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DEVELOPMENT AND ALTERATION OF CARIBOU MOVEMENT PATTERNS

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Progress Report
Federal Aid in Wildlife Restoration
Project W-22-2, Job 3.29R

(Printed June 1984)

PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: None

Project No.: W-22-2 Project Title: Big Game Investigations

Job No.: 3.29R Job Title: Development and Alteration of Caribou Movement Patterns

Period Covered: 1 July 1982 through 30 June 1983
(additional data included for January-June 1982)

SUMMARY

Progress made on tracking radio-collared female caribou (Rangifer tarandus granti) and radio-collaring their offspring is summarized. Future fieldwork is described, and sample sizes for each year are projected through spring 1987.

During the calving periods in 1982 and 1983, most radio-collared cows were found within 50 km of the arctic coast, distributed among 4 distinct areas. However, relatively more of the collared cows remained inland during calving in 1982 (8 of 23) than in 1983 (1 of 25). Distribution is apparently related to the pattern of spring snow cover and flooding within the coastal zone.

Crossings of the Trans-Alaska Pipeline Corridor/Prudhoe Bay Complex by radio-collared caribou were infrequent. Between June 1982 and June 1983, only 15 crossings by 11 individuals were detected (of 196 total relocations involving 31 radio-collared cows).

In June 1982 and 1983, 86 and 80%, respectively, of the radio-collared cows were accompanied by calves. Subsequent resightings of the 1982 cohort indicated 48% calf survival through March 1983.

Reasons for continuing this research program through 1987 are discussed.

Key words: caribou, movement patterns, Prudhoe Bay Complex, Rangifer tarandus granti, Trans-Alaska Pipeline Corridor.

CONTENTS

BACKGROUND

Caribou (Rangifer tarandus granti) surveys conducted along the Trans-Alaska Pipeline (TAP) Corridor and within the Prudhoe Bay Complex (PBC) between 1975 and 1982 yielded overall calf percentages which, with 1 exception, were substantially lower than corresponding regional estimates (Cameron and Whitten 1980; Cameron et al. 1979, 1983, unpubl. data; Smith and Cameron 1983). We interpret these results as avoidance of disturbed areas by cows and calves.

Given that female caribou and their calves respond negatively to certain combinations of development and human activity, one might logically predict that increasing disturbance would further deter cows and calves, with decreasing local representation. Conversely, a diminution of adverse stimuli should encourage reoccupancy of areas previously avoided. In addition, repeated exposure to disturbance might result in some degree of accommodation or habituation by some cow/calf bands.

The above premises are not supported by available data. Despite a net decrease in disturbance within the TAP Corridor/PBC after 1976 (Cameron and Whitten 1980, Cameron et al. 1983), local calf representation remained abnormally low (Cameron et al. 1983). Thus, cow/calf reoccupancy did not occur in response to a seemingly more favorable local environment. Similarly, there was apparently no accommodation to the relatively stable disturbance conditions within the corridor after 1976, although the fact that cows and calves did not totally abandon the area suggests that some individuals can tolerate--or readily accommodate to--certain adverse stimuli.

The central point is that an increase in local calf representation did not accompany the decline in development activity between 1976 and 1982. Possibly even the lowest of disturbance levels characterizing the corridor in recent years is above the avoidance threshold. It is also conceivable that, once displaced, caribou modify their seasonal movement patterns, which tend to persist as new traditions. Such changes might be

initiated by adult cows and sustained by their female offspring. Hence, components of range, once abandoned, may not be reoccupied for many years after the withdrawal of industrial activity, and perhaps only then by chance.

This study was designed primarily to determine the mechanisms by which patterns of caribou movement are established and subsequently sustained or altered. An understanding of these processes will assist in projecting the effects of industrial development in terms of the probable extent and minimum duration of habitat loss. Preliminary work was begun in 1981, and this report is a brief update of progress made through mid-1983 and a presentation of plans for future fieldwork.

OBJECTIVES

To evaluate the degree to which the seasonal movements of individual adult caribou are influenced by their 1st-year movements as calves.

To identify and describe any disturbance-related alteration of seasonal distribution and movements of such caribou.

To determine sexual differences in the development of caribou movement and dispersal patterns, social relationships, habitat preferences, and range fidelity.

PROCEDURES

In April 1982, 20 adult female caribou and 2 short yearlings (i.e., ca. 10 mo of age) were radio-collared on the central Arctic Slope (Whitten and Cameron 1983); 1 cow died shortly thereafter, and another has not been sighted since. The remaining individuals, together with 11 cows collared previously, were radio-tracked between June 1982 and June 1983 using standard techniques (Whitten and Cameron 1983). In March 1983, 1 additional cow and 7 short yearlings (offspring of radio-collared cows) were equipped with transmitters and relocated in April and June 1983.

As of June 1983, 29 adult females; 2, 2-year-olds; and 7 yearlings carried functional transmitters (Table 1). During the previous year, 24 of the collared cows, including those whose calves were collared in March 1983, were located at least 6 times. Hence, the 1st comparisons of calf vs. yearling movements will be possible in June 1984.

Five fewer adult females will be available for tracking in 1983-84. Two radio collars failed in July 1983 (RY 1, RY 83), an additional one is due to expire, and 2 others were not relocated in June or July 1983. Of the remaining 24 cows, 18 had calves at

heel in midsummer 1983. Those calves surviving the winter will be radio-collared in March 1984 and located regularly through June 1987. Collared cows without calves will be tracked for the life of their transmitters (Table 1).

Based on some assumptions regarding rates of mortality and transmitter failure, we can project various sample sizes through the 1986-87 field season (Table 2). A minimum of 14 chronological comparisons for adults will be possible (i.e., 1983-84 vs. 1984-85); incomplete 1981-82 data on 14 collared caribou (12 of which are listed in Table 1) should also be useful. Otherwise, by 1987, we anticipate having complete 4-year movement data on at least 11 individual caribou (4 from the 1982 cohort, 7 from the 1983 cohort), from birth through their 3rd year of life. Considerable partial information can be obtained on those individuals which, for various reasons, do not remain available for all 3 years.

FINDINGS AND DISCUSSION

Resighting information to date is insufficient for a detailed analysis of calf vs. yearling movements. Only 2 short yearlings were radio-collared in 1982 (BY 9, BY 10; Table 1) and, unfortunately, the 1st-year relocations of these individuals were too infrequent for valid between-year comparisons. Although we are not yet able to address the primary objectives of this study, the following observations on distribution, movements, and productivity of collared CAH cows are noteworthy.

The distribution of radio-collared cows during the calving period (ca. 1-20 Jun) was somewhat different in 1982 and 1983. Relocations were made on 17-22 June and 22-23 June, respectively, 7-12 days after the estimated peak of calving (Cameron and Whitten 1978). Of 23 collared cows relocated in June 1982, 15 were within 50 km of the arctic coast, distributed among 4 distinct areas: between the lower Canning and Kavik Rivers, the Milne Point/Kuparuk River area, the vicinity of the upper Miluveach/Ugnuravik Rivers, and between the Sagavanirktok and lower Toolik Rivers. The remaining 8 cows were scattered farther inland, from the south edge of Franklin Bluffs to Happy Valley Camp. In contrast, during this period in 1983, 24 of 25 radio-collared cows were distributed among the same 4 areas of the coastal plain, and only 1 individual was found inland, in this case near Sagwon.

Between-year differences in calving distribution are apparently related to spring snow cover, the progress of snow melt, and/or the extent of flooding within the coastal zone (Cameron et al. 1983). Hence, with persistent snow cover and extensive flooding in June 1982, approximately one-third of our radio-collared cows calved 50 km or more inland, whereas with an early, dry spring in 1983, virtually all of the collared cows were found within a

narrow coastal band. This annual variability emphasizes the importance of alternative calving habitats inland, as well as those on the coastal plain that are occupied repeatedly by the majority of Central Arctic Herd (CAH) cows.

Despite weather-related variations in the use of the coastal plain for calving, the relative distribution of parturient females within 50 km of the coast has been remarkably similar in recent years. Calving caribou have been consistently most numerous in the Milne Point/Kuparuk and Canning/Kavik regions, in moderate numbers in the Miluveach/Ugnuravik and Sagavanirktok/Toolik areas, and in lower density elsewhere. The "preferred" status of these specific areas implies a net benefit to caribou in terms of calving success and/or early postnatal calf survival. Perhaps such advantages are subtle, emerging only when caribou are unusually vulnerable (e.g., following a particularly severe winter or when frequent storms occur during the calving period).

Calf production among radio-collared cows was high in both 1982 and 1983. Overall, 86 and 80%, respectively, of collared cows relocated in June were accompanied by calves.

Relatively few radio-collared caribou crossed the TAP Corridor/PBC between June 1982 and June 1983. Of 196 total relocations (31 radio-collared cows), only 15 indicated that a crossing had occurred; 7 individuals crossed once and 4 crossed twice (Table 3). The majority of crossings took place in either early fall or early spring, typically periods of greatest latitudinal movement of the CAH (Cameron and Whitten 1979).

Sighting data for calves of radio-collared cows indicate excellent summer survival and moderate overwinter survival. Of 23 cows accompanied by calves in June 1982 (either observed or inferred from sightings in August), 19 were accompanied by calves in late September and 11 still had calves present in late March 1983, denoting oversummer and overwinter survival values of 83 and 58%, respectively, or 48% overall. Given an estimated initial calf production of 86 calves/100 cows (see above), this translates to a spring calf:cow ratio of 41 calves:100 cows, somewhat lower than the results of direct counts of the CAH in April 1983 (ca. 50 calves/100 cows, $\bar{N}$ = 1,045; R. Cameron, unpubl. data). Nevertheless, both data sets are within the range of estimates obtained previously for the CAH (32-60 calves/100 cows; Cameron et al. 1982, 1983) and indicate continued good recruitment.

RECOMMENDATIONS

This study is now scheduled to continue through spring 1987. Unfortunately, 1982-83 mortality among calves born to collared cows was higher than expected and, consequently, only 7 of the 1982 cohort were collared in March 1983. If, by March 1984,

fewer short yearlings or collared 2-year-olds are available than projected (Table 2), additional cows (perhaps 10-12) should be radio-collared, tracked for 1 year, and their offspring collared in 1985. This would extend the program for yet another year.

Aside from the necessity of maintaining an adequate sample of radio-collared caribou for this study, there are compelling reasons for continuing the project beyond the original termination date:

1. If oil development between the Colville and Kuparuk Rivers continues to expand and intensify at a rapid rate, partial or total abandonment of the Milne Point calving grounds is likely. Continued relocations of known-age radio-collared caribou that now occupy the area will permit proper documentation of displaced calving and an assessment of any related changes in reproductive success.

2. Similarly, it should be possible to evaluate losses of summer habitat by examining changes in the distribution of radio-collared caribou.

3. The concept of developing a strategic plan to preserve caribou movements in the Colville/Kuparuk oil field region has received considerable attention recently. Frequent relocations of radio-collared caribou would be essential in identifying and assessing the importance of various movement zones.

4. Accurate alternate-year censuses of the CAH are necessary to determine if and when a population response to oil development occurs. Radio-collared caribou are extremely useful in precensus monitoring of postcalving aggregations, and routine relocations are necessary to ensure that all groups are subsequently photographed and/or counted.

5. Periodic relocation of radio-collared cows to record the presence or absence of calves provides a valuable data supplement to standard determinations of calf production and survival.

6. Maintaining a moderate number of radio-collared individuals is useful for opportunistically monitoring seasonal movement, sexual segregation, range occupancy/fidelity, the incidence of emigration/immigration, and for studying functional relationships specific to various phases of the caribou annual cycle (e.g., insect-induced movements, distribution vs. snow conditions).

ACKNOWLEDGMENTS

Primary funding for this study was provided by the Alaska Department of Fish and Game through Federal Aid in Wildlife Restoration Project W-22-2. Supplemental support was obtained from the U.S. Fish and Wildlife Service (Arctic National Wildlife Refuge). We are grateful to J. R. Dau for skilled technical assistance.

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Table 1. Status of radio-collared caribou in the Central Arctic Herd, summer 1983.

Collar No.	Sex	Year collared	Relocation attempts (mo/yr)[a] 6/82	7/82	8/82	9/82	11/82	3/83	4/83	6/83	Calf produced in 1983[b]	Plans[c]/remarks 83/84	84/85	85/86	86/87
RY1	F	1982	X			X	X	X	X	X	+	Transmitter failed 7/83			
RY2	F	1981	X	X	X	X	X	X	X	X	-	T			
RY5	F	1981	X			X	X	X	X		?	T			
RY6	F	1982		X	X	X	X	X	X	X	+	T/Cca	T/Tca	Tca	Tca
G2	F	1983						C	X	X	N/A	T	T	T	
RY8	F	1981		X	X	X	X	X	X	X	+	T/Cca	Tca	Tca	Tca
RY9	F	1981	X		X	X				X	+	T/Cca	Tca	Tca	Tca
RY10	F	1981	X	X	X	X	X				?	T			
RY11	F	1981		X	X	X	X	X	X	X	+	T/Cca	Tca	Tca	Tca
G4	M	1983						C	X	X	N/A	T	T	T	
RY12	F	1981	X	X	X	X	X	X	X	X	+	T/Cca	Tca	Tca	Tca
G6	F	1983						C	X	X	N/A	T	T	T	
RY13	F	1982	X			X	X	X	X		-	T	T		
RY14	F	1981		X		X	X	X	X	X	+	T/Cca	Tca	Tca	Tca
G5	F	1983						C	X	X	N/A	T	T	T	
RY15	F	1981		X	X		X	X	X	X	+	T/Cca	Tca	Tca	Tca
G8	M	1983						C	X	X	N/A	T	T	T	
RY17	F	1982	X	X	X	X	X	X	X	X	+	T/Cca	T/Tca	Tca	Tca
RY19	F	1982	X	X	X	X		X	X	X	-	T	T		
RY20	F	1982	X	X	X		X	X	X	X	+	T/Cca	T/Tca	Tca	Tca
G3	F	1983						C	X	X	N/A	T	T	T	
RY52	F	1982	X	X	X	X	X	X	X	X	+	T/Cca	T/Tca	Tca	Tca
RY53	F	1982				X	X	X	X		?	T	T		
RY54	F	1982	X			X	X	X	X	X	+	T/Cca	T/Tca	Tca	Tca
RY55	F	1982	X	X	X	X		X	X	X	-	T	T		
RY56	F	1983						C	X	X	+	T/Cca	T/Tca	T/Tca	Tca
RY57	F	1982	X	X	X	X	X	X	X	X	+	T/Cca	T/Tca	Tca	Tca
RY58	F	1982	X	X	X	X	X	X	X	X	+	T/Cca	T/Tca	Tca	Tca
RY59	F	1982		X	X	X	X	X	X	X	+	T/Cca	T/Tca	Tca	Tca
RY60	F	1982	X	X		X	X	X	X	X	+	T/Cca	T/Tca	Tca	Tca
RY61	F	1982	X	X	X	X	X	X	X	X	-	T	T		

Table 1. Continued.

Collar No.	Sex	Year collared	Relocation attempts (mo/yr)[a] 6/82	7/82	8/82	9/82	11/82	3/83	4/83	6/83	Calf produced in 1983[b]	Plans[c]/remarks 83/84	84/85	85/86	86/87
RY68	F	1982	X		X		X	X	X		+	T/Cca	T/Tca	Tca	Tca
RY81	F	1982		X	X	X	X				?	T	T		
RY82	F	1980	X	X	X	X		X	X	X	+	Transmitter will expire			
RY83	F	1981	X	X	X	X	X	X	X	X	+	Transmitter failed 7/83			
G7[d]	F	1983						C	X	X	N/A	T	T	T	
BY9[e]	M	1982	X	X	X	X	X	X	X	X	N/A	T	T		
BY10	F	1982	X	X	X	X	X	X	X	X	-	T	T		
YB17	F	1982		X						X	+	T/Cca	T/Tca	Tca	Tca
YB48	F	1982		X		X	X	X	X	X	-	T	T		

[a] X = Relocated.
C = Collared.

[b] + = yes; - = no.

[c] T = Track individual.
Cca = Collar offspring of individual.
Tca = Track offspring of individual.
NOTE: Collared caribou designated "G" are offspring of the preceding collared cows.

[d] Offspring of RY18 (dead 6/82); collared as short yearling.

[e] Offspring of RY80 (transmitter failed 11/82); collared as short yearling.

Table 2. Projected numbers of radio-collared caribou by year of study.

Age status	Study year 1983/84	1984/85	1985/86	1986/87
Adult (3+ yrs) females[a]	21[b]	14[c]	1[d]	0
w/calf	16	--	--	--
w/o calf	5	--	--	--
Yearlings[e]	6	9[f]	0	0
2-year-olds[a]	2	5	8	0
3-year-olds[a]	0	2	4	7

[a] Assuming 10% annual mortality or transmitter failure.
[b] As of summer 1983, excluding those not located June-August.
[c] Collared in 1982 or 1983.
[d] Collared in 1983.
[e] Assuming 20% annual mortality or transmitter failure.
[f] Assuming 30% 1st-year mortality of 1983 cohort.

Table 3. Movements of radio-collared adult (3+ yrs) female caribou across the Trans-Alaska Pipeline Corridor or through the Prudhoe Bay Complex, June 1982-June 1983.

Collar No.	No. of relocations[a]	Location[b] Initial	Final	Remarks
RY 1	6	W	E	E by 9/82
RY 2	8	E	E	
RY 5	8	E	E	W by 9/82, E by 11/82
RY 6	7	(W)	W	
RY 8	7	(E)	W	W by 4/83
RY 9	4	W	W	
RY 10	5	W	(W)	
RY 11	7	(E)	W	W by 6/83
RY 12	8	E	E	
RY 13	5	W	(W)	E by 11/82, W by 4/83
RY 14	6	(E)	E	
RY 15	6	(E)	E	
RY 17	8	W	E	E by 8/82
RY 19	7	W	W	
RY 20	7	W	W	E by 7/82, W by 6/83
RY 52	8	E	E	
RY 53	4	(W)	(W)	
RY 54	6	E	E	
RY 55	7	W	W	
RY 56[c]	2	E	E	
RY 57	8	E	E	
RY 58	8	W	E	E by 4/83
RY 59	7	(E)	W	W by 9/82
RY 60	7	E	E	
RY 61	8	W	W	
RY 68	5	E	(E)	
RY 81	4	(E)	(W)	W by 9/82
RY 82	7	E	E	W by 9/82, E by 4/83
RY 83	8	E	E	
YB 17	2	(W)	W	
YB 48	6	(W)	W	

[a] See Table 1.

[b] E (east) or W (west) of the Dalton Highway or its extension through the Prudhoe Bay Complex (Cameron et al. 1979).
( ) = assumed, based on previous or subsequent sighting.

[c] Collared March 1983.