noatak River in suitable willow habitat, and he cited a local pilot as saying that the population was increasing in size. Several observations of Moose near Barrow were made between 1958 and 1963 (Chesemore 1968).

Moose also became more abundant in northwestern Canada during the 1950s. Numerous Moose were seen between the head of the Eskimo Lakes and Liverpool Bay, and on the Mackenzie River delta, the upper Yellowknife River, and the Lockhart River (Banfield 1951). Barry (1961) cited an observation of a group of 15 Moose on the delta of the Anderson River in the early 1950s, and reported that he commonly saw Moose on the Anderson River delta during summers 1958, 1959, and 1960.

Beginning in 1970, the Alaska Department of Fish and Game conducted and coordinated Moose surveys throughout northern Alaska. In 1970 and again in 1977, between 1550 and 1700 Moose were observed during extensive aerial surveys conducted in late winter between the Utukok River and the Kongakut River (Coady, files, Alaska Department of Fish and Game, Fairbanks). The greatest density of Moose was found on the middle Colville River and its tributaries, although sizable numbers also occurred along several streams east of the Colville drainage.

Factors Influencing Distribution and Abundance of Moose

Several factors may have affected the early distribution and abundance of Moose in northern Alaska. First, climatic amelioration and its influence on growth of shrubs may have facilitated an increase in Moose abundance, particularly during historic time (Buckley 1967; Leopold and Darling 1953a, b). Glacial advances and retreats occurred in the Brooks Range during the Recent Epoch, with the most recent advance occurring during the early 1800s (Detterman et al. 1958; Porter 1966). Since this recent advance, most glaciers have disappeared or are considerably reduced in size, ground ice in valleys of the Brooks Range has gradually melted, and the snow line has gradually increased in elevation. But the net increase in mean annual temperature in Alaska from the late 1800s to the 1960s has been only about 1°C (Hamilton 1965). Snowfall has probably not changed greatly during this period. Porter (1966) inferred that ablation of glaciers resulted from a rise in mean summer temperature rather than from a decrease in precipitation. Maximum snow depths are usually less than 60 cm at Umiat on the Colville River (University of Alaska 1975). My own observations during April

indicate that snow in winter Moose habitat in northern Alaska is usually 45–60 cm deep and not hard-packed. Therefore, meteorological changes in northern Alaska have probably not significantly favored Moose during this century.

Although moderating temperatures in northern Alaska may have resulted in some growth and expansion of alluvial shrub communities which are important to Moose, suitable habitat for Moose probably existed throughout this century. Smith and Mertie (1930) reported shrub stands with willows (*Salix* spp.) up to 6 m tall and 12 cm diameter on the Killik River and on the middle Colville River during the 1920s. Both Spetzmann (1959) and Bliss and Cantlon (1957) show photographs of the Colville River near Umiat taken in 1947 and 1953, respectively, in which shrub stands appear similar to those existing today. Plant succession on the river alluvium in northern Alaska described by Bliss and Cantlon (1957) requires several decades before "young Feltleaf Willow (*S. alaxensis*) communities" develop into "decadent Feltleaf Willow communities" which were prevalent in 1951 (Churchill 1955). In 1953 Bliss and Cantlon (1957) aged stems on decadent Feltleaf Willows at 46 yr, and in 1975 Coady and Simpson (files, Alaska Department of Fish and Game, Fairbanks) aged stems on decadent Feltleaf Willows and *S. arbusculoides* up to 65 and 85 yr, respectively. Therefore, Feltleaf Willow communities probably existed in northern Alaska in the vicinity of Umiat and elsewhere prior to 1900. Feltleaf Willows are widely used by Moose in northern Alaska today (Mould 1977), and are preferred browse wherever they occur in Alaska (LeResche et al. 1974). Therefore, I hypothesize that lack of suitable habitat was not a factor limiting Moose in northern Alaska during this century.

Predation is another factor which may have influenced Moose abundance in northern Alaska. Nunamiut hunters of Anaktuvuk Pass recall that Gray Wolves (*Canis lupus*) were uncommon in northern Alaska during the early 1900s (Rausch 1951), apparently because Caribou were scarce in the area. Wolves increased in number with the increase in Reindeer (*Rangifer tarandus*) during the 1920s and Caribou during the 1930s and 1940s. Wolf numbers in northern Alaska were sharply reduced during the 1950s because of intensive hunting from aircraft by U.S. Fish and Wildlife Service agents and private individuals. By the late 1960s wolf numbers in northern Alaska were depressed to low levels; since that time they have probably increased slightly, although density in the region is still relatively low.

Although wolves are capable of limiting Moose populations, several observations suggest that this did not occur in northern Alaska. Wolf density was low

before 1930 and increased as both Caribou and Moose populations increased in the region (Figure 2). Wolves were usually observed in association with Caribou or Reindeer but not Moose. No wolves were observed near Moose on the Colville River by U.S. Fish and Wildlife Service agents in the 1950s, and their reports of a high calf:adult Moose ratio during late winter suggest that wolves were not preying heavily on Moose. During this period wolves were particularly abundant and Moose population growth was rapid. My observations in northern Alaska indicate that wolves do not prey heavily on Moose as I have seen few wolves or wolf tracks near concentrations of Moose, and few carcasses of Moose killed by wolves; also survival of Moose calves to yearling age is high. Therefore, it does not appear that wolves were a limiting factor to Moose in northern Alaska.

Hunting is another factor which may have influenced Moose populations in northern Alaska. Bands of Nunamiut were periodically widespread throughout most of northern Alaska. Gubser (1965) stated that during the 1800s Nunamiut were composed of four major groups living throughout the Colville River drainage and hunting primarily Caribou. When the Caribou population declined between 1890 and the early 1900s, the Nunamiut population also declined because of disease, starvation, and emigration to the coast (Figure 2). From about 1920 to 1938 no Nunamiut resided in the interior of northern Alaska (Gubser 1965). In 1938 Nunamiut began returning to the Brooks Range, although by 1949 the Nunamiut population in that area consisted of only 65. By the early 1950s most Nunamiut had permanently settled at Anaktuvuk Pass.

Early hunters were clearly able to reduce wildlife populations. Nunamiut thought that the decline of Caribou in northern Alaska during the late 1800s and early 1900s resulted, at least in part, from their own excessive hunting (Gubser 1965). Hunting by Inuit and Caucasians along the coast to supply whaling crews further contributed to the decline of Caribou. Jenness (1957) noted that the Caribou population began to increase by 1915 or 1920, after most Nunamiut emigrated from the Brooks Range. Nunamiut probably temporarily eliminated Dall Sheep from several areas in the Brooks Range during the late 1800s and early 1900s (Campbell 1974), and hunting eliminated Muskox (*Ovibos moschatus*) in northern Alaska during the early 1800s (Hornaday and Brower 1911). Anderson (1924, 1938), Porsild (1945), and Kelsall (1972) presented evidence that hunting locally reduced numbers of Moose in northwest Canada during the late 1800s and early 1900s. In northern Alaska the restricted distribution of Moose habitat along major streams and the open nature of alluvial shrub

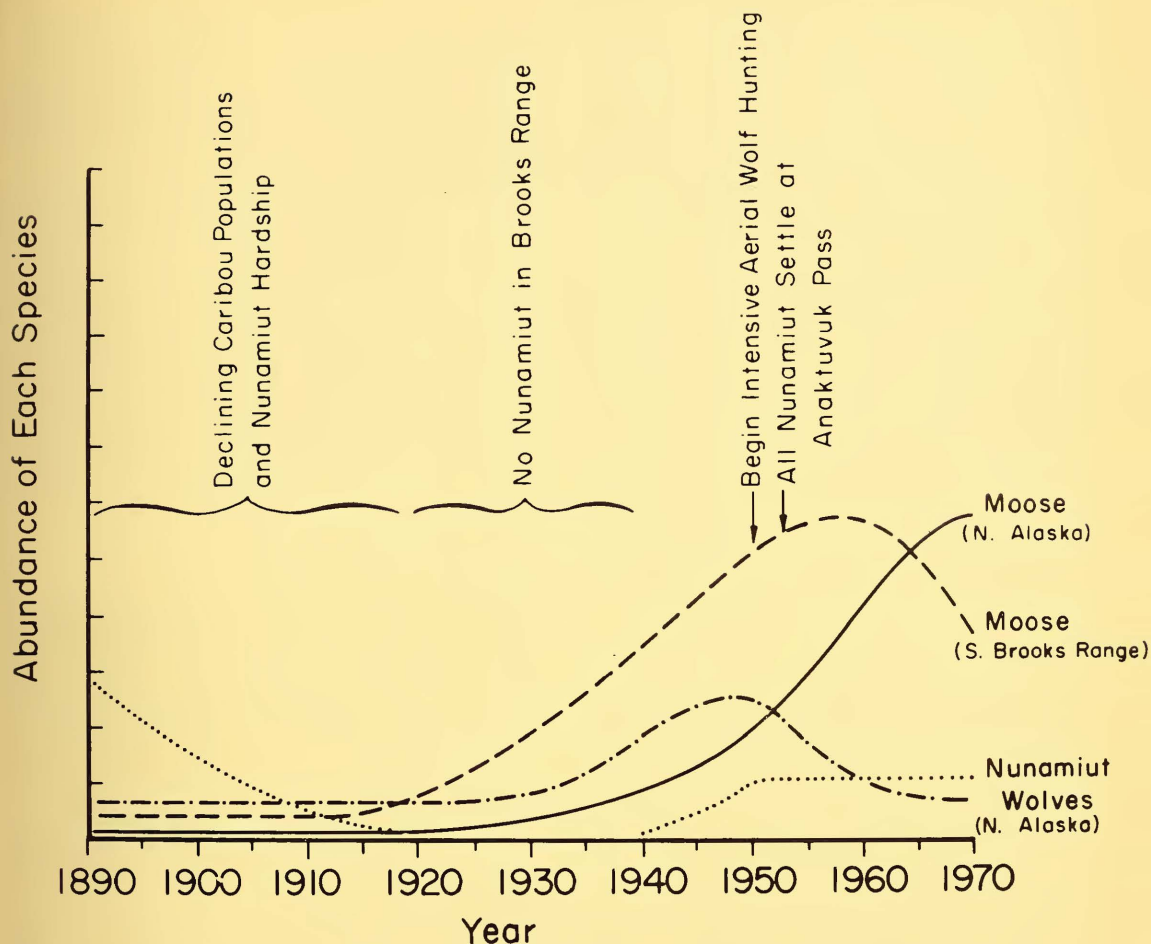


FIGURE 2. Trends in abundance of Moose, Gray Wolves, and Nunamiut north of the Brooks Range and Moose in the southern Brooks Range between 1890 and 1970. Where possible, estimates of population size are given in the text. (The magnitude of change in abundance shown for one population is unrelated to that for other populations.)

communities make Moose conspicuous targets for hunters. Hunting may therefore have precluded population growth in northern Alaska until it was terminated through Nunamiut emigration by 1920.

Hunting has probably been an important factor limiting range expansion and population growth of Moose in other areas of Alaska. On the Seward Peninsula, Moose were extremely scarce before 1950. The number of Moose began to increase in the 1950s, and the population rapidly expanded in both range and size during the 1960s and early 1970s (LeResche et al. 1974). Neither lack of suitable habitat nor excessive predation appeared to be limiting factors; however, hunting by widely dispersed miners may have prevented immigrant Moose from populations east of the region from becoming established. With the decline of

mining in the 1940s most human beings deserted interior areas of the peninsula. The resulting decrease in hunting of immigrant Moose probably allowed the species to become established on the Seward Peninsula during the 1950s and 1960s. On the delta region of the Yukon and Kuskokwim rivers a Moose population has yet to become established in spite of favorable habitat and weather conditions and low numbers of predators. An extremely mobile human population occupies inland areas, and the killing of Moose whenever they are encountered has prevented a population from becoming established and growing in this region (Jonrowe 1979).

A final factor which may have influenced Moose abundance in northern Alaska is the status of populations from which emigration could occur. Comments

by early explorers suggest that Moose were scarce on the south side of the Brooks Range during the late 1800s (Allen 1887; Schrader 1900), but increased during the early 1900s (Merrill 1920; Murie 1923; Mertie 1930; Marshall 1933, 1956) (Figure 2). Moose populations south of the Brooks Range were increasing in size during the early 1900s, immediately before and during a time when Moose in northern Alaska were increasing in number. Dispersal by some individuals to new habitat is a mechanism which has favored range expansion and survival of Moose populations (Geist 1971). Northward movement of Moose through passes in the Brooks Range has occurred (Rausch 1951; Gubser 1965), and immigrants from growing populations on the south side of the Brooks Range probably contributed to population growth in northern Alaska beginning in the 1920s. Exchange of Moose between northern Canada and Alaska may also have occurred, but movements along south-north riparian habitats through passes in the Brooks Range seem more likely than east-west movements perpendicular to these habitats.

Discussion and Summary

The limited evidence for the occurrence of Moose in northern Alaska and Canada before 1800 suggests that the breeding range of Moose did not extend into these regions. The few osteological remains of Moose that have been located probably resulted from killing by early hunters of Moose which occasionally immigrated to the area from more southern latitudes. Reports by early explorers as well as comments of native hunters suggest that Moose were seen in northwestern Canada beginning in the early to mid-1800s and in northern Alaska in the late 1800s. It is difficult, however, to determine when Moose became established in these areas on an annual basis, and thereby effectively extended their range north into arctic regions. Very early observations of Moose in northern Alaska and Canada probably represented unusual immigrations of individual animals, and not an actual extension of breeding range.

I hypothesize that both cessation of hunting north of the Brooks Range and growth of Moose populations south of the Brooks Range were the most important factors influencing the dispersal to, and the abundance of Moose in, northern Alaska. Hunting by widely dispersed Nunamiut bands in and north of the Brooks Range during the 1800s probably prevented occasional immigrant Moose from becoming established. Although Moose were generally not a preferred food of the Nunamiut, they were likely killed whenever possible. The first Moose were seen in the Colville drainage between 1880 and 1900 during a period of Nunamiut hardship and food shortage.

Movement of all Nunamiut to the coast by 1920 eliminated most hunting of Moose in northern Alaska. This coincided with a time of expanding Moose populations on the south side of the Brooks Range, and therefore probably an increasing number of immigrants to northern Alaska.

Moose apparently became established in eastern and central areas of northern Alaska in the 1920s; this was followed by a gradual extension of their range west along the Colville drainage. When Nunamiut returned to the Brooks Range in the late 1930s and 1940s Moose were few in number and not widely dispersed. Caribou were once again abundant, and therefore the impact of Nunamiut hunting on Moose was probably minimal. At present the Moose population in northern Alaska appears to have slowed its growth and perhaps stabilized in most areas. I estimate that the population now numbers approximately 2000.

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