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Investigation and Improvement of Techniques for Monitoring Recruitment, Population Trend, and Nutritional Status in the Western Arctic Caribou Herd

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PROGRESS REPORT (RESEARCH)

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SUMMARY

Results of the October 1993 composition counts and estimates of adult mortality indicate that the Western Arctic caribou herd (WAH) will continue to grow during 1993-94, but at a slower rate than in 1992-93. The severe winter of 1992-93, although accompanied by near record or record snow depths on major winter ranges, apparently had little effect on the condition or overwinter survival of calves. Although point estimates for weights and mandible fat content in calves were lower in April 1993 than in April 1992, the differences were not significant ($P > 0.1$). Mandible measurements of female calves taken in April 1993 were greater than those of calves taken in October 1992 indicating that bones of calves probably continued to grow over the winter even though body weight did not increase. The reduced fall 1993 calf:cow ratio was probably due in part to reduced natality. In mid-June 1993, 17 of 78 radio-collared females had noticeable new growth of velvet antlers compared with a maximum of 1-3 females seen with velvet antlers in previous years. Low natality rates were also reported in other Alaskan caribou (*Rangifer tarandus*) herds in 1993.

We found a much poorer relationship between percent mandible marrow fat content and percent femur marrow fat content in calves than previously found in adults. We will continue to investigate this relationship by collecting both femur and mandible marrow fat samples.

In 1992-93 at least 90% of the WAH wintered south of the Brooks Range. After an early southerly movement through the Nulato Hills, at least 50,000 caribou moved

northeast across the Koyukuk and Dolbi River Flats to the Indian River Flats where they remained from February through April. In late September and early October 1993, a major segment of the caribou herd moved across the Unalakleet River. The movement continued south to near St. Michael and Kotlik where hunters had caribou available in abundance for the first time since the 1870s.

Key Words: body condition, caribou, marrow fat, movements, natality, *Rangifer*, Western Arctic herd

CONTENTS

BACKGROUND

Caribou (*Rangifer tarandus*) from the Western Arctic caribou herd (WAH) are a significant source of food for about 20,000 people from 36 villages and 4 regional centers in northwestern Alaska. About 10,000-15,000 caribou representing about 1-1.5 million pounds of meat are taken from the herd per year. The replacement

value of the meat is about 2.5-3.5 million dollars annually. Many people within the herd's range cannot easily or economically obtain substitutes for the meat that caribou provide. Abrupt changes in regulations in response to unanticipated population declines, such as those that occurred in the mid-1970s, could cause economic hardship. To better predict caribou population changes, this research project was initiated to provide more information on body condition, natality rate, calf recruitment, and herd distribution than was being collected under the population monitoring program from 1982 to 1992.

Causes of declines in caribou herds are still not well understood and several competing and/or complimentary hypotheses explain previous decreases in various caribou herds (Leopold and Darling 1953, Klein 1968, Skoog 1968, Bergerud 1980, Skogland 1985, Van Ballenberghe 1985, Bergerud and Elliot 1986, Messier et al. 1988, Bergerud and Ballard 1989, Davis and Valkenburg 1991, Seip 1992). The WAH reached a historic high level (415,692) in 1990 and continues to grow at about 13% annually. Population density was estimated to be 1.4/km^2 in 1992. The George River herd in northern Quebec reached about 1.9/km^2 before density declined due to a decline in population size and range expansion (Couturier et al. 1990). With this research project in place as the WAH approaches a probable population peak, we can expect to document and study the mechanics of population regulation during a decline.

STUDY OBJECTIVES

To develop, validate, and implement techniques for monitoring the nutritional status and predicting the productivity and population trend of the WAH.

Job Objectives

Annually estimate calf:cow ratio in October.

Annually collar a sample of female calves at the Kobuk River or other river crossings to estimate the age at first reproduction of females and to aid in finding nonreproductive segments of the population during censuses.

Annually determine the mean fall body weight of a sample of female calves and adult cows and the spring body weight of a sample of calves from 1992 to 1997 to determine if weight and/or fat indices can be used as predictors of pregnancy rate and/or calf survival to fall.

Annually determine the distribution of radio-collared caribou in September/October and in February/March.

Place 10-20 radiocollars on bull caribou in years prior to censuses to facilitate finding bull groups during the census.

METHODS

Estimating Calf:Cow Ratio in Fall

On 15 October 1993 we used a Robinson R-22 helicopter (2 place) to conduct standard fall composition counts from the southernmost distribution of migrating WAH caribou north to the upper Tagagawik River. Valkenburg radio-tracked caribou and carried extra fuel for the helicopter in a Bellanca Scout, and T. Osborne classified caribou from the helicopter.

Collaring a Sample of Female Calves in Fall

At the inception of this project, we intended to collar female calves to gain information on mortality rate of calves during their first winter and age at first reproduction as an index to herd condition. However, WAH calves are so much smaller than calves from other interior herds that they probably cannot carry a Telonics model 600 collar, or equivalent 5-year collar. Recollaring these animals would be prohibitively expensive and a 3-year collar would not provide enough data on reproduction.

Determining Body Weight and Condition of Calves and Adults

Body weight and condition scores of adult female caribou in fall have been shown to be reasonably good estimators of calf production and survival to 1 year of age in the Central Arctic herd where predation on calves is low (Cameron et al. 1993). In addition, body weight of 10-month-old calves appears to be a reasonable predictor of calf:cow ratio in fall in the Delta herd (Valkenburg 1992), and calf weights may not decline significantly over winter even under extreme conditions (Gates et al. 1986, Huot 1989). In this project, therefore, we proposed to investigate whether adult female weight and condition in fall and calf weight and condition in fall and spring could be used as a predictor of calf:cow ratio the following fall in the WAH. Because the WAH project has been underfunded we could not afford to collect weight and condition data on both calves and adults. We, therefore, decided to collect only the data on calves because a smaller sample size is required for each collection (weights of adults are more variable and subject to influences from lactation and age), and because adult females are larger and, therefore, much more difficult and expensive to process and transport.

In March and April 1993 we obtained 10 female calves from the Indian River Flats south of Hughes where about 50,000 caribou were wintering. The animals were

weighed with a calibrated scale, gutted (G.I. tract, heart, lungs, and liver removed) and weighed again. The presence or absence of fat deposits in the rump, brisket, omentum and heart areas was also noted. Mandibles and femurs were saved for later measuring and determining marrow fat content (Neiland 1970, Davis et al. 1987). Nineteen female calves were collected from the ground in the Nelchina herd's range; 12 near Tangle Lakes and 7 near Northway. Meat from the collected calves was distributed in Glennallen and Northway.

Because we intended to involve local residents in the WAH collections, Bob Ahgook from Anaktuvuk Pass, Gary Bamford from the Hogatza River, and Seth Kantner from the Kobuk River were trained to help obtain samples and body weights of female caribou calves in April and October. All cooperators were given calibrated scales, plastic labels (premarked with a list of information needed from each animal), and a note-card with instructions. Bamford was issued a collecting permit (allowing him to take caribou the same day airborne), but all other cooperators were able to take the necessary caribou under hunting regulations. Bamford did an excellent job with the fall 1992 collection, but subsequently concluded that his participation was too risky and time-consuming and the movements of caribou too unreliable for ADF&G to rely on him as a collector. He suggested that it would be more efficient for ADF&G to do the collecting directly. The occurrence of WAH caribou around Anaktuvuk Pass was also unreliable and Ahgook was unable to procure any female calves there in 1992 or 1993. On the Kobuk, Kantner also had trouble getting calves during April and October because of weather which prevented travel or because of unreliable caribou movements. The samples collected in fall 1993 had not arrived in Fairbanks by late December and were not included in this report. Kantner was able to get calves in May 1992 and 1993 but most of these turned out to be males and probably represented the tail end of the migration. As a result, most useable information in 1993 came from the direct efforts of ADF&G biologists.

Determining the Distribution of Radio-collared Caribou

Western Arctic caribou were tracked three times during the report period; early April 1993, during the census in July 1993, and during the composition counts in early October 1993. In addition, tracking was done on the Seward Peninsula during the winter 1992-93 and fall 1993 to assist reindeer herders in keeping reindeer away from caribou.

Radio-collaring Bull Caribou

Because no census was planned for 1994, no bull caribou were collared in fall 1993. About 30 cows were radio-collared to replace individuals that have died or whose collars are stopping from battery exhaustion. The addition of these cows brought the total number of active radiocollars less than 5 years old to about 115.

RESULTS AND DISCUSSION

Estimating Calf:Cow Ratio in Fall

The bull:cow and calf:cow ratios in the WAH in fall 1993 were considerably lower and more variable from area to area than during the previous count in 1992 (Table 1). We expected the lower calf:cow ratio because mid-June counts revealed a lower natality rate in radio-collared cows and only 48 calves:100 cows in mid-June vs. a mean of 74:100 from 1987 to 1992. Natality rates in most Alaskan caribou herds were low in 1993 and may have been related to unusually severe weather in September 1992 (Valkenburg 1993). However, caribou were migrating rapidly during the composition surveys, and cows with calves were more prevalent near the front of the movement. Only 28 out of 85 active radiocollars (excluding collars deployed in 1993) were found in the area surveyed south of the Purcell Mountains, so the composition sample may not have been representative of the northern distribution of caribou and could either have overestimated or underestimated recruitment of calves to fall. Bad weather precluded more extensive radio tracking or a wider distribution of sampling effort.

If the fall 1993 calf:cow ratio was accurate and estimates of adult mortality were reasonably accurate the WAH will continue to grow, but at a slower rate than in 1992. Results of the 1993 census will be available in spring 1994.

The lower than expected bull:cow ratio was probably due to the lateness of the composition counts and movement of caribou. Bulls were apparently separating from cows and many single bulls were seen.

Determining the Body Weight and Condition of Female Calves

Despite near record or record snow depths on the 1992-93 winter range, there were no significant differences in body weight (BW), ingesta-free body weight (IFBW), or mandible marrow fat content among collections of female WAH calves (Table 2). Mandible length of calves collected in April-May were longer (t-test, $P < 0.05$) than in calves collected in October suggesting that either mandibles continue to grow during the winter or smaller calves die. Male calves collected in 1993 were marginally heavier than female calves collected in 1993 (t-test, $P < 0.1$) (Table 3). Mean femur marrow fat content was 40.0% (s.e. = 7.2%) (Table 2), indicating that calves were not in nutritional stress (Mech and DelGiudice 1985).

In WAH and Nelchina collections, we took both mandible and femur marrow fat samples for comparison (Table 2). We found a much poorer relationship between mandible fat and femur fat in calves than Davis et al. (1987:369) found in adults (Fig. 1). We will continue to investigate this relationship by collecting marrow samples from both femur and mandible.

Determining the Distribution of Radio-collared Caribou

During spring 1993 we located 112 of 139 radio-collared WAH caribou that could have had active collars. An additional 11 collars were found on mortality mode, leaving 16 outstanding. Ten of the 16 outstanding collars were older than 5 years and, therefore, were probably no longer functioning. We found none of the potentially missing collars on adjacent caribou ranges, and there was no evidence of emigration of WAH caribou to adjacent areas or herds. We estimated the October-May mortality rate to be 10% for females and 14% for males (all collars on males were on older males).

Major 1992-93 winter ranges for WAH caribou included the Selawik and Buckland Hills, Purcell Mountains, Nulato Hills south to the Unalakleet River, and the Dulbi and Indian River Flats in the Koyukuk drainage. Use of the Indian River Flats by WAH caribou had not been previously documented, and the luxurious lichen ranges of the Galena Mountain and Wolf Mountain herds were completely inundated by about 50,000 WAH caribou. Over 90% of the WAH radiocollars were south of the Brooks Range. In April, no WAH radiocollars were found in the Central Brooks Range east to the Dietrich River, in the vicinity of the Trans-Alaska Pipeline or on the north slope in the western ranges of the Central Arctic herd.

In early October 1993 there were about 115 active radiocollars (less than 5 years old) on WAH caribou. Excluding the 30 deployed along the Kobuk River in September 1993, 85 were available for determining herd distribution in fall. Twenty-eight of these were found during the composition counts, but poor weather precluded a thorough search of even the southern ranges of the WAH. By late November, for the first time since the 1870s, there were reports of large numbers of caribou near Kotlik and St. Michael. The winter 1993-94 distribution will not be fully determined until late March or April 1994 after spring surveys are completed and data from satellite collars are analyzed.

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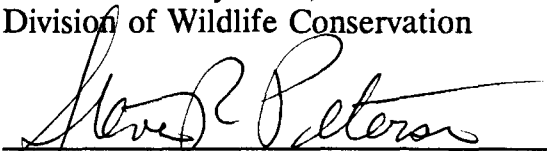

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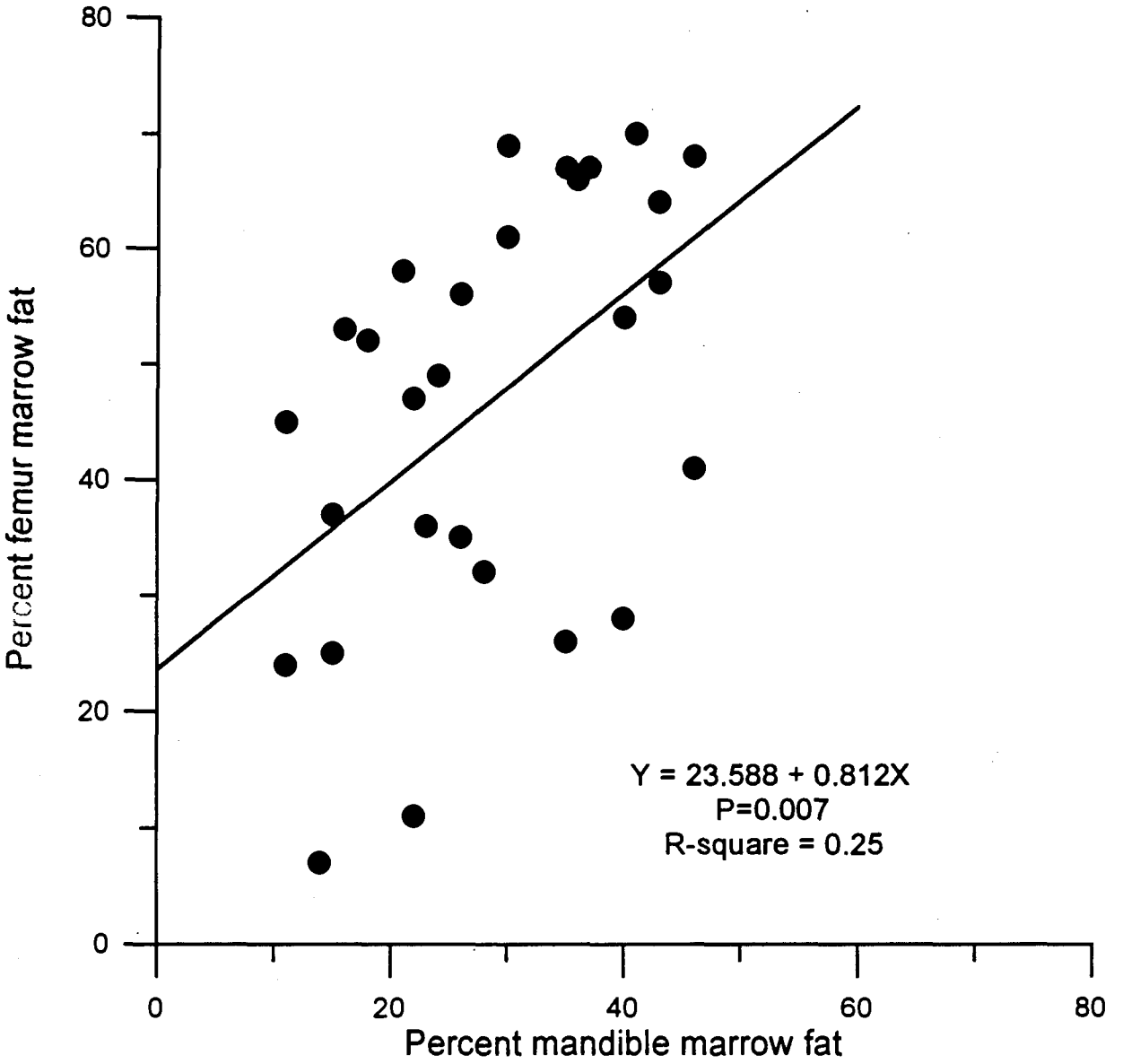

Fig. 1. Relationship between percent mandible marrow fat and percent femur marrow marrow fat for female calf caribou collected in April 1993.

Table 1. Results of sex and age composition counts of the Western Arctic herd on 15 October 1993.

Area	Bulls: 100 cows	Calves: 100 cows	% calves	% cows	% bulls	Total caribou
South of Unalakleet River	47	68	32	46	22	513
Unalakleet River	50	49	25	50	25	579
North River-Shaktoolik Hills	34	50	27	54	19	215
Ungalik Hills	35	40	23	57	20	730
East of Koyuk	41	29	17	59	24	410
North of Koyuk	39	27	16	60	24	322
Granite Mountain-Upper Tagagawik River	29	25	16	65	19	1270
All Areas[a]	38	39	21	58	21	4039

[a] Weighted by sample size

Table 2. Body weight (BW), ingesta-free body weight (IFBW), mandible length (ML), diastema length (DL), and mandibular marrow fat content (MMFC) of female Western Arctic and Nelchina caribou herd calves collected in 1992 and 1993 (raw data in Appendix A).

		BW			IFBW			ML			DL			%[a] MMFC			%[a] Femur fat			Warbles			Fat deposit
Collection	Month	Mean	SE	n	Mean	SE	n	Mean	SE	n	Mean	SE	n	Mean	SE	n	Mean	SE	n	Mean	SE	n	index[b] (n)
Nelchina 1992 (Unit 13)	April	109.4	7.2	8	76.0	4.9	8	216.7	4.9	7	83.1	2.2	8	15.5	2.8	8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.0 (8)
Nelchina 1992 (Unit 12)	April	124.4	2.7	9	87.1	2.0	9	224.8	1.5	9	86.9	1.0	9	34.4	3.6	9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	4.0 (9)
Nelchina 1993 (Unit 13)	April	118.7	3.1	12	82.7	2.0	12	221.3	1.9	12	84.6	0.9	12	23.7	2.4	12	50.0	4.0	11	46.7	7.8	12	3.5 (12)
Nelchina 1993 (Unit 12)	April	125.7	4.0	7	86.9	3.1	7	221.2	3.0	7	83.4	1.1	7	29.4	4.9	7	50.7	6.4	7	56.7	11.3	7	3.9 (7)
Western Arctic Pah Flats, Ambler, 1992	April	87.0	2.0	16	62.1	1.8	16	207.8	1.7	16	79.1	0.7	16	42.3	4.2	10	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.2 (16)
Western Arctic Pah Flats, 1992	October	89.2	4.1	13	60.4	2.8	13	192.8	1.9	13	73.7	1.4	13	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.5 (11)
Western Arctic Hunt River, 1993	April	79.3	5.2	4	55.3	3.3	4	201.8	7.5	4	75.0	3.1	4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2.3 (4)
Western Arctic Indian R. Flats, 1993	April	83.2	2.4	10	58.8	1.6	10	205.3	1.5	10	78.3	1.0	10	33.7	3.4	10	40.0	7.2	10	66.3	13.5	8	3.9 (10)

[a] After Neiland (1970). Percent marrow fat calculated from % dry weight as follows: %fat = %dry weight - (0.049 * %dry weight + 6.6).

[b] Fat deposit index is calculated by assigning a value of one point for the presence of fat in each of four sites on the carcass (i.e., rump, brisket, mesenteries, heart), summing the values for all animals, and dividing by the number of animals in each collection. For example, if each calf in a collection of 10 all had fat in each of the four fat deposit sites, the Fat Deposit Index would be 40/10 = 4.0.

Table 3. Body weight (BW), ingesta-free body weight (IFBW), mandible length (ML), and diastema length (DL) of male Western Arctic caribou herd calves collected in 1992 and 1993 (raw data in Appendix B).

		BW			IFBW			ML			DL			Fat deposit
Collection	Month	Mean	SE	n	Mean	SE	n	Mean	SE	n	Mean	SE	n	index[a] (n)
Western Arctic Ambler 1992	May-June	86.9	3.0	11	59.2	2.6	11	208.1	2.9	11	80.0	1.5	11	2.1 (11)
Western Arctic Hunt River 1993	May	92.4	2.6	9	63.4	2.6	9	206.8	3.1	9	80.3	1.2	9	2.3 (9)

[a] Fat deposit index is calculated by assigning a value of one point for the presence of fat in each of four sites on the carcass (i.e., rump, brisket, mesenteries, heart), summing the values for all animals, and dividing by the number of animals in each collection. For example, if each calf in a collection of 10 all had fat in each of the four fat deposit sites, the Fat Deposit Index would be 40/10 = 4.0.

APPENDIX A. Data from collections of female caribou calves arranged by location. Under Back, Bris. (brisket), Mesen. (mesenteries) and Heart, 0 = fat absent, 1 = fat present.

Acc. number	Date of collection	Location	Whole weight	Gutted weight	Jaw length	Diast.	Jaw % fat	Femur % fat	Back	Bris.	Mesen.	Heart	Warbles est.	Warbles #
104082	06/07/92	AMBLER	75	49	200	78			0	0	0	0	L	
104083	05/27/92	AMBLER	84	55	203	78			0	1	0	1	H	
104091	10/24/92	BAMFORD	85	60	191	74			1	1	1	1	L	
104092	10/20/92	BAMFORD	104	65	197	77			1	1	1	1	L	
104093	10/20/92	BAMFORD	90	61	190	71			0	1	1	1	L	
104094	10/22/92	BAMFORD	94	65	199	77			0	1	1	1	L	
104095	10/22/92	BAMFORD	105	77	194	64			1	1	1	1	N	
104098	10/22/92	BAMFORD	92	62	192	77			0	1	1	1	L	
104099	10/22/92	BAMFORD	99	66	198	77			1	1	1	1	L	
104100	10/23/92	BAMFORD	79	54	193	78			0	1	1	1	L	
104102	10/23/92	BAMFORD	74	52	189	72	10		0	1	1	1	M	
104103	10/20/92	BAMFORD	118	78	206	82			1	1	1	1	N	
104104	10/22/92	BAMFORD	76	49	183	69			0	1	1	1	L	
103946	04/25/92	CROSSWIND	76	52	204	78			0	1	0	1		
103949	04/25/92	CROSSWIND	95	65	196	74			0	1	0	1	L	
103930	04/23/92	DENALI	105	75		85	21		0	0	0	1	L	
103931	04/23/92	DENALI	135	94	229	92	23		1	1	1	1	L	
103932	04/23/92	DENALI	123	85	229	89	12		1	1	1	1	L	
103933	04/23/92	DENALI	110	76	220	78	25		1	1	1	1	L	
103934	04/23/92	DENALI	133	91	226	87	20		1	1	1	1	L	
103935	04/23/92	DENALI	98	70	213	82	12		0	1	1	1	L	
104128	04/12/93	DENALI HWY	105	86	219	85	23	36	1	1	1	1	L	14
104129	04/12/93	DENALI HWY	110	75	223	86	35	67	1	1	1	1	M	31
104130	04/12/93	DENALI HWY	134	92	224	85	33		0	1	1	1	L	21
104131	04/12/93	DENALI HWY	120	84	225	87	30	61	1	1	1	1	M	40
104132	04/12/93	DENALI HWY	134	95	230	89	18	52	0	0	0	1	L	20
104133	04/13/93	DENALI HWY	106	73	208	79	21	58	1	1	1	1	H	106
104134	04/13/93	DENALI HWY	112	76	213	81	16	53	1	1	1	1	M	38
104135	04/13/93	DENALI HWY	127	87	228	89	15	37	0	1	1	1	M	65
104136	04/13/93	DENALI HWY	106	75	220	84	36	66	1	1	1	1	M	31
104137	04/13/93	DENALI HWY	124	84	214	82	11	24	1	1	1	1	M	70
104139	04/13/93	DENALI HWY	120	81	226	84	22	47	0	1	1	1	M	57
104138	04/13/93	DENALI HWY	126	84	225	84	24	49	1	1	1	1	M	67
104105	11/11/92	GALENA	72	52	195	74	42		0	0	0	0		
104106	11/11/92	GALENA	71	44	179	66	46		0	0	0	0		
104068	04/27/92	HOLLY LAKES	75	54	204	77			0	1	0	1	M	
104069	04/28/92	HOLLY LAKES	82	59	202	78			0	1	1	1	M	
104085	04/27/92	HOLLY LAKES	78	59	210	78			1	1	1	1	L	
104086	04/27/92	HOLLY LAKES	92	64	217	80			0	1	1	1	L	
104180	05/29/93	HUNT RIVER	66	48					0	1	0	1	H	
104185	05/25/93	HUNT RIVER	91	64					0	1	1	1	H	
104188	05/26/93	HUNT RIVER	82	54					0	1	0	1	L	
104192	05/28/93	HUNT RIVER	78	55					0	1	0	1	L	
104121	03/10/93	INDIAN R.	79	52	204	74	46	41	1	1	1	1	L	
104122	03/10/93	INDIAN R.	95	65	211	85	46	68	1	1	1	1	L	
104169	04/02/93	INDIAN R.	78	57	201	77	14	7	0	1	1	1	L	25
104170	04/02/93	INDIAN R.	78	57	204	78	43	64	1	1	1	1	M	45
104171	04/03/93	INDIAN R.	93	68	213	78	28	32	1	1	1	1	M	60
104172	04/02/93	INDIAN R.	84	59	208	79	35	26	1	1	1	1	H	125
104173	04/02/93	INDIAN R.	74	54	200	76	22	11	1	1	1	1	H	120
104174	04/02/93	INDIAN R.	92	63	210	82	40	28	1	1	1	1	M	30
104176	04/02/93	INDIAN R.	83	58	200	77	37	67	1	1	1	1	M	75
104177	04/02/93	INDIAN R.	76	55	202	77	26	56	1	1	1	1	M	50

Acc. number	Date of collection	Location	Whole weight	Gutted weight	Jaw length	Diast.	Jaw % fat	Femur % fat	Back	Bris.	Mesen.	Heart	Warbles est.	Warbles #
104140	04/17/93	NORTHWAY	113	77	213	81	15	25	1	1	1	1	M	70
104141	04/17/93	NORTHWAY	117	82		82	26	35	1	1	1	1	M	58
104142	04/14/93	NORTHWAY	129	90	227	85	43	57	1	1	1	1		
104143	04/17/93	NORTHWAY	125	84	218	82	40	54	0	1	1	1	M	64
104144	04/18/93	NORTHWAY	134	90	229	89	30	69	1	1	1	1	M	97
104145	04/18/93	NORTHWAY	143	102	227	84	41	70	1	1	1	1	L	24
104146	04/19/93	NORTHWAY	119	83	213	81	11	45	1	1	1	1	L	27
104111	04/12/92	PAH FLATS	91	65	210	80	42		1	1	1	1		
104112	04/12/92	PAH FLATS	101	75	216	83	51		1	1	1	1		
104113	04/12/92	PAH FLATS	77	55	200	76	23		0	1	1	1		
104114	04/12/92	PAH FLATS	94	69	212	83	47		1	1	1	1		
104115	04/12/92	PAH FLATS	95	64	213	82	47		1	1	1	1		
104116	04/12/92	PAH FLATS	95	69	212	80	50		1	1	1	1		
104117	04/12/92	PAH FLATS	94	71	215	82	58		1	1	1	1		
104118	04/12/92	PAH FLATS	86	62	199	76	55		1	1	1	1		
104119	04/12/92	PAH FLATS	90	66	215	82	23		0	1	1	1		
104120	04/12/92	PAH FLATS	83	57	197	73	27		0	1	1	1		
103936	04/18/92	TOK	138	94	224	87	23		1	1	1	1		
103937	04/18/92	TOK	131	92	227	87	32		1	1	1	1		
103938	04/18/92	TOK	131	94	217	86	44		1	1	1	1		
103939	04/18/92	TOK	126	89	220	82	32		1	1	1	1		
103940	04/18/92	TOK	123	88	232	88	22		1	1	1	1		
103941	04/18/92	TOK	112	77	227	87	37		1	1	1	1		
103942	04/18/92	TOK	121	82	224	87	52		1	1	1	1		
103943	04/18/92	TOK	123	87	223	85	23		1	1	1	1		
103944	04/18/92	TOK	115	81	229	93	45		1	1	1	1		

APPENDIX B. Data from collections of male caribou calves arranged by location. Under Back, Bris. (brisket), Mesen. (mesenteries) and Heart, 0 = fat absent, 1 = fat present.

Acc. number	Date of collection	Location	Whole weight	Gutted weight	Jaw length	Diast.	Back	Bris.	Mesen.	Heart	Warbles est.
104071	05/30/92	AMBLER	101	70	221	83	0	1	0	1	H
104072	05/30/92	AMBLER	94	66	205	86	0	1	1	1	L
104073	05/30/92	AMBLER	81	51	209	80	0	1	1	1	H
104074	05/30/92	AMBLER	90	63	212	80	0	1	1	1	H
104075	05/30/92	AMBLER	85	62	205	80	0	1	0	1	H
104076	05/30/92	AMBLER	87	61	205	78	0	1	1	1	
104077	05/08/92	AMBLER	105	72	224	88	0	1	0	1	L
104078	05/27/92	AMBLER	82	59	213	81	0	1	0	1	M
104079	06/01/92	AMBLER	77	50	189	70	0	0	0	0	H
104080	06/07/92	AMBLER	82	52	200	76	0	1	0	1	M
104081	06/07/92	AMBLER	72	45	206	78	0	0	0	1	M
104110	04/08/92	PAH FLATS	97	69	217	80	1	1	1	1	L
104175	04/02/93	INDIAN R.	84	58	206	80	1	1	1	1	H
104181	05/24/93	HUNT RIVER	89	65	213	82	0	1	0	1	H
104183	05/25/93	HUNT RIVER	89	59	213	83	0	1	1	1	L
104184	05/25/93	HUNT RIVER	85	60	204	76	0	1	1	1	M
104186	05/28/93	HUNT RIVER	76	51	196	75	0	1	0	1	M
104189	05/27/93	HUNT RIVER	87	57	202	78	0	1	0	1	L
104190	05/28/93	HUNT RIVER	103	65	190	78	0	1	0	1	M
104191	05/29/93	HUNT RIVER	97	74	212	85	1	0	1	0	M
104193	05/27/93	HUNT RIVER	112	75	216	84	0	1	0	1	L
104194	05/28/93	HUNT RIVER	94	65	215	82	0	1	1	1	M

Alaska's Game Management Units