Muskox Abundance in the Southern Part of the Range in East Greenland

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ABSTRACT. During the summer of 1974, daily observations of muskoxen were recorded for a number of sites along Kong Oscars Fjord. Individuals sighted numbered 330, and the population of the region was estimated at 405, representing a density of about 0.6 animals per square kilometre in areas below the 200-metre contour. Comparison with counts from as far back as 1954 reveals that the population has increased on average by two per cent per annum over the last twenty years, allowing a partial recovery from its previously depleted level.

RÉSUMÉ. *La population des troupeaux de bœufs musqués dans la partie méridionale des pâturages, dans l'est du Groenland.* Au cours de l'été 1974, on effectua en de nombreux endroits bordant le fjord Kong Oscars des observations quotidiennes sur les bœufs musqués. On a dénombré visuellement quelque 350 bœufs musqués, mais on a estimé la population totale à 405 animaux, ce qui représentait une densité de 0.6 animal par kilomètre carré, dans des régions situées à moins de 200 mètres d'altitude. Une comparaison avec des recensements remontant jusqu'à 1954 montre que la population de bœufs musqués s'est accrue d'environ 2% par année au cours des 20 dernières années; les bœufs musqués, qui étaient menacés d'extinction, se seraient donc partiellement repeuplés.

Резюме. *Популяция мускусного быка в южной части горной системы восточной Гренландии.* Летом 1974 года вдоль фьорда Конг-Оскара велись ежедневные наблюдения за мускусным быком. Было зарегистрировано 330 особей, причем вся популяция мускусного быка в этом районе оценивается в 405 особей, что соответствует плотности, равной 0,6 особей на кв.км для областей, расположенных ниже двухсотметровой изолинии. Сравнение с подсчетами, начиная с 1954 года, показывает, что за последние 20 лет популяция увеличивалась в среднем на 2% в год, способствуя частичному восстановлению прежнего истощения данного вида.

INTRODUCTION

Northwestern Jameson Land, which includes the valley complexes of Schubert Flød and Ørsted Dal, contains some of the best range for muskoxen, *Ovibos moschatus* (Zimmerman), in the whole of East Greenland. To the west of this area the species is sparsely distributed in the glaciated mountainous country of Scoresby Land, while to the south and east the barren central plateau of Jameson Land is too poorly vegetated to hold a large summer population, though some parts of it may be extremely important in winter because of their shallow snow cover (Pederson 1962). There are only sporadic records from regions to the south of Scoresby Sund. The population of the whole of the southern part of the range is subject to periodic catastrophes as a consequence of heavy snowfall and icing conditions during winters when the Greenland Sea is relatively ice free (Vibe 1958, 1967). Such conditions prevent muskoxen from digging through the snow to reach underlying forage.

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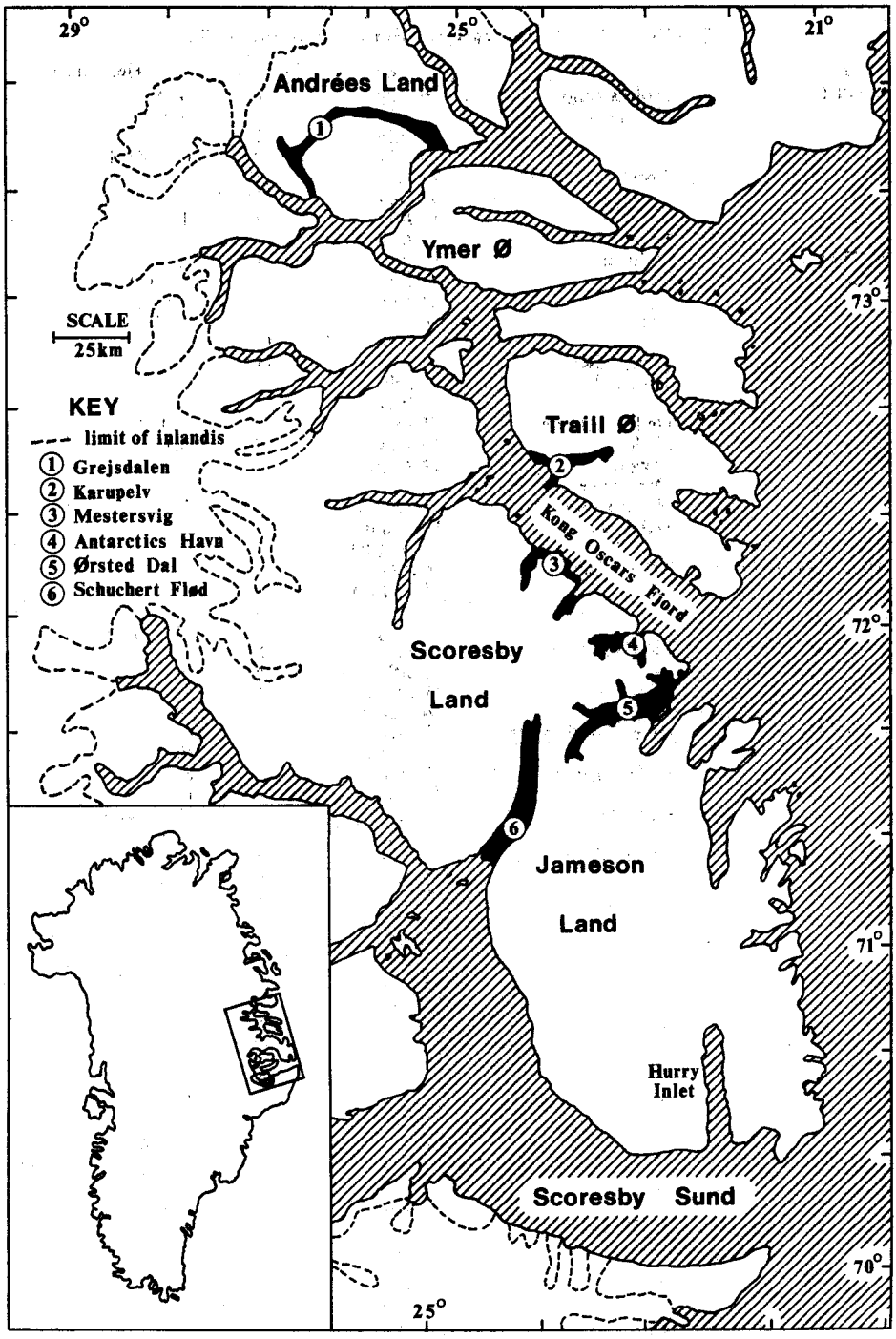

FIG. 1. Map giving the locations of major areas referred to in the text, with the whole of Greenland in inset. Only glaciers directly connected to the inlandis have their limits shown. Grejsdalen and Schuchert Flød were not visited in 1974. The only published count for the latter area, which is an important one for muskoxen, was made in late July 1962 (Hall 1964) when 86 animals were present on the western side of the valley.

TABLE 1. Observations on muskoxen in 1974.

Area	Site	Date	Number	Herd sizes[1]
Traill Ø	Holms Bugt	6 July	8	4, 4
	Karupelv	7 July	10	5, (5)
		19 July	1	
		20 July	10	(5), (4), 1
	Forelsø	29 July	(1)	
		30 July	(1)	
		31 July	4	4
	Palisaderne	3 August	1	
Mestersvig	Nyhavn	26 June	3	2, 1
		27 June	3	(2), (1)
		28 June	3	(2), (1)
	Labben	26 June	1	
		30 June	(1)	
	Langdyssen	5 July	(1)	
	Tunnelelv	2 July	3	3
		27 July	1	
	Nedre Gefionelv	27 July	5	3, 1, 1
	Skeldal	13 August	4	3,1
	Mygesø	12 August	1	
	Danevirke	13 August	1	
	Nordre Funddal	27 July	5	5
	Delta Dal	12 August	1	
		13 August	3	3
Antarctics Havn	Kolledalen	8 July	1	
		7 August	9	9
		9 August	4	4
		10 August	23	10, (9), (4)
	Flexurdal	9 July	5	5
		10 July	4	4
		11 July	14	14
		6 August	9	(9)
Ørsted Dal	Henrik Møller Dal	21 July	6	6
		4 August	9	(9)
	Edderfugledal	28 July	13	8, 5
		29 July	9	(9)
	Horsedal	6 July	27	10, 8, 4, 4, 1
		7 July	6	—
	Lower Ørsted Dal	8 July	15	4, —
		9 July	8	—
		10 July	10	—
		11 July	9	—
		12 July	3	—
		13 July	8	—
		14 July	9	—
		15 July	8	—
		16 July	0	—
		17 July	2	—
		18 July	2	1, 1
		19 July	6	—
		20 July	12	11, 1
		21 July	20	8, 6, 1, 1, 1, 1, 1, (1)
		22 July	58[2]	(9), (6), (1), (1), (1)
		23 July	26	(9), (7), 5, 3, (1), (1)
		1 August	5	5
		3 August	11	(9), 2
	Schrøter Bjerge	24 July	30	(2), —
		25 July	9	—
		26 July	7	—
		4 August	11	—
		5 August	9	5, 4
	Upper Ørsted Dal	27 July	18	9, 5, 2, 2
		28 July	10	—
		29 July	13	5, 3, 2, 1, 1, 1
		30 July	3	—

[1]Numbers in brackets indicate animals already recorded at least once. A dash indicates size not recorded.
[2]This count includes 40 seen between Henrik Møller Dal and Horsedal (herds not classified).

From 25 June to 16 August 1974, members of the Joint Biological Expedition to N.E. Greenland were based at sites along Kong Oscars Fjord (see Fig. 1). A range of biological studies were conducted, most of which entailed some travel on foot. During such journeys, observations of muskoxen were recorded, either as single total counts for each day, or in the form of simple inventories of herd size and composition. These data, together with some unpublished information from other recent expeditions, provide a useful comparison with earlier records from 1954 (Vibe 1967), 1955, 1961 and 1962 (Hall 1964), enabling an assessment to be made of population change over the last twenty years.

DISTRIBUTION AND DENSITY IN 1974

The daily records are summarized in Table 1. Using these, it is possible to derive a series of figures representing the minimum number of animals seen at each site. These are referred to as the enumerated totals in Table 2. In arriving at these figures, double counting of herds is relatively easy to avoid, since each herd is recognizable on the basis of its size and composition. It is more difficult to avoid duplication in the case of solitary bulls (see Fig. 2), but great care has been taken to ensure that the number of these has not been overestimated.

FIG. 2. Bull muskox rising from its cool resting place in a patch of snow in the Nyhavn hills, Mestersvig, on 3 July 1974.

Summer forage in this part of Greenland is largely restricted to land below the 200-m contour. Population estimates for each site have to make some allowance for areas that could not be visited, but which must have contained muskoxen. In the case of the three northernmost sites, this allowance is quite small (Table 2),

TABLE 2. Regional populations of muskoxen in 1974.

Area	Enumerated total	Population estimate	Animals per km²
Traill Ø (Karupelv)	20	25	0.4
Mestersvig (Delta Dal to Skeldal)	28	30	0.3
Antarctics Havn (Flexurdal and Kolledalen)	47	50	0.8
Ørsted Dal (Lamprenens Dal to Edderfugledal)	235	300	1.0

but in the case of Ørsted Dal, considerable sections such as Allday Dal, Gipsdalen and Pingo Dal were not adequately covered. It is clear from the descriptions given by members of previous expeditions (Marris and Ogilvie 1962; Hall 1964) and from the examination of aerial photographs, that these areas do contain suitable terrain for muskoxen. Fortunately there are some further pieces of evidence which aid in arriving at an estimate of true population size in this case. Firstly, two transects were made of the northern part of the valley from Henrik Møller Dal to Horsedal (Fig. 3), once by helicopter on 6 July (excluded from Table 1) and once by foot on 22 July. On both occasions an estimated 40 muskoxen were seen. The area sampled by this transect is about one seventh of the whole valley, which suggests a total population of about 280. Secondly, an area of 18 km^2 between Horsedal and Gipsdalen was under intensive scrutiny during most of July and it was found to contain 31 muskoxen (herds of eleven, nine and five, and six solitary bulls). Since the total area of similar habitat in the whole valley is about 200 km^2, this yields an estimated population of 344. Later visits to other parts of the valley confirmed that the distribution of animals was more or less uniform throughout, with the exception of the sandy flood plain at the mouth of the Ørsted river, which was thus excluded when measuring the total area. A reasonable compromise estimate of the muskox population of Ørsted Dal in July 1974 is 300 individuals. There is no way in which proper confidence limits can be attached to this figure, but the fact that the enumerated total was 235 suggests that the error is unlikely to exceed $\pm$ 20% and is probably less than $\pm$ 15%. For the other sites the error is probably less than $\pm$ 10%.

FIG. 3. General view of Horsedal on 6 July 1974. Such valleys are fairly typical of this part of Greenland. A small party of four muskoxen can be seen in the centre of the photograph.

Muskox densities were about three times as high in northern Jameson Land as they were in northern Scoresby Land, and this reflects the larger area of suitable feeding grounds available. Particularly favoured during July were early drying stream beds and meadows of moss and sedge. In the former situation, animals could clearly be seen to take fresh growths of *Salix arctica*. In drier areas, *Betula nana, Cassiope tetragona* and *Vaccinium uliginosum* were present in abundance, but muskoxen were not often seen feeding on these plants. Reindeer show a similar

preference for willows and sedges during the summer months (Klein 1968).

The summer range in northern Jameson Land supports a high density of muskoxen compared with other parts of the Arctic. For example, the introduced population at Nunivak Island off the west coast of Alaska has an overall density of about 0.2 per km^2 (Spencer and Lensink 1970), while the limited area of Devon Island occupied by these animals has about 0.3 per km^2 (Harington 1964). Direct comparisons of density are, however, very difficult to make because of the differing nature of the terrain in these regions. On Devon Island (Canadian Arctic) muskoxen are concentrated along the coastal strip and in optimal areas the density may be as high as 0.5 per km^2. The Greenland densities in Table 2 refer only to land below 200 m in elevation, and the overall value is closer to 0.2 per km^2 when mountainous areas are included. The northern part of Jameson Land consists of a number of large valleys separated by mountains, and the latter contain very few muskoxen. On Nunivak Island, animals range over the whole island in summer but are restricted to a mere 25 km^2 of accessible grazing during winter because of the high snowfall in that region. The density of animals in the winter range is thus 29.7 per km^2 (this is based, as is the summer figure, on the peak 1968 population of 750). In such cases it is clearly the wintering range which sets the ultimate limit to carrying capacity (Spencer and Lensink 1970; Klein 1970; Lent 1971).

In winter, the valleys of northern Jameson Land and of Scoresby Land become deeply snow filled. Satellite photographs taken in April 1975, however, show that some upland areas further south do remain relatively snow free. Notable amongst these are a number of gullies in the windswept central plateau of Jameson Land, such as the upper parts of Lodins Elv, Juraelv, Olympelven, Fegins Elv and Depotelv. A large section to the west of the Hurry Inlet also appears clear. The vegetation in such areas is undoubtedly very sparse, but at least it is accessible. Other regions which have snow-free ground at this time of year are Ole Rømer Land and Andrées Land, where some of the lower valley sides (for example Grejsdalen) are clear. Steep mountain slopes offering almost no forage remain clear throughout most of the winter, but inland areas near the ice cap appear snow-free on the lower slopes as well. It is difficult to judge how important such inland areas might be for muskoxen, though it has been suggested that they form an important reservoir of animals during the severe icing winters which can decimate populations nearer the coast (Vibe 1967).

The Jameson Land muskox population forms a relatively distinct unit, in which a regular migration must occur between summer and winter pastures. Herds can be found feeding in the northern valleys as soon as these become snow free in spring. In addition, there are movements from the lower valleys and the coast into the upland valleys, which are the last areas of all to clear. Such movements were noted at Mestersvig where animals completely disappeared from the coastal strip in July and August, and also in Horsedal when parties totalling 27 animals moved into the upper valley on 6 July, from Ørsted Dal. Few animals are present on the central plateau or in southern Jameson Land during summer (Hall 1964), yet the occasional abundance of carcasses shows that muskoxen do frequent the area in winter.

POPULATION CHANGES DURING THE PAST 20 YEARS

The available counts are summarized in Table 3. The 1954 data were obtained by Vibe (1967) during an aerial reconnaissance of suitable catching areas for the transfer of animals to West Greenland. Only seven muskoxen were seen at Merstersvig, but there were in addition 15 corpses of animals that had perished in the severe conditions of the 1953-54 winter. Considerable numbers of live animals were encountered in Grejsdalen and Ørsted Dal, however. The former site was later traversed on foot by members of the 1972 University of Dundee N.E. Greenland Expedition. Muskox numbers were very similar to those observed in 1954. The 1972 expedition recorded a further 12 animals at Mørkebjerge and three at Benjamin Bugt in Andrées Land, as well as 27 at Blomster Bugten and Noa Dal on Ymer Ø (R. M. G. O'Brien, University of Dundee, Scotland, personal communication). The enumerated total for Ørsted Dal in 1974 represents an increase of 68% over the 1954 figure, equivalent to an annual rate of increase of 2.6%. The population estimate of 300 would require an annual rate of 3.9%. The combined rate of increase in all these regions is 1.8-2.4% depending on whether enumerated or estimated population size is used in the calculation.

TABLE 3. Population counts 1954-74.

Area	1954	1972[1]	1974[1]
Grejsdalen, Andrées Land	147	165	
Mestersvig, Scoresby Land	7		28
Ørsted Dal, Jameson Land	140		235

[1]Blank space indicates that the area was not visited.

TABLE 4. Maximum daily totals from comparable areas.

Site	1961[1]	1962[1]	1974
Karupelv		8	10
Gefionelv	2		5
Oksedal	2		0
Kolledalen	5	8	23
Flexurdal	14		14
Henrik Møller Dal	7		9
Horsedal	15		27
Lower Ørsted Dal	17		58
Schrøter Bjerge	30		30
Upper Ørsted Dal	43		18
TOTALS	146		194

[1]Blank space indicates that the area was not visited.

Hall (1964) has published records in considerable detail for many of the areas visited in 1974. The most efficient way of comparing years is to examine the maximum daily counts in each case (see Table 4). The mean and total counts are too heavily biased by both the number of days spent in each area and the number of observers. The total of 146 in Table 4 was arrived at using the highest available figure for 1961 or 1962. The increase from 146 to 194 provides an index of populat on change over the 13-year period, and is equivalent to a rate of increase of 2.2% per annum.

All the above evidence suggests that a modest increase of 1-4% per annum has occurred in the muskox population of the southern part of the range over the last 20 years. This conclusion is of particular interest in view of the chequered history of this species in Greenland. Bone remnants amongst deserted Eskimo settlements indicate that muskoxen were present in the region prior to the seventeenth century, yet they were apparently absent or at a very low population ebb during the first half of the eighteenth. Not until 1869 was the first live individual reported. Since that time there has been a steady increase in numbers with perhaps optimal conditions existing in the nineteen twenties and thirties. The severe winters of 1938-39 and 1953-54 are known to have caused considerable mortality, and Vibe (1958) considers that between 1953 and 1958, the whole muskox population of Greenland may have been reduced by half, leaving only some 5,000-10,000 head. The rates of increase recorded above are of the right order of magnitude to have allowed about a 50% recovery to 1953 levels to have occurred since then.

TABLE 5. Calf production in years for which data are available.

Year	Sample size	Percentage calves
1954[1]	323	1.5
1955[2]	14	12.0
1961[2]	267	23.6
1962[2]	78	<5.1
1971[3]	28	25.0
1974	233	3.0

[1]Vibe (1967).
[2]Hall (1964).
[3]Halliday (1974).

During this period of recovery, the annual production of young has altered enormously (Table 5), presumably reflecting variations in the severity of the preceding winter seasons. The records of the 1974 expedition show that the season was a poor one, but since yearlings constituted 5.6% of the population, 1973 must have been at least a little better. Snow conditions in the 1973-1974 winter were very similar to those recorded by Hall for that of 1961-62 which was also followed by poor calf production. The 1954 figures are based on Vibe's aerial counts of Ørsted Dal, Mestersvig, Grejsdalen and Ymer Ø, which revealed only one or two calves at each of these sites. Hall's counts in 1961 were restricted to the area around Schuchert Flød, but in 1962 included several sites in both northern and southern Jameson Land. In 1955 only two herds from lower Ørsted Dal were recorded in detail, and the 1971 counts, from southern Jameson Land, were also limited to a small number of herds. If the latter two years are omitted (because of the small sample sizes) the average annual calf crop is 8.3%. Although this is within the range of 7-15% recorded for Ellesmere Island during the same time period (Tener 1965; Freeman 1971), it is rather low in view of the fact that a figure of about 10.5% is necessary to keep muskox populations stable in the long term (Freeman 1971). If all six years in Table 5 are included, the average calf crop is 11.7%.

TABLE 6. Distribution of herd sizes.

Size of herd	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Mean herd size
Number recorded in 1961	4	7	3	2	7	5	7	8	2	0	1	1	1	1	5.7
Number recorded in 1974	25	5	6	9	9	2	0	3	2	2	1	0	0	1	3.6

Despite the fact that observations covered almost exactly the same time period in 1961 and 1974, there is quite a considerable difference in average herd size (Table 6). Most of this difference is due to the greater number of solitary animals present in 1974.

CONCLUSIONS

The muskox population of the southern part of the range in East Greenland is recovering slowly from the catastrophic decrease of the early nineteen fifties. It will always be vulnerable to local declines and extinctions, however, and thus requires careful monitoring as well as continued restrictions on hunting. Observations on the numbers, movements and feeding behaviour of animals during winter are lacking for this region, and such information is badly needed before any assessment of the carrying capacity can be made.

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