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POPULATION STATUS OF THE FORTY MILE CARIBOU HERD

By

Patrick Valkenburg
and
James L. Davis

Progress Report
Federal Aid in Wildlife Restoration
Project W-22-3, Job 3.32

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PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: David G. Kelleyhouse and Daniel V. Grangaard

Project No.: W-22-3 Project Title: Big Game Investigations

Job No.: 3.32 Job Title: Population Status of
the Fortymile Caribou
Herd and Identification
of Limiting Factors

Period Covered: 1 July 1983-30 June 1984

SUMMARY

The Fortymile Caribou (Rangifer tarandus granti) Herd (FCH) declined from about 51,000 (precalving) in 1963 to about 4,800 (precalving) in 1973 ($r = -0.24$). Harvest was insignificant from 1973 through 1981, and the FCH increased to 8,000 in 1981 ($r = 0.03$). The wolf (Canis lupus) population was reduced by 50% beginning in February 1982 on the FCH's winter range in the Fortymile River drainage. The FCH subsequently increased from 8,000 in 1981 to 14,000 in 1984 ($r = 0.17$). This apparent strong correlation between the rate of herd growth and wolf control warrants qualification. The 1981 population estimate may have underestimated herd size which would underestimate r for 1973 through 1981 and overestimate r for 1981 through 1984. In addition, existing data are inadequate to reject a hypothetical conclusion that accelerated herd growth occurred prior to 1981. The wolf:caribou ratio on the Fortymile River drainage winter range was about 1:64 before wolf abundance was lowered in 1982. Subsequently, the wolf:caribou ratio was lowered to 1:130. Wolf control ceased in 1983-84, and the wolf population has since increased in the Fortymile River drainage.

Natality rate for the FCH has been consistently high, but within 6 weeks after birth about 60% of the calves die. Calf:cow ratios do not measurably decline after calves are 6 weeks old. The mean natural mortality of radio-collared adult females has been about 3% from 1980 through 1984.

Key words: caribou, Fortymile Herd, mortality, Rangifer, wolf.

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BACKGROUND

The Fortymile Caribou Herd (FCH) was the largest caribou (Rangifer tarandus granti) herd in Alaska and one of the largest in the world during the 1920's, ranging from Rampart on the Yukon River to Whitehorse, Yukon Territory and providing much of the food needed by miners, Athapaskans, and other early residents (Murie 1935). Although the cause is unknown, the FCH declined from several hundred thousand (Murie 1935) in the late 1920's to 10,000-20,000 (Skoog 1956) by the early 1940's. Factors conjectured to have contributed to the herd's decline include emigration, large subsistence harvests, and an increasing wolf (Canis lupus) population (Murie 1935, Skoog 1956, LeResche 1975, Davis et al. 1978).

The FCH began increasing coincident to the initiation of wolf control in 1947 by the Federal Bureau of Predator and Rodent Control. The herd numbered about 49,000 (precalving) from 1955 through 1960 (Davis et al. 1978). No censuses were conducted between 1961 and 1973 when the population contained about 6,500 (Davis et al. 1978). The decline was attributed to continuing high harvests and an increasing wolf population (Davis et al. 1978). In retrospect, it is clear that mismanagement contributed to the decline. Conventional wisdom of the time (and there was little evidence to refute it) was that predators generally did not control ungulate populations and that hunting mortality was often compensatory (i.e., hunters killed many animals that would have died anyway). In addition, the size of many ungulate populations was inadequately monitored and the FCH was no exception.

As a result of management based on the invalid conventional wisdom of the late 1960's and early 1970's, coupled with record severe winter weather, many Alaskan caribou and moose (Alces alces) populations declined, including the Nelchina Caribou Herd, Western Arctic Caribou Herd, Delta Caribou Herd, and Fortymile Caribou Herd (Gasaway et al. 1983). The Denali (formerly McKinley) Caribou Herd also declined, though hunting was apparently not a major factor. The Nelchina, Western Arctic, and Delta Herds recovered rapidly during the mid-1970's and early 1980's coincident with intensive management. In contrast, the largely unmanaged Denali and Fortymile Herds did not. In the 3 intensively managed herds, harvest was greatly reduced or eliminated in the early or mid-1970's, and wolves were severely reduced after about 1976 or 1977 through control by the ADF&G (Delta), high wolf harvests by the public (Nelchina and Western Arctic), and/or natural processes such as disease and reduced prey (Western Arctic). The Nelchina Herd apparently began increasing prior to wolf reduction (VanBallenberghe, pers. commun.). The slow rate of growth for the FCH from 1974 through 1981 apparently occurred

during a period of natural decline of wolf numbers. The Denali Herd apparently declined or was stable through the 1970's with a largely stable wolf population. The trend in wolf numbers was unknown during the growth of the Denali Herd in the 1980's.

The FCH has the greatest potential of any relatively accessible big game herd in the state to support significantly increased hunting and other recreation. However, the FCH only grew 3% annually from 1974 through 1981 with easy winters, insignificant harvest, and natural wolf levels. The FCH had grown to 14,000 by 1984, which was still less than 26% of the Alaska Department of Fish and Game's (ADF&G) interim pre-calving herd size goal of 50,000 (ADF&G 1984). ADF&G has proposed continuing a predator reduction program begun in February 1982 in portions of Game Management Unit 12 and Subunit 20E to restore low moose and caribou numbers to higher levels. This study was initiated to gather information necessary to direct management and to determine the effects of predator reduction on the FCH.

GOAL

To determine the status, population trend, movements, distribution, range use patterns, and limiting factors of the FCH from 1983 through 1987.

OBJECTIVES AND PROCEDURES

Five objectives are being addressed in this study. They are:

Objective 1. Determine the rate of growth of the FCH.

The herd was censused in 1983 and 1984 using the modified aerial photo-direct count-extrapolation technique (Davis et al. 1979). In the 1983 census, 8 radio-collared female and 1 male caribou were monitored. In the 1984 census, 20 radio-collared females were monitored. Census results from 1983 and 1984, as well as census results in 1973, 1974, and 1981 were used to model herd growth and provide a basis for predicting future growth. Results of the 1984 census appear in Appendix A.

Objective 2. Measure the natality rate of the FCH and compare it to the Delta and Western Arctic Herds.

During the calving period (15-31 May) in 1983 and 1984, radio-collared female caribou were checked for the presence of distended udders, hard antlers, and calves to determine their

pregnancy rate. A helicopter and ground observers were used to conduct composition counts in mid-June 1983 and in late May and mid-June 1984. Results were compared to similar counts and samples of the Delta and Western Arctic Herds.

Objective 3. To determine the mortality rate of calves and adults.

Composition counts were conducted in fall (Sep/Oct) and spring (Mar/Apr) to determine the overwinter change in calf:cow ratios. We acknowledge that comparison of ratios between seasons is only an index to the absolute calf mortality rate.

The mortality rate of adult females in the FCH was estimated from the mortality rate of radio-collared caribou (Trent and Rongstad 1974). The adult female mortality rate for the FCH was compared to other herds for which data were available.

Objective 4. To determine the patterns of range use, habitat selection, and food habits of the FCH.

Food habits will be compared by analyzing fecal samples from the respective herds for plant fragment composition. Range use and habitat selection will be determined by monitoring the radio-collared caribou and assuming they are representative of the herd.

Objective 5. To determine caribou:predator ratios in the range of the FCH.

Data on wolf numbers in a portion of the FCH's winter range were obtained from a concurrent ADF&G study: factors limiting the growth of low-density moose populations (Boertje et al. 1985). Wolf abundance was also estimated in other portions of the FCH's range. D. Grangaard spent 2 days surveying wolves in the Charley River, Seventymile River, and Slate Creek drainages which are potential caribou winter ranges and are used annually in other seasons. By using these data and information extracted from the literature, we estimated the abundance of wolves within the range of the FCH and the potential influence of wolves on the growth rate of the FCH. Comparative data for other herds are available in the literature.

Grizzly bears (Ursus arctos) and golden eagles (Aquila chrysaetos) are the other potentially important predators of caribou within the range of the FCH. Lynx (Lynx canadensis) and black bears (Ursus americanus) are also present in the area. There are no quantitative data on the abundance of these species. Incidental observations of these species were recorded and densities of grizzly bears were extrapolated from

studies in similar areas in interior Alaska (Reynolds and Hechtel 1984).

RESULTS

Growth Rate of the Fortymile Caribou Herd

Trends in population size of the FCH prior to 1975 were summarized by Davis et al. (1978). In 1963 Skoog (1964) estimated herd size to be 51,000 (precalving) and thought it was growing. However, the herd numbered only 4,800 (precalving) when next censused in 1973. For that period then, the average annual rate of decrease was 21% ($r = -0.24$).

From 1973 through 1982, there was no significant harvest, and the FCH increased slowly. Based on the 1973, 1981, 1983, and 1984 censuses, it appears that the herd increased slowly until 1981 ($\lambda = 1.03$, $r = 0.03$) when it was estimated at 6,331 caribou (precalving), and then more rapidly ($\lambda = 1.19$, $r = 0.17$) until it reached approximately 10,640 caribou (precalving) in 1984 (Fig. 1). The 1974 census was thought to be an underestimate, and it was not considered in the calculations. In addition, the 1981 census probably underestimated the population because conditions were not ideal. The number of caribou counted on census photos by different individuals regularly contribute a 10% or higher difference in the population estimate (Davis et al. 1979). Because of imprecise census estimates, calculating rates of increase necessitates making assumptions. Regardless of qualifications on census results, the data clearly show that the herd increased between 1973 and 1984. The mean annual herd growth of about 8% per year between 1973 and 1984 has been much less rapid than the growth of the Delta (20%) and Western Arctic (14%) Herds (Davis et al. 1980, 1983).

Wolf control was initiated on the FCH's winter range in 1981, and winter mortality due to wolf predation was probably reduced. Calf survival indices (i.e., calf:cow ratios) do not reflect lowered predation on calves after the initiation of wolf control (Tables 1 and 2), but since wolf control did not take place on the calving or postcalving ranges, summer calf survival was unlikely to have been affected. In addition, in situations where all caribou are vulnerable (e.g., deep snow, trees), wolves may not select calves (Davis and Valkenburg 1979, 1985), so ratio estimators used as an index to absolute mortality rates cause mortality to be underestimated because of proportional mortality among both ratio components (i.e., cows:calves).

Prior to wolf control in 1981, there were 125 wolves on the Fortymile River winter range. After control, the winter wolf

population on the Fortymile River portion of the winter range was estimated to be about 60. How much the removal of 65 wolves lowered wolf predation on the caribou can be estimated as follows. If one assumes that one-half of the winter prey of wolves on the Fortymile River wintering area were caribou and the caribou remained in the Fortymile River drainage for 9 months of the year, each wolf would be expected to kill approximately 9 caribou per winter (Skoog 1968, Kuyt 1972). Therefore, the removal of 65 wolves could have resulted in about 585 fewer caribou killed, about 6% of the population in 1981.

Natality

A. T. Bergerud and H. Butler conducted ground counts of Fortymile caribou in late May 1984 and calculated a calf:cow ratio of 72:100. By comparison, shortly after the peak of calving, the Western Arctic Herd averaged 73 calves:100 cows (SD = 5.8) between 1977 and 1982, and the Delta Herd averaged 78 calves:100 cows (SD = 5.3) between 1982 and 1984.

The calf:cow ratio had dropped to 45 calves:100 cows by 10 June. Cow:calf counts conducted on the FCH around the 3rd week of June from 1974 through 1983 averaged 34.7 calves:100 cows (SD = 6.3). A consistent pattern of rapidly declining calf:cow ratios in early summer has been documented since 1972 (Table 1). For example, in 1974 counts (Table 1) in early June showed about 50-55 calves:100 cows, but by 28 June, calf:cow ratios were down to 24:100.

Composition counts done close to calving time are a good index to natality. In this discussion, natality is synonymous with the birth rate for cows >24 months old. Composition counts conducted when peak calf:cow ratios are observed reflect natality and early postnatal mortality of calves. A confounding factor is that the degree of segregation between nonparous and gravid females is unknown. A better measure of natality rates can be gained by sampling the proportion of cows with distended udders in all cows older than 1 year (Bergerud 1964). The best measure is gained by determining the proportion of pregnant radio-collared cows:all radio-collared cows. When one compares these measures of natality, it appears that rates in the Delta, Western Arctic, and Fortymile Herds are similar (Table 2).

Mortality

Calf Mortality:

Oversummer calf mortality was estimated by comparing calf:cow ratios calculated from composition counts done in late May and June and again in September/October (Table 1). Although there

is little information on peak calf:cow ratios in late May for the FCH, calf mortality appears very high during the 1st 6 weeks of life. In 1974, the calf:cow ratio dropped from 53:100 on 5 June to 24:100 by 28 June (55% reduction). In 1984, the calf:cow ratio dropped from 72:100 on 30 May to 45:100 on 20 June (38% reduction). Some of this reduction in the calf:cow ratio from late May to late June may be due to the mixing of nonparous cows into the postcalving groups. From late June to October, little mortality is apparent. Between 1974 and 1983, the late June calf:cow ratio averaged 36:100 (SD = 7.9, n = 7), and the mean calf:cow ratio in late September/October during the same period was 31:100 (SD = 7.9, n = 7). By comparison, Delta Herd data frequently showed a higher calf:cow ratio in fall than in early summer during the late 1970's (Davis and Valkenburg 1984). Calf:cow ratios could only increase from early summer to fall by improbable events such as midsummer calving or disproportional mortality of cows. The apparent increase was most likely due to misidentification of young bulls in June when pelage patterns on the rump of bulls resemble the vulva patch on cows. Misidentifying bulls as cows thus artificially depresses the calf:cow ratio in June. Nevertheless, the mean calf:cow ratio in the Delta Herd in September/October from 1976 through 1983 was 44:100 (SD = 9.8, n = 9) (Davis and Valkenburg 1984). In the Western Arctic Herd, the mean calf:cow ratio in October from 1977 through 1982 was 51:100 (SD = 7.5, n = 4) (Davis and Valkenburg 1985).

In 1983 and 1984, we also estimated calf:cow ratios for the FCH in March/April to compare to September/October ratios to estimate overwinter survival of calves (i.e., recruitment). The calf:cow ratio dropped from 27:100 in September 1982 to 25:100 in April 1983. From September 1983 to March 1984, the ratio dropped from 36:100 to 27:100. These figures indicate that overwinter calf mortality is low. However, the counts also reflect the differential vulnerability of cows and calves to mortality sources and would be misleading if overwinter mortality of cows was greater than that of calves. If wolves do not select calves and kill large numbers of caribou, then the March/April calf:cow ratios would grossly underestimate overwinter calf mortality. Nevertheless, the difference in spring calf:cow ratios during the late 1970's and early 1980's among the Fortymile (26:100, SD = 1, n = 2), Delta (39:100, SD = 14.1, n = 2), and Western Arctic (44:100, SD = 13.4, n = 4) Herds further indicates that Fortymile calf survival to 10 months is relatively low.

The most accurate way to estimate calf mortality, short of counting all calves pre- and postwinter, is to mark a cohort of calves at birth and determine their fate. Presently, funds are insufficient to pursue this approach.

Adult Mortality:

The mortality rate of adult Fortymile caribou was estimated from the cohort of radio-collared individuals from September 1980 through late September 1984 (Trent and Rongstad 1974). Only 1 male was equipped with a radio collar during the period, and it was excluded from the calculations, so the calculated mortality rate is for females only. During the 48-month period, 423 collar months were accumulated and 1 radio-collared female caribou died. Annual mortality was calculated to be 3% using the Trent and Rongstad (1974) procedure. Annual mean total mortality rates for female Delta and Western Arctic caribou were 3% and 10%, respectively, from 1981 through 1983 (Davis and Valkenburg 1984, 1985).

Range Use, Habitat Selection, and Food Habits

The current funding level has precluded collecting and analyzing enough data to present during this report period. However, a review of the literature and analysis of existing data will be presented in a paper at the 4th International Reindeer/ Caribou Symposium, Whitehorse, Yukon Territory in August 1985. The abstract appears in Appendix B.

Wolf:Caribou Ratios

From the wolf abundance data (Tables 3 and 4), estimated caribou numbers, and the known or assumed winter distribution of the FCH, wolf:caribou ratios can be calculated for the winter prior to initiation of wolf control in February 1982 and for the following winters. Since 1981, wolf numbers have been estimated annually in the Fortymile River drainage. In April 1984, wolf numbers were also estimated in the Charley and Seventymile River drainages. Most Fortymile caribou probably have not ranged outside the Fortymile River drainage from September through April after 1981-82. In 1981-82 there were only 4 Fortymile caribou with radio collars, so distribution of the herd was difficult to determine. Apparently, about two-thirds of the herd wintered in the Fortymile River drainage and the remainder apparently wintered in the Charley and upper Salcha River and Birch Creek drainages. Approximately 20,000 Porcupine Herd caribou crossed the Yukon River near Eagle and wintered in the Seventymile, Fortymile, Charley, and Salcha River and Birch and Slate Creek drainages in winter 1981-82, so the 2 herds were mixed during winter, but no known net egress or ingress occurred.

Because of the presence of the Porcupine caribou, it is difficult to calculate meaningful wolf:caribou ratios for 1981-82. If all of the FCH and none of the Porcupine Herd wintered in the Fortymile River drainage in 1981-82, the wolf:caribou

ratio in fall 1981 was about 1 wolf:64 caribou (125 wolves: 8,000 caribou). By interpolating between the 1981 and 1983 caribou estimates, we conclude there were about 10,000 caribou in 1982 and 77 wolves (1 wolf:130 caribou). In fall 1983 there were about 87 wolves:12,000 caribou (1 wolf:138 caribou). The wolf reduction program was not operational in 1983-84 or 1984-85, and the wolf population increased substantially (Table 4). However, if the FCH continues to winter in the Fortymile River drainage, the wolf:caribou ratio on the winter range is not likely to drop below 1:100 because the caribou population has increased substantially. These calculations are admittedly crude, but it is clear that the wolf:caribou ratio has been significantly reduced since 1981.

It is difficult to calculate the influence wolves have had on the FCH during winter because wolves in the area also eat moose and some sheep (Ovis dalli).

Discussion of other predators and potential limiting factors will appear in subsequent reports.

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PREPARED BY:

Patrick Valkenburg
Game Biologist II

and

James L. Davis
Game Biologist III

APPROVED BY:

W. Lewis Pamplin, Jr.
Director, Division of Game

Steven R. Peterson
Research Chief, Division of Game

SUBMITTED BY:

Wayne L. Regelin
Regional Research Coordinator

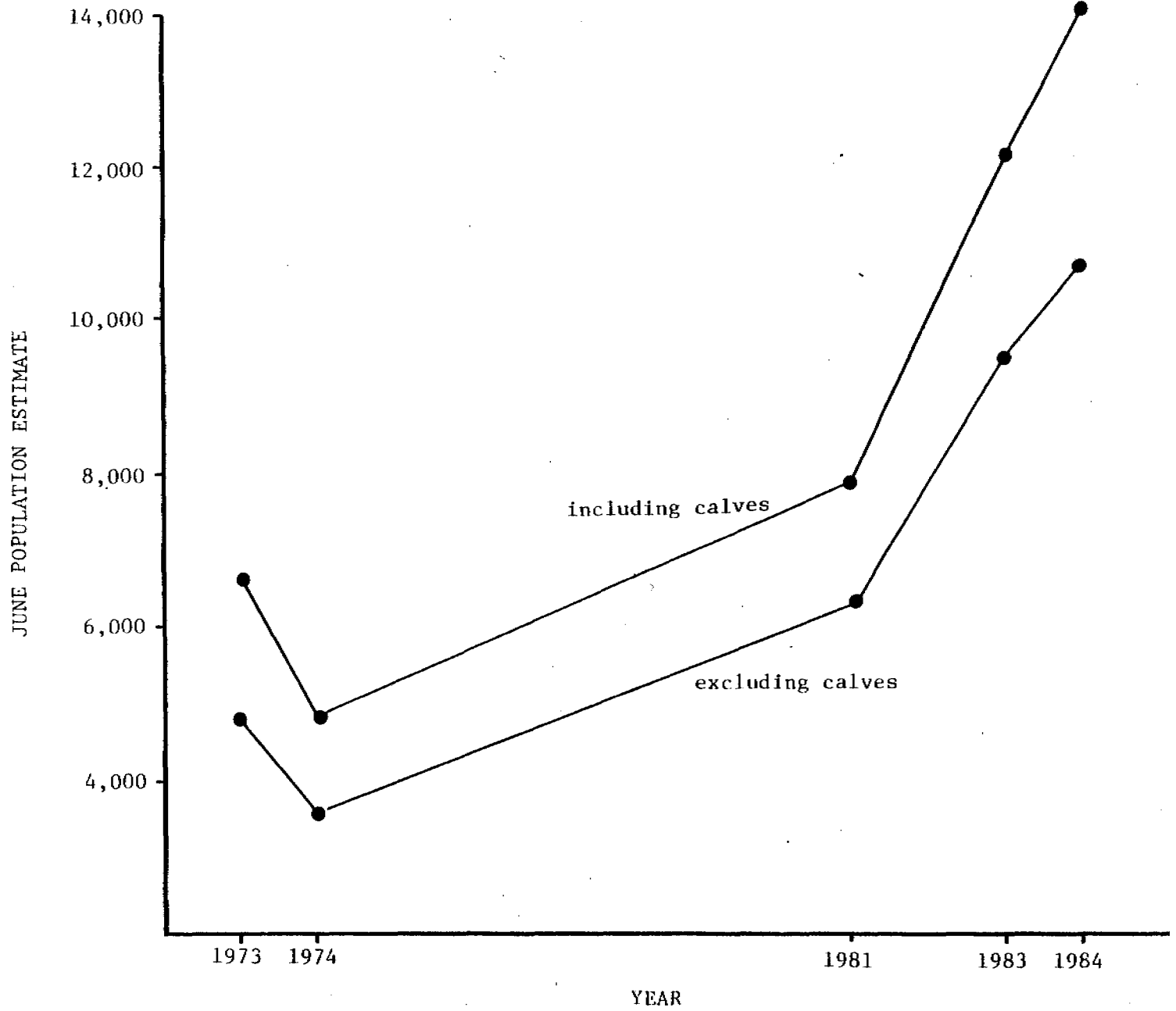


Fig. 1. Population growth of the Fortymile Caribou Herd since 1973.

Table 1. Sex and age composition of the Fortymile Caribou Herd, 1953-84.

Date	Bulls: 100 cows	Yrlgs: 100 cows	Calves: 100 cows	Yrlg % in herd	Total yrlg	Calf % in herd	Total calves counted	Cow % in herd	Total cows counted	Bull % in herd	Total bulls counted	Total caribou counted
11/53	--	--	--	--	--	29	66	--	--	--	--	228
10/54	78	--	64	--	--	26	50	41	78	32	61	189
10/55	--	--	--	--	--	16	268	--	--	--	--	1659
10/56	--	--	--	--	--	5	34	--	--	--	--	737
10/57	--	--	--	--	--	5	26	--	--	--	--	576
8/58	--	--	--	--	--	33	40	--	--	--	--	127
10/59	--	--	--	--	--	36	164	--	--	--	--	124
1960	No data											
10/61	75	30	45	12	133	18	200	40	444	30	333	1110
10-11/62	--	--	--	--	--	11	85	--	--	--	--	743
1963-71	No data											
10/72	30.5	16.5	21	9.8	66	13	84	60	400	18	122	672
9-10/73	43	9	16	5	170	10	318	60	1974	26	845	3307
6/4/74	0	0	50	0	6	33	502	67	1011	0	0	1519
6/5/74	25	0	25	0	0	17	1	67	4	17	1	6
6/6/74	0	0	55	0	0	36	183	64	330	0	0	513
6/28/74	18.4	3	24	2	37	17	276	69	1148	13	211	1672
9/20/74	32	6	20	4	35	12	108	63	553	20	176	872
9/21/74	35	9	21	5	46	13	110	61	525	21	185	866
9/74	33	8	20	5	81	13	218	62	1078	21	361	1738
1975	No data											
9/23-24/76	42	11	35	6	54	18	164	53	476	22	202	896
6/13/77	--	--	39	--	--	39	631	--	1621	--	--	2252
9/27-28/77	52	14	45	6.5	75	21	245	47	543	25	287	1150
6/14/78	--	--	35	--	--	26	123	74	356	--	--	479
10/19-20/78	39	14	26	7.8	59	15	109	56	417	22	163	748
1979	No data											
6/11/80	25	10	41	6	132	23	559	57	1371	14	338	2400
10/14-15/80	109	--	61	--	--	23	222	37	364	40	396	928 ^a
6/10/81	22	--	31	--	--	20	600	65	1928	14	427	2976

Table 1. Continued.

Date	Bulls: 100 cows	Yrlgs: 100 cows	Calves: 100 cows	Yrlg % in herd	Total yrlg	Calf % in herd	Total calves counted	Cow % in herd	Total cows counted	Bull % in herd	Total bulls counted	Total caribou counted
9/26/81	52	--	31	--	--	17	171	54	547	29	286	1004
9/29/82	54	--	27	--	--	15	241	55	901	30	483	1625
4/19/83	35	--	25	--	--	18	68	61	236	21	83	387
6/8/83	6	7	35	5	142	24	743	67	2097	4	136	3118
6/19/83	22	9	38	6	70	22	279	59	741	13	162	1252
9/20/83	44	--	30	--	--	17	166	58	560	25	247	973
10/7/83	61	--	36	--	--	18	180	51	498	31	302	980
3/22/84	16	--	27	--	--	19	206	70	754	11	123	1083
5/30-6/1/84	1	2	72	1	29	41	1072	57	1478	1	10	2589
6/20/84	42	--	45	--	--	24	954	53	2098	23	888	3940

^a These counts were probably not representative of the herd.

Table 2. Natality rate of Delta, Western Arctic (WAH), and Fortymile Caribou Herds based on counts of calves and proportion of pregnant radio-collared females 2 years old and older.

Herd and year	Calf counts			Radio-collared caribou		
	No. calves counted	No. cows counted	Calves: 100 cows	No. with distended udders	Total	Natality rate (%)
Delta 1981	--	--	--	11	14	79 ^a
Delta 1982	108	151	72	7	17	41 ^b
Delta 1983	1,629	2,052	80	18	31	58 ^c
Delta 1984	395	482 ^d	82	28	43	65 ^e
WAH 1981	885	1,079	82	31	37	84
WAH 1982	1,380	1,764	78	24	29	83
Fortymile 1984	1,072	1,478	72	20	23	87

^a All but one were 36 months old or older.

^b Seven of these were 24 months old and none of the 7 were pregnant.

^c Nine of these were 24 months old and only 1 of these was pregnant.

^d Includes some yearlings.

^e Twelve of these were 24 months old and none were pregnant.

Table 3. Estimated total numbers of wolves and respective wolf pack names in the Fortymile drainage, fall 1981-spring 1984. (All data collected by D. Grangaard and D. Kelleyhouse, Alaska Department of Fish and Game Biologists, Tok).

Pack no.	Pack name	Before wolf removal	After wolf removal ^a				
		fall 1981	spring 1982	fall 1982	spring 1983	fall 1983	spring 1984
1	Mansfield Creek	7 ^b + 2	0 + 2	8 + 2 ^c	1	5	3
2	Billy Creek	8 ^d + 1 ^c	2 ^c	2 ^c	1	8	8 ^d
3	Mosquito Flats	0	0	0	0	8	4
4	Mitchels Ranch	15 ^d	2	2	2	4	2 ^c
5	Middle Fork	11 ^e	2	3	3	5 ^c	2
6	Divide	8 ^f	0	0	0	0	0
7	Joseph Creek	6	2	2	2	6	3
8	Slate Creek	0	0	0	0	6	6
9	Portage Creek	12 ^c	4 ^c	4 ^c	0	9	8 ^c
10	Gold Creek	5 ^c	0	0	0	3	3
11	Chicken	7	3	5	4	8	4
12	Ketchumstuk	3	3	5 ^c	2	1 + 1	1 ^c + 1 ^c
13	West Fork	7 + 3	2	10 + 2 + 2	10 + 2	3 + 1	2 + 1

Table 3. Continued.

Pack no.	Pack name	Before wolf removal	After wolf removal ^a				
		fall 1981	spring 1982	fall 1982	spring 1983	fall 1983	spring 1984
14	Mount Fairplay	2	2	2 + 1	2	2	2
15	Dennison Fork	9	9	9 + 1 + 1	1	1 + 1	1
16	Liberty Creek	8	8	8	8	10	6 ^c
	Unidentified lone wolves	11	11	8	8	5	5
Total wolf numbers		125	52	77	46	87	62
Density (wolves/1,000 km ²)		8	3	5	3	6	4
Density (wolves/1,000 mi ²)		21	9	13	8	14	10

^a Department wolf take was 9 during winter 1980-81, 56 during 1981-82, 15 during 1982-83, and 7 during 1983-84. The remaining wolf take was by private trappers and hunters (ground shooting only).

^b The Mansfield Creek pack was removed from Subunit 20D in winter 1980-81.

^c One wolf had a functioning radio collar.

^d Two wolves had functioning radio collars.

^e Three wolves had functioning radio collars.

^f Two wolves were removed from this pack in Subunit 20D in winter 1980-81. The remainder were removed from Subunit 20E in winter 1981-82.

Table 4. Wolf population estimates for Subunit 20E in spring 1984.^{a,b}

Pack no.	Pack name	Pack size
1	Mansfield Creek	3
2	Billy Creek	8
3	Mosquito Flats	4
4	Mitchels Ranch	2
5	Middle Fork	2
6	Divide	0
7	Joseph Creek	3
8	Slate Creek	6
9	Portage Creek	8
10	Gold Creek	3
11	Chicken	4
12	Ketchumstuk	2
13	West Fork	3
14	Mount Fairplay	2
15	Dennison Fork	1
16	Liberty Creek	6
17	Upper Charley	9+
18	Lower Charley	4
19	Seventymile	9
20	Sorensen	3
21	Glacier	4
22	Boundary	5
Unidentified lone wolves (10%)		10
Total		101

^a There may be some additional packs along the Yukon River.

^b All data collected by D. Grangaard and D. Kelleyhouse, Alaska Department of Fish and Game Biologists, Tok.

APPENDIX A. Fortymile Caribou Herd census results, ¹⁸/~~20~~ June 1984.

Group No.	Photo No.	Low Count		High count		Number of times counted	Quality	Reason for quality classification
		Caribou	Possible (caribou)	Caribou	Possible (caribou)			
1	7	363	--	426	(63)	2	Fair	Scale
	11	96	--	100	(6)	2	Fair	Scale
	12	97	(8)	155	--	2	Fair	Scale
	13	0	(2)	10	--	2	Fair	Scale
	14	0	(9)	10	--	2	Fair	Scale
2	18	72	(1)	97	--	2	Good	Scale
	19	81	(6)	91	--	2	Good	Scale
	20	32	--	38	(2)	2	Excellent	
	21	135	--	138	(10)	2	Fair	Scale, clarity
	22	126	--	126	(10)	2	Good	Scale, fuzzy edge
	23	18	(0)	20	--	2	Good	Fuzzy edge
	25	27	--	33	(1)	2	Excellent	
	26	504	--	584	(62)	2	Good	Fuzzy edge
	27	22	--	25	(0)	2	Good	Scale
	30	399	--	489	(28)	2	Good	Scale
	31	174	--	186	(28)	2	Good	Scale
3	34	282	--	300	(12)	3	Excellent	
4	37	39	--	40	(1)	2	Excellent	
5	39	117	(8)	182	--	3	Fair	Scale, contrast, clarity
	40	285	(15)	312	--	3	Fair	Scale, clarity
6	44	1	(0)	5	--		Good	Scale
	45	486	--	510	(40)	2	Good	Scale
	49	130	(15)	170	--	3	Fair	Scale, clarity
	51	692	(72)	759	--	3	Fair	Scale, clarity

APPENDIX A. Continued.

Group No.	Photo No.	Low Count		High count		Number of times counted	Quality	Reason for quality classification
		Caribou	Possible (caribou)	Caribou	Possible (caribou)			
7	53	83	(168)	132	--	3	Poor	Scale, clarity, background
8	56	196	--	253	(9)	2	Fair	Scale
9	58	61	--	79	--	7	Good	Scale
10	61	234	--	399	(31)	3	Poor	Scale, clarity
	62	401	--	540	(32)	3	Poor	Scale, clarity
	63	334	--	508	--	3	Poor	Scale, clarity
	65	0	--	25	--	2	Poor	Scale, clarity, background
	67	122	--	124	--	2	Poor	Scale, clarity, background
	69	303	--	394	--	2	Poor	Scale, background fuzzy edge
	71	0	--	0	(3)	2	Poor	Scale
	73	4	--	11	--	2	Poor	Scale
11	75	215	--	232	--	2	Fair	Scale
	77	77	--	82	--	3	Fair	Scale
	79	50	--	67	--	2	Poor	Scale, clarity
	80	72	--	76	--	2	Fair	Scale, clarity
12	83	151	--	169	--	2	Good	Scale, fuzzy edge
12 ^a	85	247	--	277	--	2	Good	Scale, fuzzy edge
	89	28	--	35	--	2	Fair	Scale, background
13	90	46	--	--	--	2	Poor	Scale
	92	46	--	--	--	2	Poor	Scale
	94	114	--	--	--	2	Fair	Scale
	96	57	--	--	--	2	Fair	Scale
	97	38	(8)	--	--	--	1	Fair

APPENDIX A. Continued.

Group No.	Photo No.	Low Count		High count		Number of times counted	Quality	Reason for quality classification
		Caribou	Possible (caribou)	Caribou	Possible (caribou)			
14	98	135	--	--	--	2	Fair	Scale, background
	100	15	--	--	--	2	Poor	Scale, background
	102	117	--	--	--	2	Poor	Scale, background
15	103	81	--	104	--	2	Fair	Scale
15 ^a	106	111	--	154	--	3	Fair	Scale
16	108	946	--	1009	--	2	Good	Scale
	109	497	--	570	--	2	Good	Scale
	110	13	--	23	--	2	Fair	Scale, clarity
	111	2	--	8	--	2	Fair	Scale, clarity
17	113	382	--	--	--	2	Fair	Scale, background
	115	130	--	146	--	2	Fair	Scale, clarity
	116	219	--	234	--	2	Fair	Scale, clarity
	121	24	--	--	--	2	Poor	Scale, clarity, background
	122	13	--	--	--	2	Poor	Scale, clarity, background
	123	8	--	--	--	2	Poor	Scale, clarity, background
	124	22	--	--	--	2	Poor	Scale, clarity, background
	125	103	--	--	--	2	Fair	Scale, clarity, background
18	128	124	--	164	--	2	Poor	Scale, clarity, background
	130	69	--	70	--	2	Poor	Scale, clarity, background
	131	59	--	63	--	2	Poor	Scale, clarity, background
19	139	138	--	138	--	3	Fair	Scale, fuzzy edge
20	141	128	--	145	--	2	Poor	Scale, clarity, background
21	144	91	--	99	--	3	Good	Scale

APPENDIX A. Continued.

Group No.	Photo No.	Low Count		High count		Number of times counted	Quality	Reason for quality classification
		Caribou	Possible (caribou)	Caribou	Possible (caribou)			
22	148	155	--	160	(8)	2	Fair	Scale, clarity
23	150	18	--	20	--	2	Excellent	Fuzzy edge
23 ^a	151	35	--	39	--	2	Good	
24	153	58	--	69	--	2	Fair	Scale, clarity
25	154	167	--	170	--	2	Fair	Scale, clarity
26	158	299	--	311	--	2	Fair	Scale, clarity
Caribou counted from Beaver aircraft		424		424		1		
Caribou counted by David Kelleyhouse		225		225		1		
Totals		11,865		13,706				
Total from recount 2/12/85								= 13,073
Total "Possibles" from recount 2/12/85								= 658
Total count								= 13,731
Best estimate of 1984 summer population								= 14,000

APPENDIX B.

CALVING DISTRIBUTION OF ALASKA'S STEESE-FORTY MILE CARIBOU HERD: A CASE OF INFIDELITY. P. Valkenburg, J. L. Davis, and R. D. Boertje, Alaska Department of Fish and Game, 1300 College Road, Fairbanks, Alaska 99701.

The Steese-Fortymile Herd has changed its calving distribution frequently during the past 30 years. A "traditional" calving area, used for decades, west of the Steese Highway (Preacher Creek) was abandoned after 1963. By the early 1970's, a new calving area had been established 74 km to the southeast in the Birch Creek drainage. This new calving area was abandoned after 1976. From 1977 through 1983, calving occurred in annually variable locations approximately 136 km southeast of the Birch Creek calving area. In 1984, however, the herd again calved in the general vicinity of the Birch Creek calving area. General characteristics of the various calving areas are described, and calving distribution is discussed in relation to herd size, habitat disturbance, predator abundance, and other factors. Location of calving was unpredictable, which warrants reconsidering the merit of protecting only previously important calving grounds.