NUNIVAK ISLAND MUSKOX STUDIES.

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At the request of the Director, Bureau of Sport Fisheries and Wildlife, I undertook an assessment of the carrying capacity of the muskox range on Nunivak Island, Alaska. The history of the introduction of muskoxen to the Island and the record of the growth of the population there has been well documented and won't be repeated here. There is no other wild population of muskoxen anywhere whose age and sex classes have been as well recorded.

The significant facts are that the species numbered, as of August, 1968, about 750 animals and that the calf crop was 14 per cent, down from the long-term average of 19 per cent. Real concern has been expressed by those most familiar with the species and its habitat on Nunivak Island that the population may have exceeded the carrying capacity of its range, particularly in a hard winter.

I made two field trips to the Island, the first from August 16 to 21, 1968 and the second from March 4 to 12, 1969. The purpose of the first trip was to obtain some knowledge of plant species occurrence, distribution and abundance, and muskox summer ecology. The objective of the second trip was to examine the winter range to assess snow depth, icing, forage availability, and muskox distribution.

Muskox food plants on Nunivak Island are rich in numbers of species and in density of plants. The area is truly lush. Important food species such as willow, sedge, grass and woody plants, such as the Ericaceae, are abundant and didn't show, on those summer ranges examined, evidence of overgrazing. Winter range sites examined in August such as the sides and top of Twin Mountain and the dune areas along the south coast did show significant grazing effects. Both areas exhibited erosion. On Twin Mountain a heavily eroded game trail runs around the rim of the crater, and inside the crater rim heavy erosion has occurred where muskoxen, and probably reindeer also, have pawed to reach willows, birch, Empetrum and Vaccinium uliginosum. Lower ridges also were badly eroded.

Nunathloogagamiutbingòi dunes were examined on foot. Muskox winter dung was very evident as were stubs of Elymus (beach rye). An aerial survey of the dunes on the previous day revealed noticeable differences in Elymus density between steep slopes that were thickly covered in green and those areas accessible to muskoxen which were yellower and had thinner densities of the grass. Also noticeable from the air were erosion and soil slippage. Parallel game trails were observed on the sides of the dunes. The limited extent of Elymus, the presence of a significant amount of dead Elymus stubble, and

the erosion of the dunes indicate marginal winter range for the muskoxen. Elymus elsewhere has been reported to be rich nutritionally and undoubtedly is excellent muskox forage, provided it is available in sufficient quantity.

On March 10, 1969, the dunes south and west of Duckiktchluk Bay were traversed by snow machine. Frequent stops were made to examine snow depth, icing and availability of forage. In all, about eighty muskoxen were observed feeding along those dunes. Heavy icing was observed on the dunes with deep snow surrounding them. Elymus, by that date, had already been grazed extensively.

Empetrum was present in inter-dune areas and had been subjected to some grazing. In one or two instances evidence of muskoxen pawing through snow and ice on the sides of the dunes was present but it appeared generally that the steepness of the slopes, the heavy ice crust and deep snow prevented more general feeding. Under conditions observed during the study I gathered the strong impression that, important as dunes are to muskox winter ecology, under the snow and ice conditions experienced they provided marginal habitat for the species.

On August 17th, a traverse was made from Nash Harbour to Cape Algonquin. Vegetation growth on the hillsides and tops

was lush. Nearer the Cape characteristic winter range forage was present such as sedges, grasses, and some willow.

On March 8, 1969, a traverse was made by snow machine from Nash Harbour to near Lukluksukivik Lake and then north to Koweelik Bluff, west to mid-point between Kigoumiut, the mouth of the Ahlik River, then east back along Koweelik Bluff to Nash Harbour. About 60 muskoxen were observed feeding along the coastal area. The animals had been feeding on crowberry, Ledum, sedges, grasses, blueberries and birch. Much icing was present but was not too thick to prevent feeding altogether. One could observe, however, where the muskoxen had pawed at the ice and could not break it. Snow depth in the areas where feeding was taking place was about six inches. Inland the snow depth was eighteen inches and more, with a thick ice crust about four inches above ground level. Provided conditions did not deteriorate further, the area described above would appear to be adequate winter range. Additional snow and more ice would put the animals in a very precarious position, however.

Cape Mohican was examined from the air on August 18, 1968. That area is used extensively by muskoxen in winter and animals are present there also in the summer. Sedges and grasses appeared to be the principal plant species but undoubtedly woody plants were present also. We attempted to examine the area on the ground on March 8, 1969, but a white-out made travelling impossible there.

A traverse was made of the Island from Nash Harbour to Binajoaksmiut River on March 9th. Five craters were dug in

the snow to determine depths and other characteristics. The first hole was about five miles south of Nash Harbour. Snow depth was thirty-six inches with three ice layers present. Vegetation consisting of Vaccinium uliginosum and Ledum was present at the bottom. The second and subsequent holes were dug in places whose precise locations are uncertain because of very poor visibility. The second and third holes each had a fifty-inch snow depth with ice layers. Bottoms of each contained muskox winter food. The fourth hole was twenty-two inches deep, and the fifth eighteen inches, with heavy ice layers.

On March 11th a traverse was made from Duckikthluk Bay to Mekoryuk. Six holes were dug in the snow. About eight miles to the north of the Bay the first hole revealed a snow depth of thirty-one inches. Ice layers were present and the snow was hard. Dr. Peter Lent, of the University of Alaska, took some snow measurements. Empetrum and sedges were at the bottom. The second hole was dug on a plateau near Mount Roberts to a depth of forty-four inches but the bottom had not been reached at that point. Again several heavy ice layers were present. The third hole was dug east of Mount Roberts at the heighth of land between the north and south coast. Snow depth was only six inches but a two and one-half inch layer of hard ice covered the vegetation on the ground. The ice undoubtedly was too hard for any ungulate to paw through. The fourth hole was dug just south of Muskox Mountain and revealed

a forty-five-inch depth with heavy ice layers. One of the party went to the top of Muskox Mountain and discovered a layer of thick hard ice covered the ground and all vegetation. That mountain is periodically used by muskoxen in winter but it was obvious that such use would have been impossible at the time of our visit. The fifth hole was dug just opposite Muskox Mountain and it revealed a snow depth of forty-nine inches. Two feet below the surface was a hard ice layer one inch thick. Other ice layers were further down. At the bottom Empetrum, willow and sedge were present.

Earlier reports by Eskimos of the absence of muskoxen from the Island's interior were confirmed by the April, 1968, survey and by our recent, less extensive study. The moderate to deep snow conditions and heavy layers of hard ice unquestionably prevent muskoxen from feeding in the interior of the Island.

Nunivak Island, in comparison with Canadian muskox winter ranges, supports a rich flora suitable as muskox food. It is in the comparison of winter range conditions, however, which reveals how marginal winter range on Nunivak Island is for muskoxen.

No records of heavy icing on muskox winter ranges in Canada have yet been obtained. This is probably because of the continental Arctic climate of those ranges. Snow depth on Canadian ranges varies between ten and twenty inches. In such areas snow cover is often very shallow, frequently less than one inch. In such cases plants are either exposed or just below the snow surface.

The periodic ice storms which strike Nunivak Island and the much heavier snow fall reduce the availability of the excellent forage to the point where, over a very large proportion of the Island, food is simply not available to the muskoxen. It is imperative that the muskox population be brought into balance with the capability of the winter ranges to support it.

Wild populations of muskoxen in Canada and Greenland are found in regions with cold, dry climates. The southern limit of distribution on the east coast of Greenland is Scoresby Sound, an area that periodically experiences deep snow and ice storms. Hundreds of muskox perished there during the winter of 1953/54 because of deep snow and ice. Such occurrences serve as a warning to what may be expected on Nunivak Island.

CONCLUSIONS

Summer range for muskoxen on Nunivak Island appears excellent although there is some moderate grazing on willows and birch. Winter range becomes extremely limited during times of deep snow and heavy ice.

Reduced calf crops in ungulate populations have been demonstrated to reflect deteriorating range conditions. Muskoxen are no exception and the lower calf crops on Nunivak Island are symptomatic of environmental stress.

The population of muskoxen has exceeded, in my view, the winter range carrying capacity for even an average winter and only disaster can result from an unusually hard winter. In saying this I am concurring completely with the appraisal of the situation by Dr. C.J. Lensink and Mr. David Spencer of the Bureau of Sport Fisheries and Wildlife.

RECOMMENDATIONS

1. It is recommended that the safe winter range carrying capacity for muskoxen be determined. To do this precise information is needed on precipitation, its seasonal distribution, nature - rain, sleet or snow - depth of ice, periodic assessment of snow depth and temperature ranges. Also needed is specific information about vegetation characteristics of muskox winter ranges including chemical values of food plants and availability of the forage in winter. Given that information and given that an adult muskox needs approximately twenty pounds of air-dried forage per day, one can determine safe population levels.

2. Pending those studies, it is recommended that steps be taken immediately to ensure that the population of muskoxen on the Island not exceed 500 animals. An annual removal program to ensure that the figure is not exceeded each winter is recommended.

3. The sex and age classes to be maintained on the Island will depend on the objective(s) in keeping the animals there. The present excess of males presents a management problem that must be resolved. It is recommended, therefore, that a decision be made about the primary objective in having the species on the Island, and given that, that a management plan be formulated to produce the desired numbers and classes of animals.

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