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Nonrandom Distribution of Antlers Cast by Peary Caribou Bulls, Melville Island, Northwest Territories

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ABSTRACT. An aerial survey was carried out in July 1987 to determine the pattern of distribution of antlers cast by Peary caribou (*Rangifer tarandus pearyi*) bulls on north-central and northeastern Melville Island, Northwest Territories, Canada. Four transect lines were flown parallel to the coastal shorelines of Hecla and Griper Bay and adjacent Sabine Bay at distances of about 0.8, 2.4, 5.0, and 10.0 km inland. A four-person survey crew was used in a Bell-206B turbo-helicopter flown at about 90 m above ground level and at an air speed of about 160 km·h^{-1}. We recorded 531 antlers cast by bulls along *ca.* 1110 km of transects: 55% within 1.6 km of the seacoast and 89% within 3.2 km. Antlers were not randomly distributed along or among transects ($p < 0.05$). The antlers were clumped in distribution and their numbers declined significantly with distance from the seacoast ($p < 0.05$). We suggest that use of such coastal rutting areas by low-density populations of Peary caribou would confer, without any precognition or anticipation on the part of the animals, maximal timely contact between rutting bulls and cows in heat during the short temporal peak of the autumn rut by reducing a two-dimensional search problem to an essentially linear one.

Key words: Peary caribou, *Rangifer tarandus pearyi*, bulls, cast antlers, Melville Island, Northwest Territories

RÉSUMÉ. Un relevé aérien a été effectué en juillet 1987 pour déterminer le schéma de distribution des bois perdus par les caribous de Peary (*Rangifer tarandus pearyi*) mâles dans le centre-nord et le nord-est de l'île Melville, dans les Territoires du Nord-Ouest au Canada. Quatre transects ont été survolés, parallèlement au rivage le long de Hecla et de Griper Bay et de la baie adjacente, Sabine Bay, à des distances d'environ 0,8, 2,4, 5,0 et 10,0 km à l'intérieur des terres. Une équipe composée de quatre individus a effectué le relevé à partir d'un hélicoptère à turboréacteur Bell-206B, volant à environ 90 m du sol et à une vitesse aérodynamique de 160 km·h^{-1}. On a relevé 531 bois perdus par les mâles le long d'environ 1100 km de transects: 55 p. cent à moins de 1,6 km de la côte, et 89 p. cent à moins de 3,2 km. Les bois n'étaient pas répartis au hasard le long des transects ou parmi eux ($p < 0,05$). Ils formaient des groupes et leur nombre diminuait de façon significative lorsqu'on s'éloignait de la côte ($p < 0,05$). On suggère que l'utilisation de ces aires de rut côtières par des populations clairsemées de caribous de Peary favoriserait — sans qu'il y ait préconnaissance ou intention de la part de l'animal — un contact opportun maximal entre les mâles et les femelles en rut durant le pic de courte durée du rut automnal, en ramenant le problème de la recherche en deux dimensions à un problème de recherche essentiellement linéaire.

Mots clés: caribou de Peary, *Rangifer tarandus pearyi*, mâles, bois perdus, île Melville, Territoires du Nord-Ouest

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INTRODUCTION

Many older prime age (*ca.* 6+ years old) male caribou (*Rangifer tarandus* spp.) annually begin casting their antlers during the later part of the autumn rutting period or shortly thereafter (e.g., Murie, 1935; Kelsall, 1968; Skoog, 1968; Bubenik, 1975; Miller, 1982; V. Geist, pers. comm. 1991). The large cast antlers from Peary caribou (*R. t. pearyi*) bulls on the Queen Elizabeth Islands remain essentially intact for many years under the desertlike conditions of the Canadian High Arctic. Such large, bleached antlers are highly visible to airborne observers against a generally drab brownish summer landscape, which is either unvegetated or is sparsely covered with short or prostrate vegetation. Therefore, during aerial surveys of Peary caribou on Queen Elizabeth Islands in summers 1972-74 (Miller *et al.*, 1977a), aerial observers on occasion qualitatively noted what appeared to be greater numbers of cast antlers from bull caribou on some coastal areas compared to those seen on more inland adjacent areas. The systematic design of the surveys being carried out in the 1970s did not, however, lend itself to a quantitative evaluation of these apparent uneven distributions of cast bull antlers.

We had an opportunity to quantitatively measure and evaluate the distribution of cast antlers from Peary caribou bulls on the coastal shorelines of Hecla and Griper Bay and Sabine Bay, north-central and northeastern Melville Island, in July 1987. The following is a report on the distribution of the cast bull antlers and the variation in density of antlers from bulls with distance from the seacoast within the above search area.

STUDY AREA

The antler-search area was located on north-central and northeastern coastal Melville Island (Fig. 1), the largest (42 220 km^2) of the western Queen Elizabeth Islands in the Canadian Arctic Archipelago. Vegetation cover is composed of lichens, bryophytes, graminoids, herbs, cushion plants, and prostrate shrubs (e.g., Babb and Bliss, 1974; Edlund, 1983; Edlund and Alt, 1989). The strongest characteristics of the vegetation cover are its extreme sparsity over much of the area and its extreme lack of vertical displacement in its growth forms (several centimetres or less in height above ground level). The area is composed of "polar desert," with no woody plants and only 0-10% plant cover; "polar semi-desert," with moister areas having 5-20% vascular plant cover; "diverse terrain," which includes a more mesic gradation of polar semi-desert with woody plant species present and interspersed with some patches of tundra or sedge-moss meadows; and some large "wet sedge-moss meadows" (Babb and Bliss, 1974). The area falls within zones 2 and 3 of Edlund's (1983) "bioclimatic zonation." The geology has been described in detail by Tozer and Thorsteinsson (1964). Eastern and central Melville Island are generally low in elevation, mostly below 150 m above mean sea level (amsl) (Dunbar and Greenaway, 1956; Miller *et al.*, 1977a). The actual antler-search area runs from sea level to *ca.* 150 m amsl, with the exception of a few small, isolated sites rising slightly higher.

Winter comes early in September to the study area: 30-year (1951-80) climate normals for daily temperature (°C) in

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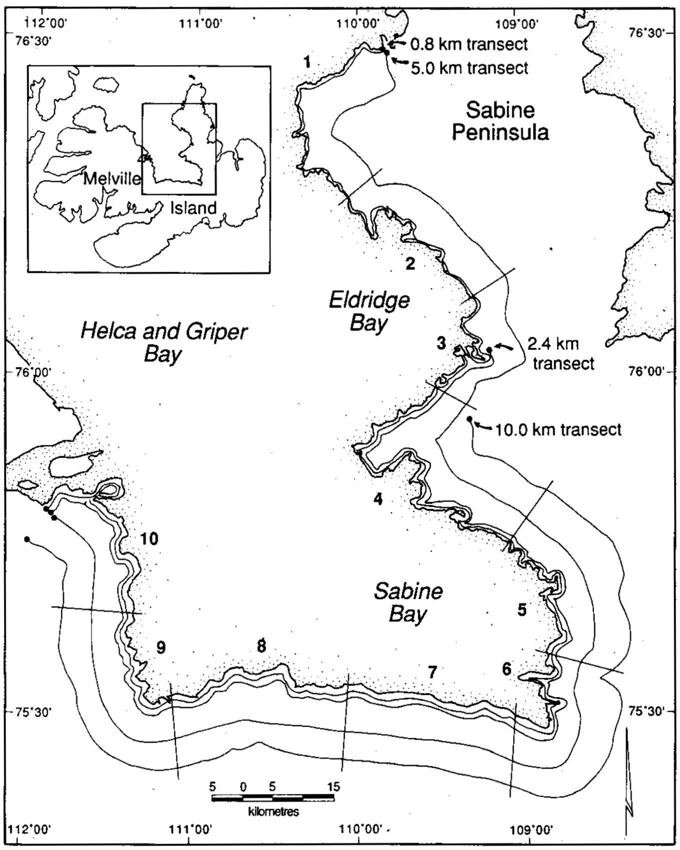

FIG. 1. Location of antler survey area for cast antlers from Peary caribou bulls; Melville Island, Northwest Territories, July 1987, showing locations of sample block boundaries.

September at the Resolute Airport (74°43′N, 94°59′W; Resolute Bay, Cornwallis Island, Northwest Territories) have averaged –7.2 minimum, –5.1 mean, and –2.1 maximum (Canadian Climate Program, 1982). September and October have the greatest monthly snowfalls and have averaged nearly 60% of all the snow that fell between 1 September and 31 March of each year from 1951 to 1980 (Resolute Airport: Canadian Climate Program, 1982).

Sea ice begins forming in September, when coves and the interparts of large bays become frozen over first. In the Resolute Bay area from 1947 to 1989, the first permanent sea ice occurred between 3 September and 8 October (mean, 20 September); complete freeze-over took place between 12 September and 26 October (mean, 29 September); and, on the average, the sea ice was first used by people, dog teams, and snowmobiles on 3 October (based on records provided by the Ice Climatology and Applications Division, Ice Centre, Atmospheric Environment Service, Environment Canada, Ottawa, 1991). Caribou or their tracks have been seen far out (5-25 km) on the sea ice as early as September (Stefansson, 1921) and October (McEwan, 1955; Miller and Gunn, 1978, 1980).

MATERIALS AND METHODS

We sampled the distribution pattern of cast antlers from Peary caribou bulls by aerial survey along four transect lines flown parallel to the coastal shorelines of Hecla and Griper Bay and adjacent Sabine Bay at distances of *ca.* 0.8, 2.4, 5.0, and 10.0 km inland (Fig. 1). The survey aircraft was a Bell-206B turbo-helicopter, flown at a height of *ca.* 90 m above ground level and an air speed of *ca.* 160 km·h^{-1}. The survey crew comprised four people, including the pilot. We recorded the locations of all antlers cast by bulls and observed within 0.8 km of either side of the flight line. Rear seat observers maintained transect strip width using hand-held clinometers; a depression angle of 6° from the helicopter to the ground when the helicopter was abeam of the antler marked the outside boundary of the 0.8 km strip. The front seat observers alerted the rear seat observers to antlers seen directly in front of the helicopter (in line with the flight path). All four observers scanned the entire transect width, and occasionally beyond. Weather conditions during the survey were clear and sunny. We assume that sunlight reflecting off the antlers should have allowed observers to detect all bull antlers within the width of each transect strip.

We identified bull antlers by their massive size and complexity of structure compared to antlers of females or young males. The various angles at which the first two proximal lateral tines (brow and bez, after Pocock, 1933, or bez and trez, of Bubenik, 1975) leave the main beam, the long, thick, strongly curved main beam, or the markedly palmated or fingerlike projections of the posterior terminal tines of the main beam singly or in combination prevent bull antlers from lying entirely flat on the ground. The elevated parts of each cast bull antler greatly increases its visibility on the ground and noticeably aids in its detection at a distance (while the small, simplistic female or young male antler usually lies essentially flat on the ground and is much more apt to be missed at a distance).

Determination of the time span over which these cast antlers accumulated was not possible, as carbon dating, even a few antlers, was not a feasible option to us because of the associated costs. The antlers we observed were large bull antlers that either appeared relatively fresh or were bleached whitish by prolonged exposure to the sun (suggesting that they were never buried over long times in the ground). Our best guess is that essentially all of the bull antlers that we counted represent at most several decades of accumulation. We cannot, however, totally rule out the possibility that some of those antlers were actually much older than we suggest (*cf.* Meldgaard, 1986). Antler material such as that reported by Meldgaard (1986) and others as being several hundreds or thousands of years old comes from archaeological or other digs, from stream cuts, or from other areas of erosion that have had the overburden forcibly removed and in doing so exposed such materials from the substratum in which they were buried. Such antler material is most often quite fragmentary and always darkly mineral stained by the substrate and does not appear similar to the bull antlers that we observed lying on the ground during the antler survey in July 1987.

Following the survey we divided each transect into segments *ca.* 10 km long (116 segments: mean segment length, 9.6 ± 0.7 km sd) and summarized the antler counts on the basis of these segments. As the antler densities on these segments were not normally distributed (Lilliefors test: Conover, 1980; Wilkinson, 1990), we resorted to distribution-free statistical methods. We assessed the serial randomness of antler densities along each transect with a Wald-Wolfowitz runs test (Zar, 1984; Wilkinson, 1990). We examined the effect that distance from shore had on antler densities with Quade's randomized block test (Conover, 1980) and a Wilcoxon signed rank test (Zar, 1984). For these latter two tests we formed sample blocks by running boundary lines perpendicular to the general lay of the shoreline and intersecting transect no. 3

(5.0 km) at *ca.* 30 km intervals (we chose transect no. 3 because its centerline most closely followed the lay of the coastline). Our analysis proceeded with the antler densities on each transect line within each sample block. For readability, we report our tabulated results as the density of antlers per 10 km^2. We used Spline curves to form a smooth line through the sample block antler densities for each transect in Figure 2 (SigmaPlot, 1991).

RESULTS

On 25 July 1987 we flew a transect that paralleled the seacoast at *ca.* 0.8 km inland from *ca.* 76°00′N northward to *ca.* 76°30′N along the east side of Sabine Bay. We then returned southward along a roughly parallel course at *ca.* 5.0 km inland (the flying was completed between 1200 and 1400 h). We added two more transects to the search design, 2.4 and 10.0 km inland from the seacoast, and completed the survey on 28 July between 0930 and 1600 h. We had intended to extend the two new transects into the area searched on the 25th but we exceeded our limited resources while completing the four transects on the remainder on the survey area on the 28th, so we could not do so. Therefore, transects no. 2 and 4 terminate south of transects no. 1 and 3 on the west coast of the Sabine Peninsula (Fig. 1).

We recorded 531 cast antlers distributed along *ca.* 1110 km of survey transects (Tables 1 and 2; Fig. 1). Seven additional cast antlers were also seen during the survey but rejected as female or possibly young male antlers. Proportional to search effort, we found 45% of the antlers cast by bulls within 1.6 km of the seacoast and 86% within 3.2 km of the coast (Table 2). Furthermore, if we had observed antlers inland from the seacoast at those densities that we observed on transect no. 1, then such expected counts for transects no. 2, 3, and 4 indicate that transects no. 3 and 4 seriously undercontribute to the total antler count (X^2=256.6, df=3; $p < 0.01$).

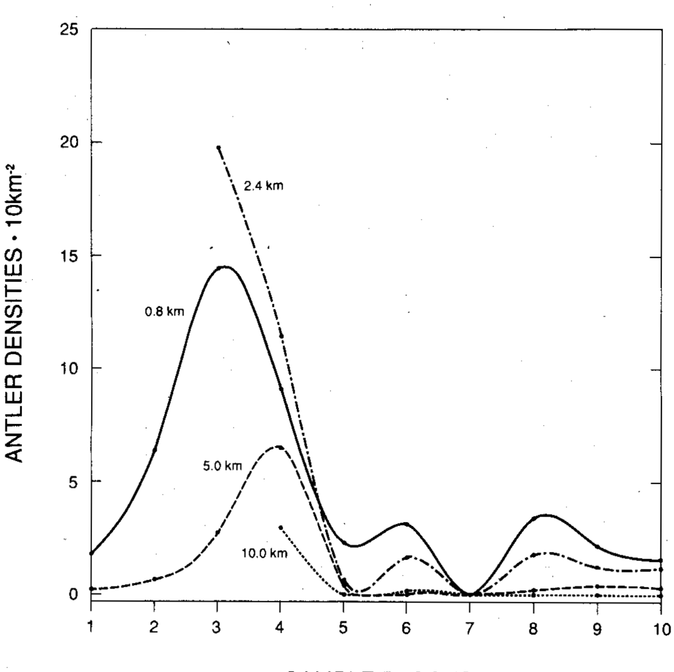

FIG. 2. Density distribution of antlers cast by Peary caribou bulls along the four transect lines, Melville Island, Northwest Territories, July 1987. Densities in sample blocks are joined with a smooth spline curve.

TABLE 1. Densities of cast bull antlers from Peary caribou by 10 km segments along each of four transect lines, Melville Island, Northwest Territories, July 1987

	Antler density · 10 km^{-2} (segment length – km) given by transect distance from shoreline to transect centerline			
Segment	1 (0.8 km)	2 (2.4 km)	3 (5.0 km)	4 (10.0 km)
1	3.6 (8.6)	16.4 (9.9)	0.0 (10.2)	4.5 (9.8)
2	4.3 (8.8)	28.5 (9.2)	0.6 (9.7)	1.3 (9.3)
3	0.6 (10.4)	20.2 (9.6)	0.0 (9.9)	0.0 (9.0)
4	0.0 (10.0)	11.6 (10.2)	2.0 (9.3)	0.0 (8.9)
5	0.7 (9.4)	8.1 (10.0)	0.0 (9.7)	0.0 (9.9)
6	2.5 (10.0)	8.8 (9.2)	0.0 (9.8)	0.0 (9.2)
7	21.0 (10.4)	3.3 (9.6)	0.0 (9.1)	0.0 (8.9)
8	4.0 (9.4)	0.6 (10.1)	0.7 (9.5)	0.6 (10.3)
9	0.0 (9.5)	0.7 (9.2)	7.5 (9.2)	0.0 (9.3)
10	0.0 (8.4)	0.0 (9.9)	11.6 (9.7)	0.0 (10.3)
11	6.9 (9.9)	1.7 (10.8)	5.3 (9.5)	0.0 (9.9)
12	32.0 (8.4)	2.3 (10.8)	2.2 (8.7)	0.0 (9.8)
13	15.4 (8.1)	0.6 (9.7)	0.0 (9.7)	0.0 (10.1)
14	20.4 (9.5)	0.0 (9.5)	0.6 (9.6)	0.0 (10.2)
15	10.8 (9.8)	0.0 (8.8)	0.6 (9.6)	0.0 (9.9)
16	7.4 (10.2)	0.0 (9.9)	0.0 (9.0)	0.0 (9.8)
17	8.3 (9.8)	3.9 (9.6)	0.0 (8.5)	0.0 (10.0)
18	7.9 (9.5)	0.0 (9.8)	0.0 (8.9)	0.0 (10.0)
19	5.4 (10.5)	0.7 (9.0)	0.0 (9.1)	0.0 (9.9)
20	1.4 (9.0)	2.2 (8.6)	0.0 (9.4)	0.0 (10.7)
21	4.0 (9.3)	0.0 (10.0)	0.0 (9.7)	0.0 (7.5)
22	1.3 (9.4)	2.4 (10.2)	0.0 (9.7)	
23	1.3 (9.3)	3.6 (10.3)	0.0 (10.3)	
24	5.2 (9.6)	0.7 (8.7)	0.8 (8.3)	
25	5.0 (8.7)	0.0 (13.4)	0.0 (9.8)	
26	0.0 (9.3)	0.0 (7.2)	0.0 (10.5)	
27	0.0 (9.4)		1.3 (9.8)	
28	0.0 (10.0)		0.7 (8.4)	
29	0.0 (9.5)		0.0 (10.5)	
30	1.3 (9.9)			
31	3.2 (9.9)			
32	5.3 (9.4)			
33	2.0 (9.4)			
34	0.0 (10.1)			
35	2.8 (9.0)			
36	8.0 (10.1)			
37	0.7 (9.3)			
38	0.8 (8.1)			
39	0.0 (10.2)			
40	0.0 (10.0)			
Total	4.8 (379.5)	4.4 (253.2)	1.2 (275.1)	0.3 (202.7)

TABLE 2. Mean densities of cast bull antlers from Peary caribou along the four transect lines, grouped into sample blocks formed by *ca.* 30 km segments along transect no. 3 (5.0 km), Melville Island, Northwest Territories, July 1987

	Antler density · 10 km^{-2} (segment length – km) given by transect distance from shoreline to transect centerline			
Block	1 (0.8 km)	2 (2.4 km)	3 (5.0 km)	4 (10.0 km)
1	1.8 (45.6)		0.2 (29.8)	
2	6.4 (43.8)		0.7 (28.8)	
3	14.5 (31.9)	19.8 (13.6)	2.7 (27.8)	
4	9.1 (65.4)	11.4 (58.1)	6.5 (27.9)	3.0 (19.1)
5	2.2 (33.8)	0.6 (29.6)	0.4 (28.9)	0.0 (37.0)
6	3.1 (28.1)	1.3 (26.9)	0.0 (26.4)	0.2 (36.7)
7	0.0 (30.1)	0.0 (29.4)	0.0 (28.2)	0.0 (28.5)
8	3.4 (33.1)	1.7 (32.3)	0.2 (28.3)	0.0 (28.1)
9	2.1 (23.4)	1.2 (25.7)	0.4 (30.1)	0.0 (37.8)
10	1.6 (44.3)	1.2 (37.6)	0.3 (18.9)	0.0 (15.5)
Total	4.8 (379.5)	4.4 (253.2)	1.2 (275.1)	0.3 (202.7)

The density of antlers per sample block varied markedly within and among transects (Table 2, Fig. 2). The greatest densities of antlers occurred within sample blocks 2, 3, and 4 in all applicable transects (Table 2, Fig. 2). Forty-five percent of all antlers seen were distributed from near the seacoast inland across sample block 4, 84% of those antlers within 3.2 km of the coast.

Wald-Wolfowitz's runs test indicated that the density of antlers on the 10 km segments was not randomly distributed ($p < 0.05$) on transects no. 1 (0.8 km), 2 (2.4 km), and 4 (10.0 km).

The density of cast antlers declined significantly with distance from shore (Quade and Wilcoxon tests, $p < 0.05$; Table 3) for all three testable combinations of blocks and transects. Multiple comparison tests indicate that the distance effect became significant when more than 3.2 km inland (between transects no. 2 and 3).

DISCUSSION

The aerial survey technique used in this study for quantitative evaluation of the distribution pattern of the cast antlers from Peary caribou bulls is most likely feasible only in the High Arctic, where the vegetation is at most only several centimetres in height.

The bull/female or young male differences in the size and complexity of antlers of Peary caribou are strongly consistent (and, we subjectively believe, often much greater than in barren-ground [*R. t. granti* or *R. t. groenlandicus*] and woodland [*R. t. caribou*] caribou). The consistent and pronounced differences between bull and female or young male antlers from Peary caribou on the Canadian High Arctic islands leave little likelihood of mistaken identity of bull antlers when viewed by low-level airborne observers. Opportunities for making such observational errors at a significant level are also markedly reduced by the consistent seasonal separation in the annual timing of antler drop by most individual caribou in the different sex/age classes. For large numbers of cast bull antlers to be found along with large numbers of female and young male antlers, it would require that the same range be used in autumn, winter, and spring through June of the year. Peary caribou on Melville Island are found mainly on exposed inland sites from at least late winter into early spring (when most young males and young females drop their antlers) and they calve (when most cows drop their antlers) along the east coast and on southeastern Melville (Dundas Peninsula) some distance from the 1987 antler-search area (Miller *et al.*, 1977a,b; Thomas and Edmonds, 1983, 1984).

TABLE 3. Results of Quade and Wilcoxon tests of the effect of distance from shore on densities of antlers cast by Peary caribou bulls, Melville Island, Northwest Territories, July 1987

Test	Transects	Blocks	df	p	Multiple comparisons	p
Quade	1, 2, 3, 4	4 - 10	3, 18	< 0.001	1 vs 2	0.166
					2 vs 3	0.007
					3 vs 4	0.134
Quade	1, 2, 3	3 - 10	2, 14	0.003	1 vs 2	0.364
					2 vs 3	0.002
Wilcoxon	1, 3	1 - 10	8	< 0.005	—	—

Basing the timing of antler drop in all bull caribou on the "rutting period" rather than on the actual time when an individual bull ceases rutting activities is somewhat misleading, as antler shedding is controlled by the internal environment of the individual, not the external environment associated with that phase of its annual life history cycle. For example, although both Kelsall (1968:39) and Skoog (1968:53-54) state in general terms that most bull caribou cast their antlers immediately or shortly after termination of the rutting period, they both also give examples of individual prime older bulls having cast their antlers well in advance of termination of the rutting period (Kelsall, 1968:172; Skoog, 1968:54). In reality, as noted indirectly by Skoog (1968:54), the casting of antlers by older (probably 6+ years old) bulls is tied temporally more to their individual rutting activities than to the termination of the rutting period per se for all breeding animals. That is, older bulls, because of their stronger social dominance, usually enter into vigorous rutting and breeding activities during the first part of the rut.

Thus, many of those bulls are spent and cease rutting relatively early during the rutting period. Most of them, especially those more severely stressed from going off feed and their robust participation in the rut, cast their antlers either immediately or shortly after ceasing their individual participation in the rut (Bubenik, 1975), even though the rutting period is not actually over for some time for many of the bulls remaining in the group or herd. As a result, antler shedding by many older bulls is actually initiated during the later part of the rutting period; while other bulls, particularly younger ones who become more active toward the end of the rutting period, do not cast their antlers until some time after the rutting period is over. Therefore, we think it is reasonable to assume that the clumped distribution of cast bull antlers observed by us is indicative of general "rutting areas" for at least much, if not most, of the segment that those animals belonged to during the rut.

The occurrence of significantly more cast bull antlers within 3.2 km of the seacoast than on adjacent sites more inland argues for a greater proportion of bulls occurring on coastal sites than farther inland during, at least, the later part of the rut or immediately thereafter. Concentrations of those antlers on certain coastal sites strongly suggest that those coastal sites actually serve as annual rutting areas. Most calving (*ca.* often 80-90%) among caribou peaks during a brief 10-day to 2-week period (e.g., Lent, 1966; Bergerud, 1974, 1975; Dauphine and McClure, 1974; Miller, 1991). This demands that the peak of rut must also occur each year during a similar brief time span. Thus, maximal contact between breeding bulls and cows in heat must take place within a *ca.* 2-week period, even though the entire rutting period might last 4-6 weeks in each year.

Peary caribou have usually occurred at low or extremely low mean densities throughout the Queen Elizabeth Islands (Tener, 1963; Miller *et al.*, 1977a; Miller, 1990b). Peary caribou on Melville Island were first estimated at a mean density of 30.3 caribou · 100 km^{-2} in summer 1961 (Tener, 1963). By summer 1973, their estimated mean density had dropped to 8.1 caribou · 100 km^{-2} and in summer 1974, after the cataclysmal winter of 1973-74, to only 4.0 caribou · 100 km^{-2} (Miller *et al.*, 1977a). Most recently, the estimated mean density has fallen still farther to only 2.2 caribou · 100 km^{-2} in summer 1987 (Miller, 1988). Therefore, we believe, common orientation and movement by caribou to certain coastal areas during prerut or early rutting periods would, without precognition or anticipation, maximize the likelihood of timely contact by bulls with all breeding cows during the short time span of the peak of the autumn rut by reducing a two-dimensional search problem to a linear one. Thus, such timely movements, regardless of the original reason(s) for them, would confer a beneficial advantage on the animals carrying them out.

Such coastal sites might provide more favourable foraging conditions than more sparsely vegetated, higher elevation, exposed inland sites do at that time of the year. Although much of the total September-March snowfall has already occurred by 1 November of the year (Canadian Climate Program, 1982), the snow cover would not yet be markedly wind packed and the caribou could crater on snow-covered coastal sites. After early winter, as the snow cover becomes hard packed, the caribou are apparently forced to move to more inland, wind-blown, exposed feeding sites, mostly at intermediate elevations (e.g., Miller *et al.*, 1977a, 1982; Thomas and Edmonds, 1983, 1984). It is also possible, however, that foraging on coastal sites in autumn is not significantly more rewarding to caribou than feeding on more inland sites. It could be that an autumn coastal distribution of Peary caribou may simply be in response to the then prevailing environmental conditions in general and is possible because of the temporary, range-wide availability of forage at that time of the year. High daily forage requirements and differences in their diet from Peary caribou tie muskoxen (*Ovibos moschatus*) to coastal wet sedge-moss meadows for most of the year (e.g., Parker and Ross, 1976; Miller *et al.*, 1977a; Thomas and Edmonds, 1983, 1984). However, the differences in foraging behaviour and daily forage requirements between Peary caribou and muskoxen during the annual period of continual snow cover tend to lead to segregation of feeding sites between the two species for 7 or 8 months (September-March or October-April) annually, with caribou seeking more inland exposed sites (Thomas and Edmonds, 1983).

Although some of the caribou on Melville Island remain year-round, many if not most caribou on Melville belong to an inter-island population that summers on Melville and then migrates annually to winter on the western islands of Prince Patrick and Eglinton (Miller *et al.*, 1977a,b; Miller, 1990a). Therefore, it seems reasonable to assume that if caribou gathered on the seacoast for the sole purpose of inter-island migration to more westerly islands, they would do so on the western coast of Melville Island rather than on the distant antler-search area of northeastern coastal Melville. Also, the timing of autumn migrations of caribou tends to vary by as much as weeks among years, depending on then-prevailing environmental conditions, especially severe autumn storms (e.g., Kelsall, 1968; Skoog, 1968). Therefore, it seems highly unlikely that most bull caribou while in migration would arrive each or most years in these same isolated coastal areas at the exact time of maximum antler drop to cause the observed "clumped distribution" of cast bull antlers. It is also possible that the observed cast antlers belonged to bulls that remained year-round on Melville Island. Thus, the locations of those antlers would not have anything to do with inter-island movements but simply reflect the locations of autumn and early winter range and, we believe, associated rutting areas.

We know of no evidence nor do we have any reason to believe that either elevation or topography in general played a significant role in the observed distribution of antlers cast by Peary caribou bulls. Eastern and central Melville Island are low lying, with elevations generally comparable throughout (Dunbar and Greenaway, 1956; Miller *et al.*, 1977a). There are no topographical features within or adjacent to the antler-search area that would funnel or otherwise significantly govern seasonal migrations or even daily movements by caribou, other that the coast itself. Most importantly, there are no topographical features that would seriously hinder free movement of caribou anywhere within or beyond the antler-search area on eastern Melville Island.

There appears to be no biologically sound reason why caribou would have to stage on the west coast of Sabine Peninsula after the autumn rut, as the icebound waters of the inner bays would be crossable even before the rut in at least early October, if not in late September. Also, land travel around the bays in September-October, even if the ice was unsafe for crossing, would be unhindered and could be accomplished at a walk in less than a day.

Actual rutting areas for Peary caribou on Melville or any of the other Queen Elizabeth Islands have not been documented to date. Therefore, we tentatively conclude from our indirect evidence that the observed distribution of antlers cast by Peary caribou bulls on the north-central and northeastern coastal areas of Melville Island is indicative, in general, of autumn rutting areas for those caribou. No inland concentration of cast bull antlers has ever been detected on Melville Island during any of the aerial surveys in 1972-74 and 1987 (Miller *et al.*, 1977a; Miller, 1988). We also suggest that the use of coastal rutting areas by low-density populations of Peary caribou, regardless of the reasons for such use, could reduce the initial search effort by bulls and thus subsequently could facilitate the timely contact between rutting bulls and cows in heat during the short temporal peak of the rut.

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