

**A REVIEW OF COMPETITION FOR LIMITING RESOURCES BETWEEN  
MUSKOXEN AND THE PORCUPINE CARIBOU HERD**

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## INTRODUCTION

Muskoxen were found throughout arctic Alaska (Hone 1934) and probably adjacent parts of Yukon Territory until their extirpation from the arctic coast between 1858 and 1865 (Allen 1912). In 1969 and 1970, a total of 64 muskoxen from Nunivak Island, Alaska were reintroduced to areas adjacent to the Arctic National Wildlife Refuge in northeastern Alaska (Reynolds 1989). Little information was collected on the status of the transplanted animals until 1972 and 1973 when muskox sightings were recorded during Arctic Gas pipeline studies (Roseneau and Warbelow 1974). From 1978 to 1981 annual muskox surveys were conducted in spring by U.S. Fish and Wildlife personnel. From 1982 to 1987, intensive studies of muskoxen in the Arctic National Wildlife Refuge commenced.

In spite of initial dispersal, enough muskoxen remained to form the nucleus of breeding populations in the Arctic National Wildlife Refuge. In 1972 and 1973, 36 and 37 muskoxen, including six or seven calves were seen (Roseneau and Warbelow, 1974; unpublished reports, U.S. Fish and Wildlife Service, Fairbanks, Alaska). From 1974 to 1985, the population within the Arctic National Wildlife Refuge study area increased rapidly, doubling every three to four years. In November 1985 476 muskoxen were seen. About five of the initially released muskoxen wandered into the Yukon Territory, some of which were shot by hunters (Roseneau and Stern 1974). Since 1972 sightings of muskoxen in the Yukon Territory have been reported annually. Most observations were in northwestern Yukon Territory, but some from the northeastern part of the Territory and as far south as the upper Babbage River (Reynolds et al. 1985). Although most sightings consisted of solitary animals, groups (mostly small but occasionally up to 20-30 have been observed since 1985 every year. The rapid expansion of the reintroduced muskox population of the Arctic National Wildlife Refuge from 1974 to 1985 appeared to follow the pattern for ungulate populations exploiting a new environment. High productivity and low mortality influenced by the high quality forage (Jingfors and Klein 1982) apparently caused the rapid growth. The rate of growth of the postcalving population (21%) was about the same as calf production (20%) and was similar to growth rates observed for colonizing muskox populations in other areas (western Alaska - Spencer and Lensink 1970, Jingfors and Klein 1982, Grauvogel 1984, Smith 1984; Queen Maud Gulf, N.W.T. - Gunn et al. 1984; Banks Island, N.W.T. - Vincent and Gunn 1981; Quebec - Le Henaff and Crete 1989; U.S.S.R. - Yakushkin 1989).

The muskoxen eruption into the calving and post-calving range of the Porcupine Caribou Herd is of concern to some Inuvialuit of the Mackenzie River delta. They fear that a continued increase of muskoxen on the North Slope may eventually have deleterious effects on the growth and well-being of caribou. Their fear stems from the decline of Peary caribou on Banks Island which has been correlated with an increase in muskoxen in that area.

Miller (1967) defined interspecific competition as the active demand by members of two or more species at the same trophic level for a resource

or requirement that is actually or potentially limiting. Few studies have been attempted to determine whether competition for limiting resources take place between muskoxen and caribou (Parker and Ross 1976, Wilkinson et al. 1976, Thomas and Edmonds 1984). However, a substantial body of literature exists that addresses distribution, habitat use, food habits, and behaviour of both species. No study has specifically addressed competitive interactions between caribou of the Porcupine Herd and muskoxen occurring within this herd's range.

This report is a review of studies dealing with resource limitation of caribou and muskoxen. From this, conclusions are drawn regarding the likelihood and level of competition between muskoxen and caribou of the Porcupine Herd.

## REVIEW

### CANADIAN HIGH ARCTIC

During the mid-1970's summer habitat use and diets of muskoxen and Peary caribou were investigated at Bailey Point, Melville Island and at Mokka Fiord, Axel Heiberg Island, N.W.T. (Parker and Ross 1976). Muskoxen showed a preference for the sedge-producing wet meadow vegetation types while caribou avoided this habitat. Caribou displayed a greater variety in plant species selection than muskoxen, favouring willow, grasses, forbs, and the flowers of vascular plants. Muskoxen fed extensively on sedges in the wet meadows. Caribou and muskoxen were occasionally found together on the same vegetation type. Prolonged observation showed, however, that direct competition for food did not occur. Caribou most often moved through an area occupied by muskoxen and feeding consisted of occasional bites of willow or flowers. Muskoxen were invariably feeding on the sedges and grasses. Parker and Ross concluded that competition between muskoxen and caribou for food and space was minimal.

### BANKS ISLAND, N.W.T.

Wilkinson et al. (1976) completed a study to determine whether muskoxen and caribou were competing for food or space on their summer range in north-central Banks Island. They found that the distribution of the two ungulates rarely overlapped and their preferred habitats and diets were correspondingly different. Muskoxen foraged mainly in wet habitats, where they ate almost exclusively lush sedges, supplemented by grasses and willows. Caribou were concentrated in sparsely vegetated uplands and ate moderate amounts of small sedges, grasses, willows, and milk-vetch.

Measurements of carcass fat, marrow fat, and rates of production and survival of young indicated that both ungulates were in good physical condition. Wilkinson et al. concluded that competition was not occurring.

### MELVILLE, N.W.T. (High Arctic)

Thomas and Edmonds (1984) evaluated habitat use by muskoxen and caribou on Melville Island based on densities of the species' feces. Use of the habitat units by caribou was significantly different from their use by muskoxen. The data on relative fecal densities of the two ungulates indicated little overlap for space or forage. Thomas and Edmonds pointed out that muskoxen require fairly extensive regions where forage biomass is relatively high. Muskoxen tend to select relatively large plants whereas caribou, in contrast, selectively feed on a wide range of species and tend to seek highly nutritious parts of plants. Caribou select relatively small plant parts with concentrated nutrients that are readily digestible. The bulk of the diet of muskoxen, on the other hand, tends to be coarser, more fibrous forages. The feeding behaviour of the two ungulates in snow tends to result in segregation of feeding sites for seven to eight months annually. Caribou seek exposed feeding sites where the snow is shallow because there is insufficient vegetation to initiate drift formation. Muskoxen break through drifts and crater in snow up to 50 cm deep.

## MUSKOXEN IN NORTHERN ALASKA AND YUKON

### Distribution

Muskoxen within the range of the Porcupine Caribou Herd currently occur in four major areas, 1) the Sadlerochit River, 2) the Tamayariak River, 3) the Okerokovik River in Alaska, and 4) the Firth and Malcolm River in the Yukon. Although long-range movements of muskoxen are common (Reynolds et al. 1986), most muskoxen use distinct, relatively small year-long home ranges (Reynolds et al. 1986, Jingfors 1984). The Sadlerochit River muskox herd ranged within an area of 330 km<sup>2</sup> (Jingfors 1984). Within their home ranges, muskoxen display movement rates considerably lower than those for caribou (Jingfors 1984, White et al. 1975).

### Habitat Use

Jingfors (1980) investigated habitat-use of muskoxen along the Sadlerochit River. The periods reported include early and late winter, and the period between calving and the rut. During early and late winter muskoxen exclusively used the riparian habitat (ie. habitat along drainages). Prior to calving tussock meadows with small bands of dry ridge communities were used. Muskoxen used this area until mid-July when the animals moved to riparian habitat where most of them remained until the end of the rut. Some animals returned to the Tussock Meadows during mid-July. A comparison of summer use of vegetation communities in relation to their availability indicated that willow thickets along creeks were highly preferred both for feeding and lying. Muskoxen selected the dry ridge type primarily for resting, while tussock meadows and riparian communities were used essentially in proportion to their availability. An apparent avoidance of the wet sedge meadow and heath polygon types was noted.

Reynolds et al. (1986) recorded terrain features and land cover categories in which muskox herds were observed during radio-monitoring flights and seasonal surveys. River and creek drainages were most frequently occupied by muskoxen throughout the year, except during the pre-calving season. During winter, pre-calving and calving seasons, ridges, plateaus, and bluffs, that often blow partly free of snow, were occupied by some muskoxen. Occurrence of muskoxen on this terrain type reached a maximum during the pre-calving season. Landcover categories were identified on the basis of features recognizable from the air. Low shrub-forb communities were occupied most frequently throughout the year. In late May or early June muskoxen were often found in upland areas of low shrub-forb communities or tussock communities. In late June and early July, as willows emerged, muskoxen moved back into major river drainages. Occupancy of tall shrub and adjacent communities of low shrub forb or gravel bars continued through summer and rut. Tall shrub communities along gravel bars were occupied in September and October as animals congregated on major river drainages drainages. Major components of habitat occupied by muskoxen on the Alaska Coastal Plain are river systems with diverse low shrub-forb and tall willow communities situated near uplands, hillsides, plateaus, or bluffs where

low snow cover can be found in winter, pre-calving, and calving seasons. Reynolds et al. suggested that the presence of these components in many areas, currently not used by muskoxen, will probably result in a continued increase and expansion into unexploited habitat. A cursory description of muskoxen habitat in northeastern Alaska is presented by O'Brian (1984). Most of the direct observations of muskoxen and of muskox sign were in the following habitat units: riparian terrace, gravel bar, riparian willow thicket, river bluff complex, dry ridgetop barren. Fecal pellets were also found in moist tussock tundra, generally adjacent to bluff edges and to the dry ridgetop barren type. Very little use was apparent in the sedge meadow, moist sedge/tussock complex, and moist frostboil upland vegetation types.

#### Food Habits

Summer food habits of muskoxen along the Sadlerochit River have been reported by Robus (1984). Important forage species included willow, forbs and, infrequently, a sedge. Productivity and quality of the range (nitrogen content) were also examined and linked to muskox forage use. The high productivity of muskoxen and the abundance of high quality forage in the Sadlerochit River drainage suggest that riparian habitats are important to the species in northeastern Alaska.

### PORCUPINE CARIBOU HERD

#### Distribution

Only in its extreme northern extension does the 250,000 km<sup>2</sup> range of the Porcupine Caribou Herd overlap with that of muskoxen. Caribou of the Porcupine Herd may be present within the distribution of muskoxen in northeastern Alaska and northern Yukon any time from early May until August (Anon. 1986). Information of seasonal distribution of caribou from the Porcupine Herd is collected through relocation of radio-collared caribou, but this is a crude approximation with less than 0.1% of the herd being radio-collared.

#### Habitat Use

Little information exists on habitat use of those caribou whose range overlaps with muskoxen. Martell et al. (1986) investigated range use of male caribou in early summer in northern Yukon. Tussock meadows appeared to be selected in late May and early June and willow thickets are selected in mid to late June. Wet sedge meadows were avoided until late June, dwarf shrub heaths were avoided after late May, and alluvial willow thickets were avoided in late May and early June.

#### Food Habits

Martell et al. (1986) reported on food habits of male caribou of the Porcupine Herd in northern Yukon during summer. Caribou fed primarily on lichens and Vaccinium in late May, lichens and Eriophorum in early June, Eriophorum in mid-June and Salix in late June. Thompson and

McCourt (1981) described the diet of the Porcupine Caribou Herd based on fecal analysis. They reported that Eriophorum and lichens were the most important components in fecal samples in late May and that samples were dominated by Eriophorum in early June and by Salix in late June.

### Behavioral Interactions

Jingfors (1980) observed nine interactions between caribou and muskoxen. In all interactions, one or more caribou approached the muskox herd. The reaction of the muskoxen varied in intensity depending upon the number of caribou approaching and the distance to the herd. Most frequently, the muskoxen bunched up and observed the passing caribou with raised heads. Jingfors mentioned one case where a band of 15 caribou passed a grazing muskoxen herd 75 m to the side, after which the muskoxen ran for 150 m and stopped. The caribou then circled downwind of the herd and left the area. Jingfors (pers. comm.) is of the opinion that muskoxen and caribou tend to avoid each other rather than feed "in harmony". This behavioral avoidance may, in turn, limit range overlap.

### Conclusions

All North American workers studying muskox-caribou interactions were of the opinion that little, if any, competition for forage or space took place between the two species. A weakness of most studies, however, was that they took place during summer, a period when food resources are most abundantly available and when forage competition could be expected to be less intense. Also, one needs to consider relative population size between the two ungulate species. The Banks Island study, for example, took place when muskox numbers were substantially lower than at present (B. McLean, pers. comm.). Conceivably, competition between two species is most intense at high densities of one or both species. It is this point of potential competition as numbers increase that the Inuvialuit are concerned about.

As mentioned above, the distribution of the Porcupine Caribou Herd may overlap with muskoxen from May to August. However, distribution of the herd is only monitored on a crude scale and very little quantitative information on distribution is therefore known of the extent of this range overlap. There appears to be overlap in the preferred type of habitat units between the two species at times, specifically alluvial willow thickets in spring. It is not known at what scale actual overlap of habitat use occurs between species. Willow appears to be a major food item for muskoxen throughout the year, and during part of the summer for caribou. Whether foraging of willow by one species impacts on the other species is unknown. Thomas and Edmonds (1984) suggested that muskoxen on Melville Island obtained most of their willow intake from the sedge meadows and peripheries, a vegetation type avoided by caribou.

The dynamics of forage species, and feeding ecology of caribou and muskoxen is only partially understood. Similarly, little is known on competition for space between muskoxen and caribou. Nevertheless, in

view of what is known from other regions, certain inferences can be made for the North Slope.

Muskox habitat is a relatively small proportion of the summer range of the Porcupine Caribou Herd. The plant species for which there is seasonal overlap in preference is selected by the Porcupine Caribou Herd only for part of the year. This species is readily available. Thus it seems more likely that if any competition for this forage occurs, muskoxen will suffer from resource stress more than caribou. The vast difference between numbers of the Porcupine Caribou Herd (178,000, Fancy 1989) and muskoxen within its range (405, Reynolds 1989) support the view that if any competition for limiting resources (space or food resources) occurs, muskoxen would suffer before caribou. At current numbers of both ungulate species any deleterious effects on caribou numbers would probably not be detectable in the event of any competition between the species. The migration strategy of the caribou appears to be a successful one in minimizing resource conflicts with other species and may be the very reason why these herds can be so large (Fryxell et al. 1988). Although muskox numbers on the Alaska North Slope experienced an initial period of exponential growth, there is already evidence that the growth rate is slowing down and that the population may stabilize at lower densities than observed in recent years (Reynolds 1989).

Perhaps it is no surprise that any evidence of competition between muskoxen and caribou in North America is limited. After all, paleontological and archaeological evidence shows that muskoxen and caribou have coexisted in arctic and periglacial habitats for at least 60,000 years (Wilkinson 1975). As Wilkinson et al. (1976) pointed out: "Interspecific competition usually has one of two principal, long-term outcomes: the local extinction of one of the competitors, or the specialization by one or both of the competitors for its ecological niche to permit their continued coexistence. If muskoxen and caribou did compete at any time in their evolutionary history, their continued coexistence suggests that they adopted more or less mutually exclusive niches, which renders competition between them improbable today".

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