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DEMOGRAPHY OF THE DELTA CARIBOU HERD

BY

James L. Davis
Patrick Valkenburg
and
Rodney Boertje

Volume I

Project Progress Report
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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: James L. Davis, Patrick Valkenburg, and Rodney Boertje

Project No.: W-21-2 Project Title: Big Game Investigations

Job No.: 3.27R Job Title: Demography of the Delta Caribou Herd Under Varying Rates of Natural Mortality and Harvest by Humans

Period Covered: July 1, 1980 through June 30, 1981 (including data through September 1981)

SUMMARY

Monitoring of radio-collared caribou continued to indicate a higher natural mortality rate for males than females. Even though our samples have been small, this pattern has occurred consistently for 3 years in the Delta and Western Arctic Herds.

Calving occurred over a larger area than in the past. About half of the cows in the herd calved west of the traditional core calving area. Based on 1 aerial survey conducted before calving ended, herd natality exceeded 63 calves/100 cows. Mean natality for radio-collared females older than yearlings was 79%. Eight of 11 of the 3-year-old radio-collared females calved in 1981. When these 11 females were 2 years old, at least 6 produced calves; 5 calved in both years.

Monitoring radio-collared caribou confirmed the existence of a Yanert Caribou Herd. The herd numbers at least 500-600 caribou and exhibits all characteristics required for herd designation and should be managed as an entity apart from the Delta Caribou Herd.

A thorough study of the Delta Caribou Herd since 1978 has verified continuous herd growth. Extrapolated population estimates from aerial photo-direct count-extrapolation (APDCE) censuses for the herd include the following: 1973 = 2,198-2,409; 1979 = 3,700; 1980 = 4,448; 1981 = 4,180-4,882. The exponential growth rate (r) from 1979-81 was r = 0.06-0.135 (6.2-14.5% growth annually). These estimates were extrapolated from relative proportions of cows, bulls, and calves observed in June aggregations and during the fall rut in the years of the APDCE censuses. However, fluctuations in estimates of the proportions of cows, bulls, and calves within and between some years were much greater than could be explained by changes in the population. These fluctuations were the sources of biases in the respective

population estimates and may explain some inconsistencies in estimates between years. As an alternate method, we calculated the mean proportion of cows, bulls, and calves present from 1979-81 and used the means to extrapolate the following set of population estimates: 1979 = 3,961; 1980 = 4,194; 1981 = 4,557-5,320. From 1979-81, using this method, r = 0.07-0.15 (7.3-16.2% growth annually).

If current conditions continue, it will be necessary to harvest about 11.5% (mid-point of 7-16%) of the Delta and Yanert caribou populations annually to stabilize them. This would be a harvest of 450-600 Delta Herd caribou and 60-70 Yanert Herd caribou.

CONTENTS

BACKGROUND

Fluctuations in the size of Alaska's caribou (Rangifer tarandus) herds have been common and are well documented (Skoog 1968, Hemming 1971, Davis 1978, 1980); however, many early estimates of herd size should be viewed skeptically. At least 3 hypotheses explaining North American caribou herd declines were advanced over the past 30 years (Bergerud 1974). Bergerud (1974, 1980) critically examined hypotheses explaining these declines and concluded that human harvests and fluctuating natural mortality rates generally determine population trends. He also concluded that natality is high and relatively constant within herds or subpopulations; our recent findings in Alaska support his conclusion (Davis and Valkenburg 1978, 1979, 1981a, 1981b; Davis et al. 1978, 1980). However, net productivity may be the same when natality and early mortality are both high or when they are both moderate or low.

Mortality may be closely related to condition at birth. For instance, mortality of neonates could be increased by stress on pregnant females as Verme (1967, 1969, 1979) documented in upper Michigan white-tailed deer (Odocoileus virginianus). Only through long-term studies, preferably involving marked animals, will we definitively ascertain the influences of environmental variables on natality and mortality and their effects on caribou population dynamics.

Recommendations from a recent workshop (Klein and White 1978), attended by most leading caribou workers in North America, identified the need for intensive demographic study of 1 or more caribou herds in Alaska. The opportunity to manipulate hunting pressure and predation rates on the Delta Herd and its proximity to the logistical and research support available in Fairbanks make this herd the best choice for studies. Hypotheses derived during investigations of the larger Western Arctic and Porcupine

Herds regarding some aspects of general caribou ecology may be more feasibly tested on the Delta Herd. Also, results of recent study of the Delta Caribou Herd (Davis and Preston 1980) revealed that herd demography was misunderstood from 1975 through 1979. The Delta Herd will continue to be intensively managed as a thorough understanding of its demography is essential.

OBJECTIVE

To determine demography of the Delta Caribou Herd under varying rates of natural mortality and harvest by humans.

PROCEDURES

We monitored the locations of 32 radio-collared caribou during 1981; 12 captured from the Delta Herd in 1979, 12 from the Delta Herd in 1981, and 8 from the Yanert Herd in 1981 (Table 1). Monitoring (Appendix I) and capture techniques were the same as those used previously (Davis and Preston 1980) except that a shoulder-held net gun (Mountain Helicopters, Greymouth, New Zealand) was used for capturing some caribou.

Mortality rates were calculated from a procedure empirically derived by W. Gasaway (pers. commun.) as follows:

$$\text{percent dying annually} = \frac{a}{b}$$

where

a = number of mortalities tallied among radio-collared animals

b = estimated number of collared animal-years (If the time interval differs from 12 months, units will not be in years.) A collared animal-year is equivalent to 12 collared animal-months; a collared animal-month is equivalent to 1 radio collar functining on 1 animal for 1 month.

b is estimated as follows:

$$b = \frac{c \cdot d}{e}$$

where

c = mean number of months that collars were transmitting, excluding animals that died

d = total number of radio-collared animals, including animals that died

e = time interval--12 months for annual mortality (The number of months differs from 12 when calculating seasonal rates of mortality.)

Table 1. Radio frequencies, collar numbers, and other pertinent information for Delta Herd and Yanert Herd caribou, 1979-81.

Frequency (MHz)	Collar number	Accession number	Cohort (year of birth)	Sex	Date collared	Comments
150.010	BK-Y21	102,361	1980	M	3/22/81	
150.016	BK-Y23	102,431	1980	F	5/30/81	
150.040	BK-Y27	102,432	1980	F	5/30/81	
150.050	BK-Y20	101,981	1978	F	5/30/81	previously Y-R 59, but di or dropped new collar
150.060	BK-Y18	102,362	pre-1978	F	3/22/81	
150.070	BK-Y29	102,363	pre-1979	F	4/18/81	Yanert River
150.080	BK-Y30	102,364	pre-1980	F	4/18/81	Yanert River, young
150.090	BK-Y16	102,360	1980	F	3/22/81	
150.100	BK-Y14	102,348	1980	F	2/27/81	
150.110	BK-Y86	102,342	probably 1979	M	2/8/81	killed 2/81 (wolves?)
150.120	BK-Y15	102,341	1980	F	2/8/81	
150.130	BK-Y22	102,350	probably 1978	F	2/27/81	
150.140	BK-Y31	102,365	pre-1979	F	4/18/81	Yanert River
150.150	BK-Y13	102,343	1980	F	2/8/81	
150.150	BK-Y32	102,366	pre-1979	F	4/18/81	Yanert River
150.190	BK-Y33	102,367	pre-1980	F	4/18/81	Yanert River
150.200	BK-Y34	102,368	pre-1979	F	4/18/81	Yanert River
150.210	BK-Y19	102,430	1980	F	5/30/81	
150.230	BK-Y35	102,369	pre-1979	F	4/18/81	Yanert River
150.240	BK-Y70	102,370	pre-1979	F	4/18/81	Yanert River
151.875	Y-R76	101,993	1978	F	3/30/79	
151.880	BK-Y58	101,980	1978	M	1/10/79	missing 2/79
151.885	Y-56	101,988	1978	F	1/4/79	
151.890	Y-R59	101,981	1978	F	1/10/79	
151.895	BK-y59	101,983	1978	M	1/10/79	killed by bear 8/1980
151.905	Y-R17	101,976	1978	M	1/9/79	missing 4/79
151.910	B-Y63	101,992	1978	M	1/11/79	radio failed
151.915	Y-R52	101,982	1978	F	1/10/79	
151.930	BK-Y79	101,994	1978	M	1/10/79	radio failed 9/1980
151.935	Y-R78	101,977	1978	F	1/9/79	

Table 1. Continued

Frequency (MHz)	Collar number	Accession number	Cohort (year of birth)	Sex	Date collared	Comments
151.940	Y-R88	101,974	1978	F	1/8/79	
151.945	Y-R79	101,994	1978	F	3/30/79	radio failed
151.950	BK-Y12	102,349	probably 1979	F	2/27/81	
151.955	Y-R53	101,973	1978	F	1/4/79	
151.960	Y-R57	101,972	1978	F	1/4/79	
151.965	BK-Y67	101,995	1978	M	3/30/79	missing 7/17/79
151.970	Y-R77	101,997	1978	F	3/30/79	collar on mortality pulse
151.975	Y-R19	101,987	1978	M	1/8/79	shed collar
151.980	Y-R18	101,979	1978	M	1/4/79	shot 11/8
151.985	Y-R58	101,985	1978	M	3/30/79	
151.990	Y-R54	101,984	1978	F	1/11/79	
151.995	BK-Y69	101,986	1978	M	1/11/79	missing 2/79

This formula underestimates mortality rates when there is both a seasonal peak in mortality near the end of the observation period and radio-transmitters fail during the observation period. However, we know of no better estimator of mortality rates.

From 16-18 June 1981, we assisted Alaska Department of Fish and Game (ADF&G) biologists L. Jennings and E. Crain in conducting an APDCE census of the Delta Herd. Post-calving aggregations were found by searching from airplanes and by locating radio-collared caribou. Aggregations were photographed with both 35 mm color and 230 mm (9x9 in) black and white film. Sex and age composition of caribou was sampled from the ground by observers with spotting scopes during the census and from both a helicopter and the ground during the rut.

We investigated the presence of a distinct subpopulation of caribou in the Yanert River drainage by radio-collaring adult females in the drainage and monitoring their movement patterns and determining where they calved.

RESULTS

Natural Mortality

In 1981, natural mortality was determined by monitoring the 32 caribou with functioning radio collars in the range of the Delta Herd, including the Yanert River drainage. Ten collared females were from the 1978 calf cohort, 5 females were from the 1979 cohort, and 7 females and 1 male were from the 1980 cohort. Seven other females and 2 males were judged to be from the 1978 or previous cohorts (a tooth from each is being processed to estimate age).

Although the number of radio-collared caribou we have monitored in the Delta Herd has been relatively small (25 in 1979, 15 in 1980, 32 in 1981), a consistent mortality pattern has emerged. In 1979, 2 of 14 males and none of 11 females died from natural causes; both mortalities were apparently from wolf (Canis lupus) predation. In 1980, 1 of 4 males and none of 11 females died from natural causes; a grizzly bear (Ursus arctos) apparently killed the male. In 1981, 1 of 5 males and none of 30 females died from natural causes (radio failures caused only 32 of the 35 to be monitored); the male was probably killed by wolves about 1 month after it was collared in February 1981, but we inspected the carcass too late to be certain.

These limited data from the Delta Herd do not warrant elaboration. However, findings from our radio-collared caribou in the Western Arctic Herd are, in some respects, similar (Davis and Valkenburg 1981a). The natural mortality rate of male radio-collared caribou was 13% during 265 collared animal-months, compared to a rate of 4% for females during 580 collared animal-months. Though samples are small, low natural mortality

of females (0-4%) and the much greater mortality of males (≥13%) has been consistent in both herds. Bergerud (1971) obtained similar results.

Natality and Calf Survival

Of the radio-collared females known to be 3 years old in June 1981, 8 of 11 had calves. When these same females were 2 years old, at least 6 of 11 had calves (Davis and Valkenburg 1981b). Five of the 6 females producing calves in 1980 also produced calves in 1981.

Of all radio-collared females older than yearlings, 15 of 19 produced calves. These figures include 6 females older than 3 years and 2 females 2 or 3 years old from the Yanert River group. Of the 6 adults, 5 produced calves, and 1 was not relocated. Only 1 of the 2 young Yanert females calved, so 6 of 7 of those relocated from the Yanert Herd calved compared to 9 of 12 from the Delta Herd.

From an aerial survey in a Bellanca Scout on 17 May, J. Davis observed 63 calves/100 caribou older than calves out of 269 caribou seen (34% newborn calves). We estimated that more calves were born on 16-17 May than during any other period, but substantial calving occurred later, so the survey did not reflect peak calf numbers. The approximate birth rate of 79% observed for all radio-collared cows probably better reflects overall herd natality. Weather during calving was not severe, and we have no reason to believe that early calf survival was detrimentally affected by weather.

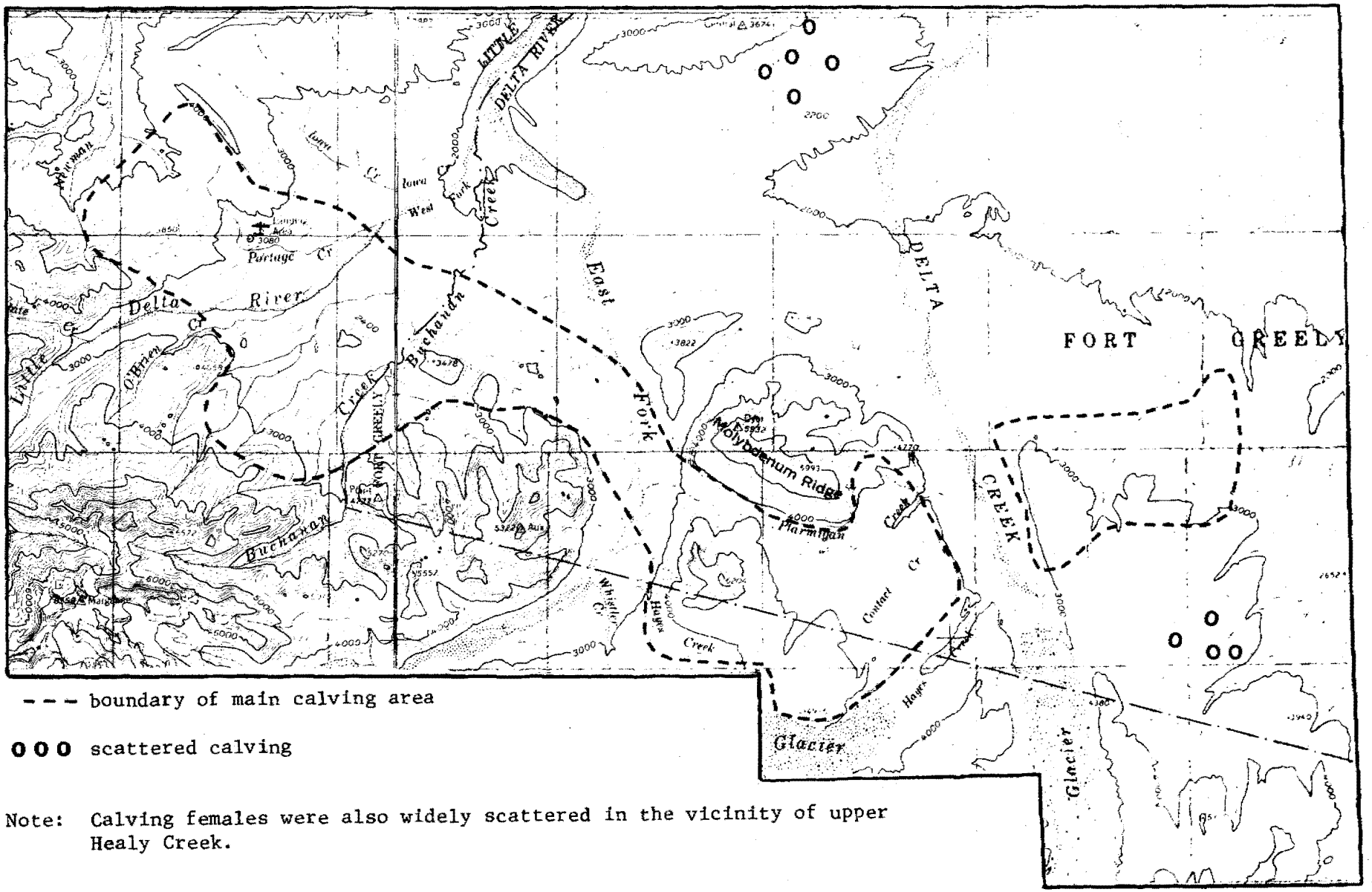
Of the 15 radio-collared females calving in May 1981, 8 were not relocated in August, and only 3 calves accompanied the remaining 7 relocated females. However, some calf-cow bonds may be loose by August. In the past we have relocated radio-collared cows unaccompanied by calves during early fall, but subsequently located them with a calf. On 2 October 1981, calves comprised 20.5% of a sample of 1,553 caribou, or 41/100 females. Assuming that the sample was representative, calf survival was good, but had been better in recent years (Table 2). However, in a rapidly growing herd the calf:female ratio can decline solely because increasing numbers of sexually immature females are present.

Calving Distribution

Distribution of calving females in 1981 differed substantially from the 1980 distribution. In 1981, about half the females calved on the main calving area between Delta Creek and the East Fork of the Little Delta River. Most others calved on the higher ridges and plateaus bounded by Dry Creek, Iowa Ridge, and the East Fork of the Little Delta River (Fig. 1). Limited calving occurred in the upper Totatlanika River drainage and on the plateaus at the head of Lignite Creek. In contrast, in 1980 most

Table 2. Sex and age composition of Alaska's Delta Caribou Herd, 1969-1981.

Date	Bulls/ 100 cows	Yrlg/ 100 cows	Calves/ 100 cows	Yrlg % in herd	# yrlg	Calf % in herd	# calves	Cow % in herd	# cows	Bull % in herd	# bulls	Sample size
10/13-15/69	40	20.0	28	10.3	(85)	14	(116)	49	(410)	20	(166)	828
10/21-23/70	77	23.0	34	9.3	(88)	14	(129)	42	(383)	33	(296)	896
10/29-11/1/71	29	11.0	16	6.8	(78)	9	(109)	64	(738)	18	(214)	1139
10/27-31/72	32	5.8	10	3.9	(46)	7	(85)	67	(795)	21	(259)	1184
10/23-24/73	28	4.0	10	2.8	(29)	7	(76)	70	(735)	20	(210)	1050
10/23-25/74	27	1.8	2	1.4	(16)	1	(17)	76	(868)	21	(240)	1141
6/11-12/75	3	0.4	12	0.3	(3)	11	(108)	86	(839)	2	(26)	976
Fall 1975	No counts conducted											
6/3/76	1		41			28	(395)	70	(955)	1	(15)	1365
6/6-22/76	1		55			35	(390)	63	(699)	0	(10)	1099
10/29-11/1/76	38	0.9	45	0.5	(5)	24	(258)	54	(572)	20	(220)	1055
6/16-19/77	9	12.1	34	7.8	(95)	22	(269)	64	(784)	6	(76)	1224
10/26-11/2/77	32	5.8	42	3.2	(44)	23	(319)	55	(756)	18	(246)	1365
6/13-14/78	12	7.9	23	5.5	(52)	16	(157)	69	(661)	8	(81)	951
10/26/78	75	10.0	39	4.5	(33)	17	(126)	44	(324)	33	(242)	725
6/23/79	11	17.9	44	10.3	(76)	25	(189)	57	(424)	6	(49)	738
12/7/79	39		65			32	(115)	49	(177)	19	(69)	361
6/14/80	18		43			26	(324)	61	(748)	11	(137)	1209
10/15-11/3/80	85		49			21	(288)	42	(585)	36	(496)	1369
6/17/81	12	16.0	33	9.0	(87)	21	(182)	62	(543)	8	(68)	880
10/2/81	59		41			20	(319)	50	(776)	29	(458)	1553



--- boundary of main calving area

O O O scattered calving

Note: Calving females were also widely scattered in the vicinity of upper Healy Creek.

Scale - 1:250,000

Fig. 1. Distribution of the Delta Caribou Herd during calving, 1981.

caribou calved on the traditional main calving area between the Delta River and the East Fork of the Little Delta River.

Reasons for the shift in calving distribution are unclear. Snowfall was very light in 1980-81, and most of the herd's range was snow-free by early April. Most of the herd spent April and May on and around the area traditionally used for calving. Although we have no data to support the conjecture, by calving time caribou may have depleted the Eriophorum buds which usually form the bulk of their diet prior to and during calving. If this preferred food source was depleted, the herd may have shifted their calving grounds to an area of greater food availability. Another explanation for the calving ground shift may be related to the recent increases in the Delta Herd population size. With this increase, it could be conjectured that the main calving area is no longer adequate for all females due to limitations of high quality food or space. However, we doubt that is the sole explanation.

Yanert Herd

Monitoring radio-collared caribou and general aerial surveys confirmed the existence of the Yanert Caribou Herd as a herd separate and distinct from the Delta Herd. Existence of a herd of several hundred caribou, residing year-round primarily in the Yanert River drainage, was suggested for a number of years by incidental observations of ADF&G staff (ADF&G files, Fairbanks) and by discussions with people familiar with the area (Lynn Castle, Upper Wood River resident and big game guide, pers. commun.).

One of the 8 female caribou radio-collared in the Yanert River drainage in April 1981 was never heard again, but all others have remained in the drainage or the adjacent headwaters of the Wood River. Of the 7 caribou with functioning radio collars, 6 calved, all within the headwaters of Dean and Dick Creeks or adjoining areas. All calved at locations above 5,000 ft (1,500 m) and were usually observed above nearby Dall sheep (Ovis dalli). Unlike the Delta Herd, they were widely dispersed during calving. This may indicate a different strategy to avoid predation.

During the June 1981 photo-census of the Delta Herd, 431 caribou were observed in the Yanert drainage. In November 1981, P. Valkenburg and R. Boertje observed about 500 Yanert Herd caribou during a radio-collared caribou monitoring flight. Since this was an incomplete survey, the herd probably contains a minimum of 500-600 caribou.

No mixing between Delta and Yanert radio-collared caribou has been observed. Delta caribou rarely range south of the crest of the Alaska Range, and although Yanert caribou do range into the upper Wood River, this usually occurs when most Delta caribou are farther north.

1980 and 1981 APDCE Censuses

Recent APDCE censuses of the Delta Herd resulted in population estimates of 4,448 for 1980 and 4,180 to 4,882 for 1981 (Table 3, Figs. 2, 3, and Appendix II). Censusing methods are still being perfected for the Delta Herd and both censuses warrant discussion. No previous census has included the caribou in the Yanert River drainage even though, for management purposes, they were considered as part of the Delta Herd prior to 1981. It is probable that the Yanert Herd numbered at least 500-600 caribou through the 1970's.

Although cumulus cloud build-up in midday and accompanying turbulence detracted from the 1981 census, as it did in 1980, we believe the 1981 census is the most accurate census conducted to date. While it is possible that some aggregations of caribou were not located, the aerial searches for groups peripheral to the known aggregations were thorough in 1981. In addition, all radio-collared caribou were located during the census and should have minimized the likelihood of missing any sizable aggregation. We believe that if the census was inaccurate, the error was probably an underestimate of the number of caribou.

Herd Size, Composition, and Modeling

The Delta Caribou Herd was photo-censused in 1973, 1979, 1980, and 1981. Results (Table 3) indicate that the herd has increased since 1973, but determining the rate of increase or year-to-year change is confounded by inconsistencies in the data. Davis and Preston (1980) reviewed data available in 1979 and concluded that the herd was stable or slightly declining from 1973 through 1975 and grew rapidly from 1976 through 1979. They surmised that inception of wolf control in early winter 1976 resulted in increased calf survival and yearling recruitment after 1975.

Davis and Preston (1980) calculated that yearlings comprised 17-19% of the precalving population in 1979, which constituted an increase in the population of 20-24% from 1978. Mortality in other cohorts could have ranged from 5-9% and still allowed a net increase of 15%. By using the 1979 population estimate of 3,691 and assuming a 15% rate of increase, we predicted a population of 4,255 in 1980. Assuming a constant recruitment rate, there should have been 4,893 caribou present in 1981. Comparing these values to the estimates in Table 3 is heartening and suggests that our modeling may be coming close to mimicing the actual population as reflected by our censuses. Nevertheless, if the same process is followed for the segment of the herd which includes only females older than calves, the results are less consistent.

The proportion of females, males, and calves in the herd, determined by sampling during June and September annually from 1979-81, has fluctuated more than is explainable or probable by actual change in the population (Table 3). Consequently,

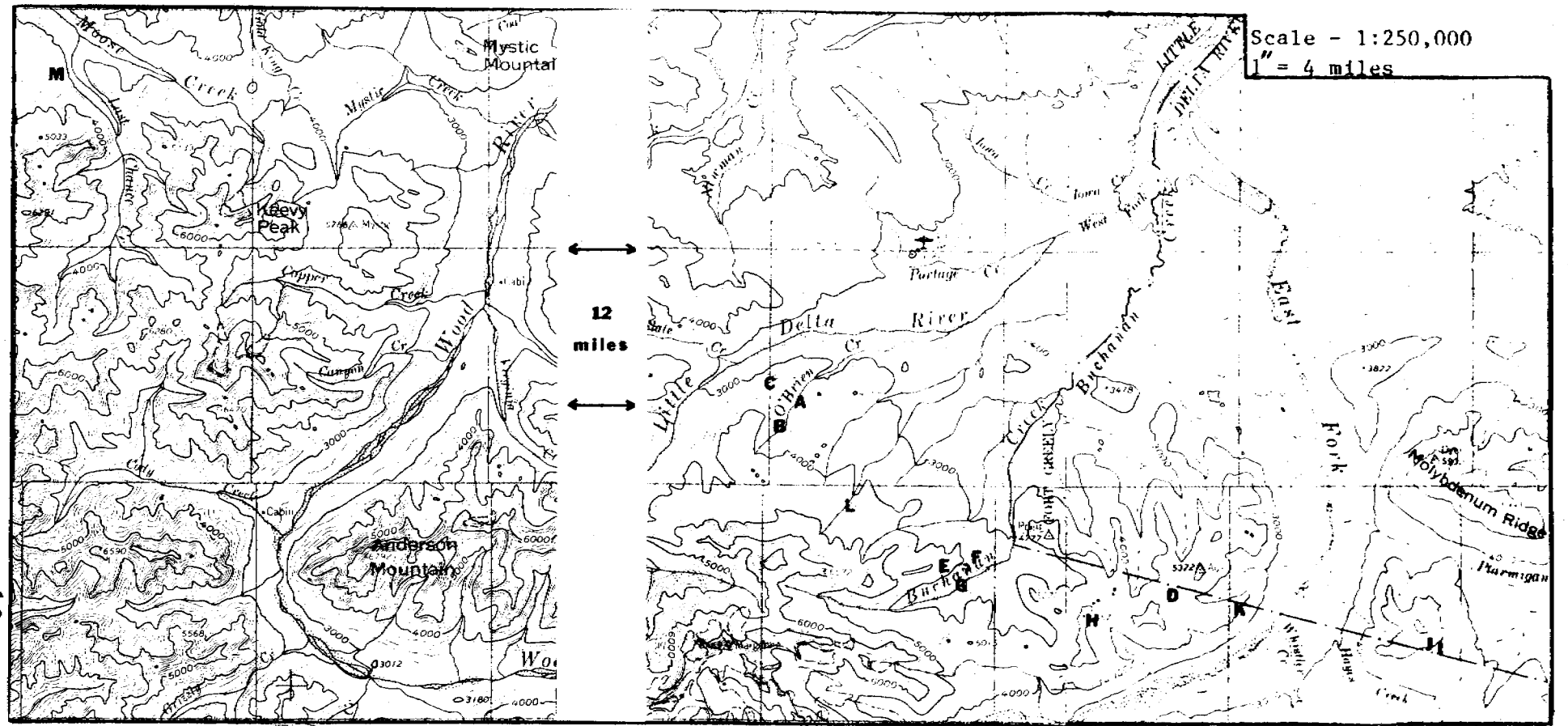
Table 3. Estimates of population size of Alaska's Delta Caribou Herd 1973 and 1979-1981.

Year	Caribou counted in post-calving aggregations	Percent females older than calves in post-calving composition counts	Extrapolated number of females excluding calves	Extrapolated[1] total from census results (APDCE census estimate)	Expected total assuming 15% growth after 1979
1973	2,0882,288	75	1,5851,737	2,1982,409	-
1979	3,166[2]	62	1,817	3,691	-
1980	3,020[3]	61	1,924	4,448	4,255
1981	3,7584,414[2]	61	2,0902,441	4,1804,882	4,893
Projected 1982 estimate					5,627

[1] This is the population estimate extrapolated from the caribou counted from photos and peripheral groups visually counted, and from composition data obtained at the time of each photo-census and from the following fall. No adjustments are made to account for probably biased composition data.

[2] Some aggregations were comprised mainly of males and were not included in calculations to obtain the extrapolated number of females (column 4).

[3] An additional 58 females not in post-calving aggregations were counted directly from aircraft.



12

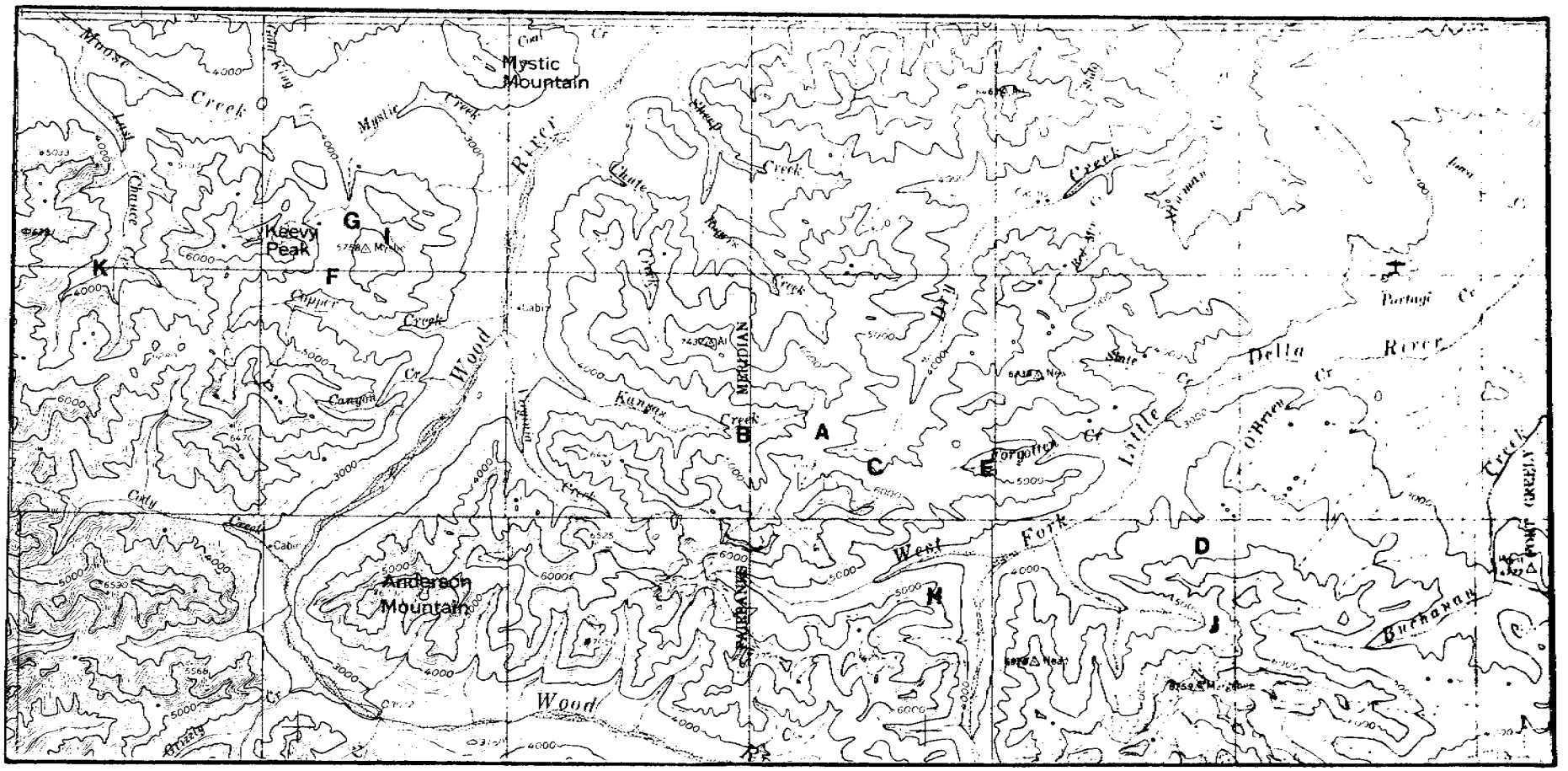
Photographed in 9" x 9" black and white

A	800 (mixed)	
B	799 (mixed)	
C	270 (mixed)	
D	805 (mixed)	

Not photographed

E	41 (28 females, 13 calves)	
F	10 (males)	
G	4 (males)	
H	28 (yearlings, 2-6 females, 1 calf)	
I	19 (10 cows, 9 calves)	
J	29 (16 cows, 13 calves)	
K	5 (males)	
L	236 (mixed)	
M	110 (mixed)	

Fig. 2. Distribution, size, and composition of post-calving aggregations during the photo-census of the Delta Caribou Herd, 14 June 1980.



Photographed in 9" x 9" black and white			Not photographed	
A	190- 221 (mixed)	E	75- 76 (mixed)	H 250 (mixed)
B	1,134-1,534 (mixed)	F	335-403 (mostly males)	I 16 (mixed)
C	910- 984 (mixed)	G	214-275 (mostly males)	J 75
D	386- 451 (mixed)		624-754	341
	2,620-3,190			

Fig. 3. Distribution, size, and composition of post-calving aggregations during the photo-census of Alaska's Delta Caribou Herd, 17 June 1981.

extrapolated population estimates for any year may be biased. This bias may, in part, explain inconsistencies between predicted and observed changes in the population.

Because of these inconsistencies and for comparative purposes, we also calculated census estimates using an alternate method. We calculated the mean proportion of cows, bulls, and calves present from 1979 through 1981 and extrapolated population estimates for the respective years.

For illustrative purposes, if we assume that the actual population in autumn 1981 was 5,000 caribou, then we can calculate the number of females, calves, and males present using the 2 ways described above. First, assuming that the autumn composition in 1981 (Table 2) was representative of the actual population, the composition can be calculated as follows:

5,000 x .500 females = 2,500 females
5,000 x .205 calves = 1,025 calves
5,000 x .295 males = 1,475 males

Using the alternate method, the mean proportions of females, calves, and males in samples from 1979 through 1981 are used to calculate composition as follows:

5,000 x .47(23) = 2,362 females
5,000 x .24(50) = 1,225 calves or 51.8/100 females
5,000 x .28(20) = 1,413 males or 60/100 females

The calculations which use actual composition differ considerably from the calculations which use mean composition. Use of the mean composition data to extrapolate comparable population estimates for 1979 through 1981 (see Table 3) shows contrasting population estimates as follows:

	Actual composition		Mean composition
1979 =	3,691	vs.	3,850
1980 =	4,448	vs.	4,076
1981 =	4,180-4,882	vs.	4,428-5,172

(If mean composition at the time of photo-censusing was calculated, a set of still different estimates would result.) Depending upon which of the above calculated figures we consider, the mean rate of increase since 1979 was about 7-16% (mid-point of 11.5% per year. If this rate continues, about 450-600 Delta Herd caribou will need to be harvested annually if the herd is to be maintained at 4,180-5,320 caribou. Likewise, assuming 11.5% annual net increase, about 60-70 Yanert Herd caribou should be harvested annually if the herd is to be maintained at 500-600 caribou. No more than 50% of the harvest should be males.

Annual aerial photo-censuses should enable us to refine our population model and enhance our understanding of herd demography.

RECOMMENDATIONS

Although demographic study of the Delta Herd has been more intensive since 1978, questions remain. Census results do not fully agree with predictions based on estimates of natural mortality and recruitment. The herd should be censused annually for several more years. Conventional or modified APDCE censuses of post-calving aggregations may not be most appropriate for the Delta Herd. Alternative census techniques such as intensive aerial survey during rut may be preferable if snow cover is adequate.

Sex and age composition data may be more consistent and reliable if obtained during early October and from all segments of the herd. Because managing for trophy hunting is one of the management goals for the Delta Caribou Herd, the autumn sex and age composition is of considerable importance. Segregating bulls into 3 classes, based on antler size (Appendix III), during composition sampling provides an estimate of recruitment of males and will help measure the impact of hunting on numbers of males with "trophy" antlers. Data should be obtained to correlate antler size to age.

The Yanert Caribou Herd is a discrete subpopulation and should be managed as such.

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PREPARED BY:

James L. Davis
Game Biologist III

and

Patrick Valkenburg
Game Biologist II

SUBMITTED BY:

Harry V. Reynolds
Acting Research Coordinator

APPROVED BY:

Director, Division of Game

Research Chief, Division of Game

APPENDIX I. Dates of flights to monitor radio-collared Delta Herd caribou, 15 September 1980-15 August 1981.

Date	Aircraft	Remarks
26 November 1980	C-185	
1 December 1980	C-185	
2 December 1980	Scout	
11 January 1981	Scout	
12 January 1981	Scout	
8 February 1981	Bell 206 Helicopter	for collaring
27 February 1981	Scout and Bell 206	for collaring
20 March 1981	Scout	
21 March 1981	Scout	
22 March 1981	Bell 206 Helicopter	for collaring
30 March 1981	Bell 206 Helicopter	for collaring
16 April 1981	Scout	
18 April 1981	Bell 206 Helicopter	for collaring in Yanert River
14 May 1981	Scout	
15 May 1981	Scout	Yanert group
19 May 1981	Scout	
22 May 1981	Scout	Yanert group
23 May 1981	Scout	
15 June 1981	Super Cub	
16-17 June 1981	Scout	census
8-10 August 1981	Scout	
30 September 1981	Scout	
29 October 1981	C-185	

APPENDIX II. Analysis of the 1980 and 1981 Delta Caribou Herd APDCE censuses.

1980 Delta Caribou Herd Census

Post-calving groups photographed		Size
A		800
B		799
C		270
D		805
	Total photographed	2,674
Groups not photographed, but with the same composition as those photographed		
L		236
M		110
	Subtotal	3,020
Groups not photographed and composition different than groups A-D and L-M		
E-K		136
	Total	3,156

From the June 1980 composition counts, we determined that the post- calving aggregations A-D and L-M contained 61.8% females older than calves. Therefore, the total number of females older than calves in the aggregations = .618 x 3,020 = 1,866. An additional 58 females were present in groups E-K, which made a "female base population"of 1,924.

During fall composition counts, 85 males/100 females and 49 calves/ 100 females were observed. Assuming that these figures were representative, the population estimate was extrapolated as follows:

Number of females	=		1,924
Number of males	=	1,924 x .85 =	1,635
Number of calves	=	1,924 x .49 =	943
Total extrapolated population		=	4,502

However, comparison of summer and autumn composition led us to believe that the summer composition count, and hence "the female base figure," was not accurate. For example, the calf:cow ratio observed during autumn was higher than the ratio observed during summer (Table 2). The misclassification of some yearling, 2-year-old, and 3-year-old males as females during the June composition counts may be the main source of the inaccuracy. With an autumn calf:female ratio of approximately 50:100, we expected a summer ratio of at least 55:100. To get a ratio of 55:100 we subtracted 158 from the June female sample and added 158 to the number of males sampled in June as follows:

June Sample			
Calves	Females	Males	Total
324	748158 = 590	137+158 = 295	1,209

The adjusted "female base" was then calculated to be:

$$\frac{590}{1,209} \times 3,020 = 1,474$$

Using this adjusted "female base" figure and the autumn 1980 composition figures, an alternate estimate for 1980 was extrapolated as follows:

Calves		Females		Males	Total
(.49 x 1,474 = 722)	+	(1,474)	+	(.85 x 1,474 = 1,253)	3,449

The 23% lower estimate from the alternate population estimate illustrates the "bias" that inaccurate composition data may cause, and the wide range between the 2 estimates based on the same data illustrates the problems inherent in extrapolating. We prefer to census caribou herds with a modified APDCE census procedure eliminating the need to use sex and age composition data to extrapolate the population estimate, but it does require photographing or counting all groups (Davis et al. 1979). However, during the 1980 census, several groups of males were not photographed or estimated, and for this reason it was necessary to estimate the male segment by extrapolation.

1981 Delta Caribou Herd Census

Post-calving Group	Size (range of counts by 3 observers)		
A	190	221	
B	1,134	1,534	
C	910	984	
D	386	451	
E	75	76	
F	335	403	(mostly males)
G	214	275	(mostly males)
Total photographed	3,244	3,944	
Counted from aircraft and not photographed	471		
Total Delta Herd caribou seen	3,585	4,285	
Caribou (upper Dean and Dick Creeks--Yanert drainage)	430		
Total Delta and Yanert caribou	4,015	4,715	

During the 1981 census, we believe that most segments which compose the population were counted, including those bull and yearling groups which are often not present in post-calving aggregations. Therefore, extrapolation to include these segments was not necessary.

To check this conclusion, we excluded groups comprised primarily of males, calculated a "female base," and then extrapolated for males and calves using the same procedure as in the 1980 census. Both a minimum and maximum "female base" were calculated. The minimum number of females older than calves (less groups F and G) = .617 x 3,036 (min. no. observed) = 1,873; the maximum = .617 x 3,607 (max. no. observed) = 2,226. Because groups F and G contained about 20% females, we added 20% of the low and high estimates of these groups to the minimum and maximum estimates of females, respectively, as follows:

Min. no. females = 1,873 + 110 = 1,973

Max. no. females = 2,226 + 136 = 2,362

Using these figures for the "female base" and the composition data from autumn classification counts, the low and high population estimates (excluding Yanert caribou) were:

	Low estimate	High estimate
Females	1,973	2,362
Calves	809	968
Males	1,164	1,394
Total	3,946	4,724

These extrapolated estimates are about 400 higher than the comparable direct counts. This difference is not great and could either reflect that some males were not located during the census, or other biases inherent in extrapolation. Despite some lingering doubts about whether we found all of the post-calving aggregations, the 1981 census is probably the most accurate census ever done on the Delta Herd.

The population estimate of the Yanert River drainage was further refined when we counted about 500 caribou in the drainage in November during a radio-tracking flight. Based on that observation, we believe the Yanert Herd numbers about 600. Lynn Castle, who lives and guides in Game Management Unit 20A, also estimated the herd size at about 600.

APPENDIX III. Notes on antler growth of radio-collared caribou.

Availability of known-age radio-collared caribou in the Delta Herd enabled us to observe antler size progression during the first 3 years of life for several caribou. J. Davis saw 5 radio-collared caribou of known age during the 1981 autumn composition counts (Table A). Observations of caribou radio-collared as calves lead us to the following tentative conclusions regarding size and growth of antlers of Delta caribou in October:

Category

1. Adult female: Variable including some naturally polled or with only 1 antler, but normally with 2 small branched antlers. Antlers rarely palmed, normally with mean antler spread of 12-14" and mean length of main beam 12-18." Total number of points 1" or longer on antlers rarely exceeding 15.

2. Small males: (those with antlers no larger than adult females) Includes all yearlings (16 months) and many 2-year-olds (28 months).

3. Medium males: (those with antlers larger than adult females, but smaller than large adult bulls) Includes some 2-year-olds, all 3-year-olds (40 months), and some 4-year-olds (52 months).

4. Large males: (males at or near the peak of antler growth) Includes some 4-year-olds and most older males.

5. Yearling females: Have spiked or small branched antlers and are normally without velvet in October.

6. Yearling males: Normally have branched antlers and most have antlers that resemble those of smaller adult females.

7. Calves: Normally have spikes less than 10" and rarely are branched. Almost always retain some velvet in October.

Table A. Antler characteristics of knownage Delta caribou seen during sex and age composition surveys, 2 October 1981.

Collar #	Sex	Age	Remarks
BKY 13	F	16 mo	antlers 18", spikes with 4" brow tine on 1 side
BKY 19	F	16 mo	antlers 12", spikes with 1" brow tine on 1 side (small diameter spikes)
YR-77	F	40 mo	"typical" adult female antlers (e.g., length of main beams 12-18", inside spread 12-14", rarely palmed)
YR-?*	M	40 mo	Both of these males were in the mediumsize bull antler category. However, there was a great difference in antler size. One's antlers were just slightly larger than an adult female. The other was approaching the lower end of the large bull category.
YR-?*	M	40 mo	

* The yellow numbers had worn from these collars but they were probably YR 17, YR 18, or YR 58.