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POPULATION STATUS OF THE FORTYMILE CARIBOU HERD AND IDENTIFICATION OF LIMITING FACTORS

By

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Progress Report

Federal Aid in Wildlife Restoration
Project W-22-4, W-22-5, Job 3.32R

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PROGRESS REPORT (RESEARCH)

State: Alaska

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

Period Covered: 1 July 1984-30 June 1985
(Includes data through September 1985)

SUMMARY

Natality of the Fortymile Caribou Herd (FCH) continued to be high. In late May 1985, 92% of 137 female caribou (Rangifer tarandus granti) >24 months of age had distended udders, which indicated they had produced a calf. Survival of calves to 1 month of age was 45 calves:100 cows in late June 1984 and 48:100 in late June 1985, compared with 30-35:100 during the 1960's and 1970's. The April 1985 calf survival survey indicated that overwinter calf survival was good. Mean annual natural mortality of radio-collared female caribou was 10%. The natural mortality rate of adult male caribou was probably higher than that of cows, although the sample size remains too small for accurate calculation. A paper entitled "Calving distribution of Alaska's Steese-Fortymile Herd--A case of infidelity?" which summarizes recent work on calving range use and habitat selection, was presented at the 4th International Reindeer/Caribou Symposium, Whitehorse, Yukon Territory, in August 1985. An estimated 135 wolves (Canis lupus) composed the 1985 pre-pupping population on the 1985 winter range of the FCH. The wolf:caribou ratio was estimated to be 1:104.

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

CONTENTS

BACKGROUND

The Fortymile Caribou Herd (FCH) was probably the largest caribou (Rangifer tarandus granti) herd in Alaska and one of the largest in the world during the 1920's. The herd ranged from Rampart on the Yukon River to Whitehorse in the Yukon Territory, and provided 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 that are thought 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 concurrent with initiation of wolf control by the Federal Bureau of Predator and Rodent Control in 1947. The herd numbered approximately 49,000 (precalving) from 1955 through 1960 (Davis et al. 1978). No censuses were conducted between 1961 and 1973, and by 1973 the population contained approximately 6,500 caribou (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 of caribou 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; 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. These declining herds included the Nelchina Caribou Herd, Western Arctic Caribou Herd, Delta Caribou Herd, and the FCH (Gasaway et al. 1983). The Denali (formerly McKinley) Caribou Herd also declined, though hunting was apparently not a major factor. The rapid recoveries of the Nelchina, Western Arctic, and Delta Herds during the mid-1970's and early 1980's coincided with intensive management.

In contrast, the largely unmanaged Denali and Fortymile Herds did not recover rapidly. In the 3 intensively managed herds, harvest was greatly reduced or eliminated in the early or mid-1970's, and wolf populations were reduced after about 1976 or 1977 through control efforts by the Alaska Department of Fish and Game (ADF&G) (Delta Herd), high wolf harvests by the public (Nelchina and Western Arctic Herds), and/or natural processes such as disease and reduced prey (Western Arctic Herd). The Nelchina Herd may have begun increasing slowly prior to wolf reduction (VanBallenberghe, pers. commun.). The FCH grew slowly from 1974 through 1981 during a period of apparent natural decline of wolf numbers. The Denali Herd apparently declined or was stable through the 1970's with a largely stable or declining wolf population. The trend in wolf numbers was unknown during the apparent 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 for supporting a significantly larger population, and subsequently, increased hunting and other recreational opportunity. However, the FCH only grew 3% annually from 1974 through 1981 with mild winters, insignificant harvest, and relatively low wolf levels. The FCH numbered 14,000 in 1984, only 25% of the ADF&G interim goal for a precalving herd size 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 (GMU) 12 and Subunit 20E to restore low moose and caribou numbers to higher levels. In part, this study was initiated to gather detailed information necessary to direct management actions 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. Ascertain the growth rate of the FCH.

The herd was censused in 1983 and 1984 using the modified aerial photo-direct count-extrapolation technique (Davis et al. 1979). Results of these censuses have been discussed previously (Valkenburg and Davis 1985). No census was conducted in 1985, and no further work was done on this objective. A census is scheduled for June 1986.

Objective 2. Measure natality of the FCH and compare with that of other herds with known demography.

During calving time (10-30 May) in 1985, radio-collared female caribou in the FCH were checked for distended udders, hard antlers, and calves to determine the pregnancy rate. A helicopter and ground observers were used to conduct composition counts in late May and again in late June 1985. Results were compared with similar counts and samples from the Delta, Western Arctic, and Denali Herds.

Objective 3. Ascertain the mortality rate of calves and adults.

Herd composition counts were conducted in April 1985 to determine the survival of the 1984 calf cohort.

The annual mortality rate of adult females was estimated from the measured mortality rate of radio-collared female caribou (Trent and Rongstad 1974).

A preliminary annual mortality rate for male caribou was calculated based on data from 9 males collared in November 1984. Calculations included data through September 1985 (includes the early hunting season mortality).

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

We presented a paper entitled, "Calving distribution of Alaska's Steese-Fortymile Herd: A case of infidelity?" at the 4th International Reindeer/Caribou Symposium, Whitehorse, Yukon, in August 1985. A draft of the paper appears as Appendix A.

During winter 1984-85, we collected fecal samples for analysis to determine winter food habits of Fortymile caribou. Results will be presented in the final report.

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

Winter distribution of the FCH was determined from radiotelemetry flights in December 1984 and early April 1985. Data on wolf numbers in the range of the FCH during winter 1984-85 came from 3 sources: D. Grangaard conducted wolf surveys that encompassed most of the FCH's winter range; S. Ulvi, National Park Service, Eagle, conducted wolf surveys on the northern portion of the FCH's winter range along the Charley and Yukon Rivers; and the concurrent ADF&G study (Boertje et al. 1985) of factors limiting low-density moose numbers contributed additional data on wolf numbers in the southern portion of the FCH's winter range. Wolves from the Mitchel's Ranch and Gold Creek packs (Boertje et al., 1985) were radio-collared in May 1985 as part of another ADF&G study. All other previously radio-collared wolves either died or had inactive collars during winter 1984-85.

Twenty-two grizzly bears (Ursus arctos) were radio-collared within the southern portion of the FCH's range as part of another ADF&G study. Estimates of grizzly bear population densities were extrapolated from the radio-collared bear data.

RESULTS AND DISCUSSION

Growth Rate of the Fortymile Caribou Herd

No censuses were conducted during the study period, so further discussion of the FCH's growth rate is unwarranted.

Natality

All but 11 of a sample of 137 female caribou ≥24 months of age had distended udders on 24 and 25 May 1985 (92% pregnancy). We observed only 39 calves:100 cows on 25 May (Table 1) but observed 48 calves:100 cows on 19 June 1985, so considerable calving must have occurred after 25 May. All of the 19 radio-collared females located during calving had either a distended udder, hard antlers, or were accompanied by a calf, indicating 100% pregnancy among the radio-collared females. All of the radio-collared females were at least 3 years old in May 1985 which should be considered when comparing the observed pregnancy rate with that of the FCH population at large and with other herds such as the Delta Herd, where 24-month-old females are radio-collared (Valkenburg and Davis 1985).

Mortality

Calf Mortality:

Mortality of the 1985 calf cohort from birth to 1 month of age was apparently lower than in years prior to 1984 (Table 1). In 1984 and 1985, calf:100 cow ratios in late June approached 50:100, which is similar to ratios for most other caribou herds in Alaska.

Calf survival from birth to 1 month seemed greater in 1984 than in previous years. No fall counts were conducted and the April 1985 counts indicated no dramatic increase in overwinter survival. The April counts may have underestimated calf survival because counts were late, and the migration was already in progress, or overwinter mortality may have been high. Sampling at the trailing edge of the movement was inadequate in 1985. Segregation often occurs, with numbers of calves and bulls found in the rear of the migration.

Adult Mortality:

From 1 October 1984 through 30 September 1985, the 21 female caribou with active radio collars accumulated 228 collar months (Gasaway et al. 1983); 2 radio-collared females were killed by wolves during the period. The calculated natural mortality rate and total mortality rate were both 10% per year (Trent and Rongstad 1974).

There were 10 males with active radio collars between 1 October 1984 and 30 September 1985. Of these, 2 died and 57 collar months accumulated. The 2 deaths included 1 kill by wolves in February 1985 and one by a hunter in September 1985. Total calculated annual mortality rate was 35%. The small sample size limits meaningful interpretation. Two males lost their collars, which is a continuing problem.

Range Use, Habitat Selection, and Food Habits

See Appendix A for discussion of range and habitat use. Food habits will be discussed in the final report.

Wolf:Caribou Ratios

From the spring 1985 wolf surveys conducted by D. Grangaard (Table 2) and additional information collected during winter 1984-85, we concluded that there were at least 135 wolves within the winter range of the FCH in spring 1985. Valkenburg and Davis (1985) calculated a wolf:caribou ratio of 1:104 on the FCH's winter range during late winter 1984. The wolf: caribou ratio is highly dynamic because the distribution of

caribou is highly variable, the intrinsic rates of increase for both species are considerable, and annual mortality rates of both species fluctuate widely. For example, the 1 wolf:104 caribou ratio was for winter range distribution based on the relocations of radio-collared caribou. There were reports of caribou on the upper Healy and Salcha rivers during winter 1984-85 and there were several additional wolf packs in these drainages. Thus, the calculated wolf:caribou ratio may be an underestimate. During summer, caribou may be more widely dispersed and available to more wolves. Bergerud (1983) calculated that 100 caribou per wolf are necessary to maintain equilibrium in the absence of alternate prey, based on his assumptions about kill rates. Small populations of Dall sheep (Ovis dalli) and moose occur within the range of the FCH. The effect of these alternate prey on the wolf/caribou equation is unknown, as are actual kill rates. If wolves consume many young calf caribou or if surplus killing occurs during calving (Miller et al. 1985), then more than 100 caribou per wolf are necessary to maintain equilibrium. In a complex predator/prey system such as that found in the range of the FCH, the roles of alternate prey, and predators other than wolves, significantly confound meaningful interpretation of wolf:caribou ratios at the present time.

ACKNOWLEDGMENTS

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Table 1. Sex and age composition of the Fortymile Caribou Herd, 1953-85.

Date	Bulls: 100 cows	Yrlgs: 100 cows	Calves: 100 cows	Yrlg % in herd	Total yrlgs counted	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	--	--	--	--	1,659
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	1,110
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	1,974	26	845	3,307
6/4/74	0	0	50	0	6	33	502	67	1,011	0	0	1,519
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	1,148	13	211	1,672
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	1,078	21	361	1,738
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	--	1,621	--	--	2,252
9/27-28/77	52	14	45	6.5	75	21	245	47	543	25	287	1,150
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	1,371	14	338	2,400
10/14-15/80	109	--	61	--	--	23	222	37	364	40	396	928[a]

Table 1. Continued.

Date	Bulls: 100 cows	Yrlgs: 100 cows	Calves: 100 cows	Yrlg % in herd	Total yrlgs counted	Calf % in herd	Total calves counted	Cow % in herd	Total cows counted	Bull % in herd	Total bulls counted	Total caribou counted
6/10/81	22	--	31	--	--	20	600	65	1,928	14	427	2,956
9/26/81	52	--	31	--	--	17	171	54	547	29	286	1,004
9/29/82	54	--	27	--	--	15	241	55	901	30	483	1,625
4/19/83	35	--	25	--	--	18	68	61	236	21	83	387
6/8/83	6	7	35	5	142	24	743	67	2,097	4	136	3,118
6/19/83	22	9	38	6	70	22	279	59	741	13	162	1,252
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	1,083
5/30-6/1/84	1	2	72	1	29	41	1,072	57	1,478	1	10	2,589
6/20/84	42	--	45	--	--	24	954	53	2,098	23	888	3,940
4/27/85	16	--	32	--	--	22	190	68	593	11	93	876
5/25/85[a]	8	70	39	32	135	18	75	46	193	4	15	418
6/19/85	18	--	48	--	--	29	1,103	60	2,285	11	415	3,803

[a] These counts were probably not representative of the herd.

Table 2. Results of wolf surveys in Subunit 20E during March 1985.

Pack No.	Pack name	No. wolves in pack
1	Mansfield[a]	3
2	Billy Creek	2
3	Mosquito Flats	5-6
4	Mitchel's Ranch	5
5	Middle Fork	3-4
	Divide[b]	0
6	Joseph Creek	2
7	Slate Creek	4
8	Portage Creek	9
9	Gold Creek	8
10	Chicken	5
	Ketchumstuk[b]	0
11	West Fork	2
	Mt. Fairplay[b]	0
12	Dennison Fork	3
13	Liberty Creek	6
14	Upper Charley	2
15	Lower Charley/Kandik	9
	Seventymile[b]	0
16	Sorenson	9
17	Glacier	4
18	Boundary	6-7
19	O'Brien Creek	6
20	Copper Creek	6+
21	Fourth of July	5+
22	Upper Ladue	3-4
23	Lower Ladue	6-7
24	South Fork Ladue	2
25	Big Creek	8+

Total (conservative) = 123
Estimated 10% singles = 12
Total for Subunit 20E = 135

[a] These packs are not often found in Subunit 20E.

[b] Inactive pack or territory taken over by surrounding packs.

APPENDIX A.

CALVING DISTRIBUTION OF ALASKA'S STEESE-FORTYMILE HERD: A CASE OF INFIDELITY?

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ABSTRACT. The Steese-Fortymile Caribou (Rangifer tarandus granti) 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, development and disturbance, predator abundance, and other factors. Location of calving in recent years has been unpredictable, which warrants reconsidering the merit of protecting only previously important calving grounds.

Key words: caribou, Fortymile Herd, calving, Alaska, wolf.

INTRODUCTION

Caribou (Rangifer tarandus L.) have been shown to be more faithful to their calving grounds than to other seasonal ranges (Skoog, 1968:121; Fleck and Gunn, 1982; Valkenburg et al., 1983; Cameron et al., this symposium). Also, caribou seem most sensitive to disturbance during calving (DeVos, 1960; Lent, 1964; Kelsall, 1968; Bergerud, 1974; Miller and Gunn, 1979), and severe disturbance during calving may be of greater consequence to the population (through direct mortality of calves) than disturbance at other times. Presumably there are advantages, leading to increased survival, for caribou to annually use traditional calving areas.

For the above reasons, calving areas are generally considered "critical habitat" and are frequently excluded from mineral exploration and production by land managers. There is often intense pressure from industry to keep these excluded areas as small as possible, but there is mounting evidence that caribou may select different calving areas over time (Davis et al., 1985). Short-term studies, especially on northern herds where historical information is lacking, may fail to identify important potential calving areas. With this in mind, we examined the historic pattern of calving ground use by the Steese-Fortymile Caribou Herd (FCH) in east-central Alaska and discuss it in relation to population size, tradition, predation, development, interaction with other herds, habitat, and weather.

METHODS

We examined the historical information on calving ground use in the FCH as presented by Skoog (1956, 1968), Hemming (1970), and Davis et al. (1978). Data since 1976 are from unpublished reports in the Alaska Department of Fish and Game (ADF&G) files and Shrier (1983). Information from radio-collared caribou was not available until October 1980, when four females were radio-collared. From December 1981 through April 1982, 16 more caribou (14 females and 2 males) were collared to investigate the interaction between Porcupine Herd and Fortymile Herd caribou that were wintering together. Seven of these caribou left with the caribou from the Porcupine Herd as they returned north in May, one female died from capture-related causes shortly after tagging, one was killed by wolves (Canis lupus), and one died of unknown causes, leaving 10 caribou with functioning radio collars during calving in 1982 in the range of the FCH.

During September 1983, 16 more females were radio-collared, and in December 1984, 2 females and 10 males were radio-collared. The radio-collared caribou have contributed to substantially better documentation of calving areas since May 1982.

Delineating calving grounds from old reports was subjective and often depended upon interpretations of various different observers over the years. In this paper, the main calving area is the area in which the density of calving caribou was highest and/or included over 50% of all calving caribou, based on ocular estimates during aerial reconnaissance ranging from intensive to extensive. Secondary calving areas were those areas, usually on the periphery of the main calving areas, where additional calving caribou were seen.

FCH calving areas have been aerially surveyed annually since 1950. In general, these surveys were designed to estimate initial productivity and to determine roughly where calving occurred. Little effort was made to count caribou on calving areas. The FCH was generally censused (Table 1) 10-30 days after 15-25 May, which is the normal peak of calving.

RESULTS

Calving areas of the FCH were not accurately mapped before the advent of aerial surveys in the late 1940's. From 1920 to 1950, the area northwest of Eagle and the Twelvemile Summit area were regularly used for calving (Murie, 1935), but calving was also reported in the upper Salcha, upper Charley, and upper Goodpaster River drainages in some years (Skoog, 1956) (Fig. 2a). Between 1950 and 1954, most calving occurred north of the Steese Highway in the White Mountains (Skoog, 1968; Hemming, 1970) (Fig. 2b). From 1955 through 1960 there was considerable calving along the ridges on Birch Creek and some on the upper Salcha and Charley Rivers, although the White Mountains were still heavily used (Skoog, 1968; Hemming, 1970) (Fig. 2c).

From 1961 through 1963 there was a definite shift to the southeast. What had been the main calving area in the White Mountains became a secondary calving area, and most caribou calved in Birch Creek and the upper Chena and Salcha Rivers (Skoog, 1968; Hemming, 1970) (Fig. 2d). After

1963, little calving occurred northwest of the Steese Highway, and the southeastward trend in location of the calving area continued (Hemming, 1970; Davis et al., 1978) (Figs. 2e and 2f). After 1979, the Clums Fork-Birch Creek calving area, which had been regularly used for 16 years, was abandoned, and calving was dispersed in the upper Salcha, Charley, and Seventymile River drainages and the Slate Creek drainage (Alaska Department of Fish and Game files) (Fig. 2g).

In 1984 many caribou calved in the head of the Salcha River and the South Fork of Birch Creek, near the old Clum's Fork calving area. In 1985, the spring weather was unseasonably cold and during calving the only areas that were snow-free were muskegs along the Charley River. Most calving occurred on these snow-free muskegs. However, calving also occurred in the Middle Fork of the Fortymile and upper Charley River drainages, which was along the migration route from winter range.

DISCUSSION

During the mid-1950's, some factor(s) apparently caused Fortymile Herd caribou to select calving areas other than the traditional calving area in the White Mountains. Various influences have been proposed as reasons why caribou select calving areas, but few of the proposed influences have been substantiated. Experimentation is necessary to determine the influence of some of the factors currently speculated on as affecting caribou behavior. For example, restocking calves to new ranges in Newfoundland demonstrated the importance of learning and tradition to caribou movement behavior (Bergerud, 1974).

Population Size

Population size and range size appear to be positively correlated in the FCH (Fig. 1 and Table 1), but the extent and/or location of calving areas seems poorly correlated with population size. During the early 1950's the herd was relatively small (40 000-60 000) compared with its historic size, the calving area was relatively small, and calving took place at the western extreme of the herd's range. In the late 1950's, calving distribution shifted to the southeast. This shift, which persisted into the early 1960's, occurred as the population was stable or possibly increasing (Table 1). Later, as the population declined during the 1960's and early 1970's, the size and location of the calving area apparently remained stable. After 1977, when the herd was again increasing (albeit slowly), calving appeared to be more scattered and calving distribution had shifted farther southeastward.

Tradition

Tradition probably has a strong influence on the location of calving areas from year to year. Some individual radio-collared caribou return to specific calving sites year after year (Alaska Department of Fish and Game files), and most return to the same general area unless weather conditions are particularly adverse (Lent, 1964; Skoog, 1968; Hemming, 1970; Fleck and

Gunn, 1982; Whitten and Cameron, 1983; Valkenburg et al., 1983; Davis et al., 1985). This strong affinity of female caribou for their calving areas was graphically demonstrated by the movements of one radio-collared cow from the Teshekpuk Herd (for herd locations see Davis, 1980) on the Alaskan arctic coastal plain in 1982. She had wintered with Western Arctic and Central Arctic Herd caribou near the Trans-Alaska Pipeline until late April, but was observed 160 km west of that area, in early May, migrating with Western Arctic Herd caribou enroute to the Utukok calving area. Between early May and late May she must have returned to her traditional Teshekpuk calving area 240 km to the northeast where we found her in early June.

Caribou abandon calving ranges relatively rarely, although small annual shifts within the greater calving area are common (Skoog, 1968; Bergerud, 1974; Fleck and Gunn, 1982; Davis et al., 1985). Major long-term shifts in calving distribution, such as that which occurred in the FCH beginning in the early 1960's, are not common and certainly not well-documented. In view of the affinity that caribou have for calving areas, there must have been a good reason for the shift, at least initially.

Predation

We could not determine if Fortymile Herd caribou successfully avoided wolves by shifting calving areas. Calf numbers were chronically low between 1961 and 1975, and available data suggest a strong inverse correlation between wolf numbers and calf survival and a weak correlation, if any, between shifting calving areas and calf survival (Valkenburg and Davis, 1985).

Shifting the location of calving areas could be advantageous to caribou if wolves key in on regularly used calving areas. This may be especially true if alternate prey species, e.g., Dall sheep (Ovis dalli) and moose (Alces alces), support the wolves when caribou are absent. However, wolves can also shift seasonal ranges to take advantage of a seasonal abundance of prey (Kelsall, 1968:248; Stephenson, 1979).

Predators, especially wolves, may influence the selection of calving areas by caribou (Lent, 1964; Kelsall, 1968; Skoog, 1968; Bergerud, 1974). Wolves are relatively uncommon on the calving grounds of large, migratory herds (Kelsall, 1968; Bergerud, 1974; Fleck and Gunn, 1982; Davis and Valkenburg, 1985). Wolves were extensively shot and poisoned in the White Mountains between the late 1940's and 1954 (Davis et al., 1978; Harbo and Dean, 1983). Wolf control was discontinued between 1954 and 1957. During these three years, wolves apparently increased dramatically (Davis et al., 1978; Olson, 1958) in the White Mountains calving area, and the number of calves present in the caribou population in autumn plunged (Davis et al., 1978). It may be significant that the shift in calving distribution was detected shortly after the wolf population increased after 1954.

In response to the dramatically lowered calf numbers between 1955 and 1957, poisoning and aerial hunting of wolves was resumed in 1957 and calf recruitment again rebounded (Davis et al., 1978). In 1960, predator control was terminated in all of Alaska except the Seward Peninsula reindeer ranges, and wolves again became numerous and remained numerous until the mid-1970's (Davis et al., 1978). Based on the lack of observations of

large packs of wolves by pilots and hunters and the general decline in moose and caribou after the early 1970's, it appears that the wolf population has declined on the White Mountains calving area since the mid-1970's (Alaska Department of Fish and Game files). The FCH has been increasing slowly since the mid-1970's (Valkenburg and Davis, 1985).

Development and Disturbance

The range of the FCH has remained relatively free from development and human activity although it is traversed by two major highways. The Steese Highway (Fig. 1) was built in the 1920's and has been gradually upgraded. Before upgrading in the early 1980's, it was a narrow, winding gravel road. Caribou crossed this highway regularly going to and from their calving grounds until 1963. There was never any significant hunting from the highway in spring. Caribou also often crossed the Steese Highway in August and September because they periodically used the surrounding area as summer range, and they were commonly hunted. However, there is no evidence that the Steese Highway acted as a barrier to movements, nor did cessation of caribou crossing of the Steese Highway correlate with significant increase in traffic.

In contrast to the Steese Highway, hunting was heavy along the Taylor Highway in October, especially in the late 1960's and early 1970's. "Firing line" situations were common and groups of caribou were often temporarily prevented from crossing the highway by hunters and associated traffic. Nevertheless, the caribou have continued to cross the Taylor Highway. In the absence of caribou hunters, traffic on the road is light.

Interactions With Other Herds

Two major emigrations from the FCH have been reported. In the 1957 emigration, approximately 30 000 Fortymile caribou that wintered with the Porcupine Herd in the Ogilvie Mountains supposedly went north to calve with the Porcupine Herd. Olson (1958) implied that calving in the Fortymile Herd was late that year and only 5 000 calved in the White Mountains. A "large" segment of the herd also calved in the Charley River drainage, however. If the 1957 emigration indeed occurred, the caribou must have returned almost immediately because the 1958 and 1960 censuses revealed no net loss of animals (Olson, 1959; Jones, 1962; Skoog, 1968). Skoog (1968) mentioned that, in 1964, most of the FCH had wintered in the Ogilvie Mountains and had moved north in spring. These caribou were also thought to have returned (Skoog, 1968). A general population decline was recognized throughout the late 1960's, and by 1973 only 5 312 caribou were found (Davis *et al.*, 1978). This population decline can be adequately explained by an imbalance between mortality and recruitment (Davis *et al.*, 1978).

So far, the evidence for large-scale interchanges between ranges and herds is anecdotal and speculative. Despite the presence of hundreds of radio-collared caribou in various herds throughout Alaska, there have been few documented interchanges of individuals even though it is common for caribou from different herds to share winter range (Davis and Valkenburg, 1985; Cameron *et al.*, this symposium). Perhaps interchanges could occur in periods when caribou are particularly abundant.

In 1982, approximately 20 000 Porcupine Herd caribou crossed the Yukon River and wintered in the FCH's range (Whitten and Cameron, 1983). Only one radio-collared caribou was among the 20 000, and at the time there were only four radio-collared Fortymile caribou on the air. In May, the one known Porcupine caribou returned north and the four known Fortymile caribou stayed.

Habitat

Although few data have been recorded on selection of habitat by calving Fortymile Herd caribou until recently, there has been an apparent trend away from using generally treeless, higher elevation habitat to more forested areas. The old White Mountains calving area was almost entirely treeless tussock and alpine tundra above 800 m elevation. The Birch Creek calving area has considerably more timbered habitat than the White Mountains calving area. Farther east, the upper Salcha River drainage is treeless and many ridges along the Yukon Fork, Birch Creek, and Charley River are treeless, but most of the area is at least sparsely forested. In 1983, 1984, and 1985, when radio-collared caribou were monitored, 56% of the relocations (n = 52) in late May were in treeless habitats and 44% were in sparse or closed-canopy forest habitats.

Whether caribou use open, higher elevation habitat for calving or lower elevation muskegs interspersed with spruce, the Eriophorum flower buds which are their main food prior to leaf emergence are still widely available. However, at lower elevations, caribou may have more ready access to birch (Betula spp.) and willow (Salix spp.) leaves when they first emerge. In the absence of a compelling reason to go to the White Mountains calving area, like avoiding predators, it may be advantageous for the cows to remain farther east at lower elevations to take advantage of earlier leaf emergence (Kuropat and Bryant, 1980; Bergerud, 1984).

Weather

Selection of calving habitat is partially dependent on weather (Lent, 1964; Kelsall, 1968; Skoog, 1968), and snowmelt patterns (Lent, 1980; Fleck and Gunn, 1982). If snowmelt is late, caribou may be forced or prefer to remain at lower elevations where snow disappears sooner. They may also be prevented from reaching traditional calving areas and be forced to calve en route (Lent, 1964; Kelsall, 1968; Skoog, 1968; Davis and Valkenburg, 1985). Spring 1985 was about 2-3 weeks late in the FCH's range and many caribou calved farther east than ever recorded. They also used primarily muskeg and forested habitats at low elevation for calving but climbed in elevation to open areas as soon as the snow receded.

Although weather may influence yearly variations in use of a calving area, it is unlikely that it has caused long-term shifts in use of calving areas by the FCH. Perusal of weather records for Fairbanks indicates that although there were some particularly severe winters in the 1960's and early 1970's, they were interspersed with some rather mild winters. With the exception of 1974-75 and 1984-85, winters have been mild in the Fairbanks area since 1971-72.

Landsat data have been available only since the early 1970's, so it is not possible to determine whether or not snowmelt patterns changed during

the mid-1950's when the first major shift in calving ground use was detected.

ACKNOWLEDGEMENTS

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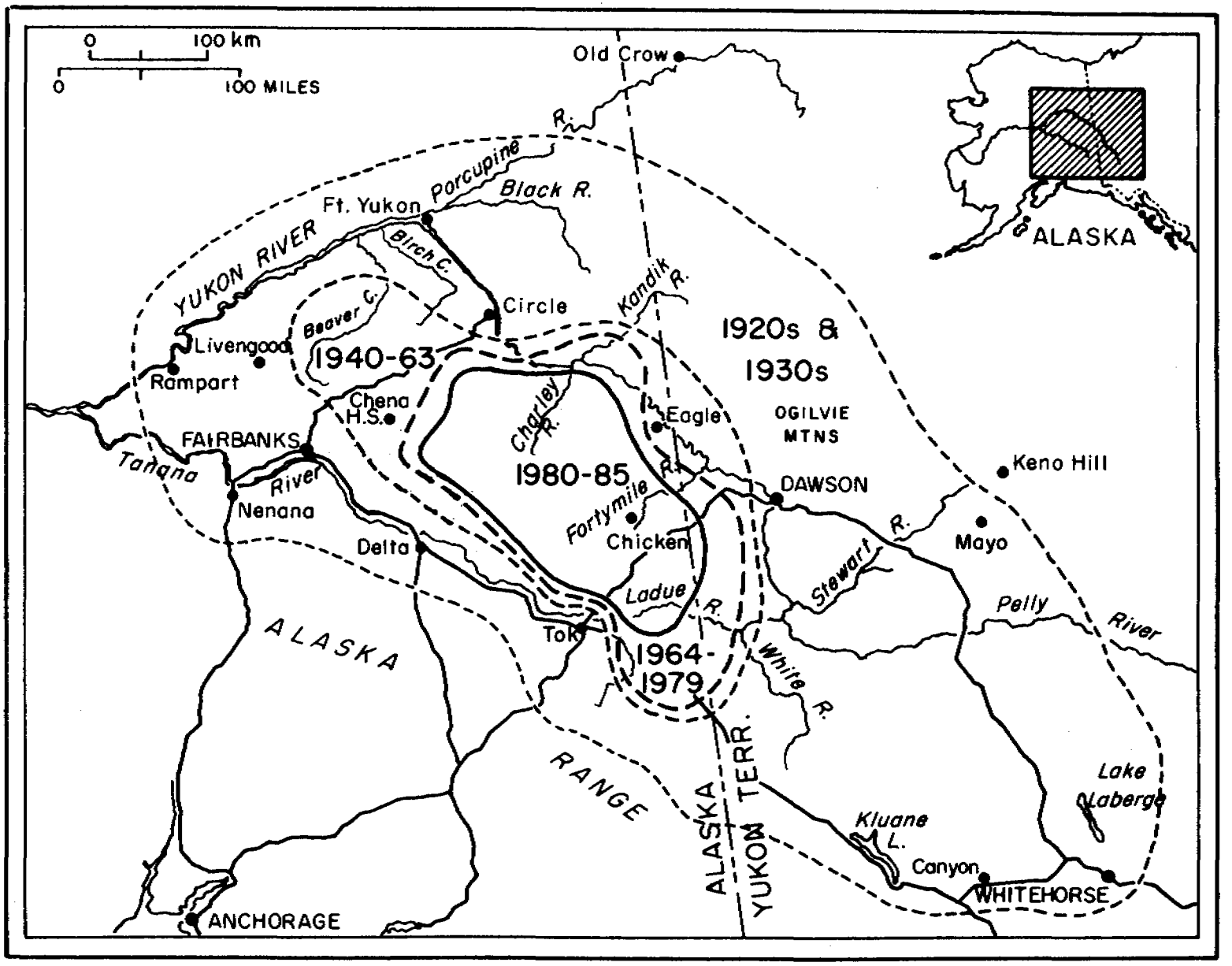

Fig. 1. Greater range of the Fortymile Caribou Herd, 1920-85.

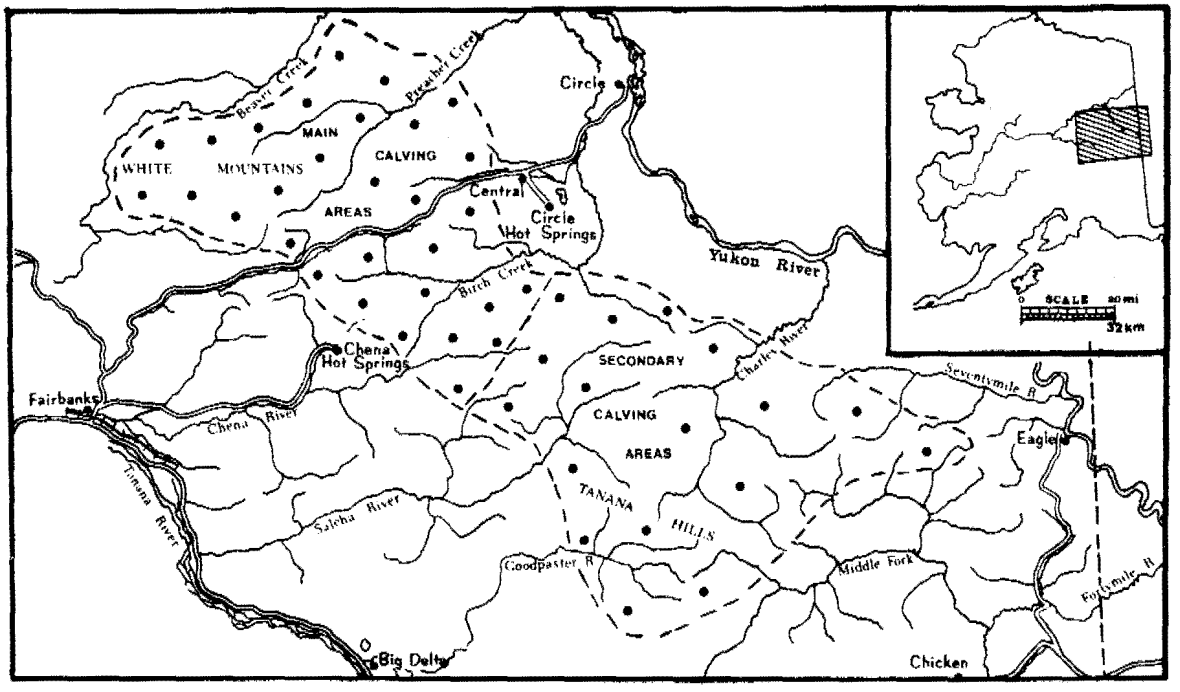

Fig. 2. Probably calving range of the Fortymile Caribou Herd, 1900-1950.

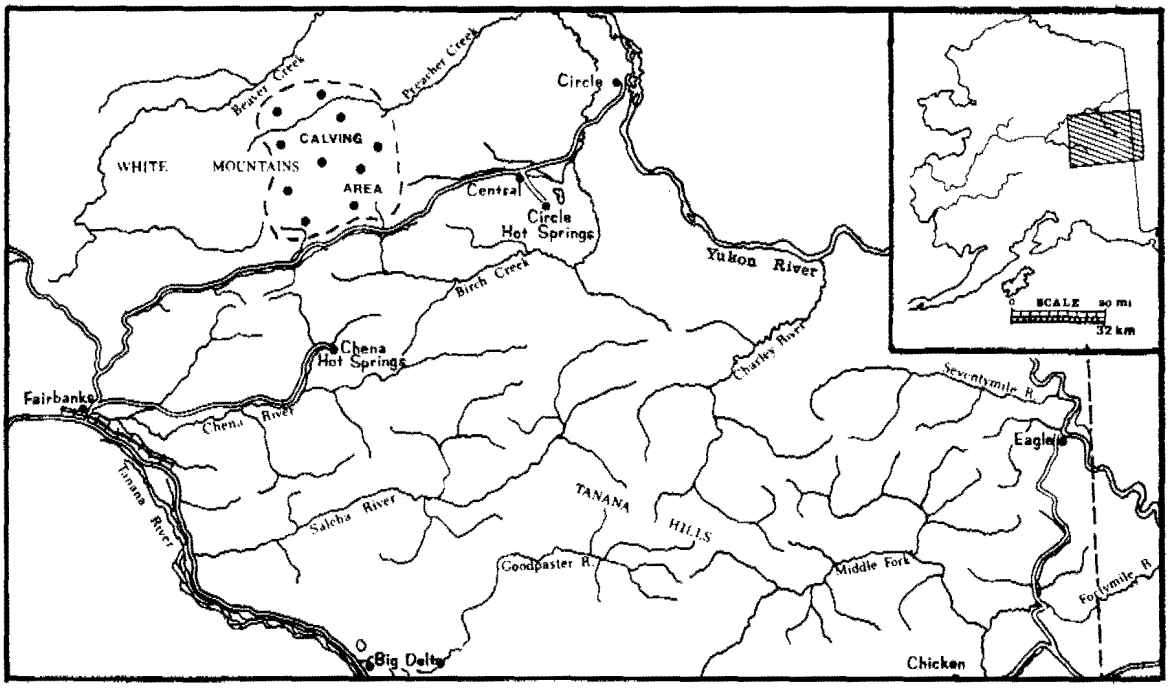

Fig. 3. Calving range of the Fortymile Caribou Herd, 1950-54.

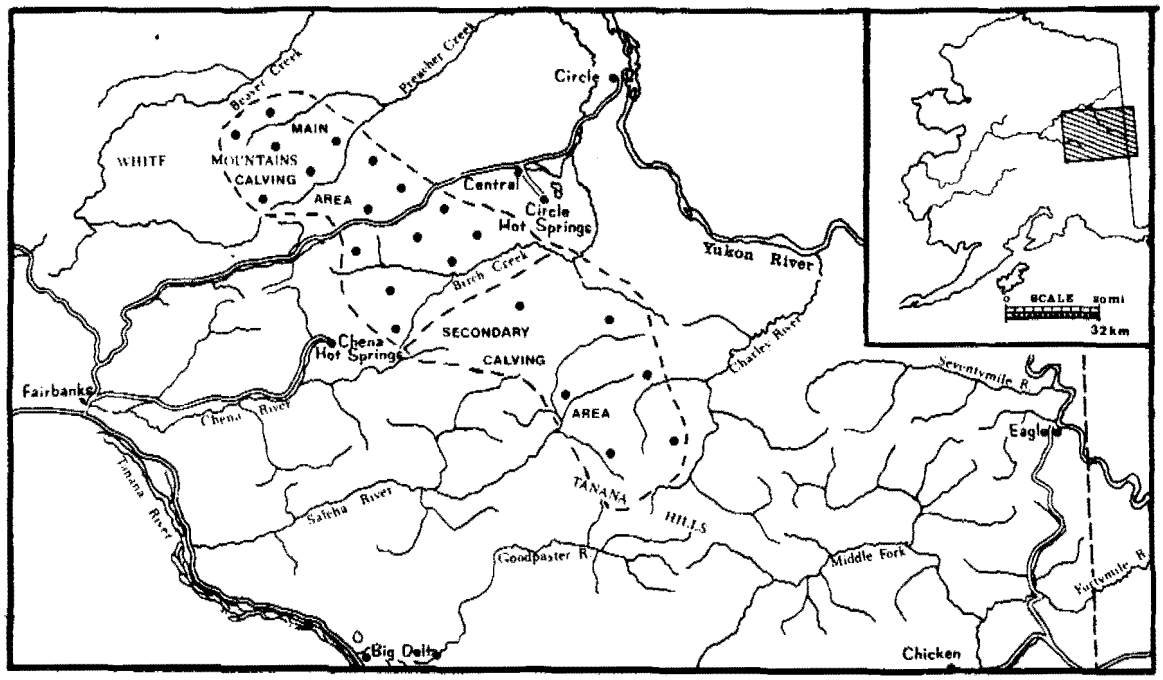

Fig. 4. Calving range of the Fortymile Caribou Herd, 1955-60.

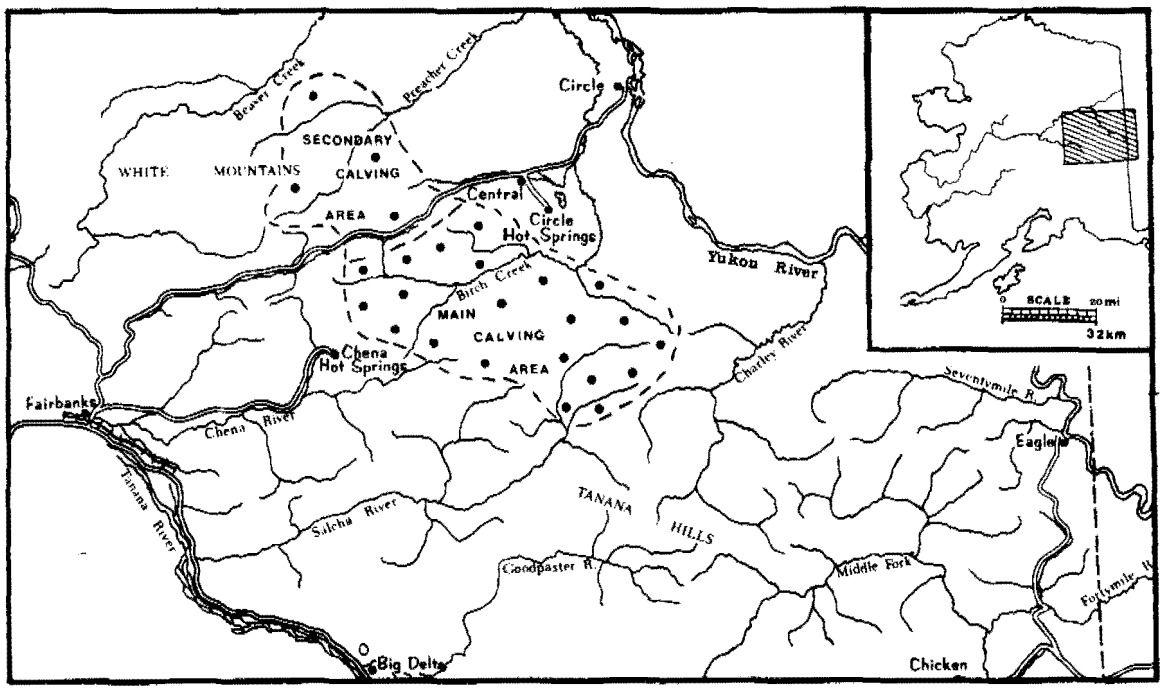

Fig. 5. Calving range of the Fortymile Caribou Herd, 1961-63.

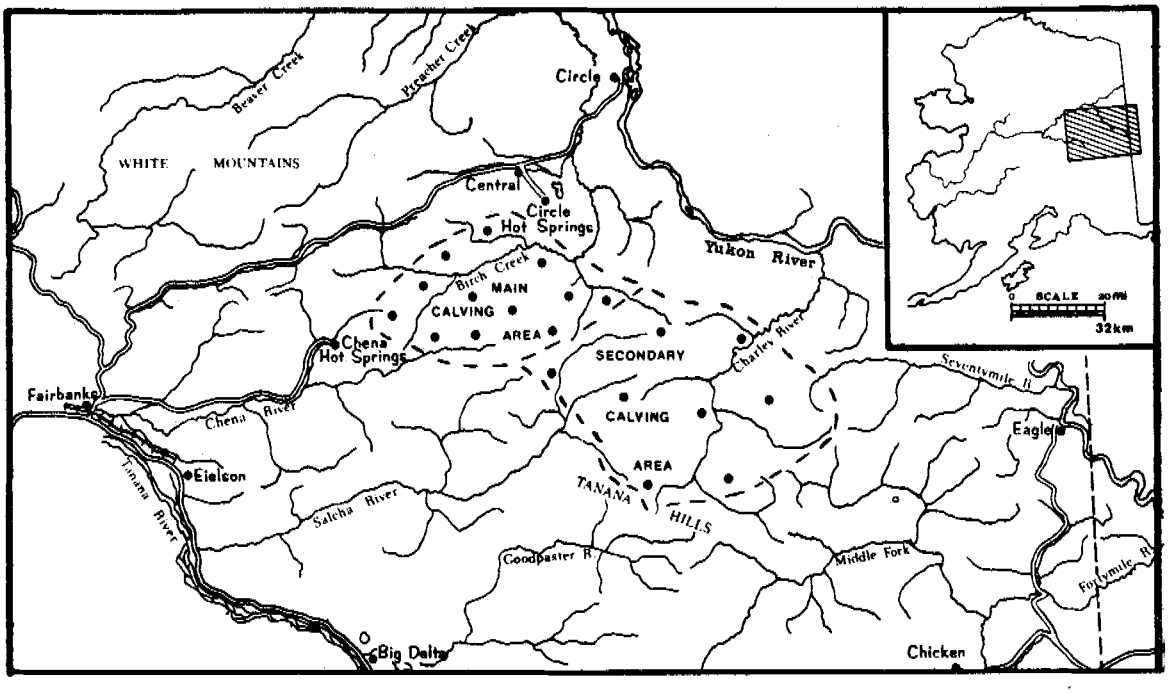

Fig. 6. Calving range of the Fortymile Caribou Herd, 1964-76.

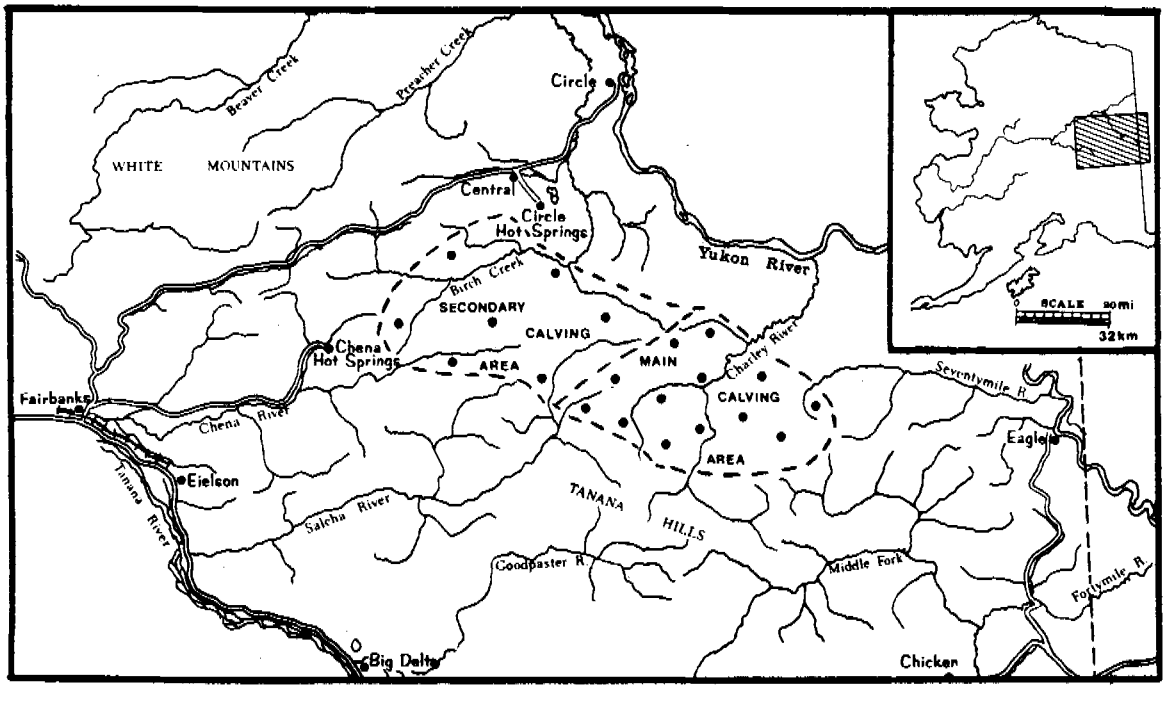

Fig. 7. Calving range of the Fortymile Caribou Herd, 1977-79.

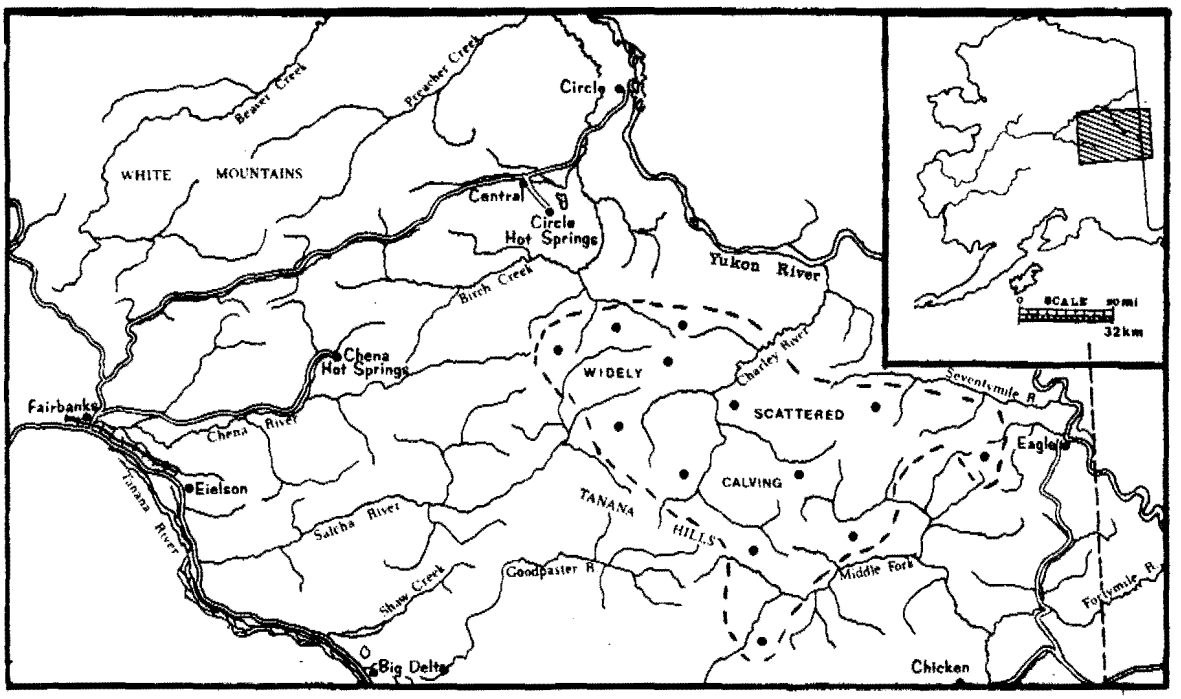

Fig. 8. Calving range of the Fortymile Caribou Herd, 1980-85.

Table 1. Estimates of the size of the Fortymile Caribou Herd since 1920.

Year	Number of caribou counted	Estimated population size	Source
1920	13 200	568 000	Murie, 1935
1953	40 000	60 000	Skoog, 1956
1956	30 000	45 000	Olson, 1957
1960	28 000	50 000	Jones, 1962
1961	--	50 000	Jones, 1963
1962	--	50 000	Jones, 1963
1963	26 000	50 000	Skoog, 1964
1964	--	30 000	Lentfer, 1965
1969	--	20 000	Alaska Department of Fish and Game files
1973	--	5 300	Davis et al., 1978
1983	12 150	12 500	Alaska Department of Fish and Game files
1984	13 073	14 000	Valkenburg and Davis, 1985