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Size and composition of the wild reindeer *Rangifer tarandus platyrhynchus* population in the Southeast Svalbard Nature Reserve

Einar Alendal, Steven de Bie, Sipke E. van Wieren

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In the summer of 1977 we studied the reindeer population on the islands Barentsøya and Edgeøya in the eastern part of the Svalbard archipelago. A total of 1374 reindeer were observed: 326 animals in the western parts of Barentsøya and 1048 animals on Edgeøya. Considering those parts of Edgeøya which were not visited, the total number of reindeer on Edgeøya was estimated at 1300 animals. The total number of reindeer was lower than in previous years. The decline probably was due to severe winter conditions in 1975/1976 and 1976/1977 confirmed by the fact that many carcasses and few yearlings were observed.

Nearly all reindeer occurred on the coastal plains and in the valleys. These areas have the relatively richest vegetation. The average recruitment of the total population (counted) was 15.9%. The adult sex ratio was in favour of females: 59% females versus 41% males. There were differences both in the recruitment and in the adult sex ratio between three distinct areas on Edgeøya and between two on Barentsøya. These differences may be due to dissimilarities in food quality and feeding conditions caused by climate, and by small exchange of reindeer between the areas.

The high frequency of shed male antlers on Frankenhølvøya and Talaveraflya, north and south coast of Barentsøya respectively, indicates that these areas belong to the wintering grounds of reindeer on this island. Concentrations of shed female antlers on Barentsøya were less pronounced. The highest frequency was in the areas Sjodalen and Kvistdalen-Talaveraflya in the northwest and south respectively. Females may use these areas as late wintering grounds and possibly as calving areas.

The average group size was 2.2 and the aggregation index 3.1. Seventytwo per cent of all groups, containing 48% of all reindeer, fell into group size 1 and 2. Males mostly were observed alone or together with one other animal. Females with calves most frequently occurred in groups of 2 and 4 animals.

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1. Introduction

Due to intensive hunting the reindeer population on Spitsbergen, especially on Nordenskiöld Land, decreased rapidly in the 1860's. The eastern part of the archipelago still had many reindeer because this area was relatively seldom visited by hunting ships (Heuglin 1874). Edgeøya was then the best hunting ground for reindeer, but also there the reindeer population decreased considerably following the changing ice-conditions

about 1890 which allowed ships to reach this island more easily (Wollebæk 1926). Although some hunting occurred after their total protection in 1925, the reindeer increased in number. Lønø (1959) suggests that at the end of the 1950's Edgeøya probably had 500–600 reindeer (maximum 800).

Also on Barentsøya the reindeer were much hunted and became probably exterminated (Lønø 1959). However, it was not until 1969 that reliable information be-

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came available concerning the total number of reindeer on these two islands (Norderhaug 1970).

This paper deals with distribution, population size, and composition of the reindeer on Edgeøya and Barentsøya. The animals are considered as belonging to one population since there apparently is no or very little exchange of animals between this and the other three local populations of reindeer on Svalbard.

2. Area description

Barentsøya and Edgeøya (about 1300 km² and 5150 km², respectively) are two islands situated about 78°N, 22°E in the eastern part of the Svalbard archipelago (Fig. 1). Both islands consist almost entirely of Triassic sediments. At some places dolerite comes to the surface. Characteristic for the landscape are the glaciers, rounded mountains, wide valleys, plateaus, and coastal plains.

Barentsøya and Edgeøya are, unlike the main island Spitsbergen, not influenced by the Atlantic Gulfstream. The climate on both islands depends on polar streams from the northeast. The precipitation is low (100–200 mm a year).

Freemansundet separates the two islands, the smallest distance being about 5 km. In winter Freemansundet normally is ice-covered while Heleysundet (between Barentsøya and Spitsbergen) due to strong sea currents normally is not.

3. Methods

Ground surveys were carried out in the period 27 July–24 August 1977 on Barentsøya and 17 July–4 September 1977 on Edgeøya. The most important reindeer summer habitats were examined, i.e. the coastal plains and the valleys. Distinct areas with no or little exchange of reindeer during the countings could be distinguished. These were examined in one period of observation in order to minimize the chance of counting a reindeer twice. Reindeer habitats in the east part of Barentsøya were not surveyed. Some reindeer habitats in the north-east and the southeast of Edgeøya were not visited.

The animals sighted were categorized as adults, yearlings and calves. The adults were sexed according to body size, size and shape of antlers and place of sex organ. All observations of reindeer were plotted on maps and undisturbed group sizes recorded.

While all reindeer males shed their antlers in winter and pregnant females just after parturition, all antler beams (N = 977) found on Barentsøya were recorded as this may show some of the reindeer habitats at different times of the year. The collection appears to be a biased sample since not all areas were examined for antlers. In nearly all cases the sex of the animal to which

they had belonged could be judged from the size and the shape of the antlers.

4. Results

4.1. Population size

A total of 1374 reindeer were observed within the surveyed areas on Barentsøya and Edgeøya. Tab. 1 gives numbers and composition within the different valleys and coastal plains and the dates when these numbers were recorded. The total population observed consisted of 27.3% males, 39.3% females, 15.9% calves, 0.7% yearlings and 16.8% unidentified with an adult sex ratio males : females = 41 : 59.

4.2. Distribution

Each area in Tab. 1 is referred to with a number corresponding to numbers on the map (Fig. 1). Almost all the

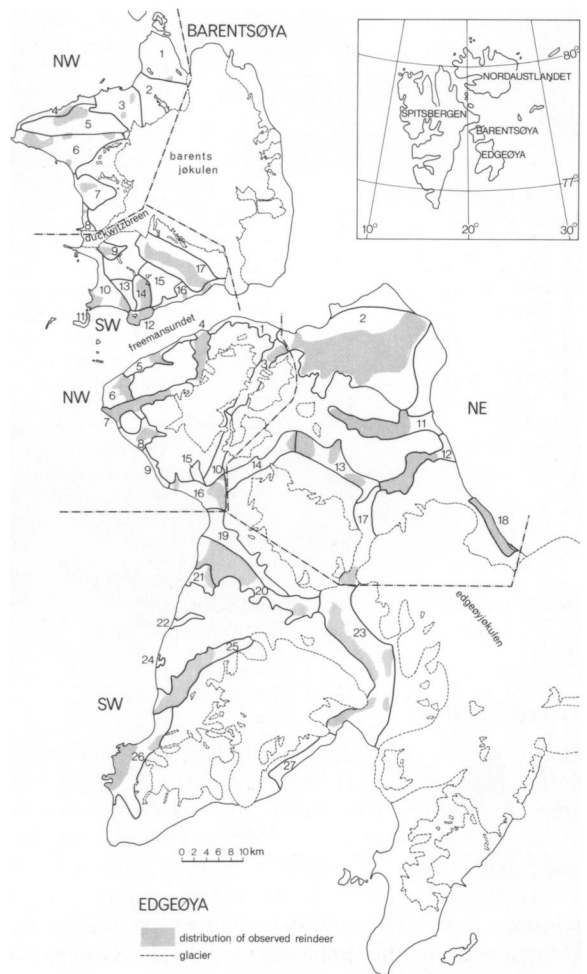


Fig. 1. Distribution of reindeer observed on Barentsøya and Edgeøya, summer 1977. Figures refer to localities listed in Tab. 1.

Tab. 1A. Observations of reindeer in the northwest and southwest part of Barentsøya 27 July–24 August 1977.

Date	Map ref.	Locality	Total numbers observed	♂♂	♀♀	calves
24 Aug	1	Frankenhalvøya	2		1	1
12 + 24 Aug	2	Glåmdalen-Heimarka	0			
13 Aug	3	Grimdalen	11	3	5	3
18 Aug	4	Grimdalen-Mistakodden	8		4	4
16 Aug	5	Grimdalen-Farken-Framslegja	20	1	10	9
16–18 Aug	6	Sjodalen	35	7	16	12
14 Aug	7	Gauldalen	7	3	4	
14 Aug	8	Coast of Gregoryfjellet	1		1	
3 Aug	9	Valley south of Duckwitzbreen	12	11	1	
2–3 Aug	10	Duckwitzbreen-Talaveraflya	20	13	6	1
3 Aug	11	Ureinskagen	2	2		
27 + 31 Jul	12	Talaveraflya	29	15	12	2
27 Jul	13	Kreffberget, south	0			
27 Jul	14	Kvistdalen	64	11	42	11
27 Jul	15	Høgflya	0			
31 Jul–1 Aug	16	Talaveraflya-Freemanbreen	29	12	14	3
1 Aug	17	Rindedalen	86	20	50	16
Total			326	98	166	62

Tab. 1B. Observations of reindeer on Edgeøya, 17 July–4 September 1977.

Date	Map ref.	Locality	Total numbers observed	♂♂	♀♀	calves	Unidentified > 1yr y
28–29 Jul	1	Meodden coast	0				
13–22 Aug	2	Berrflota	247	71	88	54	32 + 2
28–29 Jul	3	Atnadalen	5	2			3
28–29 Jul	4	Skrukkedalen	59	14	15	13	17
1 Aug	5	Svingeldalen + coast	10	6	4		
4 Sep	6	Snøskardet, Arvedalen, Åmots	32	9	18	2	2 + 1
4 Sep	7	Rosenbergdalen	77	31	40	4	+ 2
24 Jul	8	Visdalen	8	4	4		
1 Aug	9	Coast Blankodden	0				
4 Sep	10	Raddedalen	0				
4 Sep	11	Pistra valley	99	33	28	18	18 + 2
24 Jul	12	Blåfjordelva valley	60	10	32	15	3
26 Jul	13	Mangadalen	37	2	19	9	7
27 Jul	14	Smelledalen	7		1	1	7
25 Jul	15	Dirvdalen	0				
22–25 Jul	16	Diskobukta, north	20	11	1		7 + 1
1 Aug	17	Pass Blåfjord-Dyrdalen	17	4	5	3	5
29 Aug	18	Coast Albrechtbreen	20				20
18–20 Aug	19	Guldalen, north					
18–20 Aug	20	Guldalen, south	173	54	84	13	22
18–20 Aug	21	Mudalen					
1 Aug	22	Veitdalen	0				
16–17 Aug	23	Dyrdalen	51	5	18	10	18
1 Aug	24	Slåen	0				
24 Jul	25	Plurdalen	58	14	15	9	20
24 Jul	26	Grunnlinesletta	68	7	3	5	51 + 2
16 Aug	27	Coast Tjuvfjordskarvet	0				
Total			1048	277	375	156	230 + 10

animals were found in valleys and on coastal plains. These areas are characterized by a high aboveground standing crop in August (Lebouille and de Nies 1978). On Barentsøya shed male antlers (N = 729) were accumulated along the coastal areas of Frankenhalvøya

and Talaveraflya (Fig. 2). There also were several antlers on the island Kükenthaløya north of Barentsøya, although the sound between these two islands is rarely frozen due to strong sea currents.

Shed female antlers (N = 190) were mainly seen in

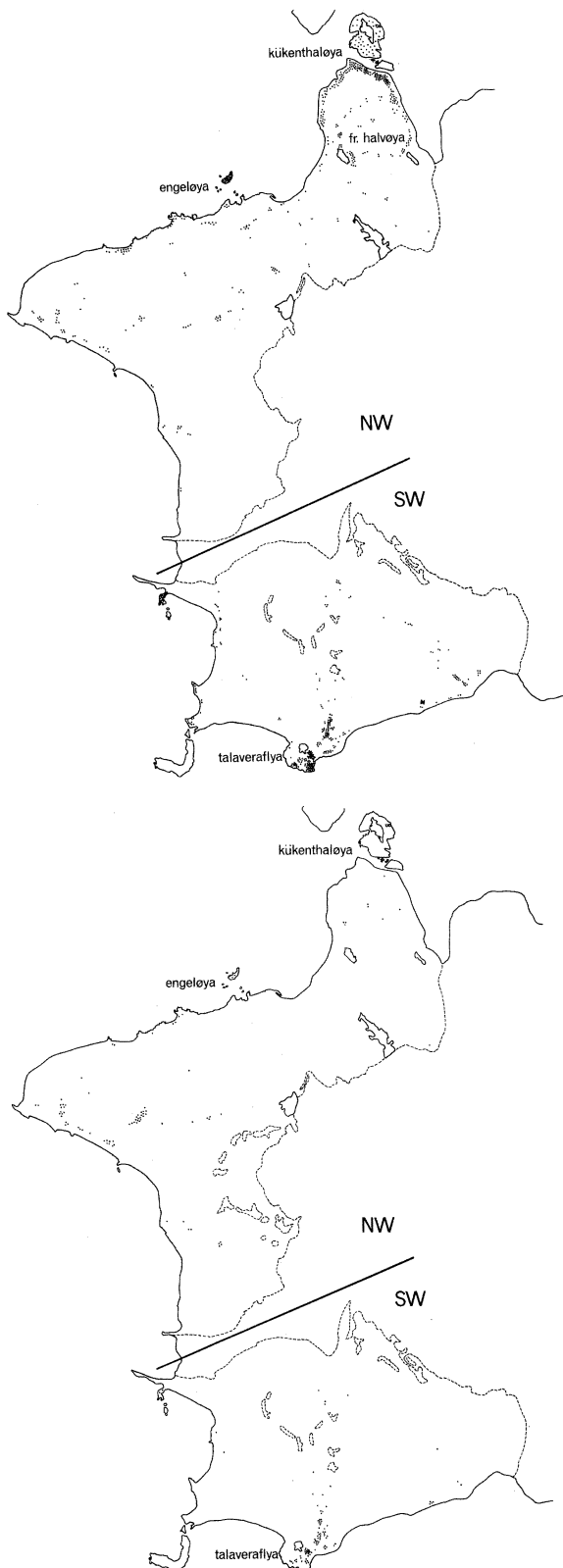


Fig. 2. Shed male (above) and female (below) antlers found on Barentsøya, summer 1977.

the valley Sjodalen in the NW and in the area Kvistdalen-Talaveraflya in the SW (Fig. 2). However, among female antlers there may be a few of younger males (up to an age of 2.75 yr). On Edgeøya antlers were not recorded.

4.3. Calf production

In order to determine recruitment the number of calves was calculated as the percentage of the total number of reindeer for the population as a whole. Recruitment was also calculated separately for three areas on Edgeøya and two areas on Barentsøya in order to see, given an equal adult sex ratio, if there would be a difference in the recruitment between the areas.

Tab. 2 shows that the percentage of calves and the ratio of calves to cows were much higher in the northwestern than in the southwestern part of Barentsøya. On Edgeøya there clearly was a higher calf percentage and ratio of calves to cows in the northeastern part of the island than in the two western areas. The adult sex ratios in the three parts of Edgeøya all favoured females, however only slightly in the northwestern part of the island.

4.4. Group size

The group size frequency of 1075 animals of the population on Barentsøya and Edgeøya is given in Fig. 3a. The number of solitaires and twos amounts to 72% of the total number of groups including 48% of the population.

Obviously the reindeer on Barentsøya and Edgeøya do not occur in large groups in the summer. Mean group size was 2.2 and the aggregation index 3.1, the latter probably being a more accurate index of showing tendencies of animals to aggregate (Jarman 1974). Fig. 3b-e shows the distribution of the total numbers of males, females, calves and yearlings as a function of group size. Males are most frequently seen as solitaires and in groups of two while females most frequently occur in groups of two and three. Sixty per cent of the calves were in groups of two and four which might indicate a tendency for a female with a calf to be together or to form a group with another female and her calf. Only 10 yearlings were observed.

5. Discussion

5.1. Population size and distribution

A helicopter census in the summer of 1969 showed a total of 484 reindeer on Barentsøya (Norderhaug 1970). In the most western part Norderhaug counted 327 reindeer which agree exceptionally well with the 326 reindeer seen in 1977 in that part of the island. However, while Norderhaug reports 182 and 145 reindeer in the NW and SW areas respectively, we saw 84

Tab. 2. Recruitment on Barentsøya and Edgeøya, summer 1977.

Island	Area	Total numbers observed	Calves		Calves : cows %	Adult sex ratio ♂♂ : ♀♀
			No.	%		
Barentsøya	NW	84	29	34.5	70.7	25 : 75
—	SW	242	33	13.6	26.4	40 : 60
Edgeøya	NW	211	19	9.0	23.2	48 : 52
—	NE	487	100	20.5	57.8	41 : 59
—	SW	350	37	10.6	30.8	40 : 60
Total		1374	218	15.9	40.3	41 : 59

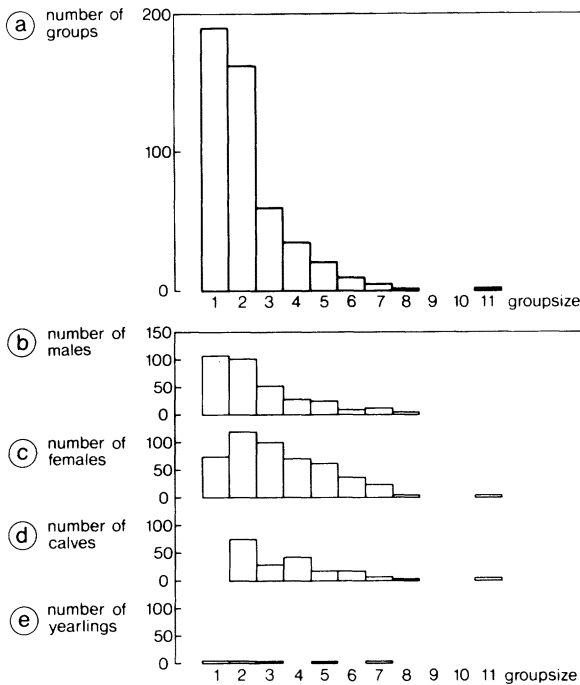


Fig. 3. Group size frequency of reindeer on Barentsøya and Edgeøya. Total population (a): total number of groups: 491, total number of animals: 1075, Average group size: 2.2, aggregation index: 3.1. Separate group size frequency distribution is shown for males (b), females (c), calves (d) and yearlings (e). Aggregation index calculated as

$$\frac{A_1x_1 + A_2x_2 + A_3x_3 + \dots + A_nx_n}{\text{total number of animals}} \text{ where } A_n = \text{number of animals in group size } n.$$

and 242 reindeer in these areas. There may be some migration over the glaciers and over the winter sea ice between the two investigated areas and also between these areas and the eastern part of the island and the smaller snowfree area north of Heleysundet. Specific climatic conditions in the NW area, however, also could have been the reason for the rather low number of adult reindeer disproportionately high in females.

On Edgeøya, Norderhaug reported 1448 reindeer in

August 1969 which Hjeljord (1975) found to compare well with the 1568 reindeer he counted by aerial survey in April 1972 (before calving). In the summer of 1977 1048 reindeer were observed on Edgeøya while a total number of about 1300 animals could be estimated for the island as a whole. A lower total number in 1977 compared with previous counts could be caused by the severe winters of 1975/1976 and 1976/1977. The very few yearlings we observed, the high number of carcasses, and the rather low calf percentage in some areas fit fairly well into this scheme.

These figures indicate that the reindeer population size on Barentsøya and Edgeøya may have stabilized and that the carrying capacity of these islands has been reached already in 1969. If so, the population now fluctuates according to birth and death rate, as there is no or negligible emigration or immigration. Drastic crashes have occurred in isolated reindeer populations on other arctic islands after the carrying capacity had been surpassed, but as pointed out by Alendal and Byrkjedal (1976) this is not likely to occur among the Svalbard reindeer. The fluctuations that do occur most likely are due to climatic factors directly or indirectly influencing the birth and death rate (Reimers et al. 1977). However, more data are needed for a better prediction of the development of the population on these islands.

Oosterveld (pers. comm.) observed that reindeer males in the northwest part of Edgeøya shed their antlers in the period December–April, by mid-March 50% and by the end of April 95% were antlerless. Younger males shed their antlers later than older males. The last years' tagging program on Nordenskiöld Land has revealed that males 2 and 3 yr old frequently carry their antlers into May (Reimers 1977).

About 55% of the lowland vegetation is snowfree in the northwest corner of Edgeøya in the winter giving grazing area for the reindeer (Oosterveld, pers. comm.). On Barentsøya the observed concentrations of shed male antlers on Frankenhavøya in the north and on Talaveraflya in the south suggest that these areas have been used as winter habitats in recent years and are to some extent snowfree during the winter. Our observations indicate that Talaveraflya also is used by

reindeer as summer habitat while Frankenhøya is not.

Hjeljord (1975) in his aerial survey in late April 1972 on Edgeøya found reindeer on the wind-exposed snow-free edges of high mountain plateaus. The reindeer on Barentsøya probably also use such habitats as grazing areas in the winter. However, this does not appear from Fig. 2a since we found almost no reindeer on the plateaus in summer and they were therefore little examined for antlers.

On Svalbard female reindeer may have specific calving areas where they shed their antlers. Concentrations of female antlers in the areas Sjødalen in the NW and Kvistdalen-Talaveraflya in the SW of Barentsøya thus could possibly indicate some of the calving areas on this island. The distribution of these antlers might also indicate some of the late winter areas as we could not distinguish antlers of pregnant females, barren females and younger males with certainty.

Oosterveld (pers. comm.) observed that from mid-May and onwards, the females in the Kapp Lee area, Edgeøya, isolated themselves and moved to the higher plateaus in order to give birth. The pregnant females usually shed their antlers shortly after the calves were born. Espmark (1971) showed that in Swedish Lapland all pregnant cows had shed their antlers a few days postpartum. Most barren females on the contrary shed their antlers before the calving season (Lent 1965, Espmark 1971, Bergerud 1976).

5.2. Calf production

Our data on recruitment on Barentsøya and Edgeøya agree well with Norderhaug (1970), Gossow and Thorbjørnsen (1974), Hjeljord (1975), and Alendal and Byrkjedal (1976) who gave data on calf production ranging between 5.9% and 24.0% from several areas on Svalbard in different years. Recruitment also agree with similar data from Canada concerning barren-ground caribou, *Rangifer tarandus groenlandicus* (Parker 1972).

The average calf percentage in Adventdalen with its branch valleys, Nordenskiöld Land, was 5.1% (N = 606) in July 1977. Weather data from West Svalbard (Svalbard Radio) and East Svalbard (Hopen Island) show that in April, May, and June 1977 maximum daily temperatures in west more often were above zero with more precipitation. The conditions for ice layer formation on the vegetation thus were better in West than in East Svalbard (confirmed by residents of Longyearbyen). As a consequence little food was available for the cows and the calf mortality was high. Thus differences in calf percentage between Nordenskiöld Land and Barentsøya plus Edgeøya may be correlated with climatic differences.

The differences in calf percentage and hence calf production between the northwest and southwest of Barentsøya and between the eastern and western parts

of Edgeøya cannot be explained solely by differences in adult sex ratio. Climatic differences between these areas in late winter and at the time of calving may have resulted in different feeding conditions with higher calf mortality in the southwest of Barentsøya and the west of Edgeøya.

Differences in food quality between these areas on Barentsøya and Edgeøya might cause differences in fitness of pregnant females in late winter and around calving time resulting in differences in pre- and post-birth mortality of calves.

5.3. Group size

Norderhaug (1970) described similar group size frequencies as we found in the population of Barentsøya and Edgeøya. On Edgeøya a group size of two was most frequent and on Barentsøya solitaries outnumbered groups of two in frequency. The reason for this discrepancy is obscure. Solitaries also outnumbered groups of two in frequency in two other populations of Svalbard reindeer, on Nordenskiöld Land (Alendal and Byrkjedal 1976) and on Reinsdyrfllya with neighbouring areas (Alendal 1977), Spitsbergen. Mean group sizes were 2.0 and 2.1, respectively.

The lack of gregarious behaviour with tightly formed large groups makes this subspecies different from almost all other subspecies of the genus *Rangifer*. The reindeer of Hardangervidda in South Norway. *Rangifer tarandus tarandus*, for instance, form large herds in summer with a maximum of up to 10000 in the beginning of August. Later on, a strong dispersion takes place and groups of 1–50 become most frequent, but still herds up to 500 animals can be seen (Thomson 1971, Skogland 1974). Kellsall (1968) emphasizes a rapid August dispersal of barren-ground caribou, while later mean group sizes are highly variable and differ from year to year. Groups of moderate size can be found throughout August.

Reaction to fly harassment is highly variable, but sometimes leads to aggregation behaviour (Kellsall 1968, Thomson 1971, Skogland 1974). Predation by wolves seems to have played an important role as a selection force in the origin of gregarious behaviour in *Rangifer* (Bergerud 1974, Cumming 1975). On Svalbard biting insects are of no importance and predators are absent. Neither aggregation nor gregarious behaviour thus are necessities, explaining the observed differences in social organization between Svalbard reindeer and other *Rangifer* subspecies. The observed spacing behaviour may be an adaptation to slow growing and also to some degree scattered vegetation.

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