

Survival, Natality, and Calf Weights of Caribou
on the Alaska Peninsula, 1998-1999

Final Report

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by

RICHARD A. SELLERS, Alaska Department of Fish and Game, PO Box 37, King
Salmon, AK 99613-0037, USA

PATRICK VALKENBURG, Alaska Department of Fish and Game, 1300 College Road,
Fairbanks, AK 99701-1599, USA

RONALD C. SQUIBB, US Fish and Wildlife Service, PO Box 277, King Salmon, AK
99613, USA

MICHAEL ROY, US Fish and Wildlife Service, PO Box 127, Cold Bay, AK 99571,
USA

BRUCE DALE, Alaska Department of Fish and Game, 1800 Glenn Highway, Suite 4,
Palmer, AK 99645, USA

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Abstract: In 1999, 93% and 77% of caribou (*Rangifer tarandus*) cows ≥ 2 years old were pregnant in the Southern Alaskan Peninsula (SAP) and Northern Alaskan Peninsula (NAP) caribou herds, respectively. Weights of neonatal calves were not different between the 2 herds or between calves from the NAP in 1999 versus 1998. Calves from the SAP were heavier in 1999 than in 1989. Through 18 June 1999, 11 of 49 (22%) radiocollared calves died. By 26 June, another 11 calves died; and by 23 August 6 more were dead, resulting in an overall loss of 66%. Predators, primarily wolves (*Canis lupus*) and brown bears (*Ursus arctos*), killed most of the calves for which the cause of death could be determined.

Key words: Alaska, brown bear, *Canis lupus*, calf mortality, caribou, natality, predation, *Rangifer tarandus*, survival, *Ursus arctos*, wolf.

INTRODUCTION

Historically, the distinctness of caribou herds on the Alaska Peninsula has been nebulous. Skoog's (1968) review of early observations suggests that the Alaska Peninsula might harbor one fluctuating and intermingling herd, but he also suggests the possibility of 3 herds: those north of Port Moller, those in present Unit 9D, and those on Unimak Island. This discussion reflects the difficulty in defining what constitutes a herd.

During expeditions of 1773-1840, Russian explorers noted caribou on several islands off the southern end of the Alaska Peninsula, including Deer, Unga, Amak, and Unimak (references in Skoog 1968). Interchange of caribou between the Unimak Islands and the mainland was documented during the early 1900s (O.J. Murie 1935, Madsen 1916: in Skoog 1968) and by commercial fishermen in the mid 1970s (ADF&G files).

Caribou numbers in Unit 9D and on Unimak have fluctuated widely, but not synchronously. In 1925 Murie (in Skoog 1968) estimated 5,000 caribou between Port Moller and the tip of the Alaska Peninsula and another 7,000 on Unimak Island. By 1949 the FWS estimated 500 caribou on the mainland. Surveys in 1949 and 1953 by the FWS reported no caribou on Unimak Island; but by 1960 Skoog (1968) reported "1,000 south (of Port Moller), most ... being on Unimak Island". By 1975 the SAP had increased to at least 2,267 in 9D and 3,334 on Unimak Island (Irvine 1976). The winter of 1975-76 was severe and reports of dead caribou on the island suggested a die off. Conceivably emigration from Unimak could have contributed to population growth in Unit 9D during the late 1970s. By the early 1980s, only a few hundred caribou remained on Unimak. Meanwhile the mainland segment grew continuously to peak at 10,200 by 1983 (FWS unpublished data).

The NAP reached peaks at the turn of the century, the early 1940s, and during the 1980s and early 1990s. During the late 1980s and early 1990s, liberal hunting regulations were maintained to reduce the herd to the lower limit of the population objective (15,000) because evidence suggested the traditional range could not sustain 20,000 caribou. During 1993-1994, the herd declined from about 15,000 to about 12,500 and then underwent a continued gradual decline to about 9,200 by 1998 (Sellers and Squibb 1998). There are indications that NAP caribou are now undernourished and may be more vulnerable to parasitism and predation than caribou in herds where nutrition is good (Sellers et al. 1998).

METHODS

Beginning 2 June 1999, we periodically observed radiocollared NAP and SAP females from a Bellanca Scout or Robinson R-44 helicopter to determine age-specific natality rates. During 2-8 June we surveyed caribou of the NAP and SAP herds (including a sample from Unimak Island) to determine the proportion of parturient females in the herd. From 3-13 June we captured 1-2 day old caribou calves by hand after a close approach by helicopter. To reduce chances of abandonment, we generally only caught calves that were already dry (at least several hours old) and ones that were not in groups with other caribou. We weighed calves with a spring scale, determined their sex, and radiocollared those from the SAP. We monitored radiocollared calves

from the air at least daily through 18 June to determine the timing and causes of mortality. We also recorded observations of predators on the calving area. Follow-up radiotelemetry flights were made during 26-29 June in conjunction with the post-calving photo count and on 23 August.

We used t-test to compare weights between areas and years. Survival rates were calculated using the Kaplan-Meier method (Pollock et al. 1987)

RESULTS

Survival of Females Captured in Fall 1998

Of 19 female calves and 2 female yearlings collared in October 1998 from the NAP, only 6 calves (29%) survived to June 1999. Survival of 13 calves and 1 yearling collared during the same capture operation from the SAP in Unit 9D was 93%, and was significantly higher ($\chi^2 = 14.0$, $P < 0.001$) than for the NAP. Because radiocollars were not retrieved until June 1999, evidence of the cause of death was scant. In a few cases collars may have been shed since remains of carcasses were not found. However, it seems unlikely that more caribou from the NAP would drop collars as compared to the SAP. Most deaths from the NAP occurred on winter range, ruling out bear predation in most cases. Evidence of wolf activity was present at several carcasses, but we could not confirm whether predation or merely scavenging occurred.

In October 1998 we put satellite radio collars on 6 adult females from the NAP and 8 from the SAP near the border between Units 9E and 9D (Sellers et al. 1998b). By June 1999, 3 (50%) NAP and 2 (25%) SAP cows had died.

Parturition Surveys

Of the 13 collared NAP caribou >2 years old that were located, 12 were found on traditional calving range from Cinder River south to Port Moller, and 1 was found on the Pacific side of the Aleutian Mountains (Table 1). Of 6 three-year-olds, 3 were pregnant (including 1 that apparently died during birth) based on presence of hard antlers or distended udder, but none was accompanied by a calf. Eighty-six percent of cows ≥ 4 years old ($n = 7$) were pregnant (Table 1). Three-year-old cows from the SAP were significantly ($P = 0.04$, $\chi^2 = 4.04$, d.f. = 1) more productive as 11 of 12 were pregnant and 9 were accompanied by calves (Table 2). The pregnancy rate for older cows in the SAP was similar (80%) to that seen in the NAP.

Since radiocollaring of known aged cows began in 1996, no 2-year-olds ($n = 25$ from the NAP and 12 from the SAP) have produced calves (Table 3). In the NAP, only 33% of 3-year-olds ($n = 18$) have been pregnant. In 1999, 92% of 3-year-olds from the SAP were pregnant. Unfortunately we are not able to compare the age at first calving in the SAP during the period of population decline during 1984-93 because only mature cows were radiocollared. Nevertheless, the high proportion of 3-year-olds in the SAP now producing calves is consistent with other indications of better body condition, probably as a result of improving range.

Of 965 caribou counted during parturition surveys of the NAP, 15 were bulls and 84 (9%) were judged to be yearling cows. Seventy seven percent of cows ≥ 2 years old were parturient (Table 4). As in past years, the northern portion of the NAP calving area had a lower percentage of parturient females than the main calving area between the Ilnik and Bear Rivers (Table 4).

Parturition rate was higher in the SAP than in the NAP in June 1999 $P < 0.001$, $\chi^2 > 10$, d.f. = 1). Of 524 caribou classified during the SAP parturition surveys, 60 were bulls and 122 (26%) were yearling cows (Table 4). The difference in the yearling cohort between these 2 herds is attributed to very good calf production by the SAP in 1998 and good survival. In contrast, the NAP had average production in 1998 and extremely high mortality of yearlings over winter (see above). Overall, 93% of SAP cows ≥ 2 years old were parturient (Table 4), and there was no difference in pregnancy rate between the Caribou River Flats (CRF) (88%, $n = 146$) and Black Hill/Trader Mountain (BHTM) (96%, $n = 196$) calving areas. However, peak of calving occurred earlier on the CRF, where 30% of the parturient cows were accompanied by calves on 4 June, compared to the BHTM area where only 21% already had calves.

Calf Weights

Newborn calves from the NAP weighed about the same in 1998 and 1999 (Table 5). Male calves from the 1999 NAP sample were slightly heavier than males from the 1999 SAP ($P = 0.09$) but there was no difference for females ($P = 0.36$). Weights of calves from the SAP were significantly heavier ($P = 0.09$ for males and 0.01 for females) in 1999 than recorded in 1989 (Table 5). There was no difference in average weights of SAP males or females from the CRF versus BHTM calving areas ($P = 0.19$ for males and 0.47 for females).

SAP Calf Survival

Of the 52 calves collared between 3 and 12 June 1999, 4 did not reunite with their mothers and consequently were censored from the study. One calf (1.210) was discovered the day after capture stranded in a deep, steep-sided "sink hole" with its mother standing nearby. This calf certainly would have drowned if we had not rescued it, so we counted it as a mortality and reentered it as a new animal. Thus the total sample size for calculating survival rates was 49 calves, including 11 males and 14 females from CRF and 12 males and 12 females from BHTM. By 26 June, 1999 22 (45%) had died, and by 23 August 1999 another 6 were dead. We used the Kaplan-Meier technique to calculate survival rates during 4 time periods for each sex in each calving area (Table 6). Females in the CRF showed a higher survival rate (0.623) compared to the other 3 groupings (range 0.222 - 0.333, Table 6). Combining sexes, calves captured in the BHTM area had lower survival during June ($P = 0.08$) than calves from the CRF.

As in the NAP in 1998, calf mortality in the SAP was prolonged, with 61% of deaths occurring after June 18 (Sellers et al. 1998).

Causes of death: Through 18 June we checked the status of collared calves daily, and were able to ascertain the cause of death for the first 11 mortalities: wolves – 4, brown bears – 3, wolverine – 1, eagle – 1, drowning – 2 (Table 8). Calves were checked next on 26 June, by which time 11 more had died. Birds had scavenged most of these late mortalities, and we could not be confident about the cause of death of 9; 2 were killed by wolves.

Abundance of predators on NAP and SAP calving areas: In contrast to caribou calving areas in interior and arctic Alaska, both the NAP and SAP calving areas had few golden eagles (*Aquila chrysaetos*) and large numbers of bald eagles (*Haliaeetus leucocephalus*). We saw only 4 golden eagles in the NAP calving area in 1998, and only 1 on the SAP calving area in 1999. Most of the bald eagles on both calving areas were concentrated along the beach, where they were apparently scavenging and awaiting the arrival of spawning fish. Few NAP or SAP calves were killed by eagles. We only saw 1 wolf on the NAP calving area in 1998. On the smaller SAP calving areas, in 1999 a pack of at least 3 adult wolves was found at a den along the Caribou River within 25 kilometers of all the major calving groups. At least 2 pups were at the den in mid June, but when we found the adults in October 1999, no pups were seen. Brown bears were common on both calving areas, and bear densities are probably higher on the NAP and SAP calving areas than on any other calving area in Alaska.

DISCUSSION

The SAP exhibited chronic low productivity during the 1980s which, in conjunction with high natural mortality of adult cows, caused the population decline. The possibility of nutritional stress in the SAP decline was posed by Sellers (1988) based on subjective assessment of body condition of adult cows captured in 1987 and later spring plant development between the NAP and SAP primary calving areas. This hypothesis was confirmed when Pitcher (1990) documented low calf weights in 1989 and Post and Klein (1999) observed late plant emergence, particularly on the BHTM. Improvement in productivity was first noted in 1994 when calves made up 21% of caribou seen during the post-calving counts (Sellers 1995).

Mortality of newborn calves during the first 3 weeks of life in this study was relatively low. In other herds early mortality during the first 3 weeks to 1 month of age has ranged from 20–85% (Whitten et al. 1992; Adams et al. 1995; Jenkins 1996; Valkenburg 1997; Boertje and Gardner 1998). Given the relatively high density of brown bears on the calving area (Miller and Sellers 1992), it was somewhat surprising that bears did not kill more newborn calves.

Post and Klein (1999) discussed various possibilities that might account for a lower proportion of calves among caribou in the BHTM calving area compared to the CRF area. They had limited data on parturition and mortality rates to evaluate. We found no difference in percent of parturient cows between the two areas. Nor was there any difference in calf weights between the CRF and BHTM areas. These results argue against a difference in nutritional condition of cows between the 2 core calving areas. Calves on the CRF had a slightly higher survival rate, which may reflect better postpartum nutrition or lower predation rates.

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Table 1. Age, pregnancy status, and location of female radiocollared caribou in the Northern Alaska Peninsula caribou herd in early June 1999.

Visual Collar	Age	Pregnancy indicator			Latitude	Longitude	Location
		Hard antlers	Distended udder	With calf			
R39	3	No	No	No	57° 10.68'	157° 48.85'	Cinder River
R16 ^a	3	Yes	Yes		57° 06.15'	158° 16.78'	Cinder River
R42	3	Yes	Yes	No	56° 00.69'	160° 19.39'	Bear Lake
R93	3	Yes	Yes	No	56° 41.66'	158° 14.97'	Meshik
R19	3	No	No	No	56° 01.77'	160° 18.10'	Sandy River
O11	3	No	Yes	No	56° 34.25'	159° 27.48'	Ilnik
R70	4	No	Yes	No	56° 57.93'	157° 29.10'	Amber Bay
R27	4	No	Yes	No	56° 32.13'	159° 32.48'	Ilnik
B15	>4			Yes	56° 13.26'	160° 22.29'	Sandy River
O71	>4			Yes	56° 32.26'	159° 32.48'	Ilnik
O75	>4			Yes	57° 23.56'	157° 52.20'	Cinder River
O74	>4	No	No	No	56° 12.07'	160° 12.93'	Sandy River
O27 ^b	>4			Yes			

^a Died at parturition

^b Nonfunctioning radio

Table 2. Age, pregnancy status, and location of female radiocollared caribou in the Southern Alaska Peninsula caribou herd in early June 1999.

Visual Collar	Age	Pregnancy indicator			Latitude	Longitude	Location
		Hard antlers	Distended udder	With calf			
B25	2	No	No	No	55° 50.61'	161° 42.34'	Caribou River Flats
G58	3			Yes	55° 44.42'	161° 23.05'	Caribou River Flats
G81	3	Yes	Yes	No	55° 43.96'	161° 54.47'	Black Hill
G19	3			Yes	55° 48.72'	161° 21.38'	Caribou River Flats
G54	3			Yes	55° 11.00'	162° 22.00'	Joshua Green
G79	3			Yes	55° 45.60'	161° 20.66'	Caribou River Flats
G80	3			Yes	55° 41.57'	161° 23.93'	Caribou River Flats
G86	3	Yes	No	No	55° 52.70'	161° 44.09'	Caribou River Flats
B15	3			Yes	55° 36.16'	161° 54.29'	Trader Mountain
0.33	3			Yes	54° 39.75'	164° 22.85'	Unimak Island
0.67	3	No	No	No	54° 52.60'	163° 52.49'	Unimak Island
0.72	3			Yes	54° 40.00'	164° 04.00'	Unimak Island
1.93	3			Yes	54° 51.18'	163° 34.40'	Unimak Island
B30 ^a	>4			Yes			Black Hill
B17 ^a	>4			Yes			Caribou River Flats
B24 ^a	>4	No	No	No	55° 33.77'	161° 45.37'	Trader Mountain
B28	>4			Yes	55° 42.07'	161° 59.77'	Trader Mountain
B29	>4			Yes	55° 40.61'	161° 47.57'	Caribou River Flats

^a Visual without functional radiocollar.

Table 3. Pregnancy rate of known aged cows in the Northern and Southern Alaska Peninsula caribou herds.

Year	2-year-olds		3-year-olds		≥4-years-old	
	Not pregnant	Pregnant (%)	Not pregnant	Pregnant(%)	Not pregnant	Pregnant (%)
Northern Alaska Peninsula herd						
1996	15	0 (0)				
1997	4	0 (0)	6	2 (25)		
1998	6	0 (0)	3	1 (25)	2	8 (80)
1999	0	0	3	3 (50)	1	6 (86)
Total	25	0 (0)	12	6 (33)	3	14 (82)
Southern Alaska Peninsula herd						
1998	12	0 (0)				
1999	1	0 (0)	1 ^a	11 (92)	1	4 (80)
Total	13	0 (0)				

^a Includes 4 caribou from Unimak Island.

Table 4. Parturition survey of the Northern and Southern Alaska Peninsula caribou herds, June 1999.

Area	Females ≥ 2 years old					Female yearling	Bull	Total
	Parturient			Not parturient	% parturient			
	W/calf	Hard antlers	Distended udder					
Northern Alaska Peninsula herd								
Cinder River	141	78	56	130	68	52	11	468
South of Port Heiden	202	149	44	66	86	32	4	497
Total	343	227	100	196	77	84	15	965
Southern Alaska Peninsula herd								
Caribou River Flats	39	70	20	17	88	65	37	248
Black Hill/Trader Mountain	40	129	20	7	96	57	23	276
Total	79	199	40	24	93	122	60	524

Table 5. Weights of newborn calves from Alaskan Peninsula Herds.

Herd and year	Males			Females		
	Weight (kg)	S $\bar{x}$	N	Weight (kg)	S $\bar{x}$	N
NAP 1998	8.44	0.24	19	7.17	0.30	20
NAP 1999	8.35	0.25	22	7.41	0.24	22
SAP 1989 ^a	6.67	0.67	8	5.44	0.57	9
SAP 1999	7.70	0.28	25	7.14	0.16	29

a Data from Pitcher (1991).

Table 6. Kaplan-Meier survival rates for neonatal caribou calf in the Caribou River Flats and Black Hill/Trader Mountain area.

Date	Caribou River Flats						Black Hill/Trader Mountain					
	Females			Males			Females			Males		
	At risk	Died	Survival Rate	At risk	Died	Survival Rate	At risk	Died	Survival Rate	At risk	Died	Survival Rate
3 Jun - 7 Jun	10	0	1.000	10	2	0.800	9	1	0.889	8	0	1.000
8 Jun - 12 Jun	14	1	0.929	9	3	0.533	11	0	0.889	12	2	0.833
13 Jun - 18 Jun	13	1	0.857	6	0	0.533	11	0	0.889	10	1	0.750
19 Jun - 26 Jun	11	0	0.857	6	1	0.444	11	5	0.485	9	5	0.333
27 Jun - 23 Aug	11	3	0.623	2	1	0.222	4	2	0.243	6	0	0.333

Table 7. Fate of radiocollared calves from the Southern Alaska Peninsula caribou herd, 1999.

Date captured	Calf identity	Sex	Capture			Date when found dead	Cause of death
			Location ^a	Latitude	Longitude		
3 Jun	1.050	m	CRF	55 39.58	161 29.53	6 Jun	wolf
3 Jun	1.210	m	CRF	55 41.16	161 43.00	4 Jun	drown
3 Jun	1.220	f	CRF	55 47.85	161 25.07		
3 Jun	1.230	m	CRF	55 44.09	161 38.01	26 Jun	unk
3 Jun	1.290	f	CRF	55 36.94	161 39.05		
3 Jun	1.300	f	CRF	55 47.22	161 25.40		
3 Jun	1.310	m	CRF	55 41.10	161 36.49	8 Jun	wolf
3 Jun	1.320	m	CRF	55 48.70	161 31.99	23 Aug	unk
3 Jun	1.350	f	CRF	55 48.91	161 32.79		
3 Jun	1.390	m	CRF	55 39.97	161 22.26		
4 Jun	1.070	m	TM	55 36.44	161 58.36		
4 Jun	1.140	f	TM	55 37.26	161 52.45		
4 Jun	1.210	m	CRF	55 41.16	161 43.00		
4 Jun	1.240	f	TM	55 36.04	161 56.27	26 Jun	unk
4 Jun	1.250	m	BH	55 31.89	161 58.05		
4 Jun	1.260	m	BH	55 37.27	162 04.50	8 Jun	eagle
4 Jun	1.270	m	TM	55 38.19	162 03.20	26 Jun	unk
4 Jun	1.370	m	BH	55 31.50	162 00.86		
4 Jun	1.380	f	TM	55 36.29	162 02.46	6 Jun	bear
4 Jun	1.470	m	TM	55 36.83	161 56.51	26 Jun	unk
4 Jun	1.580	m	BH	55 39.75	162 12.91		
5 Jun	0.370	m	CRF	55 48.17	161 24.36	abandoned	
5 Jun	0.490	m	CRF	55 49.49	161 24.81	abandoned	
5 Jun	0.360	f	CRF	55 51.88	161 26.89		
5 Jun	0.410	m	CRF	55 40.88	161 22.76	9 Jun	bear
5 Jun	0.420	m	CRF	55 41.30	161 26.32		
5 Jun	0.440	m	CRF	55 46.53	161 20.83	6 Jun	drown
5 Jun	0.450	f	CRF	55 49.69	161 32.47		
5 Jun	0.460	f	CRF	55 49.23	161 20.65	23 Aug	unk
5 Jun	0.480	f	CRF	55 50.39	161 23.99	23 Aug	unk
5 Jun	0.530	f	CRF	55 46.19	161 24.36		
6 Jun	1.620	f	BH	55 39.00	162 06.20	abandoned	
6 Jun	0.300	f	TM	55 36.11	161 53.49	23 Aug	unk
6 Jun	0.340	f	BH	55 42.03	161 54.62	23 Aug	unk
6 Jun	0.380	f	BH	55 42.74	162 01.31		
6 Jun	0.430	f	BH	55 38.13	162 02.92	26 Jun	wolf
6 Jun	1.120	f	TM	55 38.80	162 02.06	26 Jun	unk
6 Jun	1.280	m	TM	55 38.43	161 57.02	8 Jun	bear
6 Jun	1.560	f	CRF	55 47.98	161 23.09		
6 Jun	1.630	m	BH	55 42.99	161 55.92	15 June	wolf
7 Jun	0.370	f	TM	55 37.69	162 00.69	abandoned	
7 Jun	0.490	f	CRF	55 49.28	161 24.51		

Table 7.
Continued

7 Jun	1.380	f	CRF	55 48.92	161 27.68		
7 Jun	1.600	f	BH	55 42.96	161 58.86		
8 Jun	0.440	m	CRF	55 38.87	161 53.44		
8 Jun	1.620	f	CRF	55 42.21	161 43.49	16 Jun	wolf
9 Jun	1.260	f	CRF	55 40.00	161 25.31	10 Jun	wolverine
9 Jun	1.280	f	BH	55 37.11	161 59.79	26 Jun	unk
9 Jun	1.310	m	BH	55 38.61	162 05.09	26 Jun	wolf or bear
10 Jun	0.410	m	TM	55 40.98	161 52.21	26 Jun	unk
10 Jun	1.050	f	TM	55 38.82	161 54.82	26 Jun	unk
11 Jun	1.260	m	TM	55 37.40	161 51.68	26 Jun	unk
12 Jun	0.370	m	BH	55 36.07	162 10.51		

^a Locations are Caribou River Flats (CRF), Trader Mountain (TM), and Black Hills (BH).

1. The first part of the document is a list of the names of the persons who have been named in the proceedings.