ALASKA DEPARTMENT OF FISH AND GAME

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YEARLING MORTALITY IN THE DELTA CARIBOU HERD

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Project No.: W-17-11 Project Title: Big Game Investigations and W-21-1

Job No.: 3.26R Job Title: Yearling Mortality in the Delta Caribou Herd

Period Covered: July 1, 1979 through June 1980 (including data through September 1980)

SUMMARY

Twenty-five radio-collared caribou calves (11 females and 14 males) were monitored from January 1979 (7 months of age) until September 1980 (28 months of age). All 11 females survived to 28 months. During the first year, 2 of 14 males died (wolves were implicated in both deaths), 3 were of unknown status, and 9 were confirmed as surviving. One of four males with a functioning radio collar during the second year of monitoring was apparently killed by a grizzly bear at 26 months of age. The apparent greater mortality rate of male caribou was also found in other studies reported in the literature. The annual mortality rates of 9.1 percent for the first year and 6.7 percent for the second year compare well with figures from the literature.

At least 6 of the 11 radio-collared females produced a calf near their second birthdays. This minimum natality rate of 55 percent was as great as the average for cows 1 year older from other established North American caribou herds.

CONTENTS

BACKGROUND

General history of the Delta Caribou (*Rangifer tarandus granti*) Herd through 1978 was presented in the Background Section of the 1979 progress report for Job 3.26 (Davis and Preston 1980). This research was initiated to determine causes of apparent calf mortality in this herd. Results from the first year of study, however, revealed that our ongoing caribou program had not accurately predicted or determined trends in population growth during the preceding 6 years. However, knowledge of the population dynamics of the herd was improved by monitoring a cohort of radio-collared calves through their first year of life. We proposed that following the radio-collared cohort through their second year of life could be done economically, because the radios were still functioning. The results should provide a better understanding of the population dynamics of this herd, ecology of the yearling cohort, and caribou ecology in general.

OBJECTIVE

To monitor a cohort of radio-collared caribou through their second year of life (i.e. 12 months through 24 months) to ascertain the mortality rate and obtain additional information regarding the yearling cohort.

PROCEDURES

Capturing, collaring, and monitoring procedures were previously described (Davis and Preston 1980). A list of flights made to monitor the yearlings appears in Appendix I. Data collected for each relocation are outlined on the form in Appendix II and an updated summary of herd composition data is contained in Appendix III.

RESULTS

Mortality of Yearlings

We monitored 11 radio-collared female yearlings and four male yearlings from May 1979 when they were 12 months old through September 1980 when they were 28 months old. All females survived, three males survived, and one male (which was 26 months old) was apparently killed by a grizzly bear *(Ursus arctos horribilis)* (Table 1). Although the number of collared animals was small, our findings are reinforced by results from monitoring the radio-collared calves during their first year of life (Davis and Preston 1980). We found that 11 of 11 female calves survived their first year, and 2 of 14 male calves were confirmed to have died. Wolves *(Canis lupus)* were implicated in both deaths. Three males were of unknown status by their first birthday, and we confirmed that nine survived to 1 year of age. Because of a problem with collars falling from males, it seemed probable that the unknown status resulted from collar loss or failure rather than from death (Davis and Preston 1980).

Regardless, there was 100 percent survival of the females during their first 2 years of life. Two confirmed mortalities out of 22 animals whose fate was known during their first year and 1 mortality out of 15 caribou of known status during the second year of life indicate mortality rates of 9.1 percent and 6.7 percent, respectively. Implications of these mortality rates to the population dynamics of the herd vary significantly if considered as rates for the respective year class with the sexes combined or if the sexes are considered separately. Although the sample was small and does not unequivocally demonstrate higher mortality of males, the literature suggests that a differential mortality rate biased toward males could be expected.

Several studies have indicated that certain age or sex classes occur in greater proportion in samples of animals killed by wolves than they do in the caribou population, indicating selection by wolves. Some researchers have concluded that wolves select calves (Banfield 1954, Clark 1971, Kuyt 1972, Miller cited in Parker 1972, Miller and Broughton 1974, Miller 1975), older animals (Banfield 1954, Kuyt 1972, Miller 1975), females (Kuyt 1972), or males (Banfield 1954). Others have concluded that wolves do not select by age (Burkholder 1959) or sex (Burkholder 1959, Miller and Broughton 1974).

Mech (1970) summarized wolf selection of prey by sex as follows: "It can be said that wolf predation may exert a certain amount of selection for one sex or the other in various species and in different seasons. In most cases the year-round mortality from wolves probably occurs evenly in both sexes." He commented on age selection by saying that

Table 1. Accession numbers, collar numbers, radio frequencies, associated data, and status of caribou calves collared in the Delta Herd in 1979.

Accession Number	Collar Number	Frequency (151.) MH2	Sex	Ear Tags[1] Left	Ear Tags[1] Right	Comments
January						
101,972	57Y-R[2]	.960	F	253Y	279R	Functioning
101,973	43Y-R	.955	F	269Y	280R	Functioning
101,974	88Y-R	.940	F	292R	267Y	Functioning
101,975	62Y-Bl	.925	M	17851	17852	Collar shed
101,976	17Y-R	.905	M	17854	17853	Unknown 4/17/79
101,977	78Y-R	.935	F	17873	17872	Functioning
101,978	57BK-Y	.950	M	k7856	17855	Dead, wolves implicated
101,979	18Y-R	.980	M	263Y	281R	Functioning
101,980	58BK-Y	.880	M	17861	17862	Unknown 2/16/79
101,981	59Y-R	.890	F	17857	17858	Functioning
101,982	52Y-R	.915	F	17860	17859	Functioning
101,983	59BK-Y	.895	M	17871	17870	Dead, bear implicated
101,984	54Y-R	.990	F	17868	17869	Functioning
101,985[3]	56BK-Y	.920	M	293R	278R	Radio failed, recollared
101,986	68BK-Y	.995	M	17876	17877	Unknown 3/18/79
101,987	19Y-R	.975	M	287R	255Y	Collar shed
101,988	56Y-R	.885	F	261Y	283R	Functioning
101,989	47BK-Y	.900	M	17867	17866	Collar shed
101,990		--	F	17874	17875	Died after immobilization
101,991	79BK-Y	.930	M	259Y	291R	Functioning
101,992	63Y-B	.910	M		256Y	Radio failed
March						
101,985[3]	58Y-R	.985	M	293R	278R	Unknown 3/1/80
101,993	76Y-R	.875	F	12528	12526	Functioning
101,994	79Y-R	.945	F	17865	17864	Functioning
101,995	67BK-Y	.965	M	17863	17878	Unknown 7/17/79
101,996	62Y-Bl	.925	M	17879	17880	Dead, wolves implicated
101,997	77Y-R	.970	F	17881	17882	Functioning

[1] Ear tags with 5 numbers are metal and those with 3 numbers and a letter are plastic "roto" tags.

[2] Abbreviations for colors are as follows: Y-R = yellow on red; Y-Bl = yellow on blue; BK-Y = Black on yellow.

[3] This animal was recollared as 58Y-R after its first radio collar failed.

during winter wolves prey primarily on the youngest and oldest members of most, if not all, primary prey species.

Bergerud (1971) presented data that suggested males incur greater natural mortality than do females. He showed that lynx *(Lynx canadensis)* were the primary predator on caribou in his area, although they killed mostly calves. He concluded that losses of adults to predation which may be biased toward males were minor. He found that 30 percent more male calves were killed by lynx than were females, and concluded that male calves were more vulnerable because of their tendency to wander farther from their dams. He demonstrated a significant difference between the sexes in this regard. He speculated that predation by lynx might take a higher proportion of stags than does because stags tend to be less wary than females. Furthermore, stags more than does frequent timbered river valleys in winter where lynx are most abundant.

Bergerud (1971) estimated that natural annual mortality rate of adults, including all animals older than 6 months, was 6 percent for the Avalon Peninsula Herd. For the Interior Herd it was estimated at 4 percent for does, yearlings, and 6-month-old calves, and 9 percent for stags. For the total population (older than calves) it was 5 percent.

Exclusive of predation, Bergerud also demonstrated that adult males died at a greater rate than females. The mean age of stags he captured during the fall migration was 3.0 years and does 4.7 years. He reasoned that legal hunting of only stags should not reduce the mean age of males unless heavily biased to certain age groups. However, he stated that better evidence for his argument of a differential mortality by sex was that 21 dead stags and only 13 dead does were found during his investigation. The sex ratio of living adults ranged from 32 to 23 percent stags. With equal susceptibility to death, a minimum of more than 40 dead females would be expected. Similarly, Davis and Valkenburg (1977) found 12 Western Arctic Herd caribou which had died from malnutrition during winter, including 8 males, 3 females, and 1 of unknown sex when the adult sex ratio of the herd was about 60 males:100 females.

Klein (1970), from a review of North American deer literature, stated that females generally outnumber males among natural populations of deer species. The caribou literature supports this generalization. Bergerud (1978) showed that the mean percent of adult males was 39 (i.e. 64 bulls:100 cows) for eight caribou populations which either were not hunted or were hunted nonselectively (Bergerud 1974).

The sex ratio at birth normally favors males in caribou, with approximately 51-55 percent of neonates being male (Bergerud 1978). Because adult sex ratios favor females, it

follows that males experience higher overall mortality, including natural mortality. It also follows that because longevity of females is greater than males (Bergerud 1971, Miller 1974), a higher mortality rate for males is expected. Klein (1970) stated that male deer fawns, perhaps due to their higher metabolic rate resulting from a greater rate of growth, activity, curiosity, and independence, are more subject than females to mortality when food becomes limiting. Klein further concluded that males continue to suffer heavier mortality throughout their lives than do females. The larger loss of males is related to their greater growth requirements when young, their greater activity and therefore increased propensity for accidents, and perhaps more importantly their tendency to utilize fat reserves during the breeding season which results in entering the winter in poor condition.

Klein (1968) illustrated the differential vulnerability of the sexes to mortality through documenting the reindeer population crash on St. Matthew Island. This introduced herd increased to 6,000 by 1963, 19 years after their introduction, and suffered a population crash the following winter. The adult sex ratio before die-off was 69 males to 100 females. Among the 42 animals known to survive, all were females except one. It was an abnormal, nonreproductive male, which may have contributed to its survival.

From the above evidence we tentatively concluded that the mortality pattern observed from the radio-collared cohort in this study is representative of the pattern for the entire Delta Herd, and is not an artifact of our small sample. Natural mortality is apparently heaviest on males but in total is not very great at present.

Our findings seem consistent with Bergerud's (1978) generalizations about expected natural mortality rates for caribou. We mentioned earlier Bergerud's (1971) estimates of natural mortality rates from Newfoundland where there was little predation on adult caribou. Two other estimates of natural mortality rate in addition to Bergerud's (1971) estimate of 5-6 percent are available for caribou in North America. Skoog (1968) estimated a rate of 5-6 percent per year for the Nelchina Herd and Kelsall (1968) estimated a rate of 5 percent for the herds in the Northwest Territories. Neither of these estimates was based on actual data but rather on the extensive experience of the two investigators. Also, both were from herds in which wolf control had greatly diminished predation.

Bergerud (in press) recently calculated natural mortality rates for eight North American caribou herds existing with uncontrolled wolf populations. He used a "census interpolation" method and estimated the annual natural mortality rate as 7 to 13 percent for adults with a midpoint of 10 percent.

Reproduction by Yearlings

At least six of our 11 radio-collared yearling females produced a calf at 2 years of age (Table 2). Nine of the radio-collared females were located on 24 May 1980. Six of these had newborn calves at their side, and these cow/calf pairs were all far enough away from any other caribou that it is improbable the calf belonged to another cow. Also, two were still being cleaned of afterbirth when seen. Two of the females could not be located during this flight.

Female 52YR was not located until 26 June 1980. At that time we initially thought she exhibited a bond with a calf but she was in such a large, moving group that we could not be certain. When located on 4 September 1980 she did not have a calf present. Female 76YR was first located after the calving period on 31 August 1980 and was not accompanied by a calf. When last seen on 10 September 1980 there was no calf with her.

From these observations a minimum of six of the 11 radio-collared females (i.e. 55%) gave birth when they were 24 months old. We have insufficient data to calculate the pregnancy rate. Also, during the active calving period we only searched diligently for the radio-collared females on 24 May 1980 when we saw 6 of 9 with new calves. Our observed 55 percent natality rate is a known minimum rate. Early loss of a calf before our first flight on 24 May, parturition after 24 May but subsequent mortality before the next relocation, or our inability to locate 52YR and 76YR during calving may have precluded detecting the birth of additional calves.

By mid-September 1980 only 57YR and 88YR were confirmed to be with calves. Caribou 54YR and 79YR were of unknown status because they were in groups that included calves but associations between cows and calves could not be determined. The Delta caribou are frequently almost oblivious to the presence of light aircraft so we could not use observations of calves running to cows when disturbed to detect possible cow/calf bonds. This can often be done in other herds which exhibit greater fear of aircraft and in this herd under some conditions.

The observed minimum natality rate of 55 percent for 2-year-old females was much higher than expected from the literature. Bergerud (in press) reviewed the literature on population dynamics of caribou in North America and concluded that caribou generally first come into estrus at about 29 months of age and have their first calf at 3 years of age (Bergerud 1971, Dauphine 1976). If nutrition is especially favorable, some 17-month-old animals come into estrus but if the diet is especially poor some animals may not breed until 41 months of age (Dauphine 1976). Also, the age of puberty varies little between years within established populations (Bergerud

Table 2. Reproductive history of radio-collared female caribou from the Delta Herd.

Accession Number	Collar Number	Date First Seen With a Newborn Calf	Date Last Confirmed With a Calf	With Calf When Last Seen
101,972	57YR	5/24/80	9/4/80	yes
101,973	53YR	Never seen w/calf		
101,974	88YR	5/24/80	9/10/80	yes*
101,977	78YR	Never seen w/calf		
101,981	59YR	5/24/80	5/24/80	no
101,982	52YR	Never seen w/calf		
101,984	54YR	5/24/80	5/24/80	?
101,988	56YR	Never seen w/calf limping badly 5/24/80		
101,993	76YR	Never seen w/calf		
101,994	79YR	5/24/80	5/24/80	?
101,997	77YR	5/24/80	5/24/80	no

*Seen 14 June 1980 but couldn't tell if with calf because too many in group, seen 12 August 1980 and thought without calf.

1971, Dauphine 1976). However, when caribou are introduced into suitable new ranges, more yearlings reach puberty than on established ranges.

In contrast, reindeer usually reach puberty at 17 months and if nutrition is favorable some females breed as calves (see citations in Bergerud in press).

A comparison of our findings with other available data is presented in Table 3. If the sample of one from the George River Herd is excluded, then the observed minimum natality rate (55%) for the "1-1/2 year" cohort from the Delta Herd is considerably greater than for any other established herd (i.e. excluding transplanted animals in unoccupied habitat). The natality rate for the yearling cohort of the Delta Herd was 27.5, 1.7, and 4.2 times greater, respectively, than for the Kaminuriak, Beverly, and Nelchina Herds. In fact, the natality rate of 1-1/2-year-old Delta Herd females is equivalent to the mean pregnancy rate for 2-1/2-year-old females from other herds. The actual contribution that early breeding can make to potential herd growth can be great because the young-age cohorts are proportionately large in populations with a "normal" age structure. However, the actual contribution depends on the survival rate of the offspring and whether producing a calf at 2 years of age will cause the female to not produce in some subsequent year or years.

Our data suggest that the 2-year-old cows may have realized a greater loss of calves by 3 months of age than the population as a whole, but our observations are equivocable. We often find it difficult to establish if a cow has a calf when we are observing from fixed-wing aircraft. In addition, by mid-July we also noted that calves frequently were seen by themselves several hundred yards from any other caribou. Weights taken when the collared calves from this study were about 7 months old suggest that they had grown much faster than expected for caribou at this latitude (Davis and Preston 1980). It is possible that calves which rapidly mature physically may also rapidly develop behaviorly. This might explain why calves exhibit loose or no bonds with cows by their second and third months of life. Our data on calf survival are inconclusive at present and will be reported more fully in the future.

Calving Ground Observations

J. Davis spent the period from 14 May through 21 May conducting ground observations on the major or "core" calving area of the herd (Fig. 1) and covered the major calving area by helicopter three times during this period. We estimated (partially subjectively) from extensive aerial reconnaissance in 1979 and 1980 that 75 to 90+ percent of the adult cows in the herd calved in the core area. This pattern of adult calving was apparently similar to that of the past because

Table 3. Percentage of females pregnant (from collections) or parous (from calving ground classifications). Table expanded from Bergerud (in press).

Herd	Percent Pregnant					Percent Parous
	Calf	1-1/2yr	2-1/2yr	3+ yrs	Total[1]	2+ yrs
Kaminuriak	0(48)[2]	2(57)	48(69)	90(280)	70	82(343)
Beverly	--	33(3)	50(16)	78(69)	73	--
Nelchina	0(24)	13(31)	61(46)	89(335)	80	86(3526)
Western Arctic	--	--	--	78(130)	78	92(517)
George R.	--	100(1)	100(6)	100(15)	100	89(?)
Spatsizi	--	--	--	--	--	80(353)
Level Mtn.	--	--	--	--	--	81(?)
Ontario	--	--	--	--	78	--
Interior (Nfld)	--	--	--	--	81(21)	85(6657)
Porcupine	--	--	--	--	86(123)	--
Delta 1979	--	--	--	--	--	98(479)
Delta 1980	--	55(11)[3]	--	--	--	98(102)
Total	0(72)	7(92)	55(137)	85(829)	81	85

[1] Excludes calves and yearlings.

[2] Sample size in parentheses.

[3] This is an observed minimum natality rate.

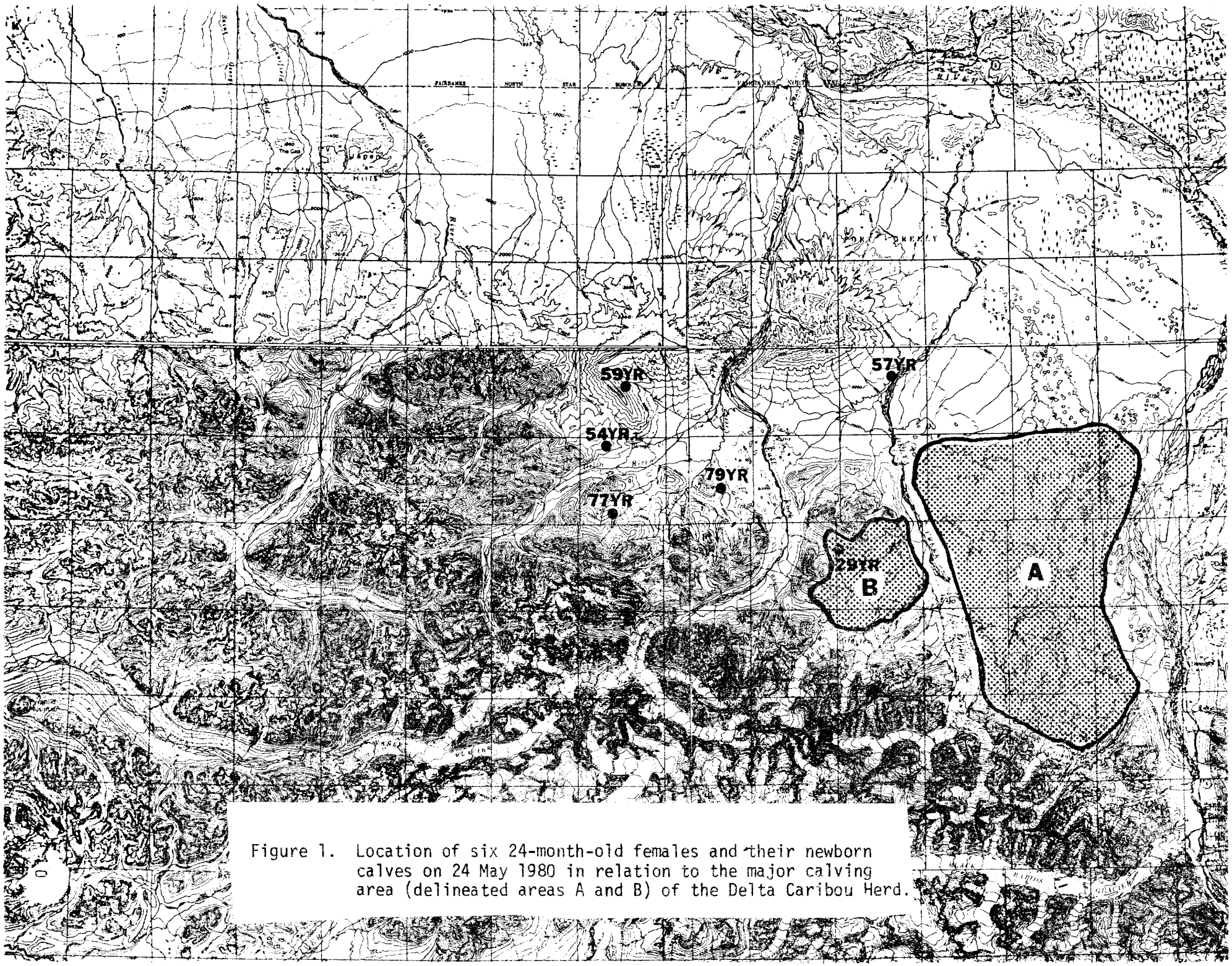

Figure 1. Location of six 24-month-old females and their newborn calves on 24 May 1980 in relation to the major calving area (delineated areas A and B) of the Delta Caribou Herd.

M. Buchholtz (pers. comm.) stated that most calving occurred in the areas delineated as A and B in Fig. 1 from the late 1960's through 1978.

Segregation of the 2-year-old cohort from adult cows during spring was further illustrated as follows. On 16 May 1979 we flew a survey in the area east of Wood River and west of the East Fork of Little Delta River. We saw 31 caribou including 1 adult female with hard antlers, 2 adult bulls, 26 long yearlings (i.e. 24 months old), and 2 that were unclassified. Thus, 84 percent of the caribou in this area were long yearlings. In contrast, in the major calving area (Fig. 1) we saw 39 newborn calves and 297 caribou older than calves with a notation that fewer than 20 percent of the total were long yearlings.

While on the calving ground, data regarding calving chronology and natality rate were collected and are summarized in Fig. 2 and Table 3. Calving chronology was advanced several days in 1980 compared to 1979. Many interesting observations regarding calving were made that warrant elaboration but are beyond the scope of this report. Included are:

1. The Delta Herd calved earlier in 1979 and 1980 than expected from previous reports from adjacent herds. Calving was much earlier than in years for which there are data from the Fortymile and Nelchina Herds (i.e. those herds immediately north and south, respectively).

2. Human disturbance contributing to cows abandoning calves was insignificant in contrast to observations by Bos (1974) in the Nelchina Herd. Strong early bonds with calves were documented and the bonds were stressed severely in several instances.

3. Golden eagle (*Aquila chrysaetos*) predation on calves was the most frequently noted cause of mortality.

4. This herd has the highest percent of parous females on the calving ground of any established (i.e. excluding recently transplanted animals) North American caribou herd.

RECOMMENDATIONS

Although this is a final report, investigation of the demography of the Delta Herd is continuing under a new Job (3.27R). We will use computer modeling to investigate the implications of the relatively high rate of reproduction by 2-year-old females observed in this study as well as the different mortality rates observed.

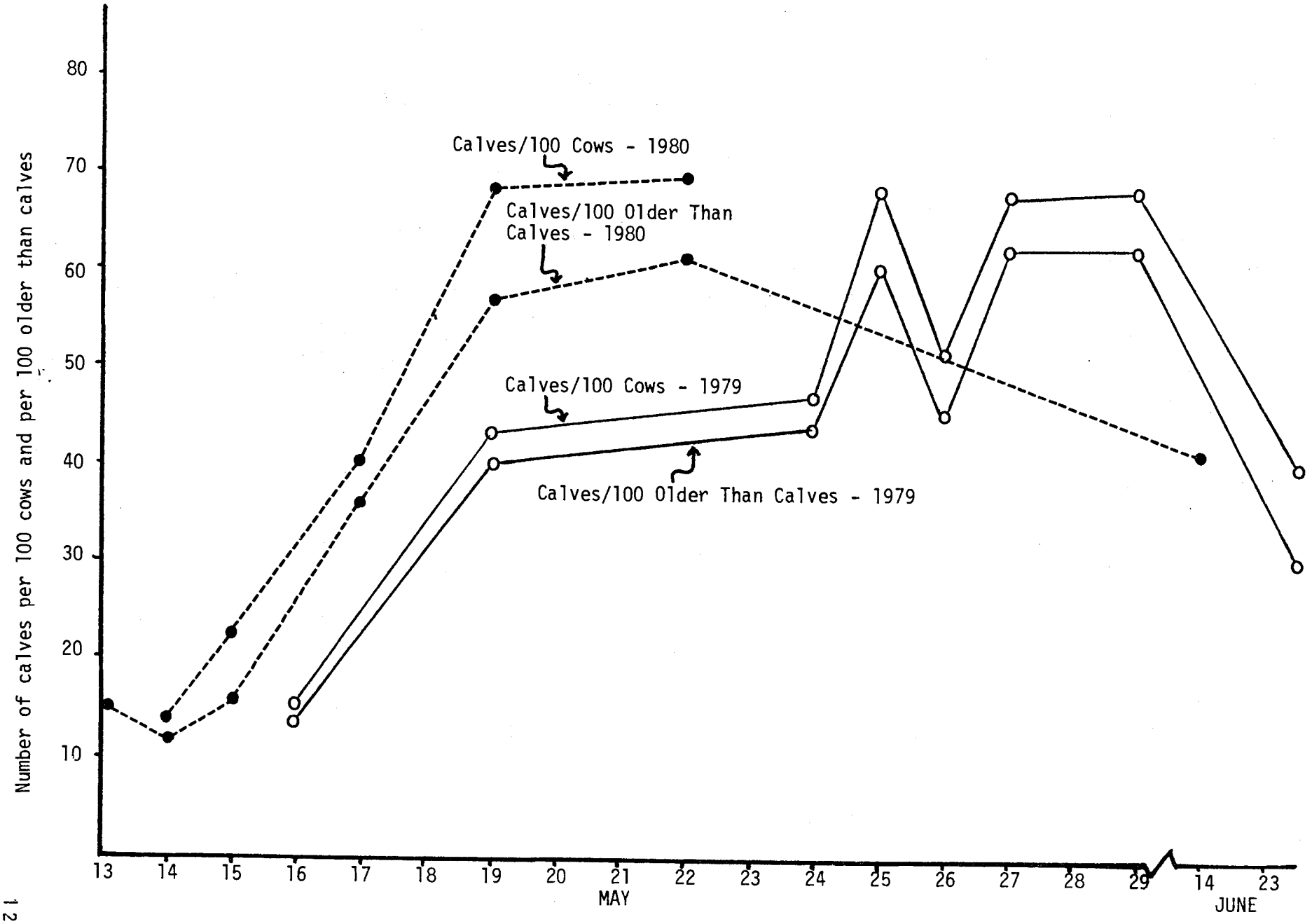

Figure 2. Progression of calving and calf survival during May and June 1979 and 1980 in the Delta Caribou Herd.

Results of recent investigations on the Delta Caribou Herd (Davis and Preston 1980) revealed that the demography of the herd was grossly misunderstood from 1975 through 1979 under the level of study it received. The herd should be more intensively studied to clarify understanding of demography. This is especially true because the herd will likely be exposed to greatly differing rates of natural mortality (i.e. predation) and levels of human harvest within the succeeding few years. A good quantitative assessment of the demography of an Alaskan caribou herd has never been conducted over a period of greatly varying rates of natural mortality and human harvest. Recommendations from a recent workshop (Klein and White 1978) attended by most leading caribou workers in North America identified a need for intensive demographic study of one or more caribou herds in Alaska. The opportunity to manipulate hunting pressure and predation rates on this herd and its proximity to Fairbanks (the current center of research for caribou in Alaska--because of existing facilities and staff at the University of Alaska and because it is the duty station for most ADF&G staff conducting caribou research) make it the herd most desirable for study from a cost:benefit ratio. Hypotheses formulated regarding some aspects of general caribou ecology from investigations of larger herds (e.g. Western Arctic and Porcupine) may be more feasibly tested on the Delta Herd.

ACKNOWLEDGMENTS

A substantial portion of the Fairbanks Game Division staff, as well as others, collected data contained in this report. M. Buchholtz, L. Jennings, and D. Simpson collected much of the data on herd composition and population size. J. Coady and P. Valkenburg flew most of the radio-collared caribou relocation surveys. R. O'Connor, K. Whitten, E. Crain, D. Haggstrom, and J. Coady assisted in caribou tagging. R. O'Connor organized data and efforts and aided in all other facets of the early part of the radio-collaring project. J. Wright aided in field work and counted the census photos for 1973 and 1979. He and P. Valkenburg aided in data collection and summarization. D. Preston aided in many facets of the study.

Charter pilots W. Lentsch and J. Kannebec safely flew operations demanding considerable skill and experience during portions of the study.

The U.S. Army made possible the 1979 calving ground work that made a major contribution in our analysis of the demography of the Delta Caribou Herd. Army personnel Lt. H. Griese, Lt. J. Kerns, and Mr. W. Gossweiler participated in the field. The Army provided helicopter transportation and Cols. L. Bonito and D. Pinney and Mr. W. Quirk authorized and coordinated the logistic support for the project.

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Appendix I. Dates of flights conducted to monitor radio-collared Delta Herd yearling caribou from 1 July 1979 through 15 September 1980.

Date	Aircraft Type	Remarks
18 May 1979	Scout	
1 June 1979	Scout	
5 June 1979	Scout	
16 June 1979	Super Cub	Part of photo census
23 June 1979	Helicopter 206(B)	Part of photo census
17 July 1979	C-185	
20 July 1979	C-185	
7 August 1979	C-185	
17 August 1979	C-185	
25 August 1979	Scout	
1 October 1979	C-185	
15 October 1979	C-185	
27 November 1979	Scout	
30 November 1979	Helio Courier 295	
7 December 1979	Scout	Part of composition counts
15 January 1980	Scout	
29 February 1980	Scout	
1 March 1980	Scout	
24 May 1980	Super Cub	
14 June 1980	Helicopter 206(B)	Part of photo census
26 June 1980	Scout	
12 August 1980	Scout	
31 August 1980	Scout	
4 September 1980	Scout	
10 September 1980	Scout	

Appendix II. Data collection form used for "relocations."

DATE_____ TIME_____ COL. NO. AND COLOR_____
HERD_____
PILOT_____ OBSERVERS_____ OBSERV. NO._____
ELEV._____ EXPOS._____
AIRCRAFT TYPE_____ (ATTACH MAP LOCATION)

HABITAT:
___ RIPARIAN-WILLOW/BOTTOM
___ DWARF BIRCH-WILLOW/SIDE HILL
___ DRYAS/RIDGETOP
___ SPRUCE WOODLAND (SPARSE UPLAND SPRUCE)
___ SPRUCE FOREST
___ TUSSOCK TUNDRA
___ SEDGE MEADOW

SNOW:
___ HARD ___ BARE ___ 0-15"
___ SOFT ___ PATCHY ___ 16-30"
___ ENTIRE ___ 31" +

WEATHER: WIND _____ TEMP. _____

CARIBOU SIGHTED:
GROUP SIZE _____ COMPOSITION: B____ C____ Y____ Ca____ Ad.____ UNKNOWN_____

BEHAVIOR: FEED_____ REST_____ WALK_____ OTHER_____

ANTLERS: SIZE_____ VELVET_____ HARD_____

ESTIMATED DISTANCE TO NEAREST OTHER GROUP:_____

DISTURBANCE:	REACTION (Class 1-5, see below)	HORIZ. DIST.	VERT. DIST.	REMARKS
1st PASS				
2nd PASS				
3rd PASS				

We divided the reaction of caribou into five classes, as follow:

Class 1. Panic response. Animals were completely out of control; they stumbled, collided with one another, and ran into obstacles such as willow patches or trees. There was some subjectivity in distinguishing this class from the following one.

Class 2. Strong escape response. Animals trotted or ran, and usually continued running after the aircraft has passed.

Class 3. Mild escape response. Animals moved away from the aircraft or from the original direction of movement in the case of traveling animals. This class included only animals which walked or trotted a short distance.

Class 4. Stationary response. Animals stopped feeding, rose from resting position, or assumed alarm posture (Pruitt 1960).

Class 5. No visible response. Animals continued feeding or resting or, if moving, continued at the same pace in the same direction.

Appendix III. Summary of sex and age composition counts of the Delta Caribou Herd since 1969.

Date	Bulls per 100 Cows	Yrlgs per 100 Cows	Calves per 100 Cows	Yrlg % in Herd	(Total Yrlg)	Calf % in Herd	(Total Calves)	Cow % in Herd	(Total Cows)	Bull % in Herd	(Total Bulls)	Sample Size
10/13-15/69	40.0	20.0	28.0	10.3	(85)	14.0	(116)	49.5	(410)	20.0	(166)	828[a]
10/21-23/70	77.0	23.0	34.0	9.8	(88)	14.4	(129)	42.7	(383)	33.0	(296)	896
10/29-11/1/71	29.0	11.0	16.0	6.8	(78)	9.6	(109)	64.8	(738)	18.8	(214)	1139
10/27-31/72	32.4	5.8	10.7	3.9	(46)	7.2	(85)	67.1	(795)	21.8	(259)	1184
6/19/73	4.4	8.1	24.4	6.0	(67)	17.9	(201)	72.9	(820)	3.2	(36)	1124
10/23-24/73	28.6	4.0	10.3	2.8	(29)	7.2	(76)	70.0	(735)	20.0	(210)	1050
6/13-14/74	-	-	-	3.1	(33)	3.1	(33)	89.0	(942)	4.7	(50)	1058
10/23-25/74	27.6	1.8	2.0	1.4	(16)	1.5	(17)	76.1	(868)	21.0	(240)	1141
6/11-12/75	3.1	0.4	12.9	0.3	(3)	11.1	(108)	86.0	(839)	2.7	(26)	976
Fall 1975	No counts conducted											
6/76	1.6	-	41.4[b]	-	-	28.9	(395)	70.0	(955)	1.1	(15)	1365
6/16-22/76	1.4	-	55.8	-	-	35.5	(390)	63.6	(699)	0.9	(10)	1099
10/29-11/1/76	38.5	0.9	45.1	0.5	(5)	24.4	(258)	54.2	(572)	20.9	(220)	1055
6/16,19/77	9.7	12.1	34.3	7.8	(95)	22.0	(269)	64.1	(784)	6.2	(76)	1224
10/26-11/2/77	32.5	5.8	42.2	3.2	(44)	23.4	(319)	55.4	(756)	18.0	(246)	1365
6/13-14/78	12.2	7.9	23.8	5.5	(52)	16.5	(157)	69.5	(661)	8.5	(81)	951
10/26/78	75.0	10.0	39.0	4.5	(33)	17.3	(126)	44.7	(324)	33.5	(242)	725
6/23/79	11.5	17.9	44.6	10.3	(76)	25.6	(189)	57.4	(424)	6.6	(49)	738
12/7/79	39.0	-	65.0[b]	-	-	32.0	(115)	49.0	(177)	19.0	(69)	361
6/14/80	18.3	-	43.3	-	-	26.8	(324)	61.8	(748)	11.3	(137)	1209

[a] Includes some animals of unknown age or sex.
[b] Yearlings not differentiated from cows.