Distribution, activity and range use of male caribou in early summer in Northern Yukon, Canada

Arthur M. Martell[1], **Wendy Nixon**[2] and **Donald E. Russell**[2]

Abstract: Males of the Porcupine Caribou Herd separated from females from the onset of spring migration until they joined them on the calving grounds in late June or early July, 4 - 6 weeks later. From late May to late June males spent an average of 50% of their time feeding and less than 2% standing and trotting/running. Males spent an average of 29% of their time lying and 19% walking, except in mid-June (40% lying, 6% walking). The average lengths of active and resting periods were 112 minutes and 104 minutes, respectively, from late May to mid-June, but decreased sharply in late June to 78 minutes and 69 minutes, respectively. Tussock meadows were selected in late May and early 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 but were selected in mid-June and late June. 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.

Key words: *Rangifer,* caribou, activity budget, habitat selection, food habits, Yukon

[1] Canadian Wildlife Service, P. O. Box 340, Delta, British Columbia, Canada V4K 3Y3
[2] Canadian Wildlife Service, 202-204 Range Road, Whitehorse, Yukon, Canada Y1A 3V1

Rangifer, Special Issue No. 1, 1986: 181 - 189

Introduction

The Porcupine Caribou Herd (*Rangifer tarandus granti*) calves on the Arctic Coastal Plain of northeastern Alaska and northwestern Yukon, and winters primarily in north-central Yukon and adjacent Alaska. Calving occurs from late May to mid-June with a peak in the first week of June. During calving, and for a variable period before and after calving, males are segregated from females. It has been suggested that this segregation occurs because males follow the northward initiation of growth of forage while pregnant females move quickly to the calving grounds for other reasons, such as predator avoidance (Whitten and Cameron, 1979). Recent proposals for a seaport, quarries and roads in northern Yukon in the area used intensively by males in early summer have focused attention on the need for information on that component of the herd.

Study area

Investigations were conducted in northern Yukon, north of the Porcupine River (Fig. 1). The area can be divided from south to north into three broad ecoregion bands: Old Crow Basin, Northern Mountains and Northern Coastal Plain (Wiken *et al.*, 1981). The Old Crow Basin, which includes the Old Crow Flats and the surrounding pediments, is generally flat or gently undulating terrain covered by boreal forest - tundra transition zone vegetation. The Northern Mountains include the British, Barn and Richardson Mountains with broken, ridged terrain interspersed by river valleys and intermountain basins. Vegetation consists of arctic and alpine tundra communities except for some intrusion of boreal forest along river valleys. The Northern Coastal Plain slopes gently from the mountains to the Beaufort Sea and is covered by arctic tundra vegetation.

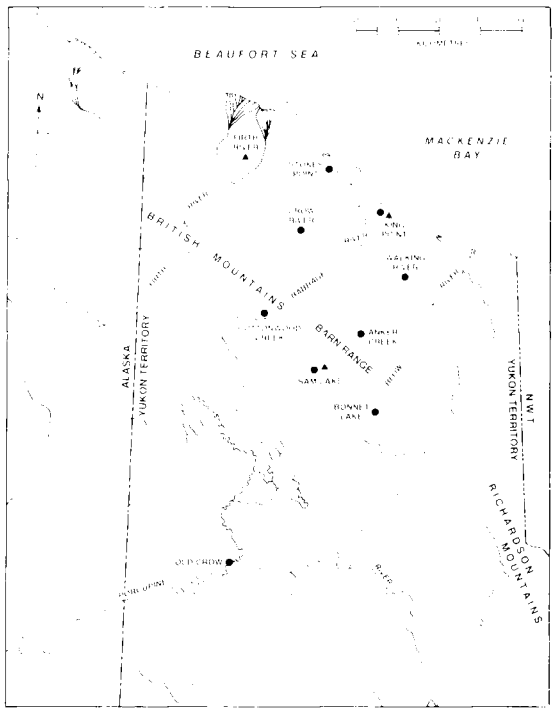

Fig. 1. Map of northern Yukon showing locations of field camps (triangles) and sites for documenting plant phenology (circles).

Three campsites were used for observing caribou in 1983: Sam Lake, 21 May - 12 June; King Point, 13 - 21 June; Firth River, 22 - 30 June (Fig. 1). The Sam Lake camp was at the southern edge of the Barn Mountains and overlooked rolling, tundra-covered pediments. The King Point and Firth River camps both lay on the coastal plain in rolling arctic tundra. Sites for documenting plant phenology (Fig. 1) were established on the Old Crow pediments (Sam Lake, Bonnet Lake), in the intermountain basins (Cottonwood Creek, Anker Creek), on the inner coastal plain (Crow River, Walking River) and at the coast (Stokes Point, King Point).

Methods

Distribution

To follow the movements of caribou, radio transmitters on collars were placed on animals on the winter range. Between 5 and 15 caribou were available for relocation each year (1981 —5; 1982 — 5; 1983 — 15). In 1981 and 1982, four relocation surveys were flown between 3 and 28 June and in 1983 six surveys were flown between 8 May and 1 July. In addition to the locations of radio-collared animals, the locations of all male caribou observed on aerial surveys and reported by other researchers were plotted on maps.

Activity

We observed caribou with 15x - 60x zoom spotting scopes from the three field camps. A band of caribou was defined as a socially interacting group of animals spatially distinct from other bands in the area. Activity data were collected using the instantaneous scan method (Altmann, 1974). We scanned each band at 15-minute intervals and tallied the number of caribou engaged in each of five general activities. The proportion of caribou observed in each activity and the estimated 95% confidence limits were calculated by the ratio estimator method (Cochran, 1977). Because of serial correlations among 15-minute observations of a given band of caribou, but not among different bands, estimated 95% confidence limits were based on a single ratio for each band observed. Differences were considered to be significant if the estimated 95% confidence limits did not overlap.

Phenology

We observed snowmelt and the development of vegetation in eight relatively flat cottongrass (*Eriophorum vaginatum*) tussock meadows (Fig. 1). We estimated the relative stage of development of the flowers of *Eriophorum vaginatum* (flower bud, early flower, full flower, past flower, seed) for 24 tussocks at approximately 5-m intervals along a transect at each site. Along the same transect we also documented the relative stage of development of the leaves of 24 plants of *Salix pulchra, Betula glandulosa* and *Ledum palustre* (leaf bud, leaf unfolding, full leaf).

Habitat selection

We divided the area of observation at each campsite into six distinct habitat types and determined their availability by mapping them on aerial photographs. The habitat types and their approximate classification according to Viereck and Dyrness (1980) were: Tussock Meadow, 2C2c; Wet Sedge Meadow, 2A3a; Dwarf Shrub Heath, 2D2a and 2A4a; Alpine Barren, 2E1b; Alluvial Willow, 3A1a; and Open White Spruce, 1A3d. We also documented the

use of late snow patches and sandy beaches at some camps. The areas observed at campsites appeared to be representative of much wider areas based on examination of aerial photographs and observations from aircraft.

Food habits

We collected composite fecal samples at Sam Lake (22 May, 4 - 5 June, 12 June), King Point (15 - 17 June), Firth River (26 - 27 June) and Stokes Point (15 June, 27 June). Each composite sample contained 20 fecal pellets, one from each of 20 different fresh pellet groups. Fecal samples were analyzed (Sparks and Malechek, 1968) at the Composition Analysis Laboratory at Colorado State University, Fort Collins. The relative density of plant fragments was based on 100 fields per sample. All samples were analyzed at the same time by the same technician. The accuracy of fecal analysis is influenced by differential digestion among plant species (Holechek *et al.*, 1982). Therefore, the results represent proportions of discerned fragments in fecal samples rather than actual proportions of the ingested diet.

Data analysis

For the purpose of comparison among data sets, the field season was divided into four periods: late (20 - 31) May, early (1 - 11) June, mid (12 - 20) June and late (21 - 30) June. Statistical procedures follow Siegel (1956) and Sokol and Rohlf (1969).

Results and discussion

Distribution

Male caribou follow the females on spring migration along essentially the same routes leading from the two principal wintering areas, the Ogilvie Mountains of north-central Yukon and the Arctic Village region of northeastern Alaska. Females reach the calving grounds in mid to late May while males fan out into the rolling pediments north and east of the Old Crow Flats and into the wide basins near the headwaters of the Firth River (Fig. 2a). In early June, at the time of calving, males are distributed in a broad crescent south and east of the calving grounds (Fig. 2b). By this time, if not earlier, males from both the Alaskan and Yukon wintering areas are well mixed. Males then move eastward south of the British Mountains and northwestward from the Richardson Mountains and by mid-June large aggregations begin to form in the intermountain basins near the headwaters of the Spring, Trail, Babbage and Running rivers as well as, in some years, on the Firth River (Fig. 2c). By late June males are found moving westward and northwestward towards the coast of the Beaufort Sea near the Alaska-Yukon border (Fig. 2d). At this time, band sizes frequently number in the thousands and smaller bands which have lingered behind move quickly to join the larger concentrations. Most males meet and mix with females and young on the Alaska-Yukon coastal plain by early to mid-July before returning eastward to the Richardson Mountains.

Males, therefore, are essentially segregated from females during May and June. The consistent pattern of distribution and movements among years and the formation of aggregations in mid-June prior to joining females and prior to the insect season suggest a response to food resources combined with a form of social facilitation.

Activity

In late May, at Sam Lake, many females were moving through the area and males occurred in both male-dominated and female-dominated bands. Therefore, observations included both types of bands. After that time, only male-dominated bands were observed. The average size of bands was relatively constant from late May to mid-June but increased significantly in late June (Table 1).

There was no significant difference in the proportion of time spent feeding or trotting/running among observation periods (Table 2). In mid-June the proportion of time spent lying was significantly higher than during other periods and the proportion of time spent walking was significantly lower than during other periods. The proportion of time spent standing was significantly lower in late June than during other periods. The rate of movement (Table 1) mirrored the proportion of time spent walking (Table 2) and was conspicuously low during mid-June.

It is not possible to make precise comparisons of activity budgets among studies because of differences in methods of calculation. In general, for the same season, Roby (1978) found that male

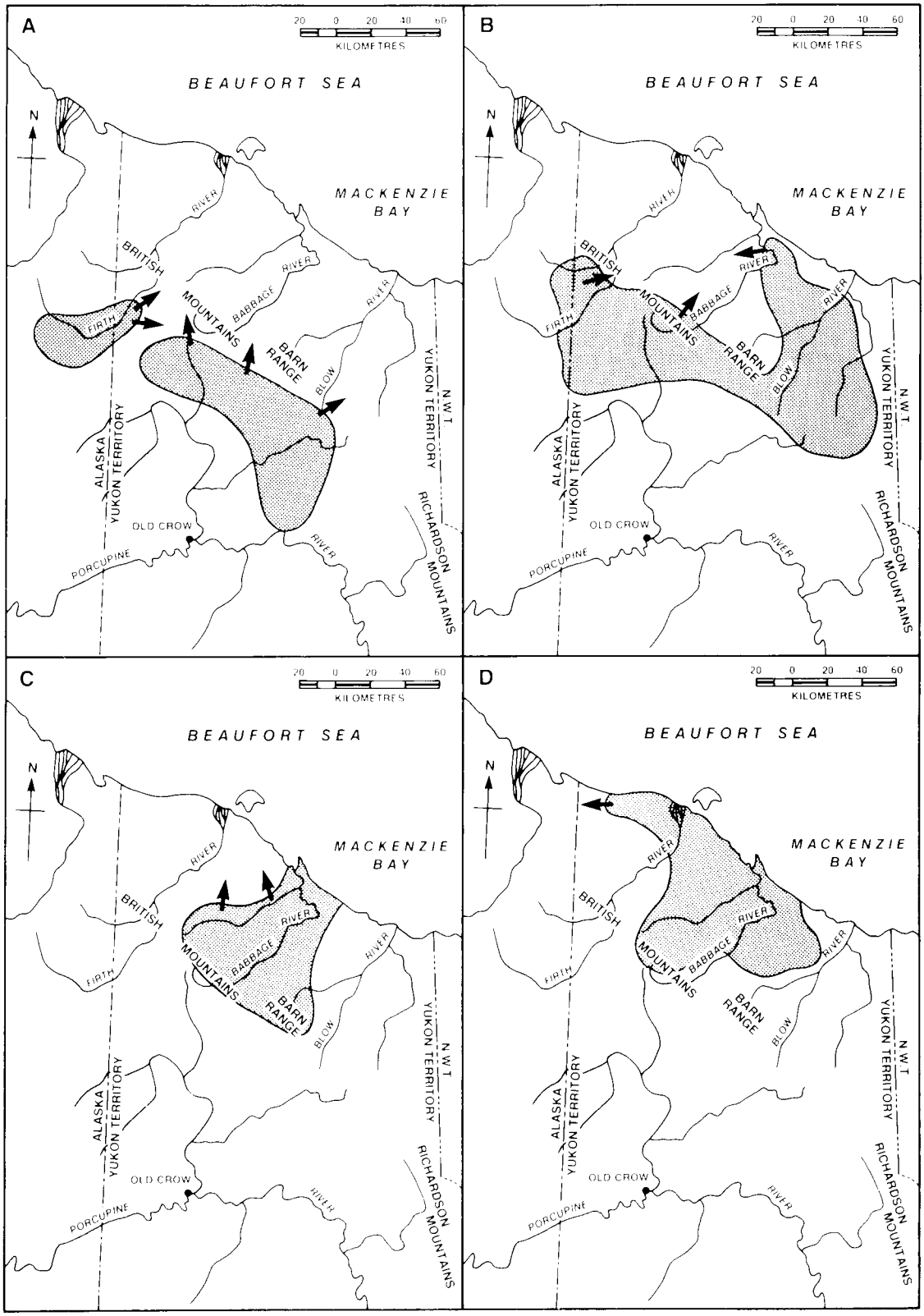

Fig. 2. General distribution (shaded) and direction of movement (arrows) of male caribou in northern Yukon in late May (A), early June (B), mid-June (C), and late June (D).

caribou in north-central Alaska spent less time feeding (39%) and more time lying (47%) than males we observed.

The mean length of both active and resting periods declined significantly from late May to late June (Table 3). The decrease from mid-June to late June was particularly conspicuous. The mean late May to mid-June active period we observed (112 minutes) was shorter than reported for summer for male reindeer (135 minutes) (Segal, 1962), while the mean late May to mid-June resting period (104 minutes) was not significantly different (105 minutes).

Phenology

On 18 - 19 May 1983, the Old Crow pediments were about 80% snow covered while farther north all sites were about 95% snow covered. By 3 June the snow cover had declined to less than 5% on the Old Crow pediments and

Table 1. Size and rate of movement (km/h) of bands of male caribou in northern Yukon in 1983[1].

Period	Size		Rate[2]	
	(n)	x ± SE	(n)	x ± SE
late May	(45)	17.5± 1.78[a]	(574)	0.35±0.026[a]
early June	(55)	24.2± 2.90[a]	(730)	0.54±0.025[b]
mid-June	(65)	19.9± 4.47[a]	(1088)	0.15±0.007[c]
late June	(29)	103.8±21.62[b]	(301)	0.74±0.042[d]

[1] Band sizes or rates of movement with the same superscript are not significantly different from each other at the P = 0.05 level.

[2] Rate was measured from the estimated distance moved by bands between 15-minute scans.

Table 2. Daily activity budgets (% time ± estimated 95% confidence intervals) for male caribou in northern Yukon in 1983.

Date	Late May	Early June	Mid-June	Late June
Number of observations	619	787	1153	330
Number of bands	45	55	65	29
Number of individuals	8443	14 498	19 554	25 592
Feeding	51.0±4.0	47.6±3.4	52.0±3.0	49.0±2.8
Lying	31.1±6.4	31.9±5.0	40.4±3.3	25.4±4.3
Standing	1.8±1.1	0.9±0.3	0.9±0.2	0.4±0.1
Walking	14.8±4.9	19.1±2.4	6.3±0.9	24.1±5.6
Trotting/running	1.2±1.1	0.5±0.3	0.3±0.3	1.0±0.4

Table 3. Length (minutes) of active and resting periods[1] ($\bar{x}$±SE) for male caribou in northern Yukon in 1983[2]. Sample sizes in parentheses.

	Late May	Early June	Mid-June	Late June
Active period	(7) 118±18.4[a]	(10) 111±12.9[ab]	(29) 110±6.4[ab]	(5) 78±11.0[b]
Bedded period	(23) 103± 6.9[a]	(34) 98± 5.2[a]	(46) 109±4.7[a]	(12) 69± 6.5[b]

[1] The length of an active period was calculated as the time between the point when the majority of a group ceased lying until the majority of the same group was again lying. The length of a resting period was calculated in an analogous manner.

[2] Active periods (or bedded periods) with the same superscript are not significantly different from each other at the P = 0.05 level.

the coast but was about 50% (30 - 70%) beetween those sites. By 10 June the intermountain and inner coastal plain sites were about 10% (5 - 20%) snow covered and by 17 June all sites were essentially snow-free.

In general, the development of vegetation was most rapid on the Old Crow pediments (Table 4). In early June, the development of *Eriophorum vaginatum* was more advanced on the coastal plain than at inland sites but by mid-June plant development on the coast was behind that at other sites and remained so. This was probably due to the temperature gradient which develops between the coast, which is strongly influenced by the ice-covered Beaufort Sea, and the thermal basin surrounding the Old Crow Flats (Pearson and Nagy, 1976). In general, plant development on the Old Crow pediments was at least a week in advance of that on the coast.

Habitat selection

Tussock Tundra was weakly selected in late May and early June while Wet Sedge Meadow was strongly avoided until late June (Table 5). Dwarf Shrub Heath began to be avoided weakly after late May and Alluvial Willow shifted from being avoided in late May and early June to being selected in mid-June and late June. Other habitat types were too poorly represented to compare.

Food habits

In late May *Cladonia*-type lichen and *Vaccinium* (likely *V. vitis-idaea*) were the most important components of the fecal sample (Table 6). Those species continued to be important in early June, although *Eriophorum* (likely *E. vaginatum*) was the most important item. *Eriophorum* predominated in the samples in

Table 4. Phenology of vegetation in northern Yukon in 1983. The percentage of plants in each stage of development is presented in sequence. Blank spaces indicate that the plant had not yet begun to develop.

	Date				
	June 3	June 10	June 17	June 24	July 1
Eriophorum vaginatum	B/E/F/P/S[1]	B/E/F/P/S[1]	B/E/F/P/S[1]	B/E/F/P/S[1]	B/E/F/P/S[1]
coast	0/33/67/0/0	0/6/92/2/0	0/0/0/100/0	0/0/0/0/100	0/0/0/0/100
coastal plain	0/48/52/0/0	0/0/88/12/0	0/0/0/100/0	0/0/0/0/100	0/0/0/0/100
mountain basins	0/88/12/0/0	0/2/67/31/0	0/0/0/90/10	0/0/0/0/100	0/0/0/0/100
pediments	0/60/40/0/0	0/4/46/50/0	0/0/0/0/100	0/0/0/0/100	0/0/0/0/100
Salix pulchra[3]	B/U/L[2]	B/U/L[2]	B/U/L[2]	B/U/L[2]	B/U/L[2]
coast		100/0/0	0/100/0	0/96/4	0/0/100
pediments	58/42/0	38/62/0	0/10/90	0/0/100	0/0/100
Betula glandulosa			B/U/L[2]	B/U/L[2]	B/U/L[2]
coast			56/27/17	2/54/44	0/0/100
coastal plain			46/50/4	0/0/100	0/0/100
mountain basins			48/38/14	0/0/100	0/0/100
pediments			2/29/69	0/0/100	0/0/100
Ledum palustre					B/E/F/P/S[1]
coast					86/14/0/0/0
coastal plain					80/20/0/0/0
mountain basins					66/34/0/0/0
pediments					0/0/100/0/0

[1] flower bud/early flower/full flower/past flower/seed.
[2] leaf bud/leaf unfolding/full leaf.
[3] *Salix pulchra* was not sufficiently abundant to tally on the inner coastal plain and intermountain basin sites.

Table 5. Availability (A, % area), utilization (U, % caribou) and selection (S)[1] of habitat types by male caribou in northern Yukon in 1983. Approximate area observed at each campsite in parentheses.

	Sam Lake (29 km²)					King Point (26 km²)			Firth River (23 km²)		
	Late May			Early June		Mid-June			Late June		
Habitat type	A	U	S	U	S	A	U	S	A	U	S
Tussock Meadow	51	60	+0.16	82	+0.24	88	97	+0.05	76	80	+0.02
Wet Sedge Meadow	18	3	—0.69	1	—0.88	10	1	—0.87	19	17	—0.05
Dwarf Shrub Heath	21	18	+0.02	14	—0.20	-	-	-	4	2	—0.20
Alpine Barren	1	1	0.00	1	—0.05	-	-	-	1	<1	—0.83
Alluvial Willow	8	3	—0.36	1	—0.73	<1	1	+0.54	<1	1	+0.90
Open White Spruce	1	-	—1.00	<1	—0.87	-	-	-	-	-	-
Beach	-	-	-	-	-	1	<1	—0.75	-	-	-
Late Snowpatch[1]	-	15	-	-	-	-	<1	-	-	<1	-

[1] Selectivity measured as (U—A)/(U+A). Utilization values were adjusted by removing late snowpatches because their availability could not be measured.

mid-June but declined sharply in late June. *Salix* increased markedly from early June to mid-June and dominated the samples in late June.

There were no marked differences in diet, as reflected in fecal samples, at the two sample sites in late June, but there was a noticeable variation among sites in mid-June. In mid-June the proportion of *Eriophorum* increased from Sam Lake (50%) to King Point (61%) to Stokes Point (91%) while evergreen shrubs declined over the three sites (25%, 3%, 1%, respectively). Also, *Salix* was highest at King Point (32%), lower at Sam Lake (16%) and lowest at Stokes Point (1%). Those variations did not appear to be precisely related to either availability or phenological stage. The phenological stages of

Table 6. Average percentages of discerned plant fragments in fecal samples collected from male caribou in northern Yukon in 1983. Sample sizes in parentheses.

Food Items[1]	Late May (1)	Early June (1)	Mid-June (3)	Late June (2)
Moss	8.6	4.3	2.6	0.1
Lichens	33.9	34.9	3.0	0.3
Cetraria-type	4.5	3.0	0.6	0.2
Cladonia-type	23.4	28.7	1.6	0.2
Stereocaulon	5.2	3.2	0.8	-
Horsetails *(Equisetum)*	-	1.5	0.3	0.1
Graminoids	10.0	36.7	67.3	2.3
Carex	6.8	3.1	1.0	0.7
Eriophorum	3.2	33.6	65.8	1.5
Deciduous shrubs *(Salix)*	-	2.0	16.5	95.8
Evergreen shrubs	47.5	19.9	9.6	0.6
Dryas	1.5	0.7	5.0	0.3
Ledum	5.3	3.7	1.1	-
Vaccinium	40.8	14.7	3.6	0.1
Forbs	-	0.6	-	0.7

[1] *Astragalus, Festuca,* fungi, *Lupinus, Peltigera, Picea, Poa, Saxifraga* and unidentified Ericaceae occurred at average frequencies of less than 1% in some sampling periods.

Eriophorum and *Salix* were more similar between Stokes Point and King Point than to Sam Lake.

Thompson and McCourt (1981) have previously reported on the diet of the Porcupine Caribou Herd based on fecal analysis. They reported that *Eriophorum* (56%) and lichens (37%) were the most important components in fecal samples in late May and that samples were dominated by *Eriophorum* (77%) in early June and by *Salix* (99%) in late June. Although the proportions of lichen in late May and *Salix* in late June are consistent with our findings, the proportions of *Eriophorum* are not; they appear high in relation to expected phenological stage, especially in late May. Duquette (1984) reported on diet of females of the Porcupine Caribou Herd based on fecal samples and found that in late (16 - 26) May samples were dominated by lichens (41%), *Salix* (22%) and evergreen shrubs (16%), with *Eriophorum* making up less than 1%. The high proportion of *Salix* is noticeably different either from that we observed (0%) or from that reported by Thompson and McCourt (1981) (0.1%). In late May, therefore, caribou of the Porcupine Herd apparently feed primarily on lichens but supplement the diet with whatever palatable green matter is available.

Summary and conclusions

In late May male caribou were distributed south of the mountains where snowmelt was more advanced than farther north. Caribou used tussock meadows, dwarf shrub heaths and alpine barrens but avoided low-lying wet sedge meadows and alluvial willow thickets where snowmelt was slower. Diet consisted primarily of lichens and evergreen shrubs which were widely distributed in the habitat types utilized. By early June, as snowmelt progressed south of the mountains and on the eastern coastal plain, males moved northward to those areas. Intermountain basins, where snowmelt was retarded, were avoided. As the season progressed males continued to use, and avoid, essentially the same habitat types but there was less use of dwarf shrub heaths. They continued to feed on lichens but began to use *Eriophorum* as it came into flower. In mid-June, males moved into intermountain basins as snowmelt there progressed. Caribou used tussock meadows and alluvial willow thickets as the diet shifted to *Eriophorum* and *Salix*. At that time, large aggregations of caribou formed in intermountain basins and they spent more time lying, less time walking, and had a lower rate of movement than in other periods. By late June, males began to use the western coastal plain where they used tussock meadows, wet sedge meadows and alluvial willow thickets. *Salix*, which was common in all three habitat types, predominated in the diet. At that time, *Salix* on the coast was at a similar phenological stage to that at inland sites 2 weeks earlier when it was not used as heavily as *Eriophorum*. However, by late June *Eriophorum* was in seed and therefore not as desirable as a food for caribou. In late June average band size increased significantly and rate of movement was greatest as males moved westward towards Alaska. As well, the mean length of active and resting periods decreased by about one-third. This sharp decrease may reflect both the high availability and high digestibility of young willow leaves.

In general, the distribution of male caribou followed the pattern of snowmelt and plant phenology and diet reflected both preference and phenologieal stage. Activity and movements, however, were not related to snowmelt, plant phenology or diet. Rather, they appeared to follow a temporal pattern.

Acknowledgements

We would like to thank the many people who helped with various aspects of the study, in particular L. Hartman and F. Jensen for their assistance with the field work. We are grateful to G. Hobson of the Polar Continental Shelf Project, Canada Department of Energy, Mines and Resources, and to P. Lewis and J. Ostrick of the Western Arctic Scientific Resources Centre, Canada Department of Indian Affairs and Northern Development, for their continued logistic support. The study was conducted while the first two authors were with the Canadian Wildlife Service, Whitehorse, and the third author was with the Department of Renewable Resources, Government of Yukon, Whitehorse.

References

Altman, J. 1974. Observational study of behaviour: sampling methods. — *Behaviour 49:227-265.*

Cochran, W. G. 1977. Sampling techniques. Third edition. — *John Wiley and Sons, New York. 444 p.*

Duquette, L. S. 1984. Patterns of activity and their implications to the energy budget of migrating caribou. — *M.Sc. Thesis, University of Alaska, Fairbanks. 95 p.*

Holechek, J. L., Vavra, M. and **Pieper, R. D.** 1982. Botanical composition determination of range herbivore diets: a review. — *Journal of Range Management 35: 309-315.*

Pearson, A. M., and **Nagy, J.** 1976. The summer climate at Sam Lake, Yukon Territory. — *Arctic 29:159-164.*

Roby, D. D. 1978. Behavioral patterns of barren-ground caribou of the Central Arctic Herd adjacent to the Trans-Alaska Oil Pipeline. — *M.Sc. Thesis, University of Alaska, Fairbanks. 200 p.*

Segal, A. M. 1962. Reindeer in the Karelian A.S.S.R. — *Soviet Academy of Sciences, Moscow. (Translated from Russian, Canadian Wildlife Service, Ottawa).*

Siegel, S. 1956. Nonparametric statistics for the behavioral sciences. — *McGraw-Hill Book Company, New York. 312 p.*

Sokal, R. R., and **Rholf, F. J.** 1969. Biometry. — *W. H. Freeman and Company, San Francisco. 776 p.*

Sparks, D. R., and **Malechek, J. C.** 1968. Estimating percentage dry weight in diets using a microscope technique. — *Journal of Range Management 21:264-265.*

Thompson, D. C., and **McCourt, K. H.** 1981. Seasonal diets of the Porcupine Caribou Herd. — *American Midland Naturalist 105:70-76.*

Viereck, L. A., and **Dyrness, C. T.** 1980. A preliminary classification system for vegetation of Alaska. — *United Sates Department of Agriculture, Forest Service, General Technical Report PNW-106. 38 p.*

Whitten, K. R., and **Cameron, R. D.** 1979. Nutrient dynamics of caribou forage on Alaska's arctic slope. — *In: Reimers, E., Gaare, E., and Skjenneberg, S. (eds.). Proceedings of the Second Reindeer/ Caribou Symposium, Røros, Norway, 1979. Direktoratet for vilt og ferskvannsfisk, Trondheim: 159-166.*

Wiken, E. B., Welch, D. M. Ironside, G. R., and **Taylor, D. G.** 1981. The Northern Yukon: an Ecological Land Survey. — *Environment Canada, Lands Directorate, Ecological Land Classification Series No. 6. 197 p.*