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CARIBOU

Susan M. Abbott, Editor

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TABLE OF CONTENTS

LOCATION

Game Management Units: 7 and 15 (8,397 mi^2)

Herds: Kenai Mountains, Kenai Lowlands, Killey River, and Fox River

Geographical Description: Kenai Peninsula

BACKGROUND

There are 4 small caribou herds on the Kenai Peninsula following reintroductions in 1965-66 and 1985-86 (Spraker 1989). The Kenai Mountains caribou herd (KMCH) occupies that portion of Unit 7 drained by Chickaloon River, Big Indian Creek, and Resurrection Creek. The Kenai Lowlands caribou herd (KLCH) summers in Subunit 15A north of the Kenai airport to the Swanson River; the herd winters on the lower Moose River to the outlet of Skilak Lake. The Killey River caribou herd (KRCH) is found in the upper drainages of Funny and Killey Rivers in Subunit 15B. The Fox River caribou herd (FRCH) occupies the area between upper Fox River and Truuli Creek in Subunit 15C. The spring 1992 estimated population sizes of the KMCH, KLCH, KRCH, and FRCH were 406, 80, 225, and 50 caribou, respectively.

The KMCH has been hunted annually since 1972. The number of permits issued and animals harvested sharply increased as hunters became aware of the KMCH. In 1974, a harvest quota of 50 caribou was recommended to stabilize the herd at approximately 250 animals. The carrying capacity of their range was unknown. From 1972 to 1976, the department issued an unlimited number of registration permits and the season was closed by emergency order when necessary. In 1977 a limited permit system began that still remains in use. During the past 5 years the mean annual success rate was 27%. Following the 1985 peak in population numbers, the KMCH began to decline for unknown reasons. The department reduced harvest from 1987 to 1990. Biologists surveyed the herd in fall 1992, and tallied 390 caribou, however, calf recruitment was poor. Population trends correlated with harvest data collected over the past 27 years suggested the carrying capacity for this herd's range was 300 to 350 caribou.

The Kenai Lowlands herd has grown slowly compared to the other 3 Kenai Peninsula herds. Growth has been limited by predation rather than by habitat. Free-ranging domestic dogs and coyotes probably killed calves in summer and wolves preyed on all age classes during winter. The KLCH was hunted in 1981, 1989, 1990, and 1991. The department issued 5 permits the first year and 3, for bulls only, in subsequent years. Biologists felt harvests were not a significant mortality factor.

The Killey and Fox River herds have grown steadily since the reintroduction of 80 caribou in 1985 and 1986. The herds occupied subalpine habitat rarely used by moose, however, the caribou may have competed with Dall sheep for winter range. Caribou have been absent from this area since 1912 (Palmer 1938) wolf predation was low. Biologists documented 2 instances of wolves killing caribou. As the caribou population builds, and the moose population declines, wolf predation on caribou should increase.

MANAGEMENT DIRECTION

Management Objectives

The management objective for the Kenai Mountains caribou herd is to maintain the posthunting herd at 400 animals until the carrying capacity of the winter range is determined.

The management objective for the Kenai Lowlands caribou herd is to increase the herd to a minimum of 150 animals by 1990.

Management objectives for the Killey and Fox River caribou herds are to: 1) reestablish viable caribou populations throughout suitable and or historic, but unoccupied, caribou habitat in Subunits 15B (Killey River) and 15C (Fox River); and 2) provide for additional opportunities to hunt caribou on the Kenai Peninsula.

METHODS

Biologists flew aerial surveys to determine the number, distribution, and composition of caribou herds. A Piper Super Cub (PA-18) was used to locate the herd, followed by a Bell-Jet Ranger (206B) helicopter to determine the sex and age composition. Surveyors classified caribou as calves, cows, or bulls and calculated ratios. The department collected harvest data through a mandatory reporting requirement of the drawing permit program.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

Kenai Mountains Caribou Herd. The KMCH has had 2 population peaks in its 27-year history. The original introduction grew to a pre-season population of 339 animals by 1975. Hunters reduced the population to 193 by 1977. The herd reached another pre-

season peak of 434 in 1985 and declined to an estimated 305 animals in 1988. Since 1988 the herd has increased to 406 animals, pre-season 1992 (Table 1).

Kenai Lowlands Caribou Herd. The KLCH reached a peak of 117 caribou during spring 1989 (Table 2). The population was stable for a year then declined to 98 animals in spring 1991, and 74 caribou in spring 1992. The primary management concern was low recruitment caused by predation.

Killey and Fox River Caribou Herds. The KRCH (Table 3) and FRCH (Table 4) have grown steadily since their introductions in the mid-1980s. The KRCH has grown the fastest, with a mean annual rate of increase of 29% (range = 14-35%) between fall 1989 and 1992. The Fox River herd's mean annual rate of increase was only 7%, (range = 0-13%). This growth rate appeared low when compared to the KRCH, however, the FRCH has been difficult to survey and may have been larger during fall surveys. Data collected incidentally during a July 1992 sheep survey indicated the herd contained 70 caribou. If the July 1992 survey was accurate, the mean annual rate of increase was 29%.

Population Composition:

Kenai Mountains Caribou Herd. There were 34 calves:100 cows and 39 bulls:100 cows in fall 1990. Calves comprised 20% of the herd. We did not collect herd composition data during fall 1991 because of poor counting conditions. Data from fall 1992 were included for comparative purposes. Herd composition for 1992 was 24 calves:100 cows and 43 bulls:100 cows; calves comprised 14% of the caribou observed. Calf recruitment apparently declined in the mid- to late 1980s then increase in 1990. Another decline occurred from fall 1990 to fall 1992. The mean percentage of calves in the herd between 1987 and 1992 was 15%, with a high of 20% in 1990. The ratio of bulls to cows remained relatively stable from 1987 to 1992 with a mean of 41:100 (range = 37-44%).

Kenai Lowlands Caribou Herd. Biologists only surveyed the KLCH during spring because of poor fall survey conditions. The area where this herd aggregated during the fall rutting period was heavily timbered and it was difficult to locate and classify caribou. Data collected from 1987 to 1991 indicated the mean calf survival was 15%, (range = 9-24%) June (Table 2). Surveyors counted 12 calves in 1990, and 18 young in 1991, however, the population declined from 98 to 74 caribou during the same period. Staff conducted surveys in spring and bull:cow ratios were not available. Incidental observations suggested the ratio was probably stable and similar to KMCH.

Killey River Caribou Herd. Biologists surveyed the KRCH during fall 1991 and tallied the following ratios: 55 calves:100 cows and 82 bulls:100 cows; calves comprised 23% of the caribou observed (Table 3). Although surveyors did not classify bulls as small, medium, or large, field notes suggested many bulls were in the medium to large

category. A composition survey was not conducted in spring 1991. The mean annual calf recruitment from 1988 to 1990 was 22%.

Fox River Caribou Herd. Biologists completed composition surveys on the FRCH only in fall 1988. They counted 32 caribou with the following ratios: 64 calves:100 cows and 64 bulls:100 cows; calves comprised 28% of the caribou observed (Table 4). Mean annual calf rate of increase was 33% during fall surveys from 1988 to 1990 (range = 27-44%).

Mortality

Harvest:

Season and Bag Limits.

Kenai Mountains Caribou Herd. Open season for resident and nonresident hunters in Unit 7, north of the Sterling Highway and west of the Seward Highway, was 10 August to 30 September; the bag limit was 1 caribou by drawing permit only; up to 250 permits could be issued.

Kenai Lowlands Caribou Herd. Open season for resident and nonresident hunters in that portion of the Kenai National Wildlife Refuge of Subunit 15A was 1-20 September; the bag limit was 1 bull caribou by drawing permit only; up to 3 permits could be issued.

Killey and Fox River Caribou Herds. The Board of Game has not authorized hunting on these herds.

Board of Game Actions and Emergency Orders. Although the Board of Game did not take any action for this report period, survey data collected in fall 1990 allowed for an increase in number of permits issued from 50 to 100 for the 1991 season. The bag limit was also changed to include either sex for 1991.

Permit Hunts.

Kenai Mountains Caribou Herd. Hunting of this small introduced population was regulated by drawing permit. Number of permits issued was unlimited between 1972 and 1976. The department received over 1,000 applications for 50 permits in 1990, and 1,351 applications for 100 permits in 1991.

The mean annual harvest for the past 5 years was 21 caribou (range = 7-44%), and bulls averaged 60% of the harvest (Tables 5 and 6). Permittees harvested 7 bulls in 1990 and 16 caribou (9 bulls, 7 cows) during 1991. The 1990 harvest was the result of fewer permits and a bulls only season.

Kenai Lowlands Caribou Herd. The department received 795 applications in 1990 and 899 applications in 1991 for the 3 permits issued annually to hunt the KLCH. This hunt was the most difficult permit to draw. Permittees harvested 2 bulls, each year in 1990 and 1991 (Tables 7 and 8). The 2 bulls taken in 1990 exceeded the minimum score for entry into the records of North American Big Game.

Hunter Residency and Success.

Kenai Mountains Caribou Herd. Forty percent of permittees reported they did not hunt in 1990, while 45% did not go afield in 1991 (Table 6). Seven (23%) of the 30 hunters in 1990 and 16 (29%) of the 55 hunters in 1991 were successful (Table 6). Local residents harvested 2 caribou and nonlocal residents harvested 5 caribou in 1990-91 (Table 9). Unit 7 residents took 2 caribou, nonlocal residents harvested 13 animals and 1 nonresident killed a caribou in 1991-92.

Kenai Lowlands Caribou Herd. The department issued 3 permits each year and all permittees hunted (Table 8). Hunters harvested 2 caribou each year. Local residents killed both animals in 1990, and a local resident and a nonlocal resident each harvested 1 caribou in 1991 (Table 10). The unsuccessful hunter in 1990 was a local resident and the unsuccessful permittee in 1991 was a nonlocal resident.

Harvest Chronology.

Kenai Mountains Caribou Herd. The harvest chronology was similar in 1990 and 1991; hunters harvested most of the caribou before 1 September (Table 11). Permittees harvested 4 (57%) of the 7 caribou harvested in 1990 during the first 6 days of the season. Hunters took 2 (13%) of 15 caribou harvested in 1991. One hunter failed to report date of kill in 1991.

Kenai Lowlands Caribou Herd. In 1990 hunters harvested both caribou during the first 2 weeks of the season (Table 12). In 1991, permittees harvested both caribou during the last 5 days of the 20-day season.

Transport Methods.

Kenai Mountains Caribou Herd. In 1990 and 1991 most successful hunters used highway vehicles for access and then hiked into the areas they hunted (Table 13). In 1990, 5 (71%) successful hunters walked while 2 (29%) used horses. The following year 11 (69%) successful hunters walked while 3 (19%) relied on horses, 1 (6%) used an aircraft and 1 (6%) used a mountain bike (ORV). Unsuccessful hunters followed a similar pattern of reliance on foot travel.

Kenai Lowlands Caribou Herd. The 2 successful hunters in 1990 reported using highway vehicles for access (Table 14). In 1991 both successful hunters used 4-wheelers to access the hunt area.

Habitat

Assessment:

Biologists have not thoroughly investigated the habitat components of the Kenai Mountains herd. The ADF&G initially discussed habitat concerns during the mid-1980s when the herd started to decline. Between 1980 and 1984 the KMCH had high calf:cow ratios and the herd was growing in size. Subsequent declines in the calf:cow ratios and herd size between 1985 and 1990, aroused concerns over habitat adequacy. Hunting mortalities probably became additive around 1985, and while hunting may have accelerated the decline, it provided some habitat protection. The herd declined to 300 animals by 1988 and remained at that size until 1990. The calf:cow ratio improved with 34:100 in fall 1990. As the herd increased, the percentage of calves observed declined from 20% in 1990 to 14% in fall 1992. Assuming recruitment reliably indicated herd health, the KMCH appeared more productive when stabilized around 300 to 350 caribou.

Biologists have not assessed range conditions for the KLCH. Calf production appeared normal and animals examined were large compared to animals from the KMCH. Calf survival has been low because of predation. This herd occupies a large range and habitat is not limiting the growth of the KLCH at this time.

The Kenai National Wildlife Refuge staff conducted preliminary habitat assessments for the Killey and Fox River herds before reintroduction in the mid-1980s (Ted Bailey, pers. commun.). The unpublished results suggested the KRCH's range should sustain a minimum of 350 caribou and the FRCH could sustain approximately 80 caribou. Calf recruitment for these herds has been high and habitat has not limited the growth of either herd.

CONCLUSIONS AND RECOMMENDATIONS

Recent survey and harvest data suggest the ADF&G is meeting the KMCH post-season population objective of 400 caribou. Limited habitat, inclement weather, predation, and human harvests are plausible explanations for the herd's decline from 434 in 1985 to 310 in 1990. Recent reductions in harvests allowed the herd to increase, however, calf survival declined. If neonate mortality continues to be moderately high, I suggest we reduce the population objective to a maximum of 350 caribou before the season, and allow an annual harvest of 50 animals until we identify factors influencing calf recruitment.

Low calf recruitment has been the primary management concern for the Kenai Lowlands herd for the past decade. Department and FWS biologists suspect predation, rather than available range, is limiting herd growth. The department cannot initiate appropriate management until mortality causes are identified. Limited harvests of bulls is not influencing herd growth. If the herd continues to decline, I recommend discontinuing hunting until the herd increases to more than 100 animals.

The Killey and Fox River herds have increased significantly and annual recruitment suggests these herds have sufficient range to achieve projected population sizes. A secondary management objective is to allow hunting as these herds increased. I recommend the department issue a limited number of permits for the 1993 season for both herds. Decreasing the herd's growth rate will allow biologists time to determine the optimum herd size. Several years of assessing hunters' success may be necessary to properly manage annual harvests because hunter access is difficult.

LITERATURE CITED

Palmer, L.J. 1938. Management of moose herds on the Kenai Peninsula. Res. Proj. Rept. March, April, and May 1938. Unpublished manuscript. Kenai National Wildlife Refuge files, Soldotna. AK. 40pp.

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Table 1. Kenai Mountains caribou fall composition counts and estimated popualtion size, 1987-1992.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Total bulls (%)	Composition sample size	Estimate[a] of herd size
1987/88	44	20	12	--	--	--	--	303	347
1988/89	37	23	15	--	--	--	--	280	305
1989/90[b]	--	--	--	--	--	--	--	--	--
1990/91	39	34	20	59	--	--	21	303	310
1991/92[b]	--	--	--	--	--	--	--	--	--
1992/93[c]	43	24	14	60	--	--	26	390	406

[a] Estimated herd size equals postseason count plus harvest.
[b] Surveys were incomplete.
[c] Survey was conducted on 11 November 1992, after the end of this report period.

Table 2. Kenai Lowlands caribou composition counts and estimated popualtion size, 1987-1991.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Total bulls (%)	Composition sample size	Estimate[a] of herd size
1987/88[b]	--	--	11	--	--	--	--	115	115-130
1988/89[c]	--	--	9	--	--	--	--	117	117-130
1989/90[d]	--	--	17	--	--	--	--	117	117-130
1990/91[e]	--	--	12	--	--	--	--	98	98-110
1991/92[f]	--	--	24	--	--	--	--	74	74-80

[a] Estimated herd size equals count plus harvest
[b] Survey date 17 June 88.
[c] Survey date 19 June 89.
[d] Survey date 13 June 90.
[e] Survey date 25 June 91.
[f] Survey date 6 June 92.

Table 3. Killey River caribou composition counts and estimated popualtion size, 1987-1992.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Total bulls (%)	Composition sample size	Estimate[a] of herd size
1987/88	No surveys conducted									
1988/89[b,e]	--	--	19	--	--	--	--	--	--	91
1989/90[c,e]	--	--	25	--	--	--	--	--	--	132
1990/91[d]	82	55	23	42	--	--	--	54	154	154
1991/92[e,f]	--	--	--	--	--	--	--	--	--	--

[a] Estimated herd size equals postseason count plus harvest.
[b] Survey date 27 June 1989.
[c] Survey date 18 June 1990.
[d] Survey date 2 November 1990.
[e] Survey date 11 November 1991.
[f] Aerial survey using fixed-wing aircraft - total count only.

Table 4. Fox River caribou fall composition counts and estimated popualtion size, 1987-1991.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Total bulls (%)	Composition sample size	Estimate[a] of herd size
1987/88		No survey								
1988/89[b]	64	64	28	44	--	--	--	9	32	32
1989/90[c,f]	--	--	44	--	--	--	--	--	23	37
1990/91[d,f]	--	--	27	--	--	--	--	--	--	37
1991/92[e,f]	--	--	--	--	--	--	--	--	--	40

[a] Estimated herd size is postseason count plus harvest.
[b] Survey date 27 June 1989.
[c] Survey date 18 June 1990.
[d] Survey date 2 November 1990.
[e] Survey date 11 November 1991.
[f] Aerial survey using fixed-wing aircraft - total count only.

Table 5. Kenai Mountains caribou harvest and accidental death, 1987-91.

Regulatory year	Hunter Harvest: Reported M	(%)	F	(%)	Unk.	Total	Estimated: Unreported	Illegal	Total	Accidental death	Grand total
1987/88	21	(48)	23	(52)	0	44	--	--	--	--	44
1988/89	15	(60)	10	(40)	0	25	--	--	--	--	25
1989/90	12	(86)	2	(14)	0	14	0	0	0	0	14
1990/91	7	(100)	0	(0)	0	7	0	0	0	0	7
1991/92[a]	9	(56)	7	(44)	0	16	0	0	0	0	16

[a] Bull only season in 1990.

Table 6. Kenai Mountains caribou harvest data by permit hunt, 1987-91.

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsucessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
501/	1987/88	250	37	28	72	48	52	--	44
Unit 7	1988/89	150	47	31	69	60	40	--	25
	1989/90	150	49	18	77	86	14	--	14
	1990/91	50	40	23	77	100[a]	0	--	7
	1991/92	100	45	29	71	56	44	--	16

[a] The fall 1990 season permitted the harvest of bulls only.

Table 7. Kenai Lowlands caribou harvest and accidental death, 1987-91.

Regulatory year	Hunter Harvest: Reported M (%)	F (%)	Unk.	Total	Estimated: Unreported	Illegal	Total	Accidental death	Grand total
1987/88	--	--	--	0	--	--	0	--	0
1988/89	2	1	0	3	--	--	0	--	3
1989/90	2	0	0	2	--	--	0	1[a]	3
1990/91	2	0	0	2	--	--	0	1[b]	3
1991/92	2	0	0	2	--	--	0	2[c]	4

[a] Road killed adult male.
[b] Road killed adult female.
[c] Road killed adult female and calf.

Table 8. Kenai Lowlands caribou harvest data by permit hunt, 1987-91.

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsucessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
506/15A	1987/88	0	--	--	--	--	--	--	--
	1988/89	3	0	100	0	2 (67)	1 (33)	0	3
	1989/90	3	0	67	33	2 (100)	--	--	2
	1990/91	3	0	67	33	2 (100)	--	--	2
	1991/92	3	0	67	33	2 (100)	0	0	2

Table 9. Kenai Mountains caribou annual hunter residency and success, 1987-91.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	
1987/88	--	--	--	44	(--)	--	--	--	--		--
1988/89	--	--	--	25	(--)	--	--	--	--		--
1989/90	1	13	0	14	(18)	9	50	2	62[b]	(82)	76
1990/91	2	5	0	7	(23)	3	20	0	23	(77)	30
1991/92	2	13	1	16	(29)	2	35	0	37	(67)	55[b]

[a] Local resident resides in Unit 7 or 15.
[b] Total includes unsuccessful hunters of unknown residence.

Table 10. Kenai Lowlands caribou annual hunter residency and success, 1987-92.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	
1987/88[b]	--	--	--	--		--	--	--	--		--
1988/89	1	2	0	3	(100)	0	0	0	0		3
1989/90	2	0	0	2	(67)	1	0	0	1	(33)	3
1990/91	2	0	0	2	(67)	1	0	0	1	(33)	3
1991/92	1	1	0	2	(67)	0	1	0	1	(33)	3

[a] Local resident resides in Unit 7 or 15.
[b] Herd not hunted.

Table 11. Kenai Mountains caribou annual harvest chronology percent by time period, 1987-91.

Regulatory year	Harvest periods				n
	8/10-8/15	8/16-8/31	9/1-9/15	9/16-9/30	
1987/88	23	37	14	26	44[a]
1988/89	28	20	32	20	25
1989/90	29	36	29	7	14
1990/91	57	14	29	--	7
1991/92	13	40	20	27	15[a]

[a] One hunter failed to report harvest chronology.

Table 12. Kenai Lowlands caribou annual harvest chronology percent by time period, 1987-91.

Regulatory year	Harvest periods		n
	9/1-9/15	9/16-9/30	
1987/88	No season		
1988/89[a]	100	0	3
1989/90[a]	50	50	2
1990/91[a]	100	0	2
1991/92[a]	0	100	2

[a] Season dates 1-20 September 1988-92.

Table 13. Kenai Mountains caribou harvest percent by transport method, 1987-91.

Regulatory year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	n
1987/88	2	25	--	--	--	--	68	5	44
1988/89	8	16	--	--	--	--	76	0	25
1989/90	--	14	--	--	--	--	86	0	14
1990/91	--	29	--	--	--	--	71	0	7
1991/92	6	19	--	--	--	6[a]	69	0	16

[a] ORV includes mountain bike.

Table 14. Kenai Mountains caribou harvest percent by transport method, 1987-91.

	Percent of harvest								
Regulatory year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	n
1987/88					No season				
1988/89	--	--	--	--	--	--	100	--	3
1989/90	--	--	--	--	--	--	100	--	2
1990/91	--	--	--	--	--	--	100	--	2
1991/92	--	--	--	100	--	--	--	--	2

LOCATION

Game Management Units: 9A, 9B, 16B, 17, 19A, and 19B (40,000 mi^2)

Herd: Mulchatna

Geographical Description: Northern Bristol Bay and the Nushagak Hills

BACKGROUND

Little objective information is available on the Mulchatna caribou herd (MCH) before 1973. Skoog (1968) hypothesized that in the 1830s, "A large caribou population occurred along the Bering Sea coast from Bristol Bay to Norton Sound." Records indicate that this herd ranged from the Yukon and Kuskokwim Rivers to the Innoko River and the Taylor Mountains. During the 1800s caribou calf hides were a major trading item with the Russians in Togiak. This herd apparently reached peak numbers in the 1860s and began declining in the 1870s. By the 1880s, large migrations of caribou across the lower Kuskokwim and Yukon Rivers ceased.

Caribou numbers began increasing again in the Mulchatna area in the early 1930s (AK. Game Comm. Repts. 1925-39), remaining relatively stable throughout that decade. Indications were that the herd began declining in the late 1930s (Skoog 1968); however, no substantive information was collected between 1940 and 1950 to support this theory.

Reindeer were brought to the Bristol Bay area during the early part of the 20th century. The numbers and fate of these animals were not recorded, but many residents remember a widespread thriving reindeer industry before the 1940s. Herds ranged between Togiak and the Mulchatna River drainages, with herders following small groups throughout the year. Wolf predation and expansion of the commercial fishing industry probably led to the demise of the reindeer herds. Local residents suggested many reindeer interbred with Mulchatna caribou and eventually joined the herd.

Aerial surveys of the Mulchatna area were first conducted in 1949, when the population was estimated at 1,000 caribou. The population increased to approximately 5,000 by 1965 (Skoog 1968). In 1966 and 1972 relatively small migrations across the Kvichak River were recorded, however, major movements of this herd were not observed until recently. An estimated 6,030 caribou were observed on a survey in June 1973, but it was not until June 1974 that a major effort was made to accurately census this herd. Observers counted 13,079 caribou at that time, providing a basis for an October estimate of 14,231 caribou.

Photocensusing was used to monitor the herd as it declined in size through the 1970s. Seasons and bag limits were reduced continuously during that decade. Locating caribou during surveys was a problem that often led biologists to underestimate caribou numbers.

Twenty radio transmitters were attached to Mulchatna caribou in 1981 which helped locate postcalving aggregations. During a photocensus on 30 June 1981, 18,599 caribou were counted. Photocensus estimates of the MCH since have documented a rate of increase of approximately 17% annually.

MANAGEMENT DIRECTION

Management Objectives

Management objectives for the Mulchatna caribou herd are to: 1) maintain a minimum population of 25,000 adults with a minimum bull:cow ratio of 35:100; 2) manage the MCH for maximum opportunity to hunt caribou; and 3) manage the MCH in a manner that encourages range expansion west and north of the Nushagak River.

METHODS

Staff conducted a photocensus of the MCH during the postcalving aggregation period in cooperation with staff from Lake Clark National Park, Togiak National Wildlife Refuge, and Yukon Delta National Wildlife Refuge. Surveyors, using a Super Cub (PA-18) and Cessna 185 aircraft, estimated the number of caribou observed and photographed large (>100 animals), discrete groups using hand-held 35-mm cameras. We estimated herd size by summing 3 components of the survey: 1) the number of caribou counted in photographs; 2) the estimated number of caribou observed but not photographed; and, 3) the estimated number of animals in areas not surveyed during the census.

Aerial surveys to estimate the sex and age composition of the herd were typically conducted in June and/or October. We placed 9 additional radiocollars on caribou on wintering areas near Portage Creek (7 collars) and the South Fork of the Hoholitna River (2 collars) in April 1991. We captured 20 adult female caribou and radio-collared them near the northwest shore of Iliamna Lake in April 1992. We conducted periodic radio tracking flights to continue the demographics study that began in 1981. Radio telemetry data from this study were analyzed under a contract to Cominco Exploration-Alaska during spring 1992. Cominco was interested in caribou use near a proposed copper mine near the village of Iliamna.

Harvest monitoring and an enforcement presence were maintained along the Mulchatna and Nushagak Rivers during the first half of September when hunting pressure was most intense. We collected harvest data from statewide harvest reports. Hunter "overlay" information was not keypunched, and we did not send reminder letters to hunters who failed to report.

RESULTS AND DISCUSSION

Population Status and Trend

Since 1981 the MCH has increased at an annual rate of approximately 17% (Figure 1). We attribute this increase to a succession of mild winters, low predation rates, and since the late 1970s, an estimated annual harvest rate of less than 5% of the population.

Population Size:

We conducted photocensuses of the MCH on 2 July 1991 and on 7 and 8 July 1992. Based on results of the 1992 survey, the minimum population estimate for the MCH was 110,073 (Table 1). These data indicated the herd continued to increase in size during this report period.

Population Composition:

We did not conduct population composition surveys during this report period. Data from previous surveys (Table 2) suggested high bull:cow ratios in spite of increasing harvest pressure, particularly on bulls.

We flew radio telemetry flights to delineate calving areas on 19-21 May 1992. The peak of calving was during the census period. A survey of 4 bands of caribou in the Sleitat Mountain area yielded 591 cows with 296 calves (50.1 calves:100 cows). This was undoubtedly a minimum estimate because caribou were still calving at the time.

Distribution and Movements:

The MCH continued to increase its range as it increased in number. We had 63 radiocollared Mulchatna caribou in July 1992 for following herd movements. These included 3 radios deployed in 1981 and 1982, and 23 deployed in 1986-1988.

During this report period the most significant wintering area for the MCH was along the west-side of Iliamna Lake. The MCH and the Northern Alaska Peninsula caribou herd (NAPCH) appeared to intermingle on winter ranges. Analysis of radiotelemetry data indicated the MCH has been moving its winter range to the south and west during most of the last decade (Van Daele and Boudreau 1992). Many caribou from the MCH spent the winter south of the Kvichak River as far as Alagnak River.

Caribou also occupied new wintering areas in large numbers during winter 1991-92. Up to 10,000 animals wintered in the Aniak River drainage, according to local residents. Another large group, estimated at 20,000 caribou was observed in the Stony River drainage during late winter months.

Since 1986 an increasing number of caribou have wintered between the Nushagak and Wood Rivers, south of Kemuk Mountain. During fall 1992 approximately 5,000 caribou remained in that area for several weeks. They were visible across the Wood River from Dillingham, and there were reports of a few caribou crossing the Wood River into an area between Dillingham and Aleknagik.

The MCH has also expanded its calving areas in recent years. Taylor (1988) noted the main calving area for the MCH included the upper reaches of the Mulchatna River and the Bonanza Hills, and small groups were observed in the Jack Rabbit and Koktuli Hills, Mosquito Creek and the Kilbuck Mountains.

Surveys during 19-21 May 1992 revealed 10,000-15,000 adult female caribou along the upper Mulchatna River and fewer than 1,000 adult females in the Bonanza Hills. Mosquito River drainages contained about 20,000 calving females. Another estimated 20,000 adult females were located near Harris Creek, northeast of the village of Koliganek. Smaller groups of calving caribou were also observed in the upper Koktuli and Kaskanak River areas, along the Kokwok River, and near Portage Creek. These smaller aggregations were suspected to be members of nonmigratory subherds. We saw large male aggregations (>10,000) along Vukpalik Creek (Nushagak drainage) and Hook Creek (Hoholitna drainage).

Summer and fall range use has spread north as far as the Taylor Mountains and the Stony River drainage and as far west as the Aniak and Togiak River drainages. Over 40,000 caribou were observed in the vicinity of Tikchik River flats and the Shotgun Hills during the July 1992 census. Another 40,000 caribou were observed between the Nushagak and the Nuyakuk Rivers during that census. Staff of the NPS noted an obvious decline in the number of caribou using areas near Lake Clark National Preserve since 1990.

Several peripheral groups appeared to be independent from the MCH. About 500 caribou resided between Portage Creek and Etolin Point. Caribou in the Kilbuck Mountains and in Rainy Pass appeared to be distinct from the MCH, but overlapped some during the year. Radiotelemetry data confirmed another group resided in the upper Stuyahok and Koktuli River drainages (Van Daele and Boudreau 1992). During winter these caribou intermingled with the main herd, but they did not migrate with the main herd in spring.

Mortality

Harvest:

Season and Bag Limit. Hunting was prohibited in Subunit 17A and that portion of Subunit 17C west of the Nushagak River. The open season for Alaska residents, subsistence, and nonresident hunters in Subunits 9A, 9B, 17B, and the remainder of 17C was 10 August to 31 March. The bag limit for resident hunters was 4 caribou; however, not more than 1 (2 for subsistence hunters) could be taken from 10 - 31 August, 1 caribou

could be taken from 1 September to 30 November, and up to 4 could be taken from 1 December to 31 March. The bag limit for nonresidents was 1 caribou.

Board of Game Actions and Emergency Orders. An emergency regulation opened a portion of Subunit 17C west of the Nushagak River to the Kokwok River from 10 August to 30 September 1991. This opening was in response to a request from local residents concerned about the economic hardships associated with a strike by commercial fishermen in Bristol Bay in 1991. The board accepted the request that local residents did not have sufficient funds to access normal hunting areas, and then decided a limited opening would not jeopardize the continued westward expansion of the MCH. A similar request was made by local residents in 1992, but the department did not solicit special action by the board and the request was not granted.

Hunter Harvest. The reported harvest from the MCH was 1,573 caribou during the 1991-92 hunting season (Table 3). This total was the highest harvest recorded for the MCH. As in previous years, most of the harvest (86%) was males.

Data from harvest reports must be viewed with caution because overlays are not keypunched and there was no way to analyze the rate of return objectively. The estimated unreported harvest during this period was at least 1,700, yielding an estimated total harvest of over 3,273 caribou.

Most of the unreported harvest was attributed to local and other Alaska residents. Our efforts to increase local reporting in recent years has met with some success (46 caribou in 1989-90, 141 in 1990-91, and 185 in 1991-92). Actual local harvest was considerably higher. Subsistence Division household surveys, conducted in local villages from 1983 to 1989, indicated an annual harvest of 1,318 caribou (P. Coiley, ADFG-Subsistence pers. comm.). Unreported harvests by other Alaska residents was more difficult to quantify.

Field observations indicated the density of hunters in range of the MCH during fall season has increased steadily since the early 1980s. However, harvest levels remained less than 5% of the total population, and harvests did not appear to limit herd growth or range expansion. The prohibition of hunting in the portion of Subunit 17C west of the Nushagak River probably contributed to the increased use of this area by caribou.

Hunter Residency and Success. Nonresidents made up 46% of the reporting hunters (n = 1,464) during the 1991-92 season. Nonlocal Alaska residents accounted for 48%, and local residents 7% of the total hunters who returned harvest reports. Eighty-five percent of the reporting hunters successfully harvested at least 1 caribou (Table 4).

Harvest Chronology. Most (72%) of the reported harvest (1,573 caribou) occurred during August and September. March was also an important month for harvesting caribou (12%). This was similar to the harvest chronology reported for 1989-90 and 1990-91 (Table 5).

Transport Methods. Aircraft were the most common (81%) means of hunter transport during the 1991-92 hunting season (Table 6). Boats (9%) and snowmachines (9%) were other important means of transportation.

Other Mortality: A few incidents of wolf and brown bear predation on caribou were observed and reported during this report period, but predation rates appeared low. During aerial surveys in May 1992 we did not observe wolves and only 4 brown bears were near calving caribou. An increasing number of hunters along the Mulchatna River reported having encounters with brown bears; including bears on fresh kills, bears on hunter-killed carcasses, and bears raiding hunting camps. Individual bears were apparently learning to capitalize on an abundant autumn food source.

We used data collected from radiocollared caribou between 1981 and 1988 to calculate annual survival rates for adult females in the MCH. Using techniques described by Trent and Wrongest (1974), the estimated annual survival rate was 0.91 (K. Pitcher, ADF&G-Wildlife, pers. comm.).

The MCH was one of the most disease free caribou herds in the state. Serological surveys of blood sera collected from 14 caribou from the MCH in 1990 did not indicate any evidence of epizootic hemorrhagic disease, bovine viral diarrhea, parainfluenza 3, respiratory syncytial virus, or leptospirosis. Infectious bovine rhinotracheitus was evident in 8 of the 14 samples, but the tests were suspected to be "false positive" and all samples were being retested by an independent laboratory. Results of tests for brucellosis were not available yet, but samples collected in previous years were negative (R. Zarnke, ADF&G-Wildlife, pers. commun.).

Several dead caribou were seen in a dry lake bed near the Kokwok River in July 1992. The carcasses were near each other and in an inaccessible area. We were not able to investigate the scene, but evidence suggested the caribou were struck by lightning.

Habitat Assessment

We did not objectively assess the condition of the MCH winter range during this report period. Taylor (1989) reported the carrying capacity of traditional wintering areas had been surpassed by 1986-87, and it was necessary for the MCH to use other winter range to continue its growth. The herd apparently has used different areas at an increasing rate since then.

Portions of the range showed overt signs of heavy use. Extensive trailing was evident along migration routes. Some of the summer and fall range near the Tikchik Lakes was reported trammeled and heavily grazed. Winter range on the west-side of Iliamna Lake still appeared to have adequate lichen resources. Many areas the MCH expanded to apparently had vast quantities of ungrazed lichen communities.

CONCLUSIONS AND RECOMMENDATIONS

The MCH continued to experience exceptionally rapid growth in size and range during this report period. The minimum postcalving population estimates have increased from 18,599 in 1981 to 110,073 in 1992. Annual harvests remained at less than 5% of the population throughout this period. Total harvest and the number of hunters afield has steadily increased.

During the past decade the MCH has made dramatic changes in its range. In the early 1980s the herd spent most of the year east of the Mulchatna River between the Bonanza Hills and Iliamna Lake. During this report period the herd's range encompassed over 40,000 mi^2 and large portions of the herd infiltrated new winter, calving and summer ranges in good to excellent caribou habitat. Localized overuse was evident in portions of the range, but overall, most areas used by the MCH appeared in good condition.

A common question asked about the MCH was: "When will the herd crash?" There were few signs of stress in the herd. Adult females captured in spring were in good condition, calf production and survival appeared good, there was little evidence of disease, predation rates were low, and the herd continued to expand to good habitat.

In spite of these indicators, such rapid population growth cannot continue indefinitely. We should encourage westward expansion of the herd by recommending hunting restrictions in the new areas being used by the herd and direct hunters to areas where there are signs of range overutilization. Hunting regulations in most of the MCH range should be liberalized to slow the population increase and to use the meat resource available from this herd. Any liberalizations, however, should consider the secondary affects on other species in the area (particularly moose and bears).

Increasing harvest pressure on the MCH also affects other big game populations in the area. Moose populations near villages are experiencing less pressure and illegal moose harvests are decreasing as local hunters increase their use of caribou meat. The increasing number of caribou also attracts more nonlocal hunters participating in "combination hunts." The moose harvest by nonlocal hunters in Subunits 17B and 17C increased from 23 in 1982-83 to 141 in 1991-92 (ADF&G files).

The MCH presents new management challenges as it expands its size and range. Because the main portion of the herd is migratory, using areas from the western slopes of the Alaska Range to the Wood-Tikchik Lakes, it seasonally occupies ranges used by smaller, resident caribou herds. We must determine how (or if) we can manage each herd separately when setting management objectives and proposing regulatory formulas.

Current harvest data for the MCH are of limited value because there is no objective method to determine the rate of return of harvest tickets. Overlay data are not keypunched and reminder letters are not sent to nonrespondents. Important harvest management

decisions are necessarily based on assumptions rather than objective data. The department should strive to improve the quality of the harvest data so we can improve management of the MCH as well as the smaller herds which occur on the same range. Improved harvest data are also vital if it becomes necessary to limit harvest pressure.

Management actions I recommend for the next few years include:

1) Conduct an annual photocensus of the MCH during postcalving aggregations in 1994 and 1996;

2) Conduct composition surveys during October 1993 and 1995. Sample sizes should be at least 5% of the estimated herd size and at least 3 distinct areas should be sampled;

3) Monitor the movements of the MCH by locating radiocollared caribou at least 6 times each year;

4) Maintain at least 50 active radiocollars in the MCH by scheduling capture operations in April 1994 and 1996;

5) Develop a method of collecting harvest data and implement the method before the 1994-95 hunting season; and,

6) Continue to work with other land and resource management agencies and land owners on MCH management.

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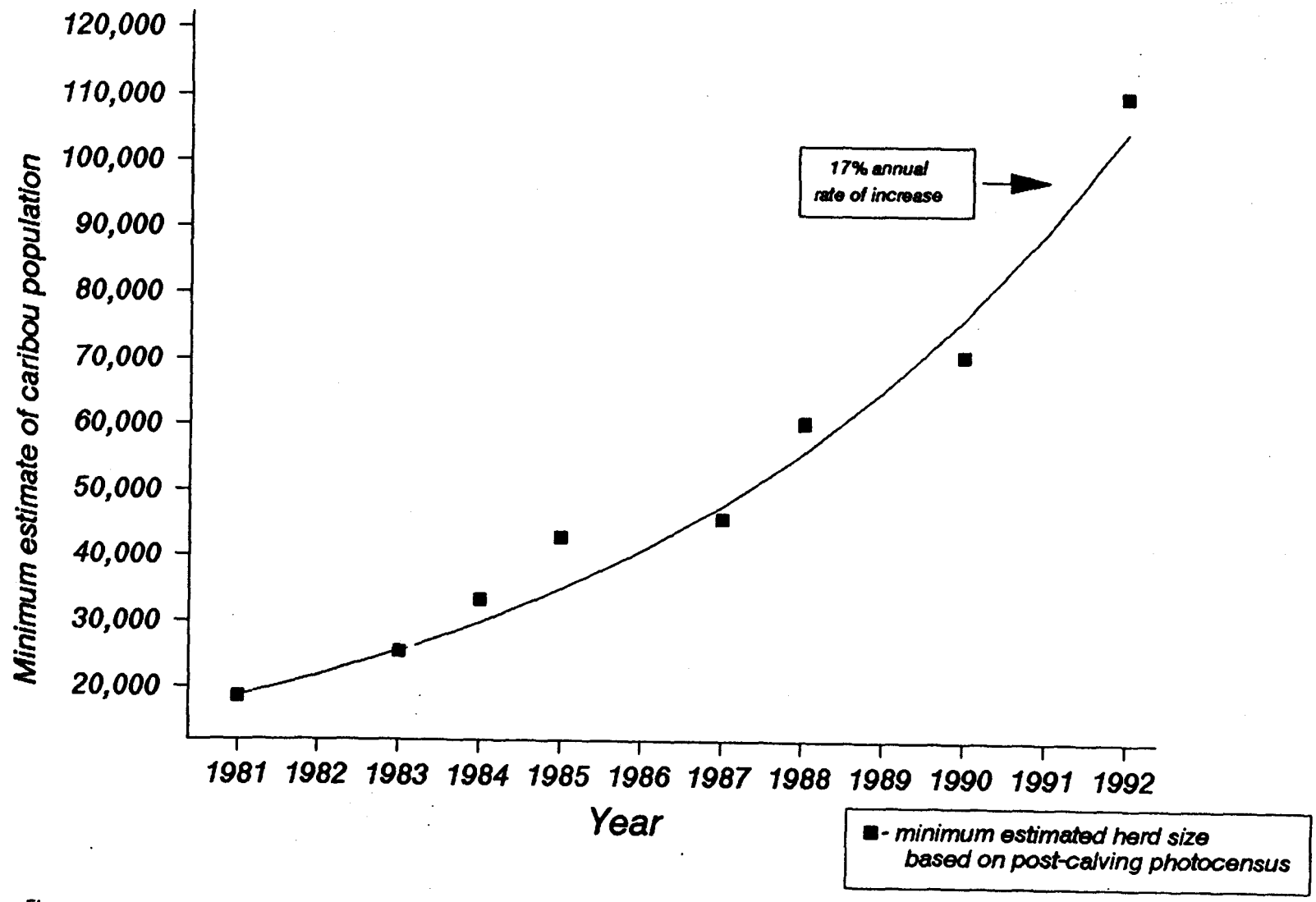

Figure 1. Annual rate of increase, Mulchatna caribou herd, 1981-1992.

Table 1. Mulchatna caribou herd estimated population size, 1987/88-1992/93.

Regulatory year	Date	Preliminary estimate[a]	Minimum estimate[b]	Extrapolated estimate[c]
1987/88	02 Jul 87	37,262	45,742	52,527
1988/89	30 Jun 88	45,456	60,328	------
1989/90	28 Jun 89	51,868	--	70,000
1990/91	01 Jul 90	61,851	70,652	82,000
1991/92	02 Jul 91	60,851	--	90,000
1992/93	07/08 Jul 92	90,550	110,073	115,000

[a] Data based on estimated herd sizes observed during the annual aerial census.
[b] Data derived from photo-counts and observations during the annual aerial census.
[c] Estimate based on observations during census and a subjective estimate of the number of caribou in areas not surveyed during the census.

Table 2. Mulchatna caribou fall composition counts and estimated population size, 1987-1991.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls (%)	Composition sample size[b]	Estimate of herd size[a]
1987/88	68	60	26%	--	--	--	--	--	1,858	52,527
1988/89	66	54	24%	--	--	--	--	--	536	70,000
1989/90	--	--	--	--	--	--	--	--	----	82,000
1990/91	--	--	--	--	--	--	--	--	----	90,000
1991/92	--	--	--	--	--	--	--	--	----	115,000

[a] Estimate based on observations during census and a subjective estimate of the number of caribou in areas not surveyed during the census.
[b] Estimate derived from photo-counts, corrected estimates, and subjective estimate of the number of caribou in areas not surveyed during the census.

Table 3. Mulchatna caribou harvest and accidental death, 1987-91.

Regulatory year	Hunter harvest							Accidental death	Grand total
	Reported				Estimated				
	M(%)	F(%)	Unk.	Total	Unreported	Illegal	Total		
1987/88	88	11	0	985	1,270	--	1,270	--	2,255
1988/89	78	19	3	1,471	1,500	--	1,500	--	2,971
1989/90	88	11	1	1,201	1,500	--	1,500	--	2,701
1990/91	84	16	1	1,151	1,500	--	1,500	--	2,651
1991/92	86	13	1	1,573	1,700	--	1,700	--	3,273

Table 4. Mulchatna caribou annual hunter residency and success, 1987-91.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local resident	Nonlocal resident	Nonresident	Total (%)	Local resident	Nonlocal resident	Nonresident	Total (%)	
1987/88	--	--	--	--	--	--	--	--	--
1988/89	--	--	--	83%	--	--	--	17%	1,781
1989/90	46[a]	424	621	85%	1	117	70	15%	1,279
1990/91	87[b]	366	532	87%	12	70	68	13%	1,135
1991/92	89	562	599	85%	9	136	69	15%	1,464

[a] Includes residents of Unit 17.

[b] Includes residents of villages within the range of the Mulchatna Caribou Herd.

Table 5. Mulchatna caribou annual harvest chronology percent by time period, 1987-91.

Regulatory year	Harvest periods									
	August	September	October	November	December	January	February	March	Unk.	n
1987/88	--	--	--	--	--	--	--	--	--	--
1988/89	--	--	--	--	--	--	--	--	--	--
1989/90	23	59	4	1	1	1	1	11	0	1,201
1990/91	21	51	6	1	2	1	4	14	1	1,138
1991/92	29	43	6	0	2	1	4	12	2	1,573

Table 6. Mulchatna caribou harvest percent by transport method, 1987-91.

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	n[a]
1987/88	--	--	--	--	--	--	--	--	--
1988/89	--	--	--	--	--	--	--	--	--
1989/90	85	0	9	1	3	0	0	2	1,398
1990/91	84	1	7	1	7	0	0	2	1,277
1991/92	81	0	9	1	9	0	0	2	1,750

[a] Total includes all hunters; hunters harvesting more than 1 caribou are counted more than once.

LOCATION

Game Management Subunits: 9C and 9E (19,560 mi^2)

Herd: Northern Alaska Peninsula

Geographical Description: Alaska Peninsula

BACKGROUND

The Northern Alaska Peninsula caribou herd (NAPCH) ranges throughout Subunits 9C and 9E. Historically, the size of this population fluctuated widely, peaking at the end of last century and again in the early 1940s (i.e., 20,000 caribou). The last population low occurred during the late 1940s (i.e., 2,000 caribou) and by 1963 the herd increased to over 10,000 animals. The first radiotelemetry-aided census in 1981 estimated 16,000 caribou and by 1984 the herd increased to 20,000. It has remained relatively stable between 16,000 and 20,000 since then.

MANAGEMENT DIRECTION

Management Objectives

Management objectives for the Northern Alaska Peninsula caribou herd are to maintain the mid-summer population between 15,000 and 20,000 caribou and an October sex ratio of 40 bulls:100 cows.

METHODS

We conducted a radiotelemetry-aided aerial photocensus in late June on postcalving concentrations. In most years, including 1991, this survey was accomplished with 2 fixed-wing aircraft (eg. Cessna 185); but in 1992, we used a Robinson R22 helicopter and Cessna 185. The helicopter facilitated the operation by consolidating some dispersed herds, thereby improving the quality of the photograph. In April 1992, we captured 15 adult females using a helicopter-mounted net gun, to radio-collar and to assess body size and condition. We did fall sex and age composition surveys via helicopter in October. Reconnaissance flights (using radiotelemetry) were conducted periodically to monitor herd movement. We monitored the harvest by harvest ticket reports.

RESULTS AND DISCUSSION

Population Status and Trend

The NAPCH has grown since the early 1950s. Photocensuses from 1981-1992 have ranged from 16,000 to 20,000. Annual count variations reflected actual changes in herd size, but also resulted from sampling error and restricted coverage because of weather and other difficulties. Despite these fluctuations in counts, the NAPCH has been relatively stable at the desired population size for the past 12 years.

Population Size: Actual counts from the 1991 and 1992 photocensuses were 15,400 and 16,500 respectively, and total herd estimates were 16,000-17,000 and 17,000-18,000 for the 2 years. Although the herd may have grown from 1991 to 1992, it was probably the helicopter that improved the quality of the census and increased the numbers in 1992.

Population Composition: A sample of 1,653 caribou classified from the June 1991 photocensus showed 29% calves in the herd. A sample of 1,639 caribou classified in October 1991 showed 42 bulls:100 cows and 47 calves:100 cows (Table 1). A sample of 6,166 caribou classified from the June 1992 photocensus showed 31% calves. In October 1992 a sample of 2,766 caribou had 40 bulls:100 cows and 44 calves:100 cows.

Since 1981 the percent calves present during postcalving censuses of the NAPCH has ranged from 25%-33%, while the fall composition surveys have estimated 16-26% calves. By either measure, the NAPCH remains twice as productive as the neighboring Southern Alaska Peninsula caribou herd (SAPCH). The sex ratio of the NAPCH from 1989-92 has averaged 40 bulls:100 cows.

Distribution and Movements: The NAPCH's primary calving grounds were in the Bering Sea flats between the Cinder and Sandy Rivers. In recent years the postcalving migration north has begun earlier, and in the past 2 years most of the herd was north of the Egegik River by 1 August. Traditionally, this herd wintered between the Egegik and Naknek Rivers. However, starting in 1986, many caribou have wintered between the Naknek River and Lake Iliamna, overlapping with a portion of the Mulchatna herd.

Mortality

Harvest:

Season and Bag Limits. The open season for all hunters in Subunits 9C and 9E was 10 August to 31 March. The bag limit for resident hunters was 4 caribou; however, not more than 2 could be taken from 10-31 August and the September-November bag limit was 1. Under a federal permit, qualified subsistence hunters had a 2 caribou bag limit during September-November. The bag limit for nonresident hunters was 1 caribou.

Board of Game Actions and Emergency Orders. Because of a late spring migration in 1992, caribou were not available to villagers from Pilot Point and southward. The board was petitioned and granted a special emergency 4-day hunt from 18-21 April in the southern portion of Subunit 9E. At the fall 1992 board meeting, the resident season in Subunit 9E was extended through April with a 2 caribou bag limit. This extension increased hunting opportunity for villagers in the southern portion of Subunit 9E, but was not expected to attract many nonlocal hunters because spring breakup made access difficult.

Hunter Harvest. The 1990-91 reported harvest from the NAPCH was 791 animals (Table 2), including 679 males (86%), and 110 females (14%). The 1991-92 reported harvest was 806 animals (Table 2), including 688 males (86%), and 115 females (14%). During the emergency, 4-day hunt in April 1992, hunters from 4 villages killed an estimated 94 caribou (Fall 1992). The ADF&G estimated the nonsubsistence reporting rate was 60% (Sellers 1989) and unreported subsistence harvest was 900-1,000 (Morris 1985, Morris 1987, Fall 1992). The total annual human harvest for 1990-91 and 1991-92 was 2,000 caribou.

Hunter Residency and Success. For 1990-91 and 1991-92 nonresidents comprised 50% and 46%, respectively, of the successful hunters (Table 3); but because of the larger bag limit for residents, nonresidents only accounted for 41% and 35%, respectively, of the total reported harvest. Local residents made up less than 10% of all hunters that reported during these 2 years, but most village residents did not comply with reporting requirements. Based on subsistence harvest estimates (Fall 1992) and a 60% reporting rate for other Alaskans, the total estimated harvest was partitioned as follows: local residents 50%; other Alaskans 30%; nonresidents 20%.

Harvest Chronology. Most of the reported kill for the NAPCH occurred between 10 August - 31 October which corresponded with the best weather conditions, best chance for taking a trophy bull and relatively easy access by boat and aircraft from King Salmon and Naknek (Table 4). The proportion of reported caribou harvest occurring during October increased during odd-numbered years because of the concurrent brown bear season (Table 4). During the past 6 winters, more caribou have crossed the Naknek River where they were more accessible to hunters using vehicles. This easy access, low air fares from Anchorage and a liberal bag limit resulted in higher winter harvests than before 1987. When the November bag limit was reduced from 4 to 1 in 1988, more hunting effort was shifted to the late season (Table 4).

Future winter harvests will depend on how many caribou are accessible along the King Salmon road and trail system. The subsistence harvest is primarily opportunistic, and peak harvests vary between villages depending on caribou availability.

Transportation Methods and Commercial Services. Most successful hunters, especially those hunting during fall, reported using aircraft (60-68%), with the remainder split

among boat, 3- or 4-wheelers, highway vehicles, and snowmobiles (Table 5). With increased winter hunting north of the Naknek River, highway vehicles, 3- or 4-wheelers, and snowmobiles have become more important. Subsistence hunters who did not report made less use of aircraft than indicated in Table 5.

For 1990-91 and 1991-92 combined, 37% of all hunters reported they did not use commercial services during their hunt. These hunters reported a success rate of 79%. For the same 2 years, 22% of all hunters reported using registered guides and had a 90% success rate. Forty-one per cent of hunters used other commercial services (transportation to the field - 21%, non-guided hunting services - 14%, lodges - 5%) and reported an overall success rate of 84%.

Other Mortality:

Although we lack specific data on natural mortality in the NAPCH, we believe it is much lower than for the SAPCH. The past 2 winters have been relatively mild and winter mortality was not severe.

Habitat

Assessment: Quantitative data is not available to assess range conditions, however, preliminary analysis of data (body weights, blood parameters, and body size) from the caribou transplanted in 1988 and from animals captured in April 1990 and 1992 show NAPCH adult females are intermediate in body size and condition between SAPCH and Mulchatna herd animals (Pitcher *et al.* 1990). Expansion of the winter range north of the Naknek River may indicate depletion of the herd's winter range.

Nonregulatory Management Problems/Needs

This herd was nominated by a panel of caribou biologists for experimental management because the NAPCH has been relatively stable at a moderately high density for the past 12 years and because of its importance to hunters. The panel proposed to maintain the current population size indefinitely and closely monitor the herd, including population composition, distribution, and animal condition. It will be necessary to maintain 20-25 radios on adult females to accomplish this objective.

CONCLUSIONS AND RECOMMENDATIONS

The NAPCH has remained within the population objective for the past 12 years. We recommend no changes in objectives or in hunting regulations. Intensive monitoring of population parameters will be needed to meet the experimental management objectives recommended.

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Table 1. Northern Alaska Peninsula caribou fall composition counts and estimated population size, 1988-92.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Total bulls (%)	Composition sample size	Estimate of herd size
1988/89	49	48	26	46	34	20	25	1,156	20,000
1989/90	37	33	19	62	19	0	22	312	20,000
1990/91	41	29	17	NA	NA	NA	24	1,484	17,000
1991/92	42	47	25	54	34	12	22	1,639	17,000
1992/93	40	44	24	44	38	19	22	2,766	17,500

Table 2. Northern Alaska Peninsula caribou harvest, 1987-1991.

Regulatory year	Hunter Harvest						Estimated unreported	Grand[a] total
	Reported							
	Males	(%)	Females	(%)	Unk.	Total		
1987/88	841	84	158	16	4	1,003	1,300	2,300
1988/89	841	85	147	15	1	989	1,400	2,400
1989/90	766	85	137	15	0	903	1,400	2,300
1990/91	679	86	110	14	2	791	1,200	2,000
1991/92	688	86	115	14	3	806	1,200	2,000

[a] Grand total is rounded-off.

Table 3. Northern Alaska caribou annual hunter residency and success, 1989-91.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[b] resident	Nonlocal resident	Nonresident	Total	(%)	
1989/90	49	345	358	752	(98)	4	6	5	15	(2)	767
1990/91	51	270	321	640	(84)	8	76	39	123	(16)	763
1991/92	56	283	282	621	(79)	15	120	27	162	(21)	783

[a] Local resident resides in Unit 9 or Unit 10.

Table 4. Northern Alaska Peninsula caribou annual harvest chronology percent by time period, 1987-91.

Regulatory year	Harvest periods					n
	August	September	October	November	December-March	
1987/88	13	31	23	19	14	999
1988/89	11	37	19	7	27	981
1989/90	10	37	21	5	28	899
1990/91	12	36	12	4	36	884
1991/92	14	35	20	2	29	789

Table 5. Northern Alaska Peninsula caribou harvest percent by transport method, 1987-91.

Regulatory year	Percent of harvest							n
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	
1989/90	68	0	13	7	4	1	8	758
1990/91	64	0	12	11	1	3	9	632
1991/92	60	0	14	14	4	1	7	616

LOCATION

Game Management Units: 9D and 10 (6,435 mi^2)

Herd: Southern Alaska Peninsula

Geographical Description: Alaska Peninsula and Unimak Island

BACKGROUND

The range of the Southern Alaska Peninsula caribou herd (SAPCH) includes the Alaska Peninsula south and west of Port Moller. There have been numerous reports of caribou moving between Unimak Island and the mainland, including what may have been a substantial emigration in 1976. Historically, the size of the SAPCH has varied widely, ranging from 500 to over 10,000. Skoog (1968) speculated that the Alaska Peninsula was marginal habitat for sustaining large caribou populations, because of periodically severe ice conditions and volcanic ash which affect food availability. Recent herd history includes a growing phase from 1975 to 1983 and a declining phase from 1983 to the present. The number of caribou on Unimak Island has also varied substantially, ranging from 5,000 in 1975 (Irvine 1976) to about 300 in 1983.

Harvests were fairly high from 1980-1985, possibly exceeding 1,000 in several years. These high harvests were encouraged in an attempt to control herd growth during the early 1980s. Following evidence in 1986 that the herd was declining, progressively more restrictive regulations have reduced the harvest to approximately 100 caribou. Undernutrition appears to be a factor in the decline of the SAPCH. Predation by wolves and brown bears as well as human harvest may also have contributed to the decline in numbers (Pitcher *et al.* 1990).

MANAGEMENT DIRECTION

Management Objectives

The management objective for the Southern Alaskan Peninsula caribou herd is to maintain a population of 5,000 to 6,000 caribou in midsummer with an October sex ratio of 40 bulls:100 cows.

In light of new information about range condition and possible adverse affects of poor nutrition on animal condition and productivity, the current management strategy is to ensure hunting does not depress the herd below 2,500 animals and the sex ratio does not drop below 15 bulls:100 cows for 2 consecutive years.

METHODS

A postcalving, aerial radiotelemetry survey in late June or early July has been conducted in most years since 1984. Fall sex and age composition surveys were periodically flown by helicopter in October. We used occasional radiotracking flights to monitor herd distribution. Staff of the Izembek National Wildlife Refuge (INWR) attempted annual late-fall aerial censuses along systematic transects. Hunter harvests were monitored by harvest tickets and supplemented by field checks by INWR staff around Cold Bay. During 1989-1990 studies were conducted on causes of low calf recruitment in the SAPCH (Pitcher *et al.* 1990). During 1991-92, caribou range was analyzed with various vegetation sampling techniques (Eric Post, pers. commun.).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: We counted postcalving aggregations on 9 July 1991 and on 22 and 23 June 1992 with total counts of 2,287 and 2,380, respectively. We estimated total herd size as 3,000. Similar surveys in 1989 and 1990 tallied 3,386 and 3,375 caribou respectively. During 16 and 17 December 1991, a winter count conducted by INWR staff counted 2,830 caribou (C. Dau, pers. comm.). Although the 1991 and 1992 postcalving counts were similar, other population parameters such as continued low production and an old age structure indicated a continuing decline that began in 1984.

Population Composition: During the 1991 and 1992 postcalving surveys, 18% and 15%, respectively, of the caribou observed were calves. Fall helicopter surveys in 1991 and 1992 classified 883 and 746 caribou and showed 13% and 15% calves, respectively (Table 1). Ratios were 28 and 22 bulls:100 cows and 19 and 22 calves:100 cows, respectively. Recent composition data (Table 1) indicated continued low calf recruitment and a decline in the bull:cow ratio compared to 1987-88.

Fall 1991 composition data indicated caribou from the Caribou River flats (CRF) were more productive (33 calves:100 cows) than caribou from the Black Hills (17 calves:100 cows) as documented by Pitcher *et al.* (1990). This difference was evident in June 1992 as the CRF segment had over 20% calves versus 10% for the Black Hills group. Radiotelemetry showed that some CRF caribou were among caribou classified near Cold Bay in October 1992; this blurred any difference in fall calf:cow ratios.

Distribution and Movement: Data from radiotracking surveys conducted by staff from both INWR and the ADF&G suggested the SAPCH has 2 main subgroups which calve in separate areas (Pitcher *et al.* 1990). Approximately 25% of the herd appeared to calve on the CRF. Many of these animals appeared relatively sedentary and remained in the area through the winter. However, some have been located near Cold Bay during winter.

The remainder of the herd calved in the Black Hills-Trader Mountain area and wintered around Cold Bay. Further radiotelemetry studies will be needed to clarify the discreteness of the 2 major calving components of this population. A few caribou also calve in the mountains east of the CRF. Exchange of caribou between Unimak Island and the mainland has not been documented in recent years.

Mortality

Harvest:

Season and Bag Limits. The 1990-91 open season in Subunit 9D and Unimak Island (Unit 10) for resident hunters was 1 September to 31 March with a bag limit of 1 bull. For nonresident hunters the season was 1 September to 31 October; the bag limit was 1 caribou. The 1991-92 resident season was 10 August to 30 September and 1 December to 31 March with a bag limit of 1 bull. The nonresident season was 1-30 September with a 1 bull bag limit. In 1991-92, only local residents could hunt on federal lands.

Board of Game Actions and Emergency Orders. Regulatory changes made since 1986 by the Board of Game and by emergency order were summarized by Johnson (1990). In response to the continued decline in this herd, the board changed the 1990-91 bag limit for all hunters to 1 bull, and endorsed the department's recommendation that all hunting be stopped if the herd drops below 2,500 caribou. In October 1990, the USFWS used its regulatory authority under Alaska Native Interest Lands Claim Act to announce an emergency closure of nonsubsistence hunting on federal lands. This closure was made to ensure a priority for local residents in anticipation of an influx of nonrural hunters if the caribou became readily available along the Cold Bay road system. The department submitted a proposal for the spring 1991 board meeting to eliminate nonresident hunting and to split the resident season by closing it from 1 October to 30 November when caribou were near the Cold Bay road system. This proposal was made in cooperation with INWR staff to avoid a Tier II hunt by proposing a season that was not attractive to nonlocal hunters. Neither the Federal Subsistence Board nor the Board of Game enacted this proposed season. The state retained a nonresident season during September and federal lands remained open only to local residents.

Hunter Harvest. The 1990-91 reported harvest of the SAPCH was 45 caribou, including 43 males, 1 female, and 1 of unspecified sex (Table 2); however, when unreported sport and subsistence harvests were considered, the total harvest may have approached 100 caribou. In 1991-92 the reported harvest was 35 bulls.

Hunter Residency and Success. Nonresidents harvested 45% of the reported harvest for the 2 regulatory years 1990-91 and 1991-92 (Table 3). Only 17% of the reported harvest was taken by nonlocal Alaskans. Because the general season closed before caribou became available along the Cold Bay road system, few residents found it attractive to travel to Cold Bay and charter a vehicle for 1 caribou.

Harvest Chronology. In 1990-91, 66% of the harvest occurred during September and October; another 24% occurred between December and March. In 1991-92, 60% of the harvest occurred during fall and 40% occurred between December and March.

Transport Methods. Virtually all nonsubsistence hunters used aircraft for access, while most of the subsistence harvest that was reported occurred near Cold Bay with the use of highway vehicles, 3- or 4-wheelers and boats (Table 5).

Other Mortality: Pitcher *et al.* (1990) estimated annual survivorship of radiocollared adult females from the SAPCH was estimated at 0.61, which was extremely low compared with other Alaska caribou herds. Causes of death were not determined, although predation by wolves and brown bears was probably a factor. Both predators were abundant on the SAPCH range.

Calf survival in the SAPCH was low throughout the 1980s; during the report period the percentage of calves in the herd averaged 16% in mid- to late June, less than 1 month after calving. Undernutrition was considered a factor in the low survival, although predation was probably involved (Pitcher *et al.* 1990).

Habitat

Assessment: Habitat on the Caribou River flat is substantially different than in the Black Hill-Trader Mountain area; the Caribou River flat is a wet, lowland area with abundant sedge meadows interspersed with willow shrublands. The Black Hills-Trader Mountain and Cold Bay areas are generally mid-elevation ericaceous shrub tundra. Plant phenology is earlier on the Caribou River flat.

A preliminary analysis of fecal pellets showed very high use of mosses (Pitcher *et al.* 1990) and indicated possible poor range condition. Pitcher *et al.* (1990) reported adult female caribou from the SAPCH were smaller and weighed less than cows from either the NAPCH or Mulchatna herds. In April 1992, we captured 11 caribou to weigh, measure, test for body fat, and fit them with radiocollars.

A doctoral graduate student (E. Post) from the University of Alaska, Fairbanks began a range analysis study in 1991 under the advisement of Dr. D. Cline, with cooperative support from the department and the USFWS.

CONCLUSIONS AND RECOMMENDATIONS

It is difficult to make specific management recommendations for the SAPCH without knowing if the continuing decline in numbers is because of (1) rangewide density-dependent food limitation, (2) a shift into inferior winter range, (3) high predation rate and excessive harvests, or (4) some combination of these. Because we lack precise

answers to these questions, hunting mortality should be reduced as much as possible, particularly for female caribou. The herd is well below the stated population objective of 5,000 to 6,000 caribou. However, if density-dependent food limitation is a primary cause of the decline and is still operative at the current population size, then this objective is inappropriate. Unless we obtain information to support a different approach, we should make every effort to prevent the herd from declining below 2,500 animals (i.e., a density of 0.5 caribou/km^2), where food limitations should not be a concern. We are concerned that predators might prevent a small, low-density herd from recovering for an extended period, particularly in this instance where caribou are the only large mammalian prey. It may be difficult to manage this herd at a level between nutritional and predator limitation.

Close cooperation between the department and the INWR staff is essential for effective management and research. A cooperative management plan has been drafted and is currently under review. The plan stipulates that both agencies agree all hunting will be stopped if the population drops below 2,500 animals or if the sex ratio drops below 15 bulls:100 cows for 2 consecutive years. We will recommend that the board not authorize a nonresident season and adjust the resident season to 10 August - 30 September, and from 1 December - 31 March with a 1 bull limit. This split season will provide reasonable opportunity for local subsistence users but will reduce the influx of nonlocal hunters to the Cold Bay area when caribou usually migrate through the road system. The closure during October will also keep hunters from harvesting bulls during the peak rutting period when meat quality is poor. A split season will preclude the need to administer either a state or federal subsistence permit hunt.

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Table 1. Southern Alaska Peninsula caribou fall composition counts and estimated population size, 1987-92.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Total bulls (%)	Composition sample size	Estimate of herd size
1988/89	41	19	12	63	25	886	4,000
1989/90[a]	--	--	--	--	--	--	4,000
1990/91	19	12	9	76	15	1,051	3,300
1991/92	28	19	13	68	19	883	2,800
1992/93	22	22	15	70	15	746	2,800

[a] Composition counts not conducted.

Table 2. Southern Alaska Peninsula caribou harvest, 1987-1991.

Regulatory year	Reported						Estimated unreported	Grand[a] total
	Males	(%)	Females	(%)	Unk.	Total		
1987/88	41	(51)	40	(49)	0	81	150	230
1988/89	35	(73)	13	(27)	0	48	150	200
1989/90	50	(85)	9	(15)	0	59	150	200
1990/91	43	(98)	1	(2)	1	45	50	100
1991/92	35	(100)	0	(0)	0	35	40	75

[a] Grand total is rounded off.

Table 3. Southern Alaska caribou annual hunter residency and success, 1989-91.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[b] resident	Nonlocal resident	Nonresident	Total	(%)	
1989/90	21	3	24	48	(92)	1	2	1	4	(8)	52
1990/91	14	8	23	45	(79)	4	8	0	12	(21)	57
1991/92	16	6	13	35	(87)	3	2	0	5	(13)	40

[a] Local resident resides in Units 9 or 10.

Table 4. Southern Alaska Peninsula caribou annual harvest chronology percent by time period, 1987-91.

Regulatory year	Harvest periods					n
	August	September	October	November	December-March	
1987/88	2	0	0	26	71	54
1988/89	2	23	8	27	41	81
1989/90	0	26	28	20	28	48
1990/91	0	25	41	10	24	51
1991/92	3	54	3	0	40	35

Table 5. Southern Alaska Peninsula caribou harvest percent by transport method, 1987-91.

Regulatory year	Percent of harvest							n
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	
1987/88	--	--	--	--	--	--	--	--
1988/89	--	--	--	--	--	--	--	--
1989/90	41	0	10	10	0	0	27	59
1990/91	56	0	7	9	0	2	26	43
1991/92	34	0	20	20	3	6	17	35

LOCATION

Game Management Unit: 10 (300 mi^2)

Herd: Adak

Geographical Description: Adak Island

BACKGROUND

In 1958 and 1959, 25 caribou were transplanted from the Nelchina caribou herd to Adak Island. This effort was the result of a request by the U.S. Navy to make caribou available on the island as an emergency food source in case of military need and to provide recreation for military personnel stationed there.

The herd grew to 189 caribou in less than 10 years because of the mild climate and the lack of predators. Hunter harvest was the only feasible method to limit herd size. The first hunting season was authorized in 1964 and 4 caribou were killed. Seasons were progressively liberalized as the herd grew and by 1972 the harvest approached 100 animals. Since then the estimated posthunting population has ranged from 200-300 caribou. In the last few years, the harvest varied from 147-212 caribou per year.

Adak Island has been difficult to manage for caribou. Weather and distance from human population centers often make collecting biological data and hunting prohibitively expensive. Management has only been possible through the cooperative efforts of ADF&G, USFWS, and the U.S. Navy. The department's intent for this herd has been to provide an optimum harvest of caribou. By maintaining the herd size below the carrying capacity through hunting, biologists expected the range quality to remain high so that caribou could maintain high reproductive success.

We have been concerned about our ability to manage population growth through hunting regulations. Harvests of about 200 caribou are close to the maximum hunters are able to take on the island. A very high percentage of the annual harvest is taken by active duty military personnel stationed on the island. The military recently announced its intent to reduce staff at the Adak base. This should begin by fall 1993. We anticipate a corresponding decrease in caribou harvest. This will probably result in rapid and undesirable growth of the caribou herd on Adak. Range degradation and a subsequent period of starvation for the herd can be expected.

MANAGEMENT DIRECTION

Management Objective

The management objective for Adak Island caribou is to maintain the precalving population at 150 animals for use by all user groups.

METHODS

We flew three replicate aerial surveys between 21-23 May 1993 to determine the number and distribution of caribou on the island. Biologists completed the surveys in a Bell 206, L3 "Longranger" helicopter, flown at 60-90 mph and at an altitude usually under 500 feet. There were 1 experienced and 3 inexperienced observers, in addition to the pilot, as the helicopter flew along linear transects approximately one-half mile apart. The first survey covered the entire area south of the military reservation but excluded the northwestern portion of the island that caribou avoid because of its proximity to the naval base. On the 2 subsequent surveys, some portions of the southern study area received only cursory attention because we counted limited numbers of caribou there on the initial flight. The survey emphasis shifted to areas where caribou were concentrated.

RESULTS AND DISCUSSION

Population Status and Trend

The estimated posthunting caribou population on Adak Island ranged from 285 to 450 between 1990 to 1992. The prehunting population approached 620 caribou. The surveys were not comparable and thus the survey data do not provide much insight about herd population dynamics. However, FWS biologists on Adak Island believed the herd increased slightly during the past few years.

Population Size:

Biologists conducted aerial surveys of the Adak Island caribou herd between 21-23 May 1993. Weather conditions were best during the final survey. Knowledge gained on previous flights, about locations of caribou calving aggregations, lead us to believe the final survey was the most accurate. On that day we counted 501 adults and 160 calves in 6.2 hours of flying. We estimated the caribou population on Adak Island contained 550 adults and 175 calves on that day. Calving was not complete and an additional 75-100 calves may have been born during the season. Given the low neonate mortality, because of a lack of predators, the fall 1993 population should exceed 700 animals. We did not estimate the sex and age composition for the herd (Table 1).

Distribution and Movements:

Caribou are distributed throughout Adak Island, but most of them reside on the south end away from the naval base. Specific calving areas appear to be in upper Hidden Bay and westward toward Jenny Lake and onto the Turret Point Peninsula. During the calving period bull groups were observed on the Yakak and Caribou Peninsula and on the easternmost portions of the island.

Adak is separated from Kagalaska Island to the east by the narrow Kagalaska Strait. In places the islands are less than one-fourth mile apart. During the recent survey we flew over Kagalaska to determine if caribou were residing there. We did not observe tracks or caribou during this brief survey.

Mortality

Harvest:

Season and Bag Limit. The open season for subsistence, resident, and nonresident hunters in Unit 10 (Adak Island only) was 1 September to 31 March. All caribou hunting on Adak Island was by registration permit (Hunt No. 550). Beginning in July 1993 there will not be a closed season nor a bag limit.

Board of Game Actions and Emergency Orders. Because we lacked inadequate population information, the Adak caribou hunt has been closed by emergency order on several occasions during the past decade. Prompted by concerns of local residents, the department also recommended that the Board of Game reduce the bag limit on Adak from 4 caribou to 2 caribou and administer the hunt with registration permits. The board adopted these changes for the 1983-84 season. An emergency regulation was passed in March 1993 extending the 1992-93 season through 30 June.

In an attempt to limit herd growth and reduce herd size, in anticipation of personnel reductions at the naval base, the Board recently liberalized the season and bag limit.

Hunter Harvest. Hunters reported harvesting 198 caribou, including 93 males (47%) and 105 females (53%) from Adak Island during the 1991-92 season. The harvest declined to a 5-year low of 137 caribou during the 1992-93 season. This included 81 bulls (59%) and 56 cows (41%). Biologists did not analyze age data for caribou harvested during these periods (Table 2).

Hunter Residency and Success. Personnel from the Alaska Maritime NWR at Adak Island issued 403 and 346 registration permits during the 2 seasons (Table 2). Annually, more than 80% of the hunters were Alaska residents and military personnel accounted for most of the nonresident hunters. Most permittees lived on Adak Island.

Of the permittees who reported hunting, 48% were successful in 1991-92 and 56% were successful in 1992-93. Nearly 46% of the successful hunters harvested 2 caribou in 1991-92, while 41% of the successful hunters took 2 animals in 1992-93. The mean number of days spent hunting by successful hunters increased from 5.7 in 1991-92 to 7.7 the following year; unsuccessful hunters spent just under 6 days afield each year.

Harvest Chronology. Over 65% of the harvest occurred during the first 3 months of the season in both years of this report period. September was the most productive month, accounting for 35-45% of the harvest (Table 3).

Transport Methods. We do not have information on transportation used by caribou hunters on Adak Island. In past years, most permittees hunted on the northern part of the island via highway vehicles and on foot. The southern part of the island was reached by charter boat or Navy harbor tug. The 5 public-use cabins maintained by the FWS on the southern-half of the island were popular base camps for hunters.

Other Mortality:

We did not obtain information on natural mortality during this report period. Natural mortality is usually low in this herd, because natural predators are absent, winters are relatively mild, and the herd is essentially disease-free.

Habitat

Assessment:

Range condition was analyzed in the late 1960s and early 1970s. Department biologists were concerned about the Adak herd exceeding the range's carrying capacity. In this scenario, the herd would experience rapid growth and subsequent decline similar to that reported on Saint Matthew Island in the mid-1960s (Klein 1968).

The carrying capacity of Adak Island has not been determined, but for management purposes the posthunting season population goal was originally set at 250 caribou. In 1980 biologists conservatively revised this population objective to 150 caribou. The herd exceeds this objective by at least 100%.

CONCLUSIONS AND RECOMMENDATIONS

When biologists transplanted caribou onto Adak Island the potential for overpopulation and resulting range deterioration were well understood. Since then there have been diligent efforts to census the herd, encourage hunting, and periodically assess range condition. Efforts to obtain adequate population data were often hampered by poor

weather and limited availability of aircraft. Adak's remote location, inclement weather, and military security considerations significantly affected caribou hunting efforts.

The Adak Island caribou herd will soon be released from the limited harvest pressure that has prevented unrestricted herd growth. The herd can be expected to exceed carrying capacity and degrade range conditions quickly if the current growth rate is sustained. It is possible that food limitation, a result of overgrazing, will prompt caribou to swim the narrow strait between Adak and Kagalaska Islands. This would further complicate any future efforts to reduce or eliminate the herd. It is important the department, the FWS, and the U.S. Navy work together to evaluate alternative actions for reducing the herd. Such actions should be initiated in the near future if the personnel reductions at the naval base proceed as planned.

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Table 1. Adak Island caribou summer composition counts and estimated population size, 1985-1993.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls (%)	Composition sample size	Estimate of herd size
1985/86	--	--	--	--	--	--	--	--	313	
420-500										
1986/87	--	--	--	--	--	--	--	--	--	--
1987/88	--	--	--	--	--	--	--	--	--	--
1988/89	--	--	--	--	--	--	--	--	335	--
1989/90	--	--	--	--	--	--	--	--	437	500
1990/91	--	--	--	--	--	--	--	--	353	535
1991/92	--	--	--	--	--	--	--	--	239a	437
1992/93	--	--	--	--	--	--	--	--	661	700

[a] April count.

Table 2. Adak Island caribou harvest data by permit hunt, 1985-93.

Hunt No. /Area	Regulatory year	Permits isssued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
550/	1985/86	--	--	--	--	74 (50)	75 (50)	--	149
Adak Is.	1986/87	--	--	--	--	58 (43)	76 (57)	--	134
	1987/88	--	--	--	--	65 (54)	56 (46)	--	121
	1988/89	--	--	--	--	85 (58)	62 (42)	--	147
	1989/90	446[a]	14	58	42	113 (53)	99 (47)	--	212
	1990/91	446[b]	17	50	50	107 (53)	94 (47)	--	201
	1991/92	403[c]	19	48	52	93 (47)	105(53)	--	198
	1992/93	346[d]	36	56	44	81 (59)	56 (41)	--	137

[a] Total permits returned = 81%; no information available for 19% of permits issued.
[b] Total permits returned = 85%; no information available for 19% of permits issued.
[c] Total permits returned = 87%; no information available for 13% of permits issued.
[d] Total permits returned = 78%; no information available for 22% of permits issued.

Table 3. Adak Island caribou annual harvest[a] chronology number (%) by time period, 1988-93.

Regulatory year	Harvest periods							n
	September	October	November	December	January	February	March	
1988/89	--	--	--	--	--	--	--	
1989/90[b]	45(22)	55(27)	25(12)	15(7)	13(6)	22(11)	30(15)	205
1990/91	58(29)	50(25)	29(14)	9(5)	7(4)	37(18)	6(11)	201
1991/92	68(34)	60(30)	39(20)	0(0)	4(2)	11(6)	16(8)	198
1992/93	44(32)	30(22)	20(15)	1(1)	2(1)	6(4)	34(26)	137

[a] Hunt No. 550 is by registration permit only.
[b] Actual harvest was 212 caribou however, harvest chronology is available for only 205 animals.

LOCATION

Game Management Unit: 11 (13,257 mi^2)

Herd: Mentasta Caribou Herd

Geographical Description: Wrangell Mountains

BACKGROUND

Regular surveys of the Mentasta caribou herd (MCH) began in the early 1970s. Before this time, scant information was available about this population, but there was speculation that the herd was a remnant group from large scale movements of the Fortymile caribou herd into the Copper River Basin during the 1920s. Skoog (1968) indicated there was no evidence to support this contention, and there were records of caribou in the Wrangell Mountains before 1920. From 1973 to 1987 the estimated herd size varied from 2,200 to 3,160 and averaged 2,660 caribou. Count data indicated slow herd growth from 1973 through 1985 followed by a decline through 1992.

Hunting seasons were long and bag limits liberal during the 1960s and early 1970s because the MCH was considered inaccessible and harvests were low. From 1963 through 1972 hunting seasons were 7 to 8 months long and the bag limits were 3 to 4 caribou. From 1968 to 1971 substantial numbers of the Nelchina caribou herd (NCH) wintered on and adjacent to Mentasta caribou range. Reported harvests for the MCH during this period ranged from 288 to 1,693 caribou, but many of these animals were from the NCH. Beginning in 1972, and in conjunction with regulatory changes for the NCH, the season and bag limit were reduced to 50 days in fall and 1 caribou, respectively. As a result of these changes, harvests were reduced substantially, ranging from 81 to 236 caribou per year between 1972 and 1976. Beginning in 1977 the Mentasta caribou hunt was regulated by drawing permits. This process was instituted because of increasing harvests and expected displacement in hunting pressure from Unit 13 to Unit 11 after the Nelchina permit hunt was established. In addition to the drawing permit hunt, a registration permit hunt for subsistence hunters was instituted in 1986. Most of this herd's range was within the Wrangell-St. Elias National Park and Preserve (WRST), established in 1980.

MANAGEMENT DIRECTION

Management Objectives

Management objectives for the Mentasta caribou herd are to maintain a minimum over-wintering population of 2,000 adults and a minimum posthunting bull:cow ratio fo 30:100.

METHODS

An aerial postcalving aggregation census and a fall sex and age composition survey were conducted most years since 1973. The postcalving census involved a direct count of all caribou observed in aggregations. In some years, this was followed immediately by a sex and age composition survey. The proportions of calves and bulls in the population were estimated from a fall sex and age composition survey, and were used with the postcalving cow base to extrapolate a total fall population estimate. The fall aerial sex and age composition count was also used to evaluate calf recruitment and adult sex ratios. Beginning in 1991, National Park Service (NPS) personnel conducted spring and fall composition surveys as part of their management program.

Radiocollared caribou were located seasonally to determine herd distribution for the census and sex and age composition surveys. Range use patterns, determined from telemetry data, were used to identify critical habitats for land-use decisions. We monitored all hunts by using permit reports and by checking hunters in the field. A 3-year population dynamics study began during 1987 in cooperation with the NPS to evaluate calf production, survival of cows and calves, and use of seasonal ranges by cows and calves (Lieb *et al.* 1991).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: We estimated the MCH to number 1,426 caribou in 1992, based on the postcalving aggregation count conducted in June and the fall sex and age composition survey in October (Table 1). This estimate was 28% lower than the 1991 herd estimate of 1,968. Population estimates obtained from the MCH from 1973 to 1985 increased by an average of 3% annually. Extrapolated estimates in 1985 (3,140), and in 1987 (3,159), indicated herd growth stabilized during this period. Postcalving aggregation counts, extrapolated estimates, and proportion of calves in the herd (Table 1) indicated the MCH has rapidly declined since 1987. The most recent herd estimate was 55% below peak estimates between 1985-1987. We attributed the overall decline in herd size to low neonatal calf survival, indicated in the low calf:cow ratios observed during composition surveys (Table 1). Based on an approximate range size of 5,870 mi^2, the estimated density was 0.03 caribou/mi^2. The extrapolated herd estimate is well below the minimum management objective of 2,500 adults.

Population Composition: The calf:cow ratio and percent calves observed during spring and fall counts declined from 1985 until 1991, then increased very slightly in 1992 (Table 2). Estimates of productivity obtained between 1987-89 by observing calf production of radiocollared cows and from postcalving udder surveys led Lieb *et al.* (1991) to conclude

that productivity of the MCH was normal and low calf recruitment was because of a decline in neonatal survival. The etiology was probably increased predation.

In fall 1992 we observed 41 bulls:100 cows (Table 1). This bull:cow ratio was the same as the long-term (1973 to 1988) average and exceeds the minimum objective of 35 bulls:100 cows.

Distribution and Movements: Mentasta caribou were initially radiocollared in 1981. Between 1981 and 1986 10 collars were maintained on Mentasta cows. Beginning in 1987, the number of radiocollared caribou was increased to approximately 30 females. Before 1987, these caribou were monitored about 6 times per year. From 1987 through 1989, the herd was checked monthly as part of the Mentasta population dynamics study (Lieb *et al.* 1991).

Distribution and movements of the MCH between 1990 and 1992 were monitored by periodic flights to locate radiocollared cow caribou. During the 1990 postcalving and early summer period the MCH was distributed throughout the western and northern slopes of Mt. Sanford as far east as Tanada Lake. The MCH began migrating north and east during October 1990 and by 16 October were intermixed with Nelchina caribou between the Copper and Nabesna Rivers. By 28 December the combined herds ranged from the eastern Mentasta Mountains to Snag Creek, Canada with the majority (75%) located in the eastern Mentasta Mountains. Throughout January 1991 and until March the 2 herds ranged from Northway and the Black Hills to Snag Creek, Canada. During mid-March 1991 some of the caribou moved northwest off of the Tetlin National Wildlife Refuge.

During 1991 spring migration occurred in April and May. Caribou moved to the traditional calving grounds on the north side of Mt. Sanford. Postcalving and summer distribution of the MCH was on the north and west slopes of Mt. Sanford. By December 1991 the MCH mixed with NCH from the Nabesna River north to Northway and Tetlin. In 1992 migration was delayed because of the late spring. In May caribou moved to the traditional calving grounds on the north side of Mt. Sanford in the Boulder Creek area. During the postcalving and early summer period the MCH was distributed on the northwest side of Mount Sanford from Drop Creek to the Sanford River.

Mortality

Harvest:

Season and Bag Limit. The Board of Game closed the hunting season (Hunt 510) for the MCH in 1990. The only hunting season for Mentasta caribou in Unit 11 since 1990 was a federal subsistence hunt (Hunt 511) administered by the NPS. Federal subsistence hunting was restricted to residents of communities located within subsistence zones delineated under federal regulations for Wrangell St.-Elias National Park. The bag limit

for the federal season was 1 bull by permit only; the season was 10 August to 30 September.

Board of Game Actions and Emergency Orders. The Board of Game held an emergency meeting during July 1990 because of a state Supreme Court ruling. The court ruled (McDowell decision), that state subsistence hunts using local residency as the only basis for hunter eligibility were illegal under the State constitution. During the emergency meeting, the board defined all Alaskans as subsistence caribou hunters. The board also closed the MCH hunt, in part because a Tier II hunt could not be instituted in time for the normal fall season and also because of the dramatic decline in the herd. The board determined the harvest quota would be met during the federal subsistence hunt, conducted by the NPS. Any additional harvest during a state season would probably exceed harvest objectives. The harvest quota established for the herd in 1991-92 was 30 bulls.

Hunter Harvest. The harvest for the federal subsistence hunt was 30 bulls in 1990 and 23 bulls in 1991 (Table 2). Since 1977, when permit hunts were established, the highest reported harvest from the MCH was 149 caribou in 1978. In response to the observed decline in calf recruitment, harvest levels were reduced beginning in 1988. Fewer permits were issued to reduce the harvest to approximately one-half of the prior 4-year (1984-87) average of 97 caribou. The harvests in 1988 and 1989 were 49 and 45 caribou, respectively. Cow harvests were also reduced by eliminating cow hunting by sport hunters in 1988 and 1989. All cow harvests were eliminated in 1990.

Some illegal and unreported harvests of Mentasta caribou were documented. This information was used to estimate the number poached (Table 3). There were few highway mortalities because the MCH was seldom near a road. An additional hunter harvest of Mentasta caribou occurred in the western portion of Unit 12 (Table 3). Most of these were taken by hunters along the Nabesna Road, and by guide/outfitter operations in the Mentasta Mountains, north of the Nabesna Road, or the Nabesna and Jacksina River drainages south of the Nabesna Road. The harvests over the past 5 years (1987-91) have averaged about 15 bulls.

Permit Hunts. Sport hunting of the MCH by drawing permit (Hunt 510) occurred between 1977-84 and 1986-89. As many as 350 permits were issued during periods of caribou abundance but the number was reduced to 100 by 1989. Hunt 510 was eliminated when the herd was unable to sustain sport and subsistence hunting.

Subsistence hunting for MCH started with a Tier II hunt in 1985, which changed to a registration permit hunt (Hunt 511) in 1986. Between 1986 and 1989, only residents of Units 11, 12 and 13 along the Nabesna Road were eligible to participate in this hunt. The department managed Hunt 511 until rural preference was declared unconstitutional under state law in 1990. The federal government then assumed control of this subsistence hunt for federal lands because federal subsistence law requires a rural preference for determining subsistence eligibility on federal lands. The NPS assumed administration of

Hunt 511, thus Wrangell-St. Elias National Park and Preserve personnel now manage the only open hunting season for the MCH.

Hunter Residency and Success. Only residents of subsistence communities designated by the NPS have harvested caribou from the MCH since 1990. The number of local residents taking a Mentasta caribou in 1991 was 23, similar to the 5-year mean (1986-90) harvest of 26 caribou for local hunters (Table 4). Nonlocals were prevented from taking Mentasta caribou when the board closed the sport season in 1990. For the 5 years (1985-89) before the state closure, nonlocals averaged 48 caribou a year (range = 18-95). Overall hunter success in 1991 was 19%, down from a high of 53% in 1987. During 1990 successful subsistence hunters spent 5.6 days afield, while unsuccessful subsistence hunters spent 9 days hunting. The time required to take a caribou has increased over the last 2 years. The successful hunter averaged 3.8 days afield between 1986-89.

Harvest Chronology. Changes in the harvest chronology between 1987-89 were related partially to changes in season dates for sport and subsistence hunts (Table 5). Harvest chronology also reflected availability of caribou in relation to access points such as aircraft landing strips and roads. Harvests were evenly distributed over the early portion of the hunting season. Sport hunting for caribou coincided with the moose season. Subsistence hunters went afield before and after moose season possibly because they resided close to the Mentasta caribou range. Also, in late September, the MCH occasionally moved into the upper Copper River area close to the Nabesna Road. When this happened, subsistence hunters concentrated their hunting efforts on these accessible caribou. In some years high harvests occurred during the last week of the season.

Transport Methods. Aircraft were the most important method of transportation between 1987 and 1989 followed by 4-wheelers and highway vehicles. Aircraft importance declined in 1990 because of the elimination of the sport hunt, and 4-wheelers were the most common transportation method.

Aircraft are important to sport hunters because sport hunting is allowed only on remote preserve lands. Access to most preserve land is virtually impossible without aircraft. ORVs and 4-wheelers are important to local subsistence hunters because they can legally hunt park land adjacent to roads or ORV trails. Aircraft use is not allowed for subsistence hunting on park land.

Other Mortality: Wolf and grizzly bear predation caused significant mortality for the MCH. Although wolves were numerous over the MCH range, wolf harvests by sport hunters and trappers were low. Land-and-shoot trapping was discontinued in Wrangell-St. Elias Preserve in 1986 and wolf harvests have declined throughout the Mentasta range. Good calf production but poor calf survival was observed between 1987 and 1989. This suggested that predators affected calf survival. Predators accounted for the high level of natural mortality in adult females (16% annually) in the MCH (Lieb *et al.* 1991). The predation rate for the MCH was higher than for the NCH (10% annually).

Habitat

Assessment: In 1982, the NPS (with ADF&G cooperation) initiated a Mentasta caribou range exclosure study to monitor condition and trend of caribou forage species. Casual observations at these sites and others over the past few years suggested lichen production was low throughout a large portion of the Mentasta range. Additional information on range conditions was not available. In recent years a substantial portion of the Mentasta winter range has been used by Nelchina caribou, but effects of this use have not been studied. A recent research project (Lieb *et al.* 1991) attempted to assess range condition by evaluating body fitness of captured Mentasta caribou. All Mentasta animals were in fair-to-good condition and were comparable to NCH animals at the same time of year. The body condition and physiological parameters of Mentasta caribou did not indicate poor range conditions or physiological stress.

Enhancement: Currently, there are not any plans to enhance habitat for Mentasta caribou. Much of the MCH range is within the WRST where habitat enhancement to benefit a single species is prohibited. All enhancement depends upon wildfire. Large portions of the MCH range are in the limited fire suppression category, and should a fire occur, it would not necessarily be suppressed. Wildfire would benefit caribou by promoting sedge, shrub, and lichen growth.

Nonregulatory Management Problems/Needs

Dual management authority between the state and NPS creates management problems. Although the state has management authority, the herd is usually located on federal land within Wrangell-St. Elias National Park and Preserve. Cooperation exists between ADF&G and the NPS when it comes to data collection. However, many NPS regulations prevent management to enhance a single species, especially for the purpose of increasing human harvests. The department should continue to collect population data and set harvest quotas compatible with the existing population trends.

CONCLUSIONS AND RECOMMENDATIONS

The Mentasta herd declined 28% between 1991 and 1992 based on information from postcalving herd counts, composition data, and the Mentasta caribou calving study. This herd declined 55% from the last population peak in 1987. The decline followed a 12-year period ending in 1985 when the herd increased 3% annually. Calf ratios were low in spring and fall composition counts in recent years. Observations of radiocollared caribou and from udder counts suggested initial productivity was high. Poor survival of neonatal calves was the primary factor in the decline. Overwinter mortality of the radiocollared cows and calves was higher on the MCH than the larger, adjacent NCH.

Future research should determine the etiology of neonatal mortality. Management recommendations should address ways to reduce neonatal mortality, overwinter mortality, and improve recruitment.

Recognizing that about 90% of Unit 11 is within Wrangell-St. Elias National Park and Preserve, the overall management goal for the unit is to conserve all populations of wildlife; to manage for "natural" populations which are regulated primarily by natural environmental factors with a strong emphasis on nonconsumptive uses; to allow limited recreational hunting, under aesthetically pleasing conditions, and trapping when it will not adversely affect populations; and, to provide for bona fide subsistence needs. I recommended in my last MCH management report, that the population objective for the MCH be changed from maintaining a minimum of 2,500 adults, to maintaining a minimum fall population of 2,000 adults. In the area-specific wolf management plan for Unit 11 we adopted a population objective for the MCH of a minimum fall population of 2,000 adult caribou before allowing harvest under state regulation; and to maintain a minimum of 30 bulls:100 cows.

Drawing and registration permits have been used to control fall hunting. When the herd declined, harvests were reduced and limited to bulls only. I recommend following this procedure to determine harvests in the future.

The winter hunt in Unit 12 for Nelchina caribou unavoidably increases the harvest of Mentasta animals. When the 2 herds mix on the winter range, the number of Nelchina animals greatly exceeds the number of Mentasta animals. The number of Mentasta animals killed is unknown. If the number of Nelchina caribou declines, the harvest of Mentasta animals could increase and exceed the desired harvest. To minimize the affect of winter harvest on the MCH, the bag limit should be restricted to bulls. Annual harvests of the MCH, from all sources (state and federal hunts in Units 11, 12 and Canadian hunts) should not exceed 50 bulls.

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Table 1. Mentasta caribou fall composition counts and estimated population size, 1988-92.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Total bulls (%)	Composition sample size	Estimate of herd size	Total adults	Post-calving count
1987/88	41	12	8%	66%	27%	803	3,159	2,921	2,583
1988/89	43	18	11%	62%	27%	675	2,484	2,206	2,520
1989/90	45	15	10%	62%	28%	694	2,602	2,350	2,687
1990/91[a]	--	--	--	--	--	--	--	--	2,308
1991/92	42	02	2%	69%	29%	456	1,968	1,938	1,728
1992/93	41	06	4%	68%	28%	507	1,426	1,373	1,303

[a] Fall composition counts not conducted; extrapolated herd estimates not available.

Table 2. Mentasta caribou harvest data by permit hunt, 1987-92.

Hunt No. /Area	Regulatory year	Permits isssued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
510	1987/88	300	41	56	44	77 (81)	18 (19)	0	95
	1988/89	100	35	40	60	23 (100)	0	0	23
	1989/90	100	59	46	54	18 (100)	0	0	18
	1990/91[a]	No open season							
	1991/92	No open season							
511	1988/89	68	29	55	45	22 (85)	4 (15)	0	26
	1989/90	58	17	56	44	24 (92)	2 (8)	1	27
	1990/91[b]	166	65	30	70	30 (100)	0 (0)	0	30
	1991/92	170	47	19	81	23 (100)	0 (0)	0	23
Totals for all permit hunts	1987/88	364	39	53	47	91 (83)	20 (17)	1	112
	1988/89	169	33	47	53	45 (92)	4 (8)	0	49
	1989/90	158	44	52	48	42 (93)	2 (7)	1	45
	1990/91	166	65	30	70	30 (100)	0 (0)	0	30
	1991/92	170	47	19	81	23 (100)	0 (0)	0	23

[a] State subsistence hunt.
[b] Federal subsistence hunt administered by Wrangell St. Elias National Park/Preserve.

Table 3. Mentasta caribou harvest and accidental death, 1987-92.

Regulatory year	Hunter harvest: Reported M (%)	Reported F(%)	Reported Unk.	Reported Total	Estimated: Unreported[a]	Estimated: Illegal	Estimated: Total	Accidental death	Grand total
1987/88	91 (83%)	20 (17%)	1	112	20	20	40	--	152
1988/89	45 (92%)	4 (8%)	0	49	20	20	40	--	89
1989/90	42 (93%)	2 (7%)	1	45	20	20	40	--	85
1990/91	30 (100%)	0	0	30	20	20	40	--	70
1991/92	23 (100%)	0	0	23	20	20	40	--	63

[a] Includes an estimate of unreported successful permittees from permit hunts and a minimum number of Mentasta caribou harvested in Unit 12 under an open season intended for Chisana caribou.

Table 4. Mentasta caribou annual hunter[a] residency and success, 1987-92.

Regulatory year	Successful: Local[b] resident	Successful: Nonlocal resident	Successful: Nonresident[c]	Successful: Total (%)	Unsuccessful: Local[b] resident	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Total (%)	Total hunters
1987/88	17	95	--	112 (53)	24	76	--	100 (47)	212
1988/89	29	20	--	49 (47)	21	34	--	55 (53)	104
1989/90	27	18	--	45 (52)	21	21	--	42 (48)	87
1990/91	30	0	--	30 (30)	71	0	--	71 (70)	101
1991/92	23	0	--	23 (19)	100	0	--	100 (81)	123

[a] All hunts.

[b] Resident of Units 11, 13 or 12 along the Nabesna Road from 1987-1990, then only residents of communities designated as subsistence zones by the National Park Service.

[c] Nonresidents were excluded from hunting the Mentasta caribou herd in 1985.

Table 5. Mentasta caribou annual harvest[a] chronology percent by time period, 1987-92.

Regulatory year	Week Ending 8/19	8/27	9/03	9/10	9/17	9/24	10/01	n
1987/88	10	10	12	21	22	17	8	112
1988/89	15	17	25	13	10	17	4	49
1989/90	7	2	18	7	31	22	13	45
1990/91	6	14	7	17	14	3	38	30
1991/92	14	18	9	0	27	22	9	23

[a] All hunts.

Table 6. Mentasta caribou successful hunter harvest[a] percent by transport method, 1987-92.

Regulatory year	Percent of harvest Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	n
1987/88	69	3	4	6	--	7	8	3	112
1988/89	49	2	--	27	--	8	14	--	49
1989/90	51	4	2	27	--	9	7	--	45
1990/91	20	23	3	37	--	7	3	7	30
1991/92	17	9	4	56	--	0	13	0	23

[a] All hunts.

LOCATION

Game Management Unit: 12 (3,300 mi^2) and adjacent Yukon Territory (500-1,000 mi^2)

Herd: Chisana

Geographical Description: Upper Chisana and White River drainages in the Wrangell-St. Elias National Park and Preserve in southeastern Unit 12, and adjacent Yukon Territory, Canada

BACKGROUND

Historically, the Chisana caribou herd (CCH) has been a small, nonmigratory herd. Skoog (1968) estimated the CCH to be about 3,000 animals in the early 1960s. By the mid- to late 1970s the herd declined to an estimated 1,000 caribou, similar to the trend of other Interior caribou herds. During the 1980s environmental conditions were favorable, and the herd increased to about 1,900 caribou. Since 1988 the herd has steadily declined. Weather and predation have been the primary causes for the current decline. Harvest by humans has had a minor effect on population fluctuations since the 1950s.

Human use of the CCH dates back to the last century. Residents of the Athapascan settlement at Cross Creek along the Chisana River were the primary users. During the 1913 Chisana gold rush, 8,000 to 10,000 people came to Chisana to find employment. Gold miners extensively used the CCH as a food source. After 1913, Cooper Creek on the Nabesna River became the area's primary Athapascan village and the Chisana herd continued to be an important meat source for the residents until the village burned down in the mid-1950s (Record 1983). The store at Chisana closed in 1929 and relatively little mining activity occurred there afterward.

After 1929 the area was extensively used for guided hunting. Guided hunting has been the primary use of the CCH since the mid-1950s, with five guide/outfitters operating in the area. Few Alaskan residents fly into the area to hunt and Native people now living at Northway and Tetlin no longer hunt in the CCH range. Area use by tourists is also very light.

Before the mid-1980s, the CCH was not a high management priority because of its small size, the area's remoteness, and the light and selective (primarily mature males) hunting pressure it received over the last several decades. However, interest in the herd increased when its range was included in the Wrangell-St. Elias National Park and Preserve. Because the herd spends most of its time within Wrangell-St. Elias National Preserve it must be managed to maintain a "healthy" population, however, the term "healthy" is yet to be adequately defined. In the interim, the ADF&G and National Park Service (NPS) biologists agreed in 1992 to maintain a bull:cow ratio of 30:100.

A cooperative study with the NPS and the Yukon Wildlife Branch began in October 1987. Initially, 15 adult female caribou were radio-collared to monitor movements and facilitate spring and fall composition surveys. Subsequently, 14 calves and 2 adults were collared in early October 1990, and another 10 adult females were collared in late September 1991. The NPS provided most of the funding for radio-collaring and monitoring the herd.

MANAGEMENT DIRECTION

Management Goals

- To protect, maintain, and enhance the caribou population and its habitat in concert with other components of the ecosystem.
- To provide the greatest opportunity to participate in caribou hunting, while maintaining a "healthy" population.
- To provide a reasonable opportunity for federally qualified subsistence (i.e., local) residents to hunt caribou.

Management Objective

- Maintain an October bull:cow ratio of at least 30:100.

METHODS

During the past 5 years, sex and age composition data were collected each year during the last week in September or the first week of October. Either a Hughes 500, a Bell Jet Ranger, or a Robinson R-22 helicopter was used by a pilot/observer team who classified each caribou as either female, calf, or bull. Bulls were further classified as either small, medium, or large based on antler size.

A population estimate was obtained during late June of each year. All radio-collared caribou were located and all individuals found were counted visually or from 35mm prints of groups. Population size and trend were also estimated by using a population model designed by P. Valkenburg and D. Reed (ADF&G). Sex and age composition, recruitment, and mortality data were the primary components of the model.

During 1987, 1990, and 1991, Chisana caribou were captured and radio-collared to meet the following objectives: (1) to improve the efficiency of the census and composition surveys, (2) to monitor seasonal distribution and movement patterns, (3) to evaluate animal condition, and (4) to estimate annual mortality rates. The number of active collars operating during the report period ranged from 15 to 28.

The CCH harvest was monitored using information from returned harvest ticket report cards. Although harvest can be substantially underestimated using this type of a reporting system, most of the caribou harvested in the Chisana area were taken by guided clients and their reports were completed and turned in by their guides. Thus, the harvest report return rate in this area is high, and harvest ticket returns were not corrected for non-reporting by successful hunters.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The CCH increased through the 1980s and reached its peak in 1988 at around 1,900 caribou. Since 1988, the herd declined by an average of 8% annually and by fall 1992 was estimated at 1,303 caribou. The recent decline has coincided with warm, dry summers, relatively severe winters, and high predator numbers. Possible effects of the adverse weather patterns on Chisana caribou may have been a decrease in weight and overall body condition. Circumstantial evidence supporting this hypothesis was the relatively poor condition of outfitters' horses that range sympatrically with the caribou herd and the relatively light weight of caribou calves in fall 1989. Recruitment was poor in 1989 and 1990 and virtually nonexistent in 1991 and 1992 (Table 1).

Population Composition: Fall composition data for 1991 and 1992 indicate an accelerated population decline accompanied by a declining bull:cow ratio (Table 1). Modeling data indicate the herd's declining bull:cow ratio is mostly a function of low calf recruitment during the past 4 years. If calf recruitment does not improve soon, the adult mortality rate will begin to increase because of an older age structure. Assuming that bulls inherently have a higher mortality rate, the bull:cow ratio will then decline even faster and fall below the management objective.

Postcalving composition counts in 1991 and 1992 indicated either low natality or high mortality of calves during the first month of life or both (Table 2). Natality was only estimated in 1988, and it was high that year (Kelleyhouse 1989).

Distribution and Movements: The CCH is an international herd shared by Alaska and the Yukon Territory. The herd usually makes short seasonal movements within its range, which encompasses the Nutzotin and northern Wrangell Mountains between the Nabesna and Generc Rivers.

During years of relatively deep snowfall, the herd moves to the eastern end of its range in Canada and winters within the spruce forests along the Beaver Creek drainages. In years of average snow, most of the herd seems to remain on sedge-grass range primarily in Alaska. During the past 5 years the herd has primarily formed its postcalving aggregations from the Solo Creek Flats west to the Chisana Glacier. In winter 1991-92,

many Chisana caribou wintered near Beaver Creek, Yukon Territory. In 1992-93, following an unusually severe mid-September snowstorm, much of the herd moved to forested winter range near Wellesley Lake.

Mortality

Harvest:

Season and Bag Limit. For the past 5 years the hunting season within the range of the Chisana herd in Unit 12 was 1-20 September with a one-bull bag limit.

Board of Game Actions and Emergency Orders. No changes to the season or bag limit were made during this report period.

Human-induced Mortality. Harvest of Chisana caribou has declined in recent years (Table 3). The primary cause for the reduced harvest has been that the area's guides and principal air taxi operators have voluntarily reduced their harvest in response to the herd's decline. Only 1.3% to 2.0% of the CCH has been harvested over the past 3 years and the harvest has been restricted to bulls. This restrictive and limited harvest has had little effect on herd growth.

An additional harvest of Chisana caribou in the Yukon Territory occurs primarily by guided sport hunters during fall and by local residents during winter. The Canadian guide who is responsible for most of the fall harvest of Chisana caribou has also voluntarily reduced his harvest over the past 2 years. The winter take by locals is not known but is expected to be between 5 and 20 animals. No other hunting mortality in Alaska was documented for the CCH during 1991. Because the herd is primarily hunted by guides and is inaccessible most of the year, little or no illegal hunting seems to occur.

Hunter Residency and Success. In 1991 and 1992, nonresidents took about two-thirds of the caribou harvested within the range of the Chisana herd (Table 4). Even though nonresident participation has declined their success rate is still very high. During the last three hunting seasons the average nonresident success rate was 78% compared with the average resident success rate of 43%.

Hunter Effort. The number of days spent afield by both successful and unsuccessful hunters was less than the annual average since 1987 (Table 5). The lower number of days spent hunting in 1992 than in previous years is probably because of both the decline of the herd and because of a change in the herd's distribution during the hunting season. Hunters may have been reluctant to pass up bulls fearing they would lose their opportunity to take a caribou if they were seeing only a few.

Harvest Chronology. In 1991 the harvest chronology differed from the previous 4 years (Table 6). Normally, most of the harvest occurs during the first 2 weeks of the season

with slightly more taken during the first week (57%). During 1991 most of the harvest was taken during the second week with only 33% taken during the first week. Changes in the harvest chronology usually reflect a changing distribution of caribou.

Transport Method. During the past 5 years transportation use has basically remained the same (Table 7). All hunters of the CCH must use aircraft to reach the Chisana area initially. Most Alaskan residents hunt on foot from unmaintained float or wheel plane access points. The remainder of the Alaskan residents fly into an established airstrip and then use either 3- or 4-wheelers or horses to hunt. In comparison, nonresidents hunt almost exclusively with horses after flying into the one of the established guide camps.

Natural Mortality: Between 1990 and 1992, the annual mortality rate for collared adult females was 9.1%. We estimated overwinter mortality of calves at 64% between October 1990 and June 1991 based on the fate of 11 radio-collared female calves. Of the 9 collared caribou that died during this period, all were apparently killed by either bears or wolves based on the evidence of a violent death (blood on collar) and sign at the death site. Three of the deaths, one adult cow and two calves, can be attributed to wolves based on the timing of death (midwinter).

Essentially no calf recruitment has occurred for the past 2 years. Low natality and/or high calf mortality could explain the low calf numbers in fall. During fall composition surveys, we observed only 8 calves in 1991 and 1 in 1992. Reports from the public and incidental sightings by ADF&G staff indicate that predators, primarily wolves, grizzly bears, and coyotes, are numerous. During the last 3 years a high population of coyotes has existed within the entire range of the herd. For example, one local resident harvested 35 coyotes from one lake during winter 1991-92. The CCH range presently supports a high density of wolves with at least 40-50 wolves in 6 packs. The grizzly bear population is lightly harvested and is probably near natural densities, for an Interior population of about 16 bears/1,000 km^2.

Changed weather conditions and poor nutrition could also be resulting in lower natality and/or higher early calf mortality. Winter 1991-92 was relatively severe in terms of snow depth (maximum snow depth at Northway reached 27 inches) and late spring snows, while summers 1990 and 1991 were much hotter and drier than normal. However, females captured during September 1991 were in good-to-excellent condition, but none had not undergone the nutritional demands of lactation. The condition of the outfitters' horses indicated poor range conditions.

Habitat

Assessment: The most frequently used range of the CCH for both winter and summer is predominantly grass-sedge habitat with few lichens. However, a good standing crop of lichens exists in the timbered habitats along the Chisana River and Beaver Creek

drainages in the eastern portion of the herd's range. The CCH has selected that area to winter the past 2 years.

Enhancement: The entire range of the CCH is located in the Wrangell-St. Elias National Park and Preserve or within the Yukon Territory. It is against NPS policy to conduct wildlife habitat improvement projects. Therefore, no habitat improvement projects are being considered. Habitat enhancement for the CCH will depend on the near-natural occurrence of wildland fires under terms of the Alaska Interagency Fire Management Plan (1984) or on any wildfires that may occur within its range in the Yukon Territory.

CONCLUSIONS AND RECOMMENDATIONS

The CCH has declined by 31% since 1988 due primarily to poor calf recruitment. Causes of low calf numbers are not known, but I suspect that predation and adverse weather conditions are primary factors. At the current rate of adult mortality, the fall calf:cow ratio must exceed 18:100 to stabilize the herd. During the last 2 years recruitment has averaged less than 1 calf:100 cows.

The bull:cow ratio remains above the management objective of 30:100 but has been declining in response to the low calf recruitment. Annual harvests have declined the past 2 years because guides in Alaska and Yukon and air taxi operators voluntarily reduced their harvest. Still, either more restrictive hunting regulations or greater voluntary reductions in harvest are needed to ensure against an overharvest. The Board of Game will decide upon a management system during its spring 1993 meeting. Population modeling demonstrates that a small harvest of bulls is possible without restricting herd growth. No more than 12 bulls should be taken in 1993.

Since the 1950s, the CCH has been extensively used for guided hunting. Almost half (46%) of the hunters participating in the Chisana caribou hunt are nonresidents and are responsible for most (63%) of the harvest. Because guided nonresidents are the primary user of this herd, I believe the Board of Game should give preference to the guided, nonresident hunter when evaluating the different harvest choices and how the harvest should be allocated. A system analogous to the Kodiak brown bear registration permit hunt would also work well for Chisana caribou.

I believe the CCH offers a good opportunity for the Division of Wildlife Conservation and the NPS to cooperatively support a graduate student to try to determine and evaluate the factors limiting this herd. There are several benefits in using this herd for research. The extremely low recruitment rates experienced by the CCH over the past 4 years have never been documented in any other wild caribou herd. Also, this herd is close to being a natural herd because of the minimum amount of contact it has with humans. This status will continue because of the herd's remoteness and land ownership pattern. I recommend

that the division intensively survey the herd during calving to determine the natality rate and the incidence of perinatal mortality.

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Table 1. Chisana caribou fall composition counts and estimated population size, 1987-92.

Date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent small bulls (% of bulls)	Percent medium bulls (% of bulls)	Percent large bulls (% of bulls)	Percent bulls	Composition sample size	Total count of herd size[a]
10/9/87	39	28	17	60	53	26	21	23	760	1,800
9/27/88	36	31	19	60	28	46	26	21	979	1,882
10/16-17/89	N/A	N/A	9	N/A	N/A	N/A	N/A	N/A	625	1,802
10/4-5/90	36	10	7	69	40	43	18	25	866	1,680
9/29/91	40	10	1	71	46	42	13	28	855	1,488
9/27/92	31	0	0[b]	76	34	43	23	24	1,142	1,303

[a] Based on population modeling.
[b] Only one calf was classified in this survey.

Table 2. Chisana caribou postcalving composition counts, 1987-92.

Date[a]	Bulls: 100 cows	Calves: 100 cows	Percent calves (n)	Percent cows	Percent adults (n)	Composition sample size
6/20/87			17 (88)		83 (436)	524
5/27/88			15 (46)		85 (267)	313
6/21/89			10 (160)		90 (1,380)	1,540
6/20/90			12 (147)		88 (1,032)	1,179
6/20/91			2 (21)		98 (1,264)	1,285
6/22/92			1 (10)		99 (1,224)	1,234

[a] All counts were done in late June, except in 1988, when a May survey was done during calving. Calving was not completed when the 1988 survey was done.

Table 3. Chisana caribou harvest and accidental death, 1987-92.

Regulatory Year	Alaska harvest							Yukon harvest[a]	Total
	Reported				Estimated				
	M	F	Unk	Total	Unreported	Illegal	Total		
1987-88	49	0	0	49	0	0	0	12	61
1988-89	49	0	0	49	0	0	0	12	61
1989-90	34	0	0	34	0	0	0	18	52
1990-91	34	0	0	34	0	0	0	11	45
1991-92	21	0	0	21	0	0	0	n/a	21
1992-93	16	0	0	16	0	0	0	n/a	16

[a] An additional 5-20 caribou are taken by Native residents of the Yukon in the vicinity of the Alaska Highway near Beaver Creek when caribou winter there. Many Chisana caribou wintered there in 1991-92 and 1992-93.

Table 4. Chisana caribou hunter residency and success of hunters in Alaska, 1990-92.

Regulatory Year[a]	Successful				Unsuccessful				Total hunters
	Local resident	Nonlocal resident	Nonresident	Total[b] (%)	Local resident	Nonlocal resident	Nonresident	Total (%)	
1990-91	3	9	21	33 (69)	4	11	0	15 (31)	48
1991-92	0	8	13	21 (55)	0	9	8	17 (45)	38
1992-93	2	4	10	16 (57)	0	11	1	12 (43)	28

[a] Before 1990-91 harvest data had not been computerized.

[b] Not all hunters reported their residency so totals are lower than total in Table 3.

Table 5. Mean days hunted for successful and unsuccessful hunters of Chisana caribou in Unit 12, 1984-93.

Regulatory Year	Mean days hunted		Total hunters
	Successful hunters	Unsuccessful hunters	
1984-85	3.8	6.1	4.5
1985-86	3.7	5.8	4.2
1986-87	n/a	n/a	n/a
1987-88	4.3	6.5	4.7
1988-89	4.5	6.8	4.8
1989-90	n/a	n/a	n/a
1990-91	4.5	8.6	5.9
1991-92	3.2	5.0	3.6
1992-93	3.6	7.0	5.0

Table 6. Chisana caribou harvest by time period, 1987-93.

Regulatory year	Harvest periods			Unk	n
	9/1-9/7	9/8-9/15	9/16-9/20		
1987-88	30	12	7	0	49
1988-89	17	15	15	2	49
1989[a]-90	n/a	n/a	n/a	34	34
1990-91	15	14	5	0	34
1991-92	5	10	6	0	21
1992-93	6	8	2	0	16

[a] Data not available.

Table 7. Chisana caribou harvest by transport method, 1987-93.

Year	Percent of harvest							n
	Airplane	Horse	Boat	3- or 4-Wheeler	ORV	Walking[a]	Unknown	
1987-88	46	38	2	15	0	--	0	48
1988-89	28	54	2	15	0	--	0	46
1989-90	32	50	0	12	0	--	6	34
1990-91	27	70	0	3	0	0	0	34
1991-92	24	57	0	10	0	0	10	21
1992-93	19	75	0	6	0	0	0	16

[a] Walking was not listed as a transportation type from 1986-87 to 1989-90.

LOCATION

Game Management Subunit:	Portion of Subunit 12 and 20D (1,900 mi^2)
Herd:	Macomb
Geographical Description:	Eastern Alaska Range between Delta River and Yerrick Creek south of the Alaska Highway

BACKGROUND

The Macomb caribou herd (MCH) was relatively unknown to hunters and received little sport harvest before 1972 (Jennings 1974), and herd size was estimated at 350-400 caribou. Hunting pressure increased on the MCH in 1972 when restrictions were placed on hunting other herds accessible from the road system, including the Fortymile, Nelchina, and Mentasta herds.

With increased use of the MCH, the bag limit was reduced from 3 to 1 in caribou 1973. The Macomb Plateau Management Area (MPMA) was established in 1974 to prohibit the use of motorized vehicles for hunting from 10 August through 20 September, except for floatplanes at Fish Lake. The MPMA included the area south of the Alaska Highway, draining into the south side of the Tanana River between the east bank of the Johnson River upstream to Prospect Creek, and the east bank of Bear Creek (Alaska Highway Milepost 1357.3). Larson (1976) reported that the MCH consisted of a nucleus of about 250 caribou that remained on the Macomb Plateau year round and a group of approximately 250 caribou that moved to the plateau in October and November to rut.

By 1975, the MCH was reported to number 700-800 caribou. This apparent increase in herd size from 1972 to 1975 was probably because of increased knowledge about the herd rather than an actual increase in the number of caribou. Hunting pressure and harvest continued to increase on the MCH despite a reduced bag limit and restrictions imposed by the MPMA. In 1975, hunting pressure increased 72% over 1974 levels, and in 1976 there were 70% more hunters than in 1975 (Larson 1977). Despite the larger known herd size, the harvest was equal to or exceeding recruitment.

During the 1977 hunting season it was necessary to close the season by emergency order on 8 September. Even with the emergency closure the reported harvest totaled 93 caribou and exceeded recruitment. The large harvest, combined with predation by wolves and bears, led to the determination that harvest must be reduced (Davis 1979). In 1978 the bag limit for Macomb caribou was further restricted from 1 caribou of either sex to 1 bull by drawing permit. The drawing permit hunt reduced the reported harvest from 93 caribou in 1977 to 16 in 1978.

In addition to concerns about excessive hunting of Macomb caribou, there was also concern that the herd was limited by predation. Wolf control in the eastern Alaska Range during winter 1980-81 removed most of the wolves believed to prey on Macomb caribou. With wolf control, fall calf survival increased from 13 calves:100 cows in 1980 to 33 calves:100 cows in 1981.

The MPMA was renamed the Macomb Plateau Controlled Use Area (MPCUA) in 1981 to more accurately reflect the access restrictions that were in effect there. The boundaries and access restrictions remained the same.

Previous management objectives for the MCH (ADF&G 1976) included maintaining a population of at least 350 caribou in Subunit 20D south of the Tanana River. This population objective was based upon incomplete data on herd size, movements, and identity of the MCH.

On 29 June 1988, a population estimate for the MCH resulted in an estimate of 800 caribou. Information gathered from local residents suggested that historically there may have been more caribou between the Robertson and Delta Rivers than there were in 1988. Therefore, a population size objective was established to increase MCH size to 1,000 caribou by 1993.

MANAGEMENT GOALS AND OBJECTIVES

1. Provide for continued consumptive use of caribou.

1. Increase the size of the MCH to 1,000 caribou by 1993, unless food begins to limit the population.

2. Determine calf survival and factors affecting calf survival.

3. Determine age at first reproduction in females as an indicator of food availability and body condition.

Provide an opportunity to hunt caribou in an area free of motorized vehicles.

1. Maintain the Macomb Plateau Controlled Use Area.

Provide an opportunity to hunt large bull caribou under uncrowded conditions.

1. Survey hunters annually to determine their relative level of satisfaction with the hunt.

2. Maintain a sex ratio of 40 bulls:100 cows and 10 large bulls:100 cows after the hunting season.

METHODS

Radio-collared caribou were located from fixed-wing aircraft on 16, 21, and 23 May 1991, and from a Hughes 500 helicopter on 11 June 1991 to determine pregnancy rates, based on antler retention and presence or absence of an extended udder, and to observe newborn calves. These data were collected during a diversionary feeding study conducted on the Macomb Plateau during May and June 1991 (Boertje *et al.* 1992).

We conducted postcalving sex and age composition surveys on 11 June 1991 and 23 June 1992. The 11 June 1991 composition survey was flown with a Hughes 500 helicopter and caribou were classified as either calves, females >1 year old, or males >1 year old. The 23 June 1992 composition survey was flown with a fixed-wing aircraft and it was not possible to differentiate between adult bulls and cows. Caribou were classified as calves or adults. Radio-collared caribou were located to assist with finding groups of caribou to classify during both surveys.

Population estimates were conducted on 25 September 1991 and 26 September 1992. We used helicopters to classify caribou during population estimates. A Hughes 500 was used for the 1991 estimate and a Robinson R22 was used for the 1992 estimate. All radio-collared caribou were located from fixed-wing aircraft and we located other caribou groups by tracking in snow from the helicopter and the fixed-wing aircraft. We classified caribou as calves, bulls, or cows. We classified bulls as either small, medium, or large based on antler size.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The MCH has decreased in size from approximately 800 caribou in 1988-90 to 550 in 1992 (Table 1). This is approximately a 31% decline in herd size since 1990. The MCH is not meeting the herd size management objective of increasing to 1,000 caribou by 1993.

The MCH has decreased in size along with the Delta, Chisana, Fortymile, Denali, Tonzona, and Mentasta herds in Interior Alaska (Valkenburg 1992). Valkenburg (1992) hypothesized that warmer and drier than normal summer weather reduced conception and parturition rates and reduced body condition in calves and adults. Severe winters of 1989-90, 1990-91, and 1991-92 probably also contributed to increased winter mortality from wolves. Anecdotal information from hunters in the range of the MCH indicate that

numbers of grizzly bears may have increased, which would decrease initial survival of neonate caribou and contribute to the population decline. In addition, 15% of the radio-collared caribou in the Macomb herd wintered with other herds during 1990-91. These radio-collared caribou subsequently died before returning to the MCH.

Population Composition: Although the natality rate of radio-collared MCH females ≥3 years old was moderate (10 of 12 pregnant in 1991 and 6 of 8 in 1992, initial calf survival was low, especially in 1991 (Table 2). Since 1990, survival of calves to fall has not been sufficient to offset adult mortality. As a result, the population declined and there was virtually no harvestable surplus of bulls. Other caribou herds in the Interior have also declined. Adverse weather and high wolf numbers are the leading suspected causes of these declines.

The bull:cow ratio in the MCH declined rapidly after 1990 (Table 1). If recruitment stays low, the decline in the bull:cow ratio will continue despite the cessation of hunting.

Distribution and Movements: Four radio-collared yearling caribou emigrated during winter 1990-91 when part of the MCH mixed with other herds in a portion of Unit 12 near Tok. None of the radio-collared caribou that emigrated to other herds returned to the MCH. In early 1992, three radio-collared Macomb caribou were south of the Alaska Range, and one was on the north side of the Alaska Range east of the Tok Cutoff Highway. This is some of the first evidence of dispersal/emigration in Interior caribou herds.

Mortality

Harvest:

Season and Bag Limit.

1991 Hunting Season. The 1991 Macomb caribou hunting season in Subunit 20D south of the Tanana River was 10 August-30 September with a bag limit of one bull by registration permit for Alaskan residents. A harvest quota of 50 bulls was allowed. There was no open season for nonresidents. The hunting season was closed by Emergency Order on 4 September 1991.

1992 Hunting Season: The 1992 Macomb caribou hunting season was canceled and no permits were issued because of the decline in the size and bull:cow ratio in the MCH.

Human-induced Mortality. Hunters reported killing 50 caribou during the 1991 hunting season (Table 3). This is a slight increase from the 1990 harvest and continues the trend of increased harvest since 1985. Based on reported harvest, approximately 8.9% of the MCH was harvested during the 1991 hunting season.

I believe that illegal harvest is usually minimal although two caribou were reportedly shot and left in the MPCUA each year (Table 3).

Hunter Residency and Success. Alaskan residents received all registration permits because nonresidents were ineligible to hunt the MCH during the 1991 season. Local residents were issued 52% of the permits and nonlocal residents received 48% of the permits. Hunting success varies in the MCH and depends on herd distribution.

Hunter Effort. The number of hunters has increased significantly since the Macomb caribou hunt changed from a drawing permit hunt in 1989 to a registration permit hunt in 1990 (Table 4).

Permit Hunts. Registration permits were issued to 317 hunters in 1991 (Table 5). This was a decrease from 351 permits issued in 1990, the first year the hunt was by registration permit, but a significant increase from years the Macomb hunt was administered as a drawing permit hunt.

Harvest Chronology. Because the 1991 season was closed by emergency order on 4 September, harvest was significantly reduced after that date. Most caribou were killed during the third and fourth week of the hunt (Table 6).

Transport Means. The most commonly used vehicles for hunters who harvested caribou during 1991 were 3- or 4-wheelers, which were used by 32% of successful hunters. Three- and four-wheelers have been used more commonly since the Macomb hunt became a registration permit hunt. Highway vehicles were the second most common transportation type and were used by 20% of all successful hunters (Table 7).

Caribou Harvest Locations. Fifty-five percent of the harvest occurred outside the MPCUA. Total harvest rates were nearly equal in the two most popular areas, with 35% of all caribou coming from the upper Jarvis Creek outside the MPCUA and 33% coming from the Dry Creek/Horn Mountain portion of the Macomb Plateau inside the MPCUA. A significant portion of the harvest (16%) also came from outside the MPCUA in the Little Gerstle River.

Natural Mortality. From October 1990 to September 1992, radio-collared Macomb caribou had a 51% mortality rate. There were 27 radio-collared caribou alive in the MCH on 9 October 1990. During winter and spring 1990-91 three radio-collared caribou died and four emigrated to other herds as discussed earlier, resulting in 20 radio-collared caribou in the MCH on 11 June 1991. On 25 September 1991 there were 15 live radio-collared caribou in the MCH, 11 were alive on 23 June 1992, and 11 were still alive on 26 September 1992.

Diversionary feeding of predators did not improve caribou calf survival in the MCH (Boertje *et al.* 1992), possibly because of adverse weather conditions and there has been

a widespread caribou decline in Interior Alaska. Boertje estimated that initial calf survival from calving to 12 June 1991 was only 25%.

Habitat

Assessment and Enhancement: No habitat assessment or enhancement was accomplished during this reporting period. Habitat assessment is needed in the MCH range to determine if the range will support a larger herd or if recent declines in herd size are partially related to range.

Board of Game Actions and Emergency Orders

The 1991 hunting season was stopped by Emergency Order on 4 September 1991 as discussed earlier.

CONCLUSIONS AND RECOMMENDATIONS

The MCH has had a significant decrease in herd size since 1990, along with other Interior caribou herds. It is not meeting herd size management objectives and is below the management objective for the bull:cow ratio. The reduction in herd size is probably a result of weather factors and predation. Hunting was canceled for the MCH in 1992. I recommend that hunting not be resumed until the herd grows to at least 600 caribou. If the herd continues to decrease in size without hunting, management actions should be implemented to reduce predation rates on the herd. New herd size management objectives need to be established for the herd during the next year.

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Table 1. Macomb caribou fall composition counts and estimated population size, regulatory years 1982 to 1992.

Date	Bulls: 100 cows	Calves: 100 cows	Calves %	Cows %	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls	Composition sample size	Estimate of herd size
10/82	21	26	18	68	61	29	10	14	218	700
10/83	33	24	15	64	48	--	--	21	238	700
12/1/84	28	40	24	60	45	34	21	17	351	700
10/30/85	45	31	17	57	43	38	20	26	518	700
10/16/88	46	32	18	56	41	31	28	26	671	800
10/26/89	33	34	20	60	54	31	15	20	617	800
10/9/90	44	17	11	62	34	34	32	27	600	800
9/25/91	34	9	6	70	21	42	37	24	560	560
9/26/92	25	14	10	72	30	36	33	18	455	550[b]

[a] Large and medium bulls not classified in this survey.
[b] 527 caribou were actually counted.

Table 2. Macomb caribou postcalving composition counts and estimated population size, regulatory years 1985 to 1992.

Date	Bulls: 100 Cows	Calves: 100 Cows	Calves %	Cows %	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls %	Composition sample size
6/11/85	--	38	28	72	--	--	--	--	516
6/18/86	1	32	24	76	--	--	--	--	468
6/11/87[a]	1	48	32	66	--	--	--	1	158
7/11/89	25	37	23	62	--	--	--	15	507
6/14/90	30	32	20	62	--	--	--	18	600
6/11/91	15	16	13	76	92	0	8	11	319
6/23/92	--	--	22	--	--	--	--	--	373[b]

[a] Indicates ratios may not be comparable because yearlings were classified in this count.
[b] Fixed-wing survey; only "calves" and "total caribou" recorded.

Table 3. Macomb caribou harvest[a] and accidental death, 1985-92.

Regulatory year	Hunter harvest							Accidental death	Total
	Reported				Estimated				
	M	F	Unk	Total	Unreported	Illegal	Total		
1985-86	12	0	0	12	0	2	2	0	14
1896-87	10	0	0	10	0	2	2	0	12
1987-88	57	0	0	57	0	2	2	0	59
1988-89	42	0	0	42	0	2	2	0	44
1989-90	44	0	0	44	0	2	2	3	49
1990-91	42	0	0	42	0	2	2	0	44
1991-92	48	0	2	50	0	2	2	0	52
1992-93	Hunt canceled								

[a] Includes permit hunt harvest.

Table 4. Macomb caribou hunter residency and success of permit hunters, 1986-92.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	
1986-87[b]	9	0	1	10 (18)	19	27	1	47 (82)	57
1987-88[b]	21	36	0	57 (61)	15	21	1	37 (39)	94
1988-89[b]	15	18	0	33 (54)	4	22	0	28 (46)	61
1989-90[b]	18	20	0	38 (54)	8	24	0	32 (46)	70
1990-91[c]	28	14	0	42 (23)	80	64	0	144 (77)	186
1991-92[c]	23	27	0	50 (24)	77	81	0	158 (76)	208
1992-93 Hunt cancelled									

[a] Resident of Subunit 20D.
[b] Hunt by drawing permit.
[c] Hunt by registration permit.

Table 5. Macomb caribou harvest data by permit hunt, 1985-92.

Hunt No.	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Harvest			Total harvest
						Bulls (%)	Cows (%)	Unk.	
530[a]	1985-86	140	61	22	78	12	0	0	12
	1986-87	100	62	26	74	10	0	0	10
570[b]	1986-87	15	53	14	86	1	0	0	1
530[a]	1987-88	150	53	76	24	53	0	0	53[c]
	1988-89	150	57	55	45	36	0	0	36[d]
	1989-90	150	47	55	45	44	0	0	44[d]
535[e]	1990-91	351	42	21	79	42	0	0	42
	1991-92	317	33	16	50	48	0	2	50
	1992-93	0	0	0	0	0	0	0	0
Totals for all permit hunts	1985-86	140	61	22	78	12	0	0	12
	1986-87	115	61	24	76	11	0	0	11
	1987-88	150	53	76	24	53	0	0	53[a]
	1988-89	150	57	55	45	36	0	0	36[b]
	1989-90	150	47	53	48	44	0	0	44[b]
	1990-91	351	42	23	77	42	0	0	42
	1991-92	317	33	16	50	48	0	2	50
	1992-93	0	0	0	0	0	0	0	0

[a] Hunt 530 was a drawing permit hunt.
[b] Hunt 570 was a subsistence registration permit hunt for Dot lake residents only.
[c] Thirty-three caribou killed during the permit hunt, an estimated 20 killed in Unit 12 outside the permit area, and 4 (not included in the total) killed by subsistence hunters.
[d] Non-permit subsistence harvest was two (not included in 1988 and 1989 total).
[e] Hunt 535 was a registration permit hunt.

Table 6. Macomb caribou harvest by time period, 1987-92.

Regulatory year	Harvest periods 8/10-8/16	8/17-8/23	8/24-8/30	8/31-9/6	9/7-9/13	9/14-9/20	9/21-9/27	9/28-9/30	Unk	n
1987-88	8	6	10	3	4	1	0	0	1	33
1988-89	2	4	6	4	5	3	3	8	1	36
1989-90	1	6	8	4	5	6	5	6	0	41
1990-91	1	3	6	11	4	2	6	1	7	41
1991-92[a]	4	6	21	15	2	0	0	0	0	48
1992-93	Hunt cancelled									

[a] Season closed by emergency order on 4 September 1991.

Table 7. Macomb caribou harvest percent by transport method, 1986-92.

Regulatory year	Percent of harvest[a] Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Walking[b]	Unknown	n
1986-87	21	21	0	4	0	0	54	--	0	24
1987-88	6	37	0	6	0	3	49	--	0	68
1988-89	15	25	0	6	0	5	49	--	0	65
1989-90	5	45	0	0	5	39	7	--	0	44
1990-91	2	5	0	24	0	14	17	38	0	42
1991-92	4	10	0	32	0	8	20	0	26	50
1992-93	Hunt cancelled									

[a] Includes permit hunt harvest.
[b] Walking was not listed as a transportation type from 1986-87 to 1989-90.

LOCATION

Game Management Units: 13 and 14B (25,000 mi^2)

Herd: Nelchina Caribou Herd

Geographical Description: Nelchina Basin

BACKGROUND

The Nelchina caribou herd (NCH) contained 5,000-15,000 caribou in the late 1940s. The herd increased during the early 1950s, aided by intensive predator control. It continued to expand and peaked at about 70,000 caribou by the mid-1960s. A dramatic decline began in the late 1960s and the herd numbered between 7,000 and 10,000 caribou in 1972. In 1973-74 the NCH began to increase and grow through the late 1980s.

The NCH has been important to hunters because of its accessibility and proximity to Anchorage and Fairbanks. Hunters killed 112,000 Nelchina caribou between 1954 and 1989. The Board of Game (BOG) increased bag limits and extended seasons when the NCH began to increase in the late 1950s. From 1955 until 1971, the bag limits varied from 2 to 4 caribou and season lengths fluctuated between a split 2-month season in September and November, to a 7-month season from August to March. Annual harvests from 1955 through 1971 ranged from 2,500 to more than 10,000 caribou. The department recognized a decline in 1972 and the BOG curtailed the season and bag limit. From 1972 through 1976, the bag limit was 1 caribou and fall seasons varied from 15 to 40 days. Even with restrictions the reported harvests ranged from 560 to as high as 1,200 caribou and exceeded the desired harvest level. In 1976, the season was closed by emergency order after hunters killed 800 caribou in 5 days. It became apparent a short season was not controlling the harvest. Since 1977 Nelchina caribou have been hunted by permit only.

MANAGEMENT DIRECTION

Management Objectives

The management objective is to reduce the herd to 40,000 caribou by increasing human harvests, then maintain the herd at that level with a minimum of 40 bulls:100 cows and 40 calves:100 cows. The department recommends the annual harvest level based upon population estimates, overwinter adult survival, and calf recruitment.

METHODS

Biologists conducted an annual census and associated sex and age composition counts during the past 4 years and biennially prior to 1988. The censuses involved aerial counts of caribou observed in postcalving aggregations; counts were followed immediately by sex and age composition surveys. Surveyors estimated the cow base and the proportion of calves and bulls in the postcalving aggregations. Biologists conducted aerial sex and age composition counts annually during fall to estimate herd composition and evaluate calf recruitment. They extrapolated fall population estimates from the counts and composition data.

Surveyors located radiocollared caribou seasonally to delineate herd distribution, sex and age composition, and to determine seasonal range use. They attempted to maintain between 30 and 40 radiocollared caribou in the herd each year.

Biologists used permit reports, periodic check stations, and hunter field checks to monitor hunts. Personnel monitored forage condition and use at approximately 5-year intervals at established range stations.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The NCH increased from an estimated 30,276 caribou in 1987 to 45,484 in 1992 for an average annual growth rate of 10% (Table 1). The 1992 estimate was the highest in more than 20 years, however, the 1992 total was only slightly higher than the 1991 estimate. This suggested a cessation of growth in this herd. The estimated density was 1.03 caribou/km^2 in 1992 based on an approximate range of 44,200 km^2 (Lieb *et al.* 1988) and a population estimate of 45,484 caribou.

Population Composition: Biologists observed 63 calves:100 cows during the 1992 postcalving survey. This was the highest spring calf:cow ratio obtained in recent years and it was surprising because the spring of 1992 came very late. Some calving occurred on the Lake Louise flats for the first time in over 15 years. Between 1983 and 1990 postcalving calf:cow ratios ranged from 51 to 61 calves:100 cows. Current calf:cow ratios obtained immediately postcalving suggested high herd productivity each year. Calf:cow ratios typically declined between summer and fall and a decline of 23 calves:100 cows occurred in 1992. The 1992 fall ratio of 40 calves:100 cows was 7% below the 5-year average (1987-91) of 43 calves:100 cows.

Surveyors observed 48 bulls:100 cows during the fall 1992 survey. This was a 4% decline from the 5-year (1987-91) average of 50 bulls:100 (Table 1). Recently, fall bull:cow ratios have been lower than ratios observed in the early 1980s (x = 60 bulls:100 cows). This

reduction was the result of a harvest regime in which approximately 85% of the caribou killed during hunting seasons were bulls. Field notes from recent fall composition surveys suggested fewer large, mature bulls than in past years. This was a subjective conclusion because bulls were not classified by age class (i.e., small, medium, or large). However, it was evident that large, mature bulls were not as prevalent in breeding groups as in previous years.

Distribution and Movements:

Biologists monitored the distribution and movements of the NCH and Mentasta caribou herd (MCH) by periodic flights to locate radiocollared, cows. During the 1990 postcalving/early summer period the NCH was distributed throughout the eastern Talkeetna Mountains from Fog Lakes southeast to the Little Nelchina River. This distribution was similar to the previous 5 years. Caribou were spread widely over lower-elevation hills in the eastern Talkeetna Mountains, the Lake Louise flats and the Alphabet Hills by late August. The NCH began migrating east during early October 1990. Approximately 50% of the NCH intermixed with the Mentasta herd between the Copper and Nabesna Rivers by 16 October. The herd ranged from the eastern Mentasta Mountains to Snag Creek, Canada by 28 December. The eastern Mentasta Mountains contained about 75% of the herd. The Nelchina caribou that did not migrate eastward, out of Unit 13, wintered in the eastern Talkeetna Mountains and the Lake Louise Flats.

The intermixed NCH and MCH ranged around Northway and the Black Hills to Snag Creek, Canada from January until March 1991. During mid-March 1991, some of the caribou moved northwest from the Tetlin refuge. In early May Nelchina caribou migrated across the Lake Louise Flats into the Talkeetna Mountains.

The peak of the 1991 calving season occurred 28-31 May on the traditional calving grounds between the Oshetna River and Kosina Creek. During the 1991 postcalving/early summer period, the NCH was distributed throughout the eastern Talkeetna Mountains between the Oshetna River and Caribou Creek.

Approximately one-half the NCH observed during the 1991 fall composition counts on 2 October was migrating eastward through the Chistochina River region. The remaining caribou were located between the Maclaren and Talkeetna Rivers. In December 1991 Nelchina caribou that migrated were distributed from Jatahmund Lake to west of Tetlin and along the Alaska Highway to the Canada border. The MCH intermingled with Nelchina caribou from the Nabesna River north to Northway and Tetlin. The Nelchina caribou that remained in Unit 13 (approximately one-half of the herd) wintered on the Lake Louise Flats, with groups scattered south into the Nelchina and Tazlina drainages. Since 1988 caribou have increasingly used the Nelchina and Tazlina drainages during winter and summer.

The 1992 spring migration occurred from early April to mid-May though prolonged winter conditions delayed major movements. The Nelchina caribou that wintered north and east of Unit 13 moved westward through the Mentasta Pass, crossed the Richardson Highway between Sourdough and Meiers Lake, then crossed the Lake Louise Flats. The peak of calving occurred 26-30 May between the Oshetna River and Kosina Creek. The late spring delayed migration and caused some cows to calve on the Lake Louise flats in late May, while en route to the Talkeetna Mountains calving area. During the 1992 postcalving/early summer period the NCH was distributed, as it had been the past 6 years, throughout the eastern Talkeetna Mountains from Fog Lakes southeast to the Little Nelchina River.

Mortality

Harvests:

Season and Bag Limit. The 1990-91 season for subsistence hunters in Unit 13 and Subunit 14B was from 21-23 August, 28-30 August and 18-20 September. The winter season was 1 January to 28 February. The bag limit was 1 caribou during the fall hunt or 1 antlered caribou during winter. The 1991-92 season was from 10 August to 20 September and 5 January to 31 March. The bag limit was 1 caribou in fall or 1 antlered caribou in winter.

A state subsistence hunt for Nelchina caribou occurred in Unit 12 during winter and it was opened and closed by emergency order. There was no season in 1990, but a 13-day season was open in 1991 from 28 October to 9 November.

The Unit 13 federal subsistence seasons in 1990 and 1991 were 10 August to 20 September and 5 January to 31 March. In 1990 the bag limit was 1 caribou and in 1991 the limit was 2 caribou. The Unit 13 federal subsistence hunt was a registration hunt administered by the Bureau of Land Management and only residents of Units 13, 11 or 12 along the Nabesna Road were eligible.

The Unit 12 federal subsistence season was from 19 November to 17 December. In 1991 the season was from 7 November to 8 December. The bag limit was 1 antlerless caribou in 1990 and 1 bull in 1991. The Unit 12 federal subsistence hunt was a registration hunt administered by the USFWS and only residents of Northway or Tetlin were eligible.

Board of Game Actions and Emergency Orders. In 1989 the Alaska Supreme Court determined that local residency as a criterion for determining subsistence eligibility was unconstitutional. The BOG then defined all Alaskans were subsistence users. The sport harvest of Nelchina caribou was eliminated and only subsistence hunting has been allowed since 1990. All Alaskans were eligible to hunt in fall 1990. The 1990 fall hunt was an unlimited registration hunt because there was not enough time between the BOG meeting in July and the traditional opening of the fall hunting season in August to conduct a

Tier II hunt. Hunters obtained registration permits in Glennallen, Palmer, Delta Junction or Cantwell on 17-18 August. The department closed the 1990 fall hunt by emergency order after the first 3-day season (21-23 August) when hunters reached the fall quota. The BOG established the winter 1990-91 hunt and the entire 1991-92 season as a Tier II drawing permit.

The federal government assumed control of wildlife management on federal lands following the McDowell decision. A federal board was established to establish subsistence seasons and bag limits on federal lands beginning with the 1990 season. The major difference between federal and state caribou hunts was that only a portion of Subunit 13B was federal land and this reduced the opportunity to take caribou under a federal permit.

Hunter Harvest. The reported harvest in 1990-91 for the combined state and federal hunts was 3,020 caribou; the total harvest was 2,920 caribou in 1991-92 (Table 2). The 1990-91 harvest was a 52% increase over the 1989-90 harvest, and a 59% increase over the previous 3-year mean (1987-89) annual harvest of 1,796 caribou. Cow harvests increased 150% over the past 2 years. The winter bag limit was 1 antlered caribou to encourage the harvest of cows and immature bulls. Most breeding bulls shed their antlers before the winter season.

Illegal and unreported harvests of Nelchina caribou are an important source of mortality. We can only estimate the number of caribou taken. The most common type of illegal harvest occurs when a permittee fails to validate the permit after taking a caribou. Once a permittee transports a caribou from the field without punching the permit tag, there is minimal chance of citing them for taking additional caribou on the same permit. Also, individuals share permits with friends, similarly failing to validate the permit. There are reports of 5 caribou taken with 1 permit before the permit was validated. Enforcement is increasing and permittees who do not validate permits before transporting their caribou are cited.

Yukon residents harvested Nelchina caribou during winters when the animals moved into Canada. This harvest is expected to increase if the NCH continues migrating into the Yukon in substantial numbers and locals become aware of the opportunity to take caribou.

Road kills occur primarily during winter and are positively correlated with snow depth. Roads bisect much of the winter range and caribou seek the salt on the plowed highway. The number of caribou killed in vehicle collisions is unknown because reporting is incomplete.

Permit Hunts. Nelchina caribou were harvested exclusively by permit hunts. From 1987 to 1990, the number of Nelchina permits issued tripled, from 2,883 to 8,665 (Table 2). The increase in permits was because of a change in the hunt. Hunter participation was not limited in the registration permit hunt and the season was closed when the harvest quota

was reached. The BOG increased the number of permits issued as the herd has grown, thus the allowable harvest has increased each year.

During the past 2 years, 4 permit hunts for Nelchina caribou took place each year (Table 2). In Units 13 and 12 there were state subsistence hunts and federal subsistence hunts. The Unit 13 state hunt was the largest hunt. In 1990 this was Hunt 565, a registration hunt. The department issued 6,825 permits and hunters harvested 2,490 caribou. The department closed the season by emergency order after the first 3-day season. Since the winter 1990-91 season, state caribou hunting in Unit 13 has been by Tier II permit. In 1991, 6,840 applicants applied for Tier II permits and 2,802 permits were issued with a harvest of 1,973 caribou.

The Unit 13 federal hunt, Hunt 513, was a registration hunt for residents of Units 13, 11 and 12 along the Nabesna Road. The number of participants was comparable to when the state administered the hunt. The 1991 harvest was similar to past years (Table 2).

The number of caribou harvested in Hunt 513 varies because federal acreage is limited. In some years caribou are absent from federal lands while at other times the entire herd may be found in Subunit 13B. Concentrations often occur between Sourdough and Paxson along the Richardson Highway which is a traditional migration area for Nelchina caribou going east for winter. Ideal access provides hunters an easy opportunity to kill caribou.

The state (560T) and federal (512) registration hunts in Unit 12 were smaller because fewer caribou were available, however, 822 permittees harvested 273 caribou in Hunt 560T during 1991. The federal hunt (512) was small because it was limited to local residents of Tetlin and Northway and federal lands.

Hunter Residency and Success. Only Alaska residents could hunt Nelchina caribou. During 1990 local hunters took 355 animals (12%), and nonlocals took 2,665 caribou (88%) (Table 4). In 1991 local residents killed 898 caribou (31%) and nonlocals killed 1,946 animals (69%). Nonlocals harvested more caribou in 1990 than 1991 because the registration hunt did not limit participation to unit residents. For many nonlocal Alaskans this was the best chance at a Nelchina permit in years and they took advantage of the opportunity to hunt. Local residents' success increased in 1991. The bag limit for the federal hunt increased to 2 caribou and animals were more available on federal lands.

In 1990 successful hunters spent an average of 2 days afield, while unsuccessful hunters were afield 3.5 days. In 1991 successful caribou hunters spent an average of 4 days afield compared to 5 days for unsuccessful hunters. Tier II hunters averaged 3.7 days to take a caribou compared to 5.7 days for locals with a federal permit. Unsuccessful state permittees spent 4.3 days hunting compared to 8.5 days for federal permittees.

Hunter success in 1990 was 52%, a decline from the 1989 rate of 70% Hunter success increased to 64% in 1991. We attributed hunter success to the increased number of

permits and the shortened season. Although hunter success increased in 1991, it did not approach the 73% average success rate observed between 1987-89.

The decline in success rate is probably a result of the Tier II permit system. If a household qualifies, every member that applies receives a permit, so the number of permits may exceed the need for caribou in the household.

Harvest Chronology. Fall is the most important time to take caribou (Table 5). Hunting occurs throughout the fall and is not concentrated early or during moose season. The winter hunts are important when caribou are available. Weather dictates when hunters go afield in January, February, or March.

Transport Methods. Highway vehicles were the main form of transportation (43%) in 1991-92 followed by snowmachines and 4-wheelers (Table 6). Field observations suggested the use of 4-wheelers was increasing, while aircraft use declined last year. The use of snowmachines fluctuated widely and depended on the availability of caribou during the winter hunt.

Other Mortality: Wolf predation is a potentially significant mortality factor for the NCH. The number of wolves harvested by hunters and trappers was relatively high on the core Nelchina caribou range during the mid-1980s. The low wolf population was probably a factor in the high calf survival during that period, which aided the growth of the NCH. Since 1988 wolves have increased over much of the Nelchina caribou range. Field observations of wolf-killed caribou and the mortality rate on radiocollared caribou suggested wolf predation on caribou increased as the wolf population increased. The mortality rate on radiocollared caribou during winter 1991-92 was 16% (6 of 38). Ballard *et al.* (1987) reported Unit 13 wolves preyed primarily on moose and did not follow caribou. Field observations supported this conclusion until recently. During winter 1991-92 observations of radiocollared wolves suggested that packs followed caribou movements and preyed on them. This predation reduced the number of harvestable caribou for humans. Currently, wolf predation does not present a biological problem in the Nelchina herd as it is not resulting in a population decline.

Winter snow accumulations have been above average in recent years with the last 4 winters classified as severe. A severe winter has average snow depths exceeding 28 inches over much of the winter. Winters of 1989-90 and 1990-91 were especially severe, however much of the herd wintered in Unit 12 where snow depths were much lower. The strongest influence of deep snows during these years was in the increased energy costs to pregnant cows migrating to calving grounds. We have not documented an increase in caribou mortality specifically attributable to severe winter conditions. Mortality of radiocollared cows has increased but this was probably caused by wolf predation given the time and/or location of the death.

Habitat

Assessment:

Between 1955 and 1962 the department established 39 range stations, including exclosures, throughout much of the Nelchina caribou range. Biologists examined these stations at 5 to 6-year intervals from 1957 through 1989. The evaluations indicated lichen increased over much of the range from the early 1970s to 1983. However, as the herd doubled in size over the decade 1974-1983, increases in lichen biomass ceased in areas of substantial caribou use. Lichen development continued in areas of light caribou use. The calving and summering range in the eastern Talkeetna Mountains has a history of continuous, heavy caribou use for over 30 years, and it had a poor lichen standing crop. Lieb *et al.* (1988) stated:

> While the productivity, survival, and general condition of NCH animals has been good in recent years, it is clear that population levels in the 20-30,000 range have had a substantial negative effect on the lichen flora - even on moderately-utilized seasonal ranges. Preliminary examination of data collected during range station evaluations in summer 1989 indicate that areas receiving heavy use by caribou showed further range deterioration. Lichen standing crops are expected to continue decreasing with either increased or stable herd size. It is of concern to managers that even current numbers of caribou have dramatically impacted their seasonally preferred food and that only limited areas of lichens in good condition remain within the traditional range of the NCH. A larger herd and the resultant range deterioration could reduce body condition, increase the incidence of disease, reduce productivity and survival, increase the use of unsuitable habitats, and trigger emigration."

In 1990 the department initiated studies of body condition of Nelchina caribou in an attempt to evaluate the carrying capacity of the Nelchina caribou range. Researchers evaluated body condition of over 40 adult cows captured in late April or early May between 1990 and 1992. Initial analysis suggested Nelchina animals were in poorer body condition than animals from the Alaska Peninsula or the Mulchatna caribou herds (Pitcher, pers. comm.). However, NCH animals were not in poor condition overall. The Nelchina caribou that were examined had been migrating for at least 4 weeks and moved a minimum of 170 miles through very deep snow. Their body condition and low fat reserves could have been attributed to migration and not the condition of the winter range in Unit 13.

The potential for habitat loss because of land disposal and mining is a concern. An increase in mining activity could affect the Nelchina calving grounds. Recent land disposals on the Lake Louise Flat could result in a loss of caribou habitat. Another concern is the gas pipeline planned for construction adjacent to the oil pipeline and

Richardson Highway. This utility corridor transects the NCH winter range and if it becomes a barrier to caribou movements, it would exclude the herd from 50% of the winter range. Developments must be designed to minimize loss of caribou habitat and reduce disturbance ot caribou.

Enhancement: Caribou habitat enhancement is not planned in the near future. Enhancement depends on the occurrence of wildfire. *The Copper River Basin Fire Management Plan*, an interagency plan, designates areas in Unit 13 where wildfires will not necessarily be suppressed. The plan provides for a natural fire regime to benefit wildlife habitat. In spite of the plan, fires have not been allowed to burn regardless of the suppression category of the land. Unit 13 has not had a large fire since 1950.

Wildfire promotes lichen growth and fire suppression is detrimental to caribou range. It may take lichens several decades after an intense fire to become productive. Small, periodic wildfires are necessary to ensure a constant lichen supply. Effective fire suppression increases fuel buildup and the possibility of an intense fire over a large area. This type of wildfire creates less diversity and decreases caribou carrying capacity.

Nonregulatory Management Problems/Needs

The concerns and problems associated with monitoring the size and condition of the Nelchina herd include: (1) accurately estimating population size and trend; (2) monitoring animal condition; (3) translating range and animal condition information into a reasonable estimate of the optimum caribou population; (4) managing predator populations; and (5) minimizing land use activities that adversely affect the Nelchina range.

I recommend an annual census and composition count. Without an annual census and composition count, actual population status and trend is more difficult to determine and actual changes may go unrecognized for several years. I also recommend doing surveys of peripheral calving and postcalving sites throughout the Nelchina range to estimate the numbers of caribou in subherds. These areas should be surveyed every fourth year.

We should continue to examine the 39 existing Nelchina range stations periodically, as well as the sites established in calving, summering, and wintering areas in 1989.

The department should continue to monitor the body condition of Nelchina caribou. Growth and size measurements along with other condition factors such as fat indices, parasite load, and blood parameters should be examined. A previous investigation of spring body condition suggested Nelchina caribou were in poor condition. Future work should include animals that winter in Unit 13. We need to determine if the poor body condition of adult females is the cause of the reduced calf survival observed between spring and fall surveys.

I also recommend developing a program to monitor the wolf population on the Nelchina range and associated predation on caribou. Wolf predation on Nelchina caribou is unknown. If the number of wolves increase on the Nelchina range, and caribou harvests increase, it will be important to have good information on wolf numbers and predation levels, especially on calving grounds.

CONCLUSIONS AND RECOMMENDATIONS

Hunting for Nelchina caribou has evolved from a general open hunting season, to a drawing permit sport hunt, to a combination Tier II subsistence hunt - drawing sport hunt, to a combination local subsistence hunt - drawing sport hunt, to a registration subsistence hunt for any Alaska resident, to the current Tier II subsistence hunt for Alaska residents. Because of the large number of people interested in hunting for Nelchina caribou it is necessary to restrict participation. Unlimited participation, such as occurred during the registration hunt, poses the risk of overharvest and places undesirably large numbers of hunters in the field at the same time. The registration system for such a large hunt stretches the department's resources and is time consuming and inconvenient to hunters. I recommend that future hunting of the NCH be by limited permit such as the current Tier II system or the prior, random drawing system. This provides for long seasons and uncrowded conditions but allows taking of the desired harvest level.

Other management concerns are the winter hunts in Units 12 and 13. These have proven difficult to manage because of the unpredictable winter distribution of the herd and because of mixing with the depressed Mentasta and Delta herds. There are also concerns about overharvesting local resident subherds such as the Upper Susitna-Nenana subherd along the western Denali Highway when they are the only caribou available for a winter hunt in Unit 13 and the demand is high because of a large winter quota. I recommend that most, if not all, of the annual harvest quota be taken during fall season when distribution is predictable and herd mixing at a minimum. If winter hunts are held in areas where mixing occurs with depressed herds, harvests must be limited to bulls to minimize affects on these herds.

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Table 1. Nelchina caribou fall composition counts and estimated population size, 1987-1992.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Total bulls (%)	Composition sample size	Total adults	Estimate of herd size	Postcalving[a] count
1987/88	50	51	25	50	25	5,134	22,707	30,276	31,027
1988/89	56	48	24	49	27	2,502	--	--	--
1989/90	49	39	21	53	26	2,817	31,851	40,317	39,754
1990/91	42	33	19	57	24	3,671	29,909	36,860	42,127
1991/92	51	45	23	50	26	2,187	34,594	44,903	46,634
1992/93	48	40	21	53	25	4,135	35,807	45,484	46,948

[a] Spring census

Table 2. Nelchina caribou harvest data by permit hunt, 1987-92.

Hunt No. /Area	Regulatory year	Permits isssued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
515[a]	1987/88	1,700	12	86	14	1,064 (87)	159 (13)	5	1,228
	1988/89	1,775	12	74	26	944 (85)	167 (15)	10	1,121
	1989/90	2,230	14	74	26	1,188 (85)	203 (15)	8	1,399
565[b]	1990/91	6,825	30	54	46	1,825 (74)	639 (26)	26	2,490
566T[c]	1990/91	877	29	45	65	167 (62)	104 (38)	3	274
	1991/92	2,802	11	80	20	1,476 (75)	488 (25)	9	1,973
562W[d]	1987/88	1,183	28	65	35	306 (60)	205 (40)	8	519
	1988/89	1,161	30	68	32	349 (66)	182 (34)	4	535
	1989/90	1,292	32	61	39	410 (81)	94 (19)	1	505
513[d]	1990/91	792	36	45	55	167 (86)	28 (14)	2	197
	1991/92	2,201	22	46	54	482 (76)	151 (24)	14	647
562WY[e]	1989/90	152	24	73	27	61 (79)	16 (21)	5	82
560T[e]	1991/92	822	19	42	58	257 (94)	3 (1)	13	273
512[f]	1990/91	172	N/A	34	66	48 (84)	9 (16)	2	59
	1991/92	118	35	40	60	22 (88)	3 (12)	2	27
Totals for all permit hunts	1987/88	2,883	18	77	23	1,370 (79)	364 (21)	13	1,747
	1988/89	2,936	19	72	28	1,293 (79)	349 (21)	14	1,656
	1989/90	3,674	23	70	30	1,659 (84)	313 (16)	14	1,986
	1990/91	8,665	30	52	48	2,207 (73)	780 (27)	33	3,020
	1991/92	5,943	16	64	36	2,237 (78)	645 (22)	38	2,920

[a] Drawing permit sport hunt. [b] Registration permit subsistence hunt for all Alaskans.
[c] Tier II subsistence drawing permit. A winter hunt only in 1990-91.
[d] Subsistence registration for Unit 13 residents, administered by BLM as federal hunt 513 in 1990.
[e] A winter registration hunt for residents of Tetlin or Northway administered by ADF&G. Only the hunt number changed in 1991.
[f] A winter registration hunt administered by Tetlin National Wildlife Refuge staff for residents of Unit 12.

Table 3. Nelchina caribou harvest and accidental death, 1987-92.

Regulatory year	Hunter harvest: Reported M (%)	Reported F(%)	Reported Unk.	Reported Total	Estimated Unreported	Estimated Illegal	Estimated Total	Accidental death	Grand total
1987/88	1,370 (79)	364 (21)	13	1,747	20	25	45	27	1,819
1988/89	1,293 (79)	349 (21)	14	1,656	20	50	70	150	1,876
1989/90	1,659 (84)	313 (16)	14	1,986	100	50	150	200	2,336
1990/91	2,207 (73)	780 (27)	33	3,020	200	100	300	200	3,520
1991/92	2,237 (78)	645 (22)	38	2,920	200	100	300	200	3,420

Table 4. Nelchina caribou annual hunter residency and success, 1987-92.

Regulatory year	Successful: Local[a] resident	Successful: Nonlocal resident	Successful: Nonresident	Successful: Total[b]	Unsuccessful: Local[a] resident	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Total[b]	Total[b] hunters
1987/88	519	1,228	--	1,747	274	241	--	515	2,262
1988/89	551	1,105	--	1,656	256	387	--	643	2,299
1989/90	544	1,442	--	1,986	328	533	--	861	2,847
1990/91	355	2,665	--	3,020	690	2,166	--	2,863	5,883
1991/92	898	1,946	--	2,857	843	483	--	1,348	4,205

[a] Local resident means a resident of Units 13, 11 or 12 along the Nabesna Road.
[b] Total includes unknown residency.

Table 5. Nelchina caribou annual harvest chronology percent by time period, 1987-92.

Regulatory year	Harvest periods: Weeks (fall) 1	2	3	4	5	6	7	8	Months (winter) Nov.	Dec.	Jan.	Feb.	Mar.	n
1987/88	21	14	11	10	11	14	--	--	--	--	19	--	--	1,747
1988/89	9	18	17	16	9	9	9	--	--	--	13	--	--	1,656
1989/90	9	13	13	16	16	12	11	--	--	--	4	1	1	1,986
1990/91	1	1	83	1	1	1	1	1	--	--	4	2	3	3,020
1991/92	9	9	8	9	8	11	7	--	8	1	10	5	15	2,857

Table 6. Nelchina caribou harvest percent by transport method, 1987-92.

Regulatory year	Percent of harvest: Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk.	n
1987/88	10	1	10	22	7	16	33	1	1,747
1988/89	10	1	10	18	6	15	38	2	1,656
1989/90	10	1	9	21	4	15	35	5	1,986
1990/91	10	2	7	33	3	10	30	5	3,020
1991/92	5	1	6	16	16	7	43	6	2,857

LOCATION

Game Management Unit: 18 (41,159 mi^2)

Herd: Kilbuck and Andreafsky Mountains

Geographical Description: Yukon-Kuskokwim Delta

BACKGROUND

Historically, caribou ranged over much of the Yukon-Kuskokwim Delta including Nunivak Island, and populations probably peaked during the 1860s (Skoog 1968). By the early 1900s, few caribou were found in the lowlands of the Delta. Today two small herds occur in Unit 18, the Kilbuck and Andreafsky Mountains herds.

The Kilbuck caribou herd (KCH), located in the Kilbuck and Kuskokwim Mountains southeast of Bethel, remains low in density but continues to grow in size and expand in range. The current minimum estimate for the size of the Kilbuck herd is 2,584 caribou, based on an aerial census conducted during 16 through 18 November 1991. From 1990 through 1992, we developed the KCH Management Plan after extensive agency and public input; it now provides guidelines for managing the KCH.

Little is known of the status of the Andreafsky Mountains herd. Located in the northern portion of Unit 18, the herd's range may occasionally overlap ranges used by reindeer herds located near Stebbins, and by the Western Arctic caribou herd which frequently winters in Subunit 22A. We did not conduct any survey-inventory activities for the Andreafsky herd during this report period.

MANAGEMENT DIRECTION

General management objectives for Unit 18 are to increase caribou numbers and to better ascertain the status and size of the Kilbuck caribou herd (KCH).

METHODS

A cooperative study of the KCH began in 1986 with the USFWS and has continued until the present. This study included the use of repetitive aerial surveys and radio-collared animals to help locate groups and resulted in a better understanding of the population status of the KCH. Department and USFWS staffs conducted monthly radio-tracking flights to monitor 24 active radio collars, and completed 36 flights during the report period. We located caribou using LORAN C or GPS, and subsequently mapped the

locations. Detailed methodology for the KCH radiotelemetry study is available in Hinkes (1989) and Ernst (1993).

Of the 36 flights, we conducted 6 during late October and early November using 3 fixed-wing aircraft for an aerial census of the KCH. We selected the census area size based upon known radio-collared caribou locations, and 19 polygons were delineated within the census area (Figure 2).

Several types of composition surveys were completed during the report period. We conducted a fall composition count using a helicopter north and east of Eek Lake, including the Kisaralik and Kwethluk river drainages. All caribou observed were classified as bulls, cows, and calves. The USFWS staff also conducted survey flights using a Piper PA-18 aircraft to assess composition on the calving grounds. The calving ground surveys consisted of locating all radio-collared females and conducting composition counts on a sample of animals located near radio-collared caribou.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: An aerial census was completed on 18 November 1991 to determine the population size of the KCH, and we observed 2,584 caribou in the study area. Figure 2 shows the total area surveyed and number of caribou observed in each polygon.

Since the closure to legal hunting in June 1985, the KCH appears to have increased in size. Increased caribou sightings between 1986 and early 1992 indicate an expanding population. This apparent increase in numbers can be attributed to a succession of mild winters from 1989 through 1991, low predation rates, and minimal harvests since 1985.

Because census information is only available for fall 1991, we could not calculate the annual rate of increase. A census was not completed during 1990 because of poor weather and limited aircraft availability. We surveyed one-third of the polygons during the 1990 census attempt, and we counted 1,220 caribou.

The aerial survey and radio-tracking flights conducted since 1986 indicate that the KCH is a distinct, resident population. Evidence supporting this conclusion includes the presence of discreet calving areas and the observed fidelity of radio-collared animals to the study area. Recent evidence indicates some overlap of Mulchatna and Kilbuck caribou occurs during certain times of the year. However, they do not mix during calving, and are rarely in close proximity during other times of the year.

Population Composition: We collected fall sex and age composition data on 19 November 1991. Out of 715 caribou classified, 253 were males, 322 were females, and

140 were calves. We flew composition counts using a Bell Jet Ranger helicopter. Although classification of the smaller groups was considered good, some larger groups were difficult to classify, and caribou had already begun to segregate into bull and cow/calf herds. Data from this and previous years' surveys indicate that bull:cow ratios were high as would be expected of a non-hunted population.

Calving ground surveys completed during May 1991 and May 1992 yielded ratios of 58 calves:100 cows and 35 calves:100 cows, respectively. Previous surveys conducted from 1986 through 1990 yielded ratios ranging from 54 calves:100 cows to 75 calves:100 cows. These results indicate that calf:cow ratios decreased in 1992 compared to prior years.

Distribution and Movements: The cooperative effort by ADF&G and the USFWS to document distribution of the KCH continued during the report period. As of July 1992, 24 KCH caribou (4 males and 20 females) representing approximately 1% of the herd were instrumented with functioning radio collars. These collars were deployed during 1987, 1988, and 1989.

All radio-collared caribou remained in the western and central Kuskokwim Mountains and southern Kilbuck Mountains. However, the herd appears to have expanded its winter range south and west near Three Step Mountain, the Eek River, and the Great Ridge. A single radio-collared male moved north and east near Aniak Lake during July 1990, and 1 female moved near Nishlik Lake during July 1991. Both animals returned to ranges normally occupied by KCH animals during winter months.

Evidence is available suggesting that range overlap between Mulchatna and KCH caribou occasionally occurs near the southern Kuskokwim and Kilbuck Mountains. Much of this overlap occurs in the mountain passes between Subunits 19B, 17B, and Unit 18.

Mortality

Season and Bag Limit:

Unit 18, south of the Yukon River	No open season	
Remainder of Unit 18	All hunters: Feb. 1-31 March	One caribou

The Federal Subsistence Board authorized a registration permit hunt from 23 February to 15 March on lands managed by the Yukon Delta and Togiak National Wildlife Refuges. Only eligible local residents who qualified as subsistence hunters were allowed to participate.

Harvest:

Human-induced Mortality. The season in Unit 18 south of the Yukon River was closed by the Board of Game in 1985. We observed several poaching incidents during 1986, and some undocumented poaching was reported during 1987-88. In March 1989, USFWS biologists on aerial patrol discovered a major poaching incident and up to 30 Kilbuck caribou may have been illegally taken.

During early 1990, Kwethluk residents petitioned the Alaska Board of Game, and later the Federal District Court to allow a hunt in the Kilbuck Mountains. On 5 April 1990, the Court authorized a permit hunt allowing the harvest 50 antlerless caribou by Kwethluk residents. The hunt was monitored by the department, and 39 caribou were harvested during the 10-day season (5 April-15 April 1990).

The Alaska Board of Game during its November 1991 meeting authorized a Tier II subsistence hunt in Unit 18 for 72 bull caribou permits during a season of 23 February through 15 March 1992. However, the Federal Subsistence Board during its December 1991 meeting also authorized a caribou hunt allowing a harvest of 72 bull caribou by Federal Registration Permit during the same time period as the state hunt. The federal permits could only be issued to residents of 18 local villages which had demonstrated customary and traditional use of KCH caribou. Because local hunters favored the federal season over the state season, the confusion generated by dual management, and the potential for overharvest, the department requested that the Board of Game close the State season. On 14 January 1992 an Emergency Order was issued closing the caribou season in Unit 18 (south of Kuskokwim River) to caribou hunting on state lands.

During the Federal season, 72 Federal subsistence permits were issued to residents of 18 rural villages in Unit 18 (4 permits per village), and 22 antlerless caribou were taken.

We have no information on harvest for the Andreafsky herd other than anecdotal and unsubstantiated reports because harvest reporting rates are extremely poor. Interviews with hunters from the villages of Kotlik, Mountain Village, St. Marys, Pilot Station, and Marshall revealed that very few or no caribou were seen during the 1990 or 1991 seasons. Hunters believed that Andreafsky herd animals may have traveled into Subunit 22A with migrating Western Arctic herd caribou, or moved west and mixed with the growing reindeer herds near Stebbins.

Natural Mortality:

Little information is available on natural mortality. A female caribou was documented as killed by a pack of 7 wolves in the southern Kilbuck Mountains during February 1988 and another during November 1988. We believe that a pack of 7 wolves, and another pack of 5 wolves ranged over the study area during the last 4 years, and caribou may be an important prey species. We observed 4 caribou kill sites during the November 1991

census, 2 of which had wolves bedded down nearby. A pack of 7 wolves was seen chasing caribou between the Fog River and the Kisaralik River during this survey.

Both the Kilbuck and Andreafsky Mountains support substantial numbers of grizzly bears. Two grizzly bears were observed on the calving grounds in the Kilbuck Mountains during the May 1988 calving ground surveys, and 9 were observed during the 1989 calving ground surveys (Hinkes 1989). We did not observe any bears during the 1990 calving ground survey; however, windy, turbulent weather made visibility more difficult. Although we did not observe any bears during the 1991 or 1992 calving ground surveys, bear tracks and other signs of activity nearby indicated their presence.

Habitat

Assessment: The lichen range in the Kilbuck and southern Kuskokwim Mountains appears in excellent condition, and could support many more caribou. Neither the Andreafsky nor the Kilbuck Mountains have been substantially grazed by caribou or reindeer for over 50 years (Calista Professional Services and Orutsararmuit Native Council 1984). We estimate that the current density of caribou within the KCH range is 0.4 caribou/km^2.

Board of Game Actions and Emergency Orders

The Alaska Board of Game closed the caribou hunting season in Unit 18 south of the Yukon River in June 1985 because we believed harvest was exceeding sustained yield limits. The village of Kwethluk petitioned the Board of Game on 3 April 1990 to reopen the Kilbuck caribou herd to hunting. The board denied their request. On 4 April 1990, Kwethluk residents took their petition to the Federal District Court, and the Court ordered ADF&G to allow residents of Kwethluk to harvest 50 antlerless male caribou.

The Board of Game tried to re-establish a caribou season south of the Kuskokwim River by use of Tier II subsistence permits during a season of 23 February through 15 March 1992. However, local subsistence hunters preferred the federal season (identical to the state season) because it allowed only rural residents of 18 local villages to participate in the hunt. The state season was subsequently closed by emergency order, and only a federal season took place from 23 February through 15 March 1992.

CONCLUSIONS AND RECOMMENDATIONS

The KCH has been studied on a cooperative basis by the USFWS and ADF&G since 1986. Estimated at 2,500 animals, the KCH comprises a distinct herd resident in the Kilbuck and southern Kuskokwim Mountains. We have observed these caribou calving for 7 consecutive years on high ridges near Kisaralik Lake, east and north of Greenstone

Ridge, ridgetops on the southern edge of the Kilbuck Mountains, and the southwest edge of the Kuskokwim Mountains. The herd has continued to expand in size and range.

The decline of the KCH in the early 1980s was attributed to inadequate population monitoring and heavy harvests. In the future, a high priority should be to continue aerial censuses annually to determine herd size. We should also conduct composition counts during spring or fall to determine the sex and age structure of the herd, and to ensure that sex ratios and recruitment remain adequate. We should continue to conduct radio-tracking flights to locate groups for censuses, composition counts, and calving ground surveys. Radio collars should be retrieved periodically and replaced with refurbished collars when collars are dropped, lost to mortality, or battery life is exhausted. The data gathered from aerial surveys and censuses could then be incorporated into a basic simulation model designed to predict population changes.

The range overlap between the Kilbuck herd and the expanding Mulchatna herd needs to be further investigated. Additional animals from both herds should be radio-collared to better establish the overall range and movements of these 2 herds.

The season for Kilbuck caribou has remained closed since June 1985 because previous annual harvests probably had exceeded recruitment. The rapid growth and recovery of the Kilbuck herd since that time confirms our belief that human harvest was probably a major factor limiting herd growth. During fall 1989, knowledge of increasing caribou numbers sparked interest among local politicians and leaders, the media, subsistence hunters, and various agencies about possible future hunting of the KCH. Unfortunately, no formalized management goals were in place. During this time, the Association of Village Council Presidents (AVCP) as well as the FWS continued to support the season closure until population levels increased to suitable levels.

The department realized early on that annual harvests before 1985 probably exceeded recruitment. The season was closed to help the herd recover. However, the department also realized that this and other measures restricting hunting opportunity could never succeed without support from local hunters. Frustration that the season remained closed and a lack of alternative hunting opportunities available to local villages was an obvious concern to area hunters. During spring 1990, ADF&G made a commitment to the Board of Game and the user groups to take the lead in developing a management plan.

Management planning meetings took place between December 1990 to July 1992 between representatives of the users of the caribou resource and the managing agencies. Representatives from 18 villages of the Yukon-Kuskokwim region, Alaska Village Council Presidents (AVCP), the U.S. Fish and Wildlife Service (FWS), and ADF&G have met 8 times to cooperatively draft a KCH management plan. The plan is made up of goals and objectives aimed at promoting conservation of this caribou herd and its habitat.

We should continue to support the management planning process. Eight public meetings with village representatives from the Kuskokwim region and Togiak have already taken place to develop goals and objectives for KCH management and to draft a cooperative management plan. This management plan is already being used to set seasons and bag limits, develop research and enforcement programs, and promote cooperation among the agencies and users in managing the KCH. Support by the users of will be an important component in the future conservation of the KCH. This management plan should be finalized before FY94.

Although survey-inventory activities of the Andreafsky herd were not conducted during the report period, the status of the Andreafsky herd is of significant concern. Local residents continue to provide anecdotal reports of excessive hunting. Only 4 bull caribou have been seen during surveys conducted in the Andreafsky drainage since July 1989, and little evidence is available to suggest that a discreet herd still exists. Conflicts with increasing reindeer herds from the Stebbins and St. Michael area may be occurring as well. Hunters have seen reindeer herds present within or near the Andreafsky Mountains, and cross-breeding may be occurring. We are examining the possibility managing this area as part of the Western Arctic herd. The range of the Western Arctic herd has expanded south into the southern portion of Subunit 22A near Unit 18, and large numbers of Western Arctic caribou routinely winter in the Unalakleet drainage north of the Andreafsky Mountains.

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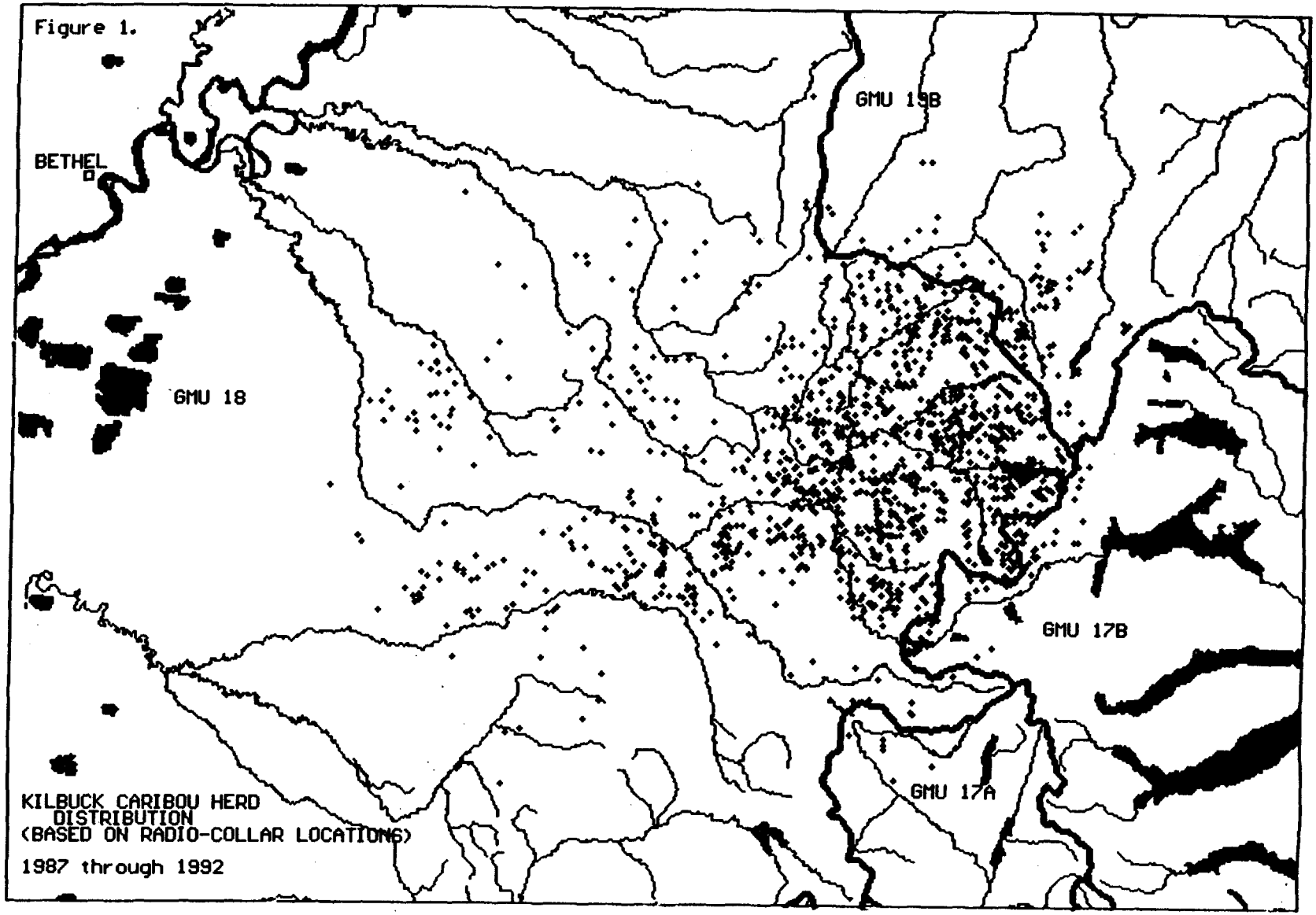

Figure 1. Kilbuck caribou herd distribution (based on radio-collar locations), 1987-1992.

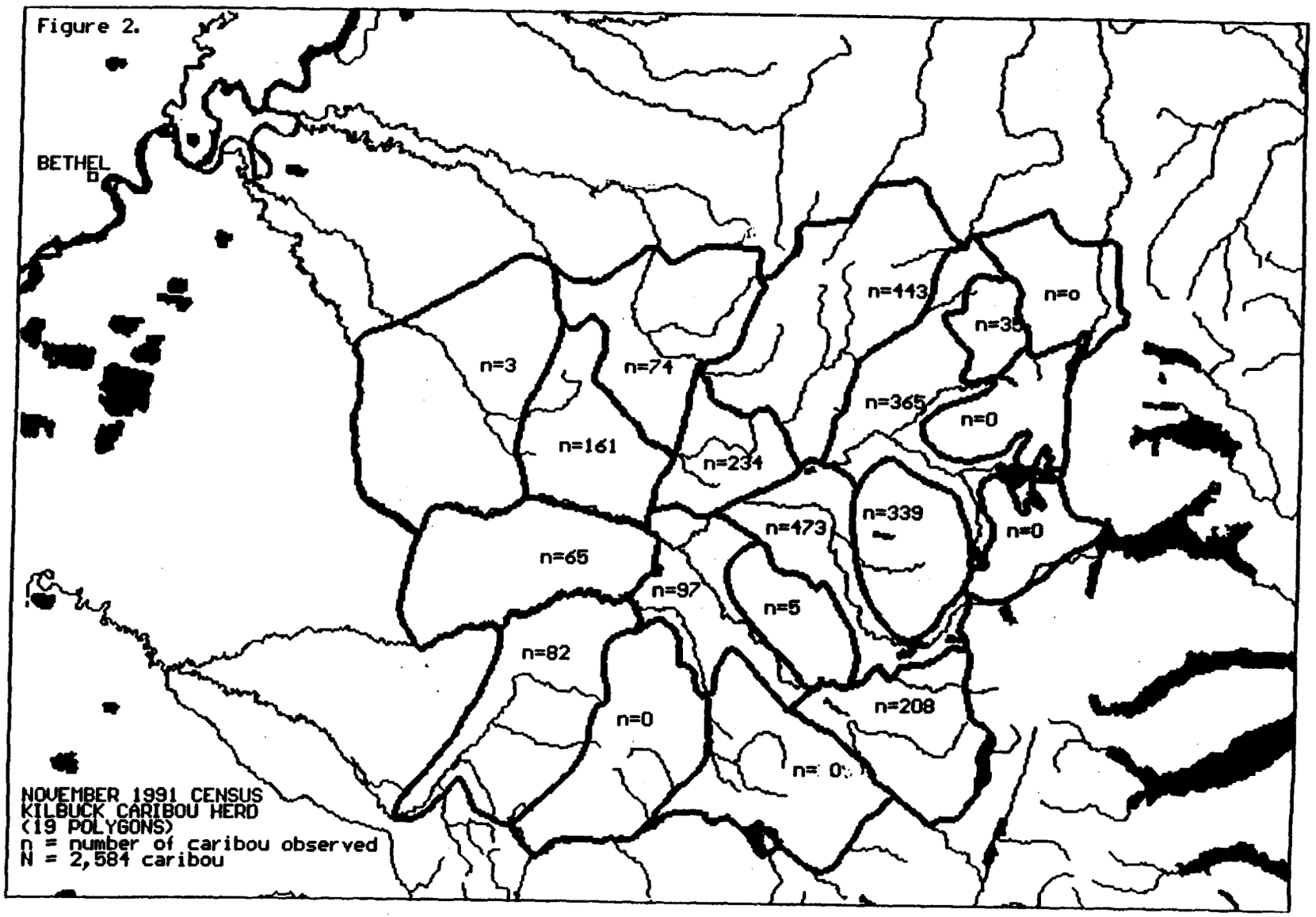

Figure 2. Kilbuck caribou herd, November 1991 census.

LOCATION

Game Management Units: 19 (A, B, C, and D) and 21 (A and E) (60,523 mi^2)

Herds: Beaver Mountains, Big River-Farewell, Rainy Pass, Sunshine Mountains, Tonzona

Geographical Description: All drainages into the Kuskokwim River upstream from Lower Kalskag; Yukon River drainage from Paimiut upstream to, but not including, the Blackburn Creek drainage; the entire Innoko River drainage; and the Nowitna River drainage upstream from the confluence of the Little Mud and Nowitna Rivers

BACKGROUND

Caribou have been historically important historic in this area. Although documentation is poor, discussions with village elders and reports of early explorers (cited in Hemming 1970) support the existence of caribou in far greater numbers and over a greater range in the 1800s than at present. As testament to their previous occurrence, a large mountain in the western Kuskokwim Mountains is called Horn Mountain, a reference to the fact that caribou horns were traditionally gathered there for use as implements and tools by surrounding Native communities. Caribou do not presently exist in that area. I suspect that the Mulchatna caribou herd once roamed throughout the Kuskokwim Basin, but as numbers dwindled they retreated to better range in the south. As the Mulchatna herd increases (the 1992 summer estimate was over 110,000 animals), it is expanding its range north to Subunit 19B and portions of Subunit 19A.

In the Kuskokwim Mountains, which divide Unit 19 from Unit 21, small caribou bands have existed since the turn of the century. Reindeer herders from the Yukon River villages of Holy Cross and Shageluk traditionally herded their animals to summer range in these mountains. As in other areas where reindeer were herded, it was common for herders to lose them. Some people believe that the caribou herds in the Kuskokwim Mountains today are descendants of feral reindeer or reindeer/caribou hybrids. The only possible supporting evidence for this theory is the fact that the Beaver Mountains caribou herd calves much earlier than many caribou herds (early to mid-May), but this may be because of the area's great food abundance rather than the influence of reindeer genes.

Caribou herds in the Kuskokwim Mountains north of the Kuskokwim River were referred to in previous reports as the Kuskokwim Mountains herd or the Beaver Mountains herd and Sunshine (Sunshine-Nixon) Mountains herd (Shepherd 1981, Pegau 1986). In the early 1980s, Pegau (1986) radio-collared caribou in the Beaver and Sunshine Mountains. During his 4-year study, no range overlap was documented. Instrumented caribou from

the Beaver Mountains ranged south almost to Horn Mountain. Caribou in that portion of the Kuskokwim Mountains (near Horn Mountain) had been referred to as the Kuskokwim Mountains herd. Based on Pegau's work, two groups of caribou exist in the Kuskokwim Mountains that warrant herd status; Beaver Mountains and Sunshine mountains.

The presently recognized herds south of the Kuskokwim River include the Tonzona, Big River-Farewell (called Big River in previous reports), and Rainy Pass herds. Telemetry studies confirmed the largely separate identity of the Tonzona herd although some interaction with the Denali herd occurs (L. Adams, pers. commun.). Caribou in the Big River herd were radio-collared near Farewell in the early 1980s by Pegau (1986). During the early studies, instrumented caribou stayed in the Farewell area. However, some of these instrumented animals moved near Swift Fork the following year and did not return for at least 2 years. These observations raised many questions regarding the discreteness and extent of the range of the Big River-Farewell herd.

The Rainy Pass area and headwater drainages of the South Fork of the Kuskokwim River are inhabited by resident caribou. These caribou are called the Rainy Pass herd; this herd is perhaps the least studied and least understood in the state. Major questions remain about herd size, discreteness, and interactions with the Mulchatna caribou herd.

South of the Kuskokwim River there has been little use of caribou by Native hunters in recent times, except that residents of Nikolai and Telida occasionally hunt Tonzona caribou. Mulchatna caribou are increasingly hunted along the Holitna and Hoholitna Rivers and within the Aniak River drainage. The Big River-Farewell and Rainy Pass herds are taken primarily by hunters who fly into the area for moose and bison hunting (Big River-Farewell caribou herd) and sheep and moose hunting (Rainy Pass caribou herd). The Tonzona herd is hunted primarily by guided nonresidents. North of the Kuskokwim River there has been little hunting since 1976, when the winter season was closed in response to a decline in the Beaver Mountains herd. Previously, this herd numbered about 3,000 (Skoog 1963, Hemming 1970). Most winter hunting activity was by residents of McGrath and Takotna on the Nixon Flats (with harvests mostly from the Sunshine Mountains herd). The caribou harvest from the Kuskokwim Mountains (north of the Kuskokwim River) was less than 15 caribou per year since the winter seasons were stopped.

MANAGEMENT DIRECTION

The herds north of the Kuskokwim River are small, lightly harvested, and probably limited in size by predation. Unless these herds increase, they will remain a low management priority. Existing management goals and objectives are to monitor population size, maintain fall seasons, and prevent significant harvest of females.

South of the Kuskokwim River in the Alaska Range, hunting pressure has increased and management goals have been to determine the size, identity, and ability of those herds to withstand harvest.

The present goals and objectives were proposed in 1990 at the Division of Wildlife Conservation's caribou workshop.

Management Goals and Objectives:

1. Ensure that hunting does not cause or continue declines of caribou herds in Game Management Units 19 and 21.

    a. Estimate herd size and trend of the herds south of the Kuskokwim River by fall 1990.

    b. Determine the seasonal ranges and discreteness of the southern Kuskokwim herds, specifically the Farewell-Big River and Rainy Pass herds, by 1993.

2. Provide for continued consumptive use of caribou.

    a. Determine the consumptive demands for caribou in consultation with the Division of Subsistence by 1992.

3. Provide increased opportunity for people to participate in caribou hunting.

    a. Determine minimum population size objectives for various herds and develop seasons and bag limits to attain those objectives by fall 1993.

METHODS

Hunter harvest reports have been keypunched into a database file, reviewed, and tabulated annually, and incidental observations of caribou numbers and calving areas were made. Surveys of the Beaver Mountains and Sunshine Mountains were also made during summer 1992. In those surveys, I surveyed all alpine areas on the north side of the Kuskokwim River from Camelback Mountain to Von Frank Mountain in a Piper PA-18. Caribou were concentrated near snow beds and all caribou were counted and classified as adults or calves. I assisted the major photocensus effort of the Mulchatna herd by surveying the upper elevation aggregation areas of Subunit 19B.

RESULTS AND DISCUSSION

Population Size, Status, and Trend

On 1 July 1992, we tallied 742 caribou in the various Kuskokwim Mountains north of the Kuskokwim River, including the Beaver, Cloudy, Page, Sunshine, and Mystery mountains. Because of weather problems and insufficient time to survey all alpine caribou habitat, I estimated that about half of the caribou in these herds were accounted for, bringing the combined Beaver and Sunshine herd estimate to about 1,500 animals. This is about 200 fewer animals than the 1990 combined estimate. Based on aerial photos taken during the surveys, percentage of calves in the respective herds was 13%.

From these data, it appears that the Beaver Mountains caribou herd is still declining, while numbers in the Sunshine Mountains area have stabilized. There has been light and stable hunting pressure in the Beaver Mountains, while the Sunshine herd is largely inaccessible during fall and receives virtually no harvest during most years when they remain at high elevations. I assume that predation (both wolf and brown bear) limits population growth on both herds.

Distribution and Movements: No additional data have been collected since June 1985 (Pegau 1986). However, harvest analyses and incidental observations provided some insights into caribou movements.

Annual summer censuses of the Mulchatna caribou herd indicate that, as numbers have increased, their range to the north and west has also expanded. During fall and winter caribou hunting seasons they are now commonly harvested along the Stony, Hoholitna, Holitna, and Aniak River drainages. If expansion continues, I expect to document additional harvests, even north of the Kuskokwim River in Subunit 19A and into southern portions of Subunit 19C and 19D.

Members of the Sunshine Mountains herd expanded their fall range to the south during 1992 according to harvest records. For the first time since detailed records have been kept, there were reported caribou harvests in the Nixon Fork flats north of McGrath, indicating this southern expansion. Keeping in mind the extraordinary movements of other caribou herds in the state during fall 1992, however, this may be an anomalous one-time movement.

Mortality

Harvest:

Season and Bag Limit.

Units and Bag Limits	Subsistence/ Resident Open Seasons	Nonresident Open Seasons
Unit 19(A), that portion within the Lime Village Management Area Resident hunters: four caribou, however cows and calves may not be taken from 1 Apr-9 Aug. Nonresident hunters: One caribou.	1 Jul-30 Jun	10 Aug-31 Mar
Unit 19(A) north of the Kuskokwim River Resident hunters: One caribou Nonresident hunters: One caribou	10 Aug-30 Sep 1 Nov-28 Feb	10 Aug-30 Sep
Remainder of Unit 19(A) and Unit 19(B). Resident hunters: Four caribou; however, no more than two caribou may be taken 10 Aug-31 Aug, and no more than one caribou may be taken 1 Sep-30 Nov. Nonresident hunters: One caribou.	10 Aug-31 Mar	10 Aug-31 Mar
Unit 19(C): One caribou	10 Aug-10 Oct	10 Aug-31 Mar
Unit 19(D) south and east of the Kuskokwim River and North Fork of the Kuskokwim River Resident hunters:	10 Aug-30 Sep	

One caribou	1 Nov-31 Jan	
Nonresident hunters:		10 Aug-30
One caribou		
Remainder of Unit 19(D)	10 Aug-30 Sep	10 Aug-30 Sep
One caribou		
Unit 21(A): One caribou	10 Aug-30 Sep	10 Aug-30 Sep
	10 Dec-20 Dec	10 Dec-20 Dec
Unit 21(E): One caribou;		
however, two additional	10 Aug-30 Sep	10 Aug-30 Sep
caribou may be taken	Winter season	
during a winter season	to be announced	
yet to be announced.		

Human-induced Mortality. Reported caribou harvests in Unit 19 and Subunits 21A and 21E have increased since 1988 (Tables 1 and 2). This is probably a reflection of increasing numbers of hunters as well as better compliance with reporting requirements. Even discounting those animals harvested from the expanding Mulchatna herd, the reported harvest more than quadrupled between the 1988-89 season and the 1991-92 seasons. Nonreporting by local residents is a chronic problem, and I suspect that documented harvest from the Beaver Mountains herd, as well as winter season hunts throughout the area, are under-reported by at least 50%.

Hunter Success and Residency. Reported hunter success has averaged about 80% during the past 5 years (Tables 2). Success rates during the 1991-92 season among herds ranged from a low of 57% to a high of 88% for Rainy Pass and Tonzona hunters, respectively. Because of disproportionate returns, however, I believe that reported success rates are significantly higher than actual success rates.

During the 1991-92 regulatory year (for which the most recent complete data are available), residency locations for hunters of all herds in Units 19 and Subunits 21A and 21E indicated that local residents (of Units 19 or 21) composed only 4% of the total hunters. Unit 18 residents made up 15%, while residents of other locations within Alaska (mainly Anchorage and vicinity) accounted for 43% of the reporting hunters. Nonresidents (both other states and nonresident aliens) made up 37% of the total reporting hunters. As mentioned earlier, local residents probably make up a significantly higher actual proportion of hunters, but are habitually poor at reporting their activities.

During the 3-year period from the 1989-90 season through the 1991-92 season, mean number of days hunted by both successful and unsuccessful hunters has evidently declined from a mean of 6.18 days to a mean of 5.32 days. It is unclear whether this is a reflection

of increased success rates or if it relates to shorter times afield because of economic or other constraints.

Harvest Chronology. Most harvest of resident herds occurs during September (Table 4). In recent years more harvest has occurred in the southern parts of Unit 19 in winter because of the expansion of the Mulchatna herd.

Transport Methods. Most hunters of resident herds use aircraft for transport in Units 19 and 21 (Table 5). As Mulchatna caribou continue to exploit new ranges in Unit 19, I anticipate increased use of boats and snowmachines for access to the herd.

Natural Mortality. Although no specific data were collected on natural mortality rates or factors, I suspect that wolf predation is relatively high within most Unit 19 and 21 caribou herds. The extent of that mortality, as well as other natural forms of mortality, has not been quantified in the area.

CONCLUSIONS AND RECOMMENDATIONS

To adequately meet the objectives stated previously, additional funds and effort must focus on gathering basic herd size, population trends, and herd composition data from all herds within Units 19 and 21. The least understood herds, thus those that should be given the highest priority for funds and efforts, are the Rainy Pass and Big River-Farewell caribou herds. Escalating harvest in the Rainy Pass area has probably resulted in overharvest. Shortening the Unit 16 season to align it with the Subunit 19C season, as well as limiting the harvest to bulls only, should be considered and adopted by the Board of Game. Hunters should be continually reminded of the importance of harvest reporting in an effort to better document the actual human harvest. Time and funds should be devoted to assessing the extent of wolf predation on the area's caribou herds.

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Table 1. Caribou harvest ticket return for Game Management Unit 19 and Subunits 21 and 21E for regulatory years 1986-87 through 1992-93.

Herd	Total harvest[a]						
	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93
Beaver Mountains	5	10	3	12	4	13	5
Big River-Farewell	12	26	50	49	69	64	55
Rainy Pass	21	51	56	84	110	101	98
Sunshine Mountains	3	1	0	2	2	0	2
Tonzona	1	27	7	12	15	37	5
Unspecified Herd	1	7	5	8	2	0	0
Totals	44	127	124	168	202	215	165

[a] Sex composition of the harvest is about 90% male.

Table 2. Reported harvest of caribou from the Beaver Mountains, Sunshine Mountains, Big River-Farewell, Rainy Pass, and Tonzona herds, 1988-92.

Regulatory year	Harvest			
	M (%)	F (%)	Unk	Total
1988-89	104 (86)	16 (13)	1 (1)	121
1989-90	152 (91)	13 (8)	2 (1)	167
1990-91	188 (89)	22 (10)	1 (<1)	211
1991-92	186 (86)	30 (14)	1 (<1)	217
1992-93[a]	109 (87)	16 (13)	1 (<1)	126

[a] 1992-93 data are as of 25 January 1993.

Table 3. Residency and success rate of hunters reporting from the Beaver Mountains, Sunshine Mountains, Big River-Farewell, Rainy Pass, and Tonzona herds, 1988-92.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	
1988-89[b]									
1989-90	4	63	97	164 (64)	2	66	25	93 (36)	257
1990-91	2	79	128	209 (71)	2	47	37	86 (29)	295
1991-92	6	99	111	216 (65)	5	78	31	114 (35)	330
1992-93[c]	4	60	63	127 (73)	2	28	18	48 (27)	175

[a] Includes residents of Unit 19 and Subunit 21A.
[b] Data are unavailable.
[c] 1992-93 data are as of 25 January 1993.

Table 4. Chronology of reported harvest of caribou from the Beaver Mountains, Sunshine Mountains, Big River-Farewell, Rainy Pass, and Tonzona herds, 1988-92.

Regulatory year	Month							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Unk	
1988-89	37	16	7	0	0	0	1	61
1989-90	48	103	14	0	0	2	1	168
1990-91	47	150	8	0	2	0	4	211
1991-92	80	122	11	2	0	0	2	217
1992-93[a]	41	80	4	0	1	0	0	126

[a] 1992-93 data are as of January 1993.

Table 5. Transport means of hunters reporting from the Beaver Mountains, Sunshine Mountains, Big River-Farewell, Rainy Pass, and Tonzona herds, 1988-92.

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	n
1988-89	76	4	7	6	1	2	<1	4	191
1989-90	81	3	5	3	2	1	4	1	261
1990-91	90	3	2	2	0	<1	2	1	297
1991-92	76	6	2	7	1	2	5	1	332
1992-93[a]	83	6	3	6	1	1	0	0	172

[a] 1992-93 data are as of 25 January 1993.

LOCATION

Game Management Subunit: 20A (6,796 mi^2)

Herd: Delta (including former Yanert Herd)

Geographic Description: Central Alaska Range and Tanana Flats

BACKGROUND

During the past 25 years, the Delta caribou herd has fluctuated dramatically, declining from 5,000 in 1969 to about 1,500-2,000 in 1975 (Davis *et al.* 1991), then increasing to nearly 11,000 in 1989, and declining to about 6,000 caribou in 1992. The herd has been ideal for long-term research because of its proximity to Fairbanks, the considerable background information available on the herd, options for intensive management, and high public interest in the herd. In addition, the adjacent Denali caribou herd acts as a valuable comparison as an unhunted herd in a similar area. Two 5-year studies of the demography of the herd were completed during the last 9 years (Davis and Valkenburg 1985, Davis *et al.* 1991). When the herd declined rapidly after 1989, we decided to continue this research to better understand the factors regulating and limiting the Delta herd.

Regulations pertaining to hunters pursuing Delta caribou have been relatively complex and have changed frequently. Before 1974, there were liberal either-sex general hunting seasons within the range of the Delta and Yanert herds. From 1974 through 1979, hunting seasons were closed because recruitment was very low from 1972 to 1974 (2-10 calves:100 cows), and the population was low. Hunting resumed in 1980 when 200 drawing permits were issued for bulls only. For 2 more years hunting was by drawing permit only. In 1983, a long, general open season resulted in a harvest of over 1,100 caribou which seemed excessive. Registration permits were tried in 1984, but over 400 caribou were taken in the first 3 days of the season, and an emergency closure was implemented. In recent years, various hunting opportunities have been provided through the Wood River and Yanert controlled use areas, the Ferry Trail and Healy-Lignite Management Areas, winter hunts, and drawing and registration hunts. Hunting has been prohibited in Subunit 20A since November 1991. Davis *et al.* (1991) thoroughly reviewed the regulations from 1968 to 1990.

Before 1987, the Delta and Yanert herds were considered distinct herds based on their segregation during calving. However, by 1987, the growing Delta herd overlapped with the Yanert herd on all seasonal ranges. Since 1988, there has been no biological basis for herd distinction, and the herds have been managed as a single herd. In this report, the Delta and Yanert herds are collectively referred to as the Delta herd.

MANAGEMENT DIRECTION

McNay (1992) summarized the management direction of the Delta herd as follows:

> During the mid-1970's when the Delta herd was relatively small, the Department of Fish and Game (ADF&G) proposed managing hunting to provide an opportunity to hunt caribou under aesthetically pleasing conditions. In 1984, the primary goal was changed to provide the maximum opportunity to participate in caribou hunting. A secondary goal of providing the opportunity for hunters to take large bulls was also proposed. The secondary goal was unpopular, as there was considerable public opposition to a regulation proposal which would have restricted the take of caribou with over 20 points (i.e., large bulls). The population objective in 1976 was 4,000; however, uncertainty about the optimal population level prompted managers to allow the herd to continue growing."

The herd grew to an all-time high of nearly 11,000 caribou in 1989. A composition survey in fall 1989 revealed that the herd contained very few large bulls (2:100 cows). To ensure that some large bulls were left in the population after the hunting season, we revised our management objectives to include a minimum large-bull:cow ratio. In addition, the Board of Game shortened the 1-15 September hunting season by deleting the last 5 days.

The Delta herd began to decline dramatically in 1989, but the role of density dependent population regulation was unclear because most other herds (including those at both high and low densities) were also declining (Valkenburg 1992). The Delta herd decline has been discussed at length by the Board of Game in recent years. In November 1992, the board approved an aerial wolf control program in Subunit 20A to decrease mortality in the declining herd. However, the administration directed the ADF&G not to proceed with the program in 1993 because of public opposition, and the board rescinded their approval in January 1993. In June 1993, however, the board reaffirmed the direction they wanted the department to proceed by authorizing a ground-based control program that is scheduled to begin on 1 October 1993.

McNay (1992) also summarized that "In 1979, the Alaska Legislature passed a "subsistence law" giving rural residents preference in hunting where there had been a history of "customary and traditional use." In 1987, the Board of Game determined that there had been no significant subsistence use of Delta and Yanert caribou. A board proposal to consider the Delta herd as a "subsistence designated herd" also failed. Therefore, subsistence use has not been a major consideration in management planning." In October 1992, the Joint Boards of Fisheries and Game established the Fairbanks Nonsubsistence Area which prohibits subsistence hunting and fishing regulations from being established within the area. This area includes most of the range of the Delta herd.

During the beginning of this report period, we were working under the following goals and objectives. Since then, we have modified objectives several times in response to the recent dramatic population decline. The revised objectives are discussed in the "Conclusions and Recommendations" sections of this report.

Management Goals and Objectives

1. To manage herd size, harvest, and predation to provide a maximum number of people with the opportunity to hunt caribou with a reasonable chance of success consistent with social and biological constraints.

   a. To determine optimal herd size and harvest by allowing the Delta herd to increase slowly until population responses to increased density become apparent and/or limiting.

   b. To gather information on the quantitative relationship of wolves and grizzly bears to caribou.

2. To manage the sex ratio of the herd to ensure that some large males are available after the fall hunting season.

   a. To maintain a bull:cow ratio of at least 30:100 and a large-bull:cow ratio of at least 6:100.

3. To manage herd size and harvest to provide information on the population dynamics of caribou and their predators.

   a. To determine optimal herd size and harvest by allowing the Delta herd to increase at about 5% annually until population responses to increased density become apparent and/or limiting.

   b. To gather information on the quantitative relationship of wolves and grizzly bears to caribou.

METHODS

Population Size

We estimated population size by censusing the herd using the modified aerial photo-direct count-extrapolation (APDCE) (Davis *et al.* 1979) and/or radio-search technique (Valkenburg *et al.* 1985). Caribou were photographed with a Fairchild T-11 9x9-inch belly-mounted aerial camera in a Dehavilland Beaver and with 35mm cameras (Kodak

Ektar ASA 100) from other fixed-wing aircraft. Small groups were counted but not photographed.

1991: On 23 June 1991, we censused the herd with the following 3 pilot/observer teams: M. McNay/R. Hunter (Scout), D. Miller (Caribou Air Service)/E. Crain (PA-18), and P. Valkenburg/D. Reed (Beaver). Using radio telemetry to locate collared caribou, McNay/Hunter searched from Molybdenum Ridge to the West Fork of the Little Delta and the Upper Wood River drainages; Miller/Crain searched the lower eastern Wood River drainage and the benches; and Valkenburg/Reed searched the western Wood River drainage and the Yanert and Wells Creek drainages. They completed a visual search without extrapolation, using radio-collared caribou as a supplement to ensure that all aggregations were located. Visual searches in the assigned count areas were also conducted after radio-collared caribou had been located. None of the radio-collars were on bulls. Weather and survey conditions were "good". Valkenburg and I counted caribou on the photographs using a 10X magnifier.

1992: On 29 June 1992, we censused the herd with 4 pilot/observer teams. McNay/B. Lenart used the Scout to search west of the Wood River, north of Cody Pass, and east of the Totatlanika River. They used radio-telemetry to locate collared caribou and searched for caribou on snowbeds in the remaining area. J. Schnurr (Tamarack Air) and I used a PA-18 to search the Wood River drainage upstream from Cody Pass. We did not have telemetry equipment but thoroughly searched the area except for the ridges between the Wood River and Yanert drainages, which had moderate-to-severe turbulence. Valkenburg, J. VerHoef, and R. Seavoy used the Beaver to locate radio-collared caribou that were not in McNay/Lenart's area. They also searched for caribou and tracks on snowbeds in the eastern Wood River drainage north of Anderson Mountain, Dry Creek, the Upper West Fork of the Little Delta River, lower Gillam Glacier, Black Rapids and 100-Mile Creek, and between Dean and Dick Creeks. Beginning at 1:30pm, Valkenburg/VerHoef used the Scout to continue searching for 4 missing radios and completely searched Dick and Edgar Creeks.

Search conditions were fair-to-good. Although skies were intermittently hazy/cloudy throughout the day, light was favorable for spotting caribou. However, by the time all large groups had been located, clouds were building up and photography was difficult. Hot weather (58°F in Grizzly Creek, 79°F at Gold King) resulted in caribou seeking insect relief on snow patches, which improved sightability. Before this census, our attempts to census the herd were delayed because of unseasonably cool weather and strong winds that did not abate until 28 June. Valkenburg and McNay counted caribou on photographs using a 10X plalupe.

Population Composition

During this report period, we conducted 5 composition counts on the Delta herd, including fall counts in 1990, 1991, and 1992, and late winter counts in 1990 and 1991.

Fall: We based our classification during the fall survey on the following criteria:

Cow	Vulva visible as dark vertical line; body size larger than calf.
Calf	Small body size; short face; antlers small, often only a spike or with one brow tine, antlers black and velvet covered. Behavioral cues often helped confirm classification as a calf.
Small Bull	"Cow-sized" animal or somewhat larger with antlers nearly indistinguishable from an adult cow; uniformly whiter rump below anus; tail often has a "cottontail appearance"; penis sheath occasionally visible from the side. This category includes all yearlings and many 2-year-olds.
Medium Bull	Antlers clearly larger than cows or small bulls; uniformly white rump below anus; as in small bulls, tail may appear fuller than in cows. This category includes bulls of several cohorts, includes some 2-year olds, all 3-year-olds, and some 4-year-olds.
Large Bull	Large-bodied, white-maned bulls; fully mature antlers that probably would not undergo significantly greater development in antler spread, beam length, or weight in subsequent years. This category includes some 4-year-olds and most older bulls.

1990. On 4 October, J. Davis and M. McNay classified caribou associated with 36 of the 43 functioning radio-collared caribou. They located caribou during 2 days of radio-tracking immediately before the survey and on the day of the survey. I recorded data and searched for caribou from the back seat of the helicopter. Weather included scattered clouds, thin overcast, 30°F and visibility of 40 miles; winds gusted to 30 knots on ridges.

1991. On 1 October, P. Valkenburg located 34 of 36 functioning radio-collared caribou from the Scout. M. McNay and I classified caribou associated with collared animals, and other caribou observed en route, from a Bell 206 helicopter piloted by Gene Peery (ERA Helicopters). Weather had been unseasonably warm in September and during the survey snow was present only on ridges above 6,000 feet.

1992. On 28 September, P. Valkenburg located 45 of 46 radio-collared caribou from the Scout and provided the Global Positioning System (GPS) locations to the survey crew. I classified caribou associated with collared caribou, and other caribou observed enroute, from a Bell 206 helicopter piloted by Jim Ackles (ERA Helicopters). T. Boudreau recorded GPS locations and classifications from the back seat of the helicopter.

Throughout most of the day, the Tanana Flats were overcast and it was snowing in the foothills. A snowstorm moved in from the east in the afternoon and obscured skies in

portions of the flats as well. Temperatures ranged from 25-35°F, no wind, and light was relatively flat. Ice covered approximately 20% of the Tanana River. Deciduous trees still had most of their leaves on them and were bent over from the weight of snow on the leaves. Although we did not land in the flats, it appeared that snow was 1-2 feet deep.

Late Winter: We used late winter counts to assess overwinter mortality after the relatively severe winters of 1989-90 and 1990-91. Even though the winter of 1991-92 was also relatively severe, we cancelled plans to do a 1992 late winter composition count because the calf:cow ratio was so low in October 1991. We weighted the April count data according to the distribution of radio-collared caribou.

Mortality

Harvest: We calculated reported hunting pressure and harvest with harvest report cards from the general season and permit hunts. These data were entered onto a DBASE file. The reporting rate for hunters is high for permit hunts and much lower for the general season.

To estimate unreported harvest and hunting pressure for the general season, we interviewed hunters from 1986 through 1990 during the first 2 weeks of September. We contacted hunters in hunting camps by landing at most known landing areas daily. In 1989 and 1990, we also operated a check station at the entrance to the main trail into the Yanert drainage and at Gold King airstrip. During the interview, we recorded the hunter's harvest ticket number and whether or not they had been successful. To reduce reporting bias, we did not reveal the purpose of the interviews to hunters; we conducted interviews as simple license checks.

To calculate a correction factor for unreported harvest and hunting pressure, the harvest report and interview data were treated as a mark-recapture sample. Confidence limits were determined for the estimates using a binomial confidence limit computer program (McNay 1990).

Other Mortality: We assisted a research project by collecting data on the causes and extent of mortality of radio-collared caribou.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Between 1979 and 1989, the Delta herd population size grew nearly continuously. The number of caribou counted during the censuses declined dramatically (46%) between 1989 (10,690 caribou) and 1991 (5,755) (Table 1). Census results from 1992 (5,877) were similar to 1991.

Davis *et al.* (1991) concluded that herd growth was detectable in census data at 3-year intervals, but that census data were not precise enough to detect change over a 1- to 2-year period. Census estimates are also influenced by that year's recruitment because all caribou on the photographs are counted, including calves.

Census results provide us with a minimum herd size because each year an unknown number of caribou are not counted during the census. The size of this missing segment varies from year to year. Confidence in our census results is highest when our census includes most or all our radio-collared caribou. The 1991 census results included approximately 1,000 caribou fewer than the population size predicted through spreadsheet computer modeling (Valkenburg 1992). However, we believe that the likelihood of us missing 1,000 caribou was relatively low because we had located 36 of 37 radio-collared caribou during the census.

We also may have missed some widely scattered small groups of caribou during the 1992 census. Although we located 45 of 46 radio-collared caribou, 7 of these (16%) collared caribou were in groups of less than 10 caribou each. The herd probably included about 6,000 caribou.

Population Composition:

Recruitment. During the last 3 years, recruitment to the Delta herd has been very low, as evidenced by fall calf:cow ratios of 17:100 (1990), 8:100 (1991), and 11:100 (1992) (Table 1). These low calf:cow ratios contrast to much higher ratios (29-46:100) during the previous 7 years.

Poor recruitment was not unique to the Delta herd. Low calf:cow ratios during the last 3 years were also recorded for the adjacent Denali (7-17:100) and Macomb (9-17:100) herds, but were not as low for the White Mountains (23-24:100) or Fortymile (16-30:100) herds.

Bull:Cow Ratios. Bull:cow ratios are influenced by recruitment, hunting, segregation of bulls away from cows, timing of composition counts, and observer classification. Fall bull:cow ratios in the Delta herd have varied widely during the last 10 years (Table 1). Ratios increased from 1983 (35:100) to 1985 (49:100), then generally decreased during the next 5 years to only 27:100 in 1989, which was below our objective for 30:100. To increase the low bull:cow ratio, the general season for fall 1990 was shortened by 5 days and the number of permits for Hunt 570 was reduced from 200 to 100. The first year of these changes, the bull:cow ratio increased to 38:100. However, since then, ratios have been below our objective of 30:100 (29:100 in 1991, 25:100 in 1992), even though the hunting season was closed in 1992. Unless recruitment improves, the bull:cow ratio will not recover.

Since 1985, the number of large bulls in the population has been relatively low (<10 large-bulls:100 cows during fall). After observing only 2 large-bulls:100 cows in 1989, we established an objective to maintain at least 6 large-bulls:100 cows. The shortened 1990 hunting season probably protected some large bulls but the large-bull:cow ratio has remained low, with only 6:100 in 1990, 5:100 in 1991, and 3:100 in 1992. Some of the difference in these ratios pre- and post-1985 could be because observers used different cutoffs for what they considered large bulls. Before 1985, most classifications were done by a different observer than after 1985. We expect the large-bull:cow ratio will remain low, even without harvest due to increased natural mortality and poor recruitment in recent years.

Overwinter survival of calves. Davis *et al.* (1991) concluded that estimates of calf:cow ratios in late winter were neither precise nor accurate, but were useful in detecting large interannual changes in survival. From 1983-84 to 1985-86, calf:cow ratios increased from fall to late winter (Tables 1 and 2). In contrast, calf:cow ratios have decreased from fall to late-winter since 1987-88. This decrease was most dramatic after the relatively severe winters of 1989-90 and 1991-92, and probably reflects higher calf mortality. Spring composition counts are not used to indicate overwinter mortality of bulls because bulls and cows are segregated in spring. Most radiocollars are on cows and we use telemetry to lead us to caribou for classifying. Consequently, we miss more bull groups during spring counts.

Distribution and Movements

From before the 1950s through the mid-1980s, the Delta herd showed strong fidelity to traditional calving areas along upper Delta River and Delta Creek in southeastern Subunit 20A (Davis *et al.* 1991). However, as the Delta herd increased, it expanded the area it used for calving. Between 1980 and 1987, the Delta herd calved in the foothills between Dry Creek and the Delta River (Valkenburg *et al.* 1988) and the Yanert herd calved between the upper Yanert and Wood Rivers. Since about 1988, the calving areas used by the Delta and Yanert herds have overlapped considerably and the herds have collectively been referred to as the Delta herd.

McNay (1992) noted that: "Snow depth, timing of deposition, and persistence appear to influence caribou in both their selection of specific calving sites and in initiation of major seasonal movements. One example occurred when caribou were dispersed throughout the eastern foothills during late August and early September 1987. On 11 September 1987, about 10 inches of snow fell in the foothills of the Alaska Range, and within 2 days most of the caribou had moved westward across the Wood River toward rutting and wintering areas. During 1988, in the absence of significant snow, caribou remained distributed throughout the eastern and western foothills until late September. A second example occurred during 1990 when caribou were widely distributed on the Tanana Flats in October, November, and early December but moved into the foothills when snow depth

increased in late December. Many moved into the Yanert River drainage where snow depths were much less than in the remainder of western Subunit 20A."

Fall and Winter 1990-91: Valkenburg (1992) noted that caribou were widely distributed in the foothills during the hunting season in early September. By the rut in early October, most caribou were in the western foothills. They moved to the western Tanana Flats by early November. Within a few days after a major snowstorm in late December, most caribou were moving south into the foothills. By mid-January, only one collared caribou was still on the flats. For the remainder of the winter, the herd was divided about evenly between the western foothills and the southwest Yanert drainage. This was the first winter that a large segment of the Delta herd used the Yanert drainage for winter range.

Calving and Postcalving 1991: In mid-May, most caribou were on the traditional calving area around Delta Creek. A major movement to the southwest began approximately 21 May. Peak of calving was about 24 May and occurred in the upper Wood River, Dick Creek, and Wells Creek.

The distribution of caribou during postcalving aggregations in late June/early July was typical of recent years. The largest groups were found in the West Fork of the Little Delta River and in Kansas Creek.

Fall and Winter 1991-92: Valkenburg (1992) stated that during the hunting season, most caribou were on the eastern portion of the range, especially in the area north of Iowa Ridge. From October through the rest of the winter, the herd was split into two groups. One group remained in the eastern range of the herd near traditional calving grounds (Little Delta River and Delta Creek drainages). The other group was in the southwest range of the herd in the Dick Creek drainage of the Yanert, an important calving area in recent years.

McNay (1991) noted that the weather during September was unseasonably warm, and on October 1 snow was present only on the ridges above 6,000 feet. He stated that the late summer-like weather may have influenced the distribution of caribou, also noting that the herd's movements in general have been less predictable in recent years. He speculated that range conditions in the western foothills may have been a factor in weakening the traditional movements.

Calving and Postcalving 1992: Valkenburg (1992) noted that spring was very late in 1992 and on 20 May the only bare ground was in the Delta Creek Impact Area on military land. All radio-collared caribou were there or on the adjacent traditional calving area until 22 May. Then, half of the collared caribou moved southwest into upper Wood River, with one or two other collared caribou continuing to Dick Creek in the Yanert drainage. The caribou that moved into the Wood River were in an area of virtually 100% snow cover. However, by the time most calves were born (peak 24 May), a few bare patches were showing on steeper southfacing slopes in this Wood River area. Many

caribou that remained in the Delta Creek area calved among the target arrays on the tussock flats east of Delta Creek on military land. We notified the Air Force that caribou were still on military land and Air Force staff flew over the area in spotter planes to make sure that caribou had not been bombed. Many avalanches occurred during the calving period, although we did not document any caribou mortality due to them.

During the postcalving aggregation in late June/early July, we found most of the herd in McIntyre Creek (upper West Fork of the Little Delta River), the headwaters of Moose Creek/Gold King Creek west of the Wood River, the Dry Creek/Kansas Creek divide, and the headwaters of the East Fork of the Little Delta River.

Fall and Winter 1992: The hunting season for the Delta herd was closed in 1992, so we did not monitor movements of the herd before late September. On about 20 September, most of the herd was in the western foothills of Subunit 20A. However, by 28 September, the herd had made a highly unusual northeasterly movement from their normal rutting area in southwest Subunit 20A, and virtually the entire Delta herd was on the Tanana Flats. On 5 October we estimated that 1,600 Delta herd caribou were within 10 miles of Fairbanks based on the distribution of radio-collared caribou. Approximately 700 of these had crossed the Tanana River and were west and north of Fairbanks. Record-breaking snow and cold in September probably precipitated this unusual movement. Twenty-four inches of snow fell in September which is more than three times the previous record snowfall. Temperatures were 13°F colder than average, making it the coldest September on record.

The unseasonable fall weather affected the distribution of other Interior herds as well. The Denali herd, adjacent to the Delta herd, also made an unusual northeasterly movement in September from their normal rutting/wintering area in the Stampede and Kantishna Hills area. The overlapping ranges of the Denali and Delta herds was documented when 6 radio-collared caribou (representing about 120 animals) from the Denali herd were located north of the Tanana River in the same area as the Delta herd. Biologists also found several other collared Denali caribou on the Tanana Flats south of Fairbanks in the same area as the Delta herd.

From late December through late April, the Delta herd was concentrated in 4 main areas: 5-10 miles west of Gold King in the Tanana Flats, east of the Eielson Air Force base runway, the East (Middle) Fork of the Chena River, and the Chatanika and Washington Creek drainages near the TAPS pipeline corridor. Two collared caribou from the Delta herd were north of the Steese Highway in the range of the White Mountains herd. Locations of radio-collared caribou confirmed that at least portions of the Delta, Denali, and White Mountains herd ranges overlapped throughout the winter.

Mortality

Harvest:

Season and Bag Limit. Regulations applying to caribou hunters in Subunit 20A have been relatively complex to provide for a variety of hunting opportunities and have changed frequently. Southwestern Subunit 20A currently includes the Wood River and Yanert Controlled Use Areas (no motorized access, except aircraft), and the Ferry Trail Management Area (caribou hunting by permit only) and the Healy-Lignite Management Area (bowhunting only). Historical caribou hunting regulations (1968-1990) for Subunit 20A were summarized in Davis *et al.* (1991). I have listed regulations for this reporting period in Table 3.

Board of Game Actions and Emergency Orders. *Regulatory year 1990-91:* During March 1990, the Board of Game reduced the fall general caribou hunting season from 15 to 10 days in Subunit 20A, reduced the number of permits in Hunt 570 from 200 to 100, and established 2 winter registration permit hunts (Hunts 569 and 574) and 1 winter drawing hunt (Hunt 573). They replaced Permit Hunt 571 for either sex of caribou in the Yanert River Controlled Use Area with a 15-day January general season in the Yanert. The newly established winter hunts were open for antlered caribou only with a quota of 250 cows. These changes fulfilled an ADF&G proposal to reduce the harvest of large bulls and to provide hunting opportunity directed toward cows during winter.

Two of the three winter permit seasons were closed early by Emergency Order. The Middle Nenana Advisory Committee submitted an emergency petition to the board to close the winter season for antlered caribou because they opposed shooting cows. The board decided that a biological emergency did not exist and they denied the request. However, before the winter hunts began, we determined that the herd had declined and recruitment was very low, so we reduced our original quota of 250 cows for winter hunts to 100 cows. The new quota allocated 50 cows to combined Hunts 569 and 574, and 50 cows for Hunt 573. The 50 cow quota for Hunts 569 and 574 was quickly met because the herd was very accessible; these 2 hunts were then closed as of 14 February 1991 by Emergency Order (No. 3-01-91). Hunt 573 proceeded as planned.

Regulatory year 1991-92: Because of concern about the Delta herd population decline, in March 1991 the board deleted the winter drawing Hunt 573, shortened the season for registration Hunt 569 to 1-15 February (Ferry Trail Management Area, 75 permits) and Hunt 574 to 16 February - 1 March (remainder Subunit 20A, 175 permits), and increased the number of drawing permits for the fall Hunt 570 (Ferry Trail Management Area) from 100 to 200 permits. However, after these changes, the June 1991 census and October 1991 composition counts confirmed a continuing population decline and poor recruitment, and all winter hunts for caribou in Subunit 20A were cancelled by Emergency Order (No. 3-11-91) in November 1991.

Regulatory year 1992-93: In March 1992, the board closed all caribou hunting in Subunit 20A because of the continuing decline in the herd. In Fall 1992, the Joint Boards of Fisheries and Game established the Fairbanks Nonsubsistence Area, which includes most of the traditional range of the Delta herd. The Joint Boards concluded (Finding 92-24-JB) that dependence upon subsistence is not a principal characteristic of the economy, culture, and way of life in this area or community. No subsistence hunting or fishing regulations are permitted within a nonsubsistence area.

Following the Joint Board meeting, the Board of Game adopted the department's draft Area Specific Wolf Management Plan for Southcentral/Interior Alaska, which was drafted after extensive public review. The plan outlined population and harvest objectives for big game species and zoned the entire area into 1 of 7 management zones, based on the intensity of human use and management. Most of the Delta herd's range was zoned as a 6 or 7 (high human use and moderate/intensive management). The board also passed an Implementation Plan for reducing the number of wolves in a portion of Unit 20A by 70-80% using aerial control. This wolf control program was intended to prevent a further decline in the Delta Herd by reducing predation. However substantial public controversy surrounded this program, and the Board of Game rescinded their November actions during a January 1993 meeting. The board discussed alternative wolf management strategies at a special meeting in June 1993 and authorized a ground-based control program for Subunit 20A.

Hunter Harvest. During the 1990-91 general and permit hunting seasons, we estimate that 1,300 hunters harvested 549 caribou (Table 4). We calculated these estimates by dividing the reported harvest and hunting pressure (196 successful and 229 unsuccessful hunters) from the general season by an estimate of the reporting rate for successful and unsuccessful hunters (51% and 34%, respectively). We had estimated these reporting rates after interviewing 133 general season caribou hunters in the field and treating the data as a mark-recapture sample (McNay 1990). We combined the resulting estimates for the general season (384 successful, 673 unsuccessful) with data from permit hunts (165 successful, 78 unsuccessful) for the estimate of total harvest and hunting pressure. A correction factor was not applied to permit hunts because reporting rates are very high. The reported harvest from the general season and permit hunts included 275 bulls, 83 cows, and 3 unknown sex.

During the 1991-92 general and permit hunt seasons, we estimate that 1,287 hunters harvested 456 caribou. Because we did not conduct field interviews in 1991, we estimated harvest for the general season by dividing the reported number of general season successful hunters (204) and unsuccessful hunters (212) by average reporting rates from 4 years without publicity campaigns (57% and 31% for successful and unsuccessful hunters, respectively). We combined these general season estimates (358 successfuls, 684 unsuccessfuls) with data from Permit Hunt 570 (98 successful, 147 unsuccessful) for the total estimate. The reported harvest from the general season and permit hunt included 277 bulls, 22 cows, and 3 of unknown sex.

The 1990-91 and 1991-92 reported caribou harvests were the lowest recorded since 1982-83. In 1990-91, the distribution of caribou during the fall was favorable for hunters. In spite of this advantage, harvest may have decreased because of bad weather (1-7 Sept.) during the fall hunting season, a shorter fall hunting season (1-10 September vs. 1-15 September in previous year), and a decline in herd size. In 1991-92, most caribou were on the eastern portion of the range, especially north of Iowa Ridge during the hunting season.

The hunting season was closed throughout 1992-93.

Permit Hunts. Since 1986, caribou hunting in the FTMA has been open by drawing permit only (Hunt 570) because of the easy 4-wheeler access to caribou via the Ferry Trail. The FTMA was not formally established, however, until 1990. Between 1986 and 1991, the department issued 200 drawing permits for this area each year except in 1990 when only 100 permits were issued. In years when we issued 200 permits, reported harvests ranged from 98 to 122 caribou (x = 112). When we issued 100 permits, 68 caribou were reported harvested (Table 5). The proportion of cows harvested in Hunt 570 ranged from 14% (16/117) in 1989-90, to 18% (12/68) in 1990-91, to 21% (21/98) in 1991-92; this increase may reflect a decline in availability of bulls.

During February and March 1991, hunters reported taking 97 caribou (52 cows, 42 bulls, 3 unknown sex) in the 3 newly-established winter hunts for the Delta herd (Table 6). Permittees hunted caribou (1) 1-13 February 1991 in the FTMA in Registration Hunt 569, (2) 1-13 February 1991 in the portion of Subunit 20A outside the FTMA and YCUA in Registration Hunt 574, and (3) 1-31 March 1991 in the portion of Subunit 20A outside the FTMA and YCUA in Drawing Hunt 573. The original season of 1-28 February for the registration hunts was closed by Emergency Order after the 50-cow quota for February was reached. Hunters in March were much less successful because of the relative inaccessibility of the caribou; they only harvested 12 of the 50-cow quota.

Harvest rates. Although Bergerud (1980) calculated that the theoretical maximum growth rate for caribou is r = 0.30, annual herd growth has approached this only in transplanted herds. Growth of much over 20% is uncommon, even under highly favorable circumstances. Davis *et al.* (1991) stated that caribou herds with good recruitment (>20% calves in fall) and adult survivorship (>90% annual survivorship) can sustain harvests of >10%. In contrast, herds with moderate or high predator:caribou ratios can withstand harvests of <5% and limited to bulls only. Since 1980, annual harvest rates in the Delta herd have varied from almost 20% to <5%, depending upon recruitment, weather, population objectives, and adult mortality. Hunters harvested 5-8% of the Delta herd annually from 1987-1991, and harvest was largely restricted to bulls.

Hunter Residency. In 1990-91, most hunters during the general season were from the Fairbanks/North Pole area (36%), were nonresidents (21%), or were from the Anchorage area (20%). Most permittees for the winter registration hunts were residents of the

Fairbanks/North Pole/EAFB area (62%) or Nenana (24%). Permittees for Hunt 570 were primarily from the Anchorage vicinity (38%), the Fairbanks/North Pole/EAFB vicinity (36%), or the Clear/Healy/Denali Park vicinity (15%). I did not tally the residency of permittees that actually hunted.

In 1991-92, nearly half (47%) of the hunters during the general season were from the Fairbanks area. Hunters from the local communities of Healy, Anderson, Clear, McKinley, and Cantwell represented 13% (54/516) of the general season hunters. Twelve percent (48/416) of the general season hunters were nonresidents. Of the permittees that participated in Hunt 570, 41% (81/147) were from the Fairbanks/North Pole/FtWW area, 36% (71/147) were from the Anchorage/Palmer/Wasilla vicinity. Only 10% (19/147) of the hunters were from the local communities of Anderson, Clear, and Healy.

Hunter Success. In 1990-91, the reported hunter success rate for the general season was 46% (196/425). Most (80%) (68/85) of the hunters in Hunt 570 were successful. Hunter success rates for the winter permit hunts varied with the distribution of the herd. In February, the herd was distributed fairly evenly between the FTMA, upper Healy Creek, and the Yanert. All 54 hunters participating in Hunt 569 (FTMA) were successful and 55% (18/33) of hunters in Hunt 574 (Remainder 20A) were successful. By March, the herd had moved south and east and was not as accessible; only 35% (25/71) of the hunters participating in Hunt 573 were successful.

In 1991-92, the reported hunter success rate for the general season was 49% (204/416). Success was higher (67%) (98/147) for hunters in Hunt 570.

Other Mortality: According to Davis *et al.* (1991), caribou:predator ratios changed from about 1 wolf:101 caribou and 1 grizzly bear:31 caribou in 1979 to about 1 wolf:50 caribou and 1 grizzly bear:61 caribou in 1989. They stated that throughout the history of the Delta herd, wolf abundance has correlated negatively with the caribou recruitment rate and positively with the natural mortality rate. Further, that determining if this relationship is one of cause and effect is confounded because of unknown density-dependent relationships within the caribou population. A separate research project is currently investigating factors regulating and limiting the Delta herd.

Calf mortality was extreme during summers 1990 and 1991, and high during winters 1989-90 and 1990-91 (Valkenburg 1992). Adult mortality was also relatively high. The preliminary estimate of 20% annual adult female natural mortality (6 of 40 adults and yearlings died between 1 October 1991 and 30 June 1992) was the highest ever recorded for the Delta herd.

Habitat

Because of the concern that the decline in the Delta herd may be influenced by density dependent factors related to habitat, we are: (1) studying the influence of weather on the

nutritional quality of plants, (2) collecting fecal samples on the winter range to determine if the abundance of lichens in the caribou diet has declined, (3) weighing female caribou as indices to body condition, and (4) studying the effects of habitat on natality rates. Results from these studies will be discussed in research reports.

CONCLUSIONS AND RECOMMENDATIONS

We have been unable to avoid a precipitous decline in the Delta herd by reducing human harvest. Despite a hunting closure since November 1991, the herd has continued to decline. This decline is because of increased mortality of calves and adults, and decreased fecundity of cows. Valkenburg (1992) hypothesizes that the relatively severe winters of 1989-90, 1990-91, and 1991-92 contributed to increased winter mortality primarily from wolf predation. He also hypothesized that lower productivity has resulted from warmer and perhaps drier than normal summer weather by reducing parturition, and probably conception rates of adult females, and reducing body condition in calves and adults.

To achieve the goal of providing maximum opportunity to hunt the herd, we had an objective to determine optimal herd size and harvest by allowing the herd to increase slowly until the population responses to increased density become apparent and/or limiting. Therefore, we are particularly interested in determining whether or not the recent decline from an all-time high of about 10,700 caribou in 1989 to less than 6,000 in 1991 reflects such a mechanism. Relatively severe winters during this population decline have made it more difficult to determine whether or not the population is responding in a density dependent fashion. We are cooperating with Research Project 3.37 to evaluate factors influencing the population dynamics of the herd.

Because of the weakness of the 3 recent cohorts, I anticipate continuing to fail to meet our objective to maintain at least 6 large bulls:100 cows in the herd for at least several more years.

We recommend revising the objectives for the next report period as follows:

1. To maintain at least 30 bulls:100 cows and at least 6 large-bulls:100 cows in the herd.

2. To reverse the decline of the herd and increase the mid-summer population to 6,000-8,000 caribou.

3. To sustain an annual harvest of 300-500 caribou.

4. Gather information on predator:prey ratios and on the significance of predation, weather, and density as mortality factors that potentially limit the Delta herd.

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Table 1. Delta caribou herd fall composition counts and estimated population size, 1983-92.

Survey date	Bulls: 100 C	Large Bulls: 100 C	Calves 100 C	Calves %	Cows %	Small bulls % of bulls	Medium bulls % of bulls	Large bulls % of bulls	Total bulls	Composition sample size	Minimum herd size[a]
10/4/83	35	12	46	25	55	59	6	36	20	1208	5,055
10/17/84	42	17	36	20	56	28	32	40	24	1093	6,227
10/9-12/85	49	9	36	20	54	57	24	19	26	1164	8,083
10//22/86	41	9	29	17	59	49	30	21	24	1934	7,204[b]
10/05/87	32	8	31	19	61	53	23	24	20	1682	7,780[b]
10/14/88	33	4	35	21	60	50	38	12	20	3003	8,338[c]
10/10/89	27	2	36	22	62	64	28	7	16	1965	10,690
10/4/90	38	6	17	11	65	45	39	16	24	2411	7,886[c]
10/1/91	29	5	8	6	73	55	29	16	21	1705	5,755
9/28/92	25	3	11	8	74	46	43	11	19	1240	5,870

[a] Numbers of caribou counted during photocensus.
[b] Census results probably considerably lower than true herd size.
[c] Excludes Yanert herd, which included approximately 600 caribou.

Table 2. Delta caribou herd late winter composition counts and estimated population size, 1983-92.

Survey date	Bulls: 100 C	Calves: 100 C	Calves: %	Cows %	Small bulls % of bulls	Medium bulls % of bulls	Large bulls % of bulls	Total bulls	Composition sample size
4/10/84	10	49	31	63	0	0	0	6	628
5/3/85	1[a]	51	34	66	0	0	0	1	759
4/20/86	21	44	26	61	0	0	0	13	1,141
No survey in 1987									
4/6/88	22	29	19	66	0	0	0	14	1,473
*4/18/89	15	21	15	74	0	0	0	11	1,053
*4/18/90	16	16	10	78	0	0	0	11	835
4/18/91	22	9	7	78	0	0	0	16	1,385
No survey in 1992									

* Indicates data were weighted.

[a] Fixed-wing survey (some bulls classified as cows).

Table 3. Caribou hunting regulations for Subunit 20A (Delta herd) 1990-91 through 1992-93.

Regulatory year	Area	Season[a]	Bag Limit
1990-91	Ferry Trail Management Area	10-Aug-10 Sept	1 Caribou by drawing permit only (Hunt 570). Up to 100 permits will be issued.
		1-13 Feb[b]	1 Antlered caribou by registration permit only (Hunt 569). Up to 75 permits will be issued.
	Yanert Controlled Use Area	1-10 Sept	1 Bull
		1-15 Jan	1 Caribou
	Remainder of 20A	1-10 Sept	1 Bull
		1-13 Feb[b]	1 Antlered caribou by registration permit only (Hunt 574). Up to 75 permits will be issued.
		1-31 March	1 Antlered caribou by drawing permit only (Hunt 573). Up to 250 permits will be issued.
1991-92	Ferry Trail Management Area	10 Aug-10 Sept	1 Caribou by drawing permit only (Hunt 570) Up to 200 permits will be issued.
		--[c]	1 Caribou by registration permit only (Hunt 569). Up to 75 permits will be issued in Nenana.
	Yanert Controlled Use Area	1-10 Sept	1 Bull
		--[c]	1 Caribou

Table 3. Continued.

Regulatory year	Area	Season[a]	Bag Limit
1991-92	Remainder of 20A	1-10 Sept	1 Bull
		--[c]	1 Antlered caribou by registration permit (Hunt 574). Up to 174 registration permits will be issued in Nenana.
1992-93	-No Open Season-		

[a] Resident and nonresident seasons. Parentheses indicate season s that were closed or canceled by Emergency Order.
[b] Published season of 1-28 Feb. closed by Emergency Order (No. 3-01-91).
[c] Published seasons of 1-15 Feb (FTMA), 1-15 Jan (YCUA), and 16 Feb- 1 March (Remainder of 20A) cancelled by Emergency Order (No. 3-11-91).

Table 4. Reported and estimated Delta and Yanert caribou herd harvest[a], Subunit 20A, 1986-87 to 1991-92.

	Reported				Estimated[a]			
	Harvest							
Year	Bull	Cow	Unk.	Total	Unsuccessful Hunters	Total Hunters	Harvest	Total Hunters
1986-87								
General	314	93	6	413	179	592		
Hunt 570	90	17	0	107	36	143		
Total	404	110	4	520	215	735	841	1,830
1987-88								
General	303	5	0	308	220	528	522	1,350
Hunt 570	88	33	1	122	30	152		
Total	391	38	1	430	250	680		
1988-89								
General	319	4	2	325	215	540	439	
Hunt 570	95	17	2	114	25	139		
Hunt 571	1	1	0	2	12	14		
Total	415	22	4	441	252	693	555	1,085
1989-90								
General	353	2	3	358	215	573	564	
Hunt 570	101	16	0	117	39	156		
Hunt 571	5	0	0	5	8	13		
Total	459	18	3	480	262	742	686	1,325

Table 4. Continued.

Year	Reported						Estimated[a]	
	Harvest				Unsuccessful Hunters	Total Hunters	Harvest	Total Hunters
	Bull	Cow	Unk.	Total				
1990-91								
General	177	19	0	196	229	425	384	1,300
Hunt 570	56	12	0	68	17	85		
Hunt 569	22	31	1	54	0	54		
Hunt 573	11	12	2	25	46	71		
Hunt 574	9	9	0	18	15	33		
Total	275	83	3	361	307	668	549	
1991-92								
General	200	1	3	204	212	416	358	
Hunt 570	77	21	0	98	49	147		
Total	277	22	3	302	261	563	456	1,189
1992-93 No open season								

[a] Values before 1990-91 were from McNay (1992). More recent values are explained in the text.

Table 5. Results of Delta caribou herd Drawing Hunt 570, 1985-1991 (season closed in 1992).

Year	Harvest				Hunted but Unsuccessful	Did not hunt	Did not report	Total permits
	Bulls	Cows	Unk.	Total				
1985	86	15	1	102	42	21	35	200
1986	90	17	0	107	36	54	3	200
1987	88	33	1	122	30	45	3	200
1988	95	17	2	114	25	56	5	200
1989	101	16	0	117	39	44	0	200
1990	56	12	0	68	17	15	0	100
1991	77	21	0	98	49	51	2	200

Table 6. Results of Delta caribou herd winter permit hunts, 1990-91.

Type	Hunt No.	Area	Season	No. Permits Issued	No. Reports Returned	Harvest				Hunted Unsuc.	Did Not Hunt	Did Not Report
						Cow	Bull	Unk	Total			
Regist.	569	FTMA[a]	Feb 1-13[c]	75	75	31	22	1	54	0	21	0
Regist.	574	Remainder 20A[b]	Feb 1-13[c]	75	66	9	9	0	18	15	35	7
Drawing	573	Remainder 20A[b]	Mar 1-31	250	243	12	11	2	25	46	176[d]	4[e]
Winter Total				400		52	42	3	97	61	232	11

[a] Ferry Trail Management Area.
[b] Excluding FTMA, Yanert Controlled Use Area.
[c] Original season of Feb 1-28 was shortened by Emergency Order.
[d] Includes 1 report returned blank.
[e] Includes 2 permittees whose reminder letters were returned as undeliverable.

Table 7. Results of permit hunts for the Delta caribou herd, Subunit 20A, 1985-86 through 1992-93.

Hunt no.	Hunt type[a]	Area[b]	Season[c]	Regulatory year	No. permits issued	Number of permittees: Successful bulls	Successful cows	Successful unknown	Successful total	Unsuccessful	Did not hunt	Did not report
570	D	FTMA	Fall	1985-86	200	86	15	1	102	42	21	35
				1986-87	200	90	17	0	107	36	54	3
				1987-88	200	88	33	1	122	30	45	3
				1988-89	200	95	17	2	114	25	56	5
				1989-90	200	101	16	0	117	39	44	0
				1990-91	100	56	12	0	68	17	15	0
				1991-92	200	77	21	0	98	49	51	2
				1992-93	0							
571	D	YCUA	Winter	1988-89	25	1	1	0	2	12	10	
				1989-90	25	5	0	0	5	8	12	0
569	R	FTMA	Winter	1990-91	75	22	31	1	54	0	21	0
573	D	20A except FTMA or YCUA	Winter	1990-91	250	11	12	2	25	45 (46)	176	4
574	R	20A except FTMA or YCUA	Winter	1990-91	75	9	9	0	18	15	35	7
Total for all permits				1985-86	200	86	15	1	102	42	21	35
				1986-87	200	90	17	0	107	36	54	3
				1987-88	200	88	33	1	122	30	45	3
				1988-89	225	96	18	2	116	37	66	6
				1989-90	225	106	16	0	122	47	56	0
				1990-91	500	98	64	3	165	77 (78)	247	11
				1991-92	200	77	21	0	98	49	51	2
				1992-93	0							

[a] D = drawing, R = Registration

[b] FTMA = Ferry Trail Management Area, YCUA = Yanert Controlled Use Area

[c] See Table 3 for exact season

Table 8. Comparison of composition of the Delta (Subunit 20A) and Denali (Subunit 20C) caribou herds, 1984–85 through 1992-93.

Regulatory year	Fall				Subsequent spring	
	Bulls:100 cows		Calves:100 cows		Calves:100 cows	
	Delta	Denali	Delta	Denali	Delta	Denali
1984-85	42	47	36	36	51	34
1985-86	49	56	36	28	44	25
1986-87	41	56	29	38	--	46
1987-88	32	56	31	37	29	32
1988-89	33	67	35	33	21	42
1989-90	27	--	36	--	17	--
1990-91	38	50	17	17	9[a]	--
1991-92	29	38	8	7	--[b]	--
1992-93	25	44	11	16	--	--

[a] Weighted value

[b] Survey cancelled because the fall calf:cow ratio was so low

LOCATION

Game Management Subunits:	20B, 20C, 20D, 20E, 25C, and adjacent Yukon Territory (20,000 mi^2)
Herd:	Fortymile
Geographical Description:	Charley, Fortymile, Salcha, Goodpaster, and Ladue Rivers, and Birch and Shaw Creek drainages between the Tanana River and the south bank of the Yukon River; the Fortymile caribou herd presently ranges up to 50 miles into the Yukon Territory

BACKGROUND

The Fortymile caribou herd (FCH) is one of five international herds shared between Alaska and the Yukon Territory. Like other caribou herds in Alaska, the FCH has displayed major changes in abundance and distribution. During the 1920s the FCH was one of the largest herds in the world, estimated at 528,000 caribou (Murie 1935). For unknown reasons, the FCH declined to only 10,000-20,000 by the late 1930s (Skoog 1956). Subsequently, the FCH began increasing possibly as the result of a federal predator control program that began in 1947. By 1953 the herd had increased to over 50,000 (Skoog 1956). Until 1963, the herd fluctuated slightly, but most population estimates approximated 50,000 animals.

Between the mid-1960s and 1975 the herd again declined, probably because of a combination of high harvests, a period of severe winters, and a high wolf population (Davis *et al.* 1978; Valkenburg and Davis,1989). The population low probably occurred in early 1976 when the herd was estimated at 5,740-8,610 caribou. The FCH began increasing again in 1976 in response to favorable weather conditions, reduced harvests, and a natural decline in wolf numbers. By 1990, the Fortymile herd had increased to about 20,000 (the annual rate of increase ranged from 5% to 10%).

Within its range, the FCH historically provided much of the food needed by Alaskan and Yukon miners, Athapaskans, and other early residents. From the late 1800s to World War I the herd was subject to market hunting in both Alaska and the Yukon Territory. Most hunting was concentrated along the Steese Highway and along the Yukon River above Dawson before the Taylor Highway was constructed in the mid-1950s. During the 1960s, hunting was concentrated along the Steese and Taylor Highways in Alaska and along the Top of the World Highway in the Yukon Territory. During the late 1960s and early 1970s, the FCH was declining rapidly and changed its movement patterns so it no longer crossed the Steese Highway. After 1973 it no longer entered the Yukon. Consequently, there was no significant harvest in the Yukon from 1973 to the present. Despite the

decline in herd size, hunting remained good along the Taylor Highway. From 1973 to 1990 seasons were deliberately set to avoid the period when road crossings were likely. Some road-crossing hunts have been deliberately provided since 1990 to accommodate the subsistence hunting priority mandated by state statute.

MANAGEMENT DIRECTION

In 1990 representatives of the Yukon Department of Renewable Resources, Canadian Wildlife Service, and ADF&G met in Whitehorse, Yukon Territory to develop draft management goals and objectives for the FCH. Since then, these goals and objectives have been presented to local residents within the Fortymile caribou range for their comment and approval through a questionnaire, local Fish and Game Advisory Committee meetings, and other public meetings. The Alaska Board of Game, many state residents, nonresidents, and special interest groups have reviewed these objectives in the 1992 Alaska Area Specific Wolf Management Plans.

One factor that was not considered during the development of the 1990 Fortymile Caribou Draft Management Plan was federal oversight of the subsistence priority on federal public lands. Pursuant to Title VIII of the Alaska National Interest Lands Conservation Act, the federal government can enact season and bag limit regulations that supersede existing state regulations. These changes can and have been made without considering the long-term management goals for a population. The federal mandate to give preference to the local subsistence user must be recognized by the state by allocating a sufficient portion of the harvest quota to the federal subsistence user. Just as importantly, the Federal Subsistence Board must familiarize itself with the state's public supported management objectives and try to cooperate with the state to accomplish them. Until the agencies work together the resource and resource user will continue to suffer.

Management Goals and Objectives

1. Rebuild the FCH in all of its historic range in Alaska and the Yukon.

   a. When weather-related nutrition is favorable, manage harvest and, secondarily, predation to increase the herd to 50,000 adults or 60,000 caribou by the year 2000.

   b. If the mean annual growth rate is greater than 10%, allow a maximum harvest of 3% of the herd and 1.5% of the females until herd size reaches 50,000 adults or 60,000 caribou. If the mean annual growth rate is 0% to 10%, allow a maximum harvest of 2% of the herd and 0.5% of the females. During years when the herd is declining, hunting may be further restricted and steps to reduce predation will be recommended, assuming poor nutritional status of caribou is not a major factor.

c. Maintain an October bull:cow ratio of at least 35:100.

2. Minimize the impact of human activities on caribou habitat.

   a. Discourage or modify developments incompatible with caribou.

   b. Maintain a near-natural fire regime.

3. Provide for increased caribou hunting and other wildlife-related recreation in Alaska and the Yukon.

   a. When weather-related nutrition is favorable, manage harvest and, secondarily, predation to increase the herd to 50,000 adults or 60,000 caribou by the year 2000.

   b. Maintain a limited open hunting season when caribou are available to resident hunters in Alaska.

   c. Determine the demand for Fortymile caribou by hunters in Alaska and the Yukon.

METHODS

Population Census

We censused the FCH between late June and mid-July in 1988, 1990, and 1992 using three spotter planes (Super Cub PA-18) and a DeHavilland Beaver, which was equipped with a belly-mounted 9-inch format aerial camera. We located most large postcalving aggregations by tracking the herd's radio-collared caribou. We photographed all groups that could not be counted accurately by the spotter planes (>50 caribou). The total population estimate was derived by counting the individual caribou on the photographs and adding those caribou in small groups that we counted visually from the spotter planes. All photographs were counted twice, each time by a different person. No correction factors were used to account for caribou missed during the search.

We estimated population size and trend using a population model developed by P. Valkenburg and D. Reed (ADF&G). Sex and age composition, recruitment, and mortality data were the primary components of the model.

Fall Composition Surveys: Between 1987 and 1992, herd sex and age composition was estimated annually between late September and mid-October using either a Hughes 500D or a Bell Jet Ranger helicopter. Most caribou surveyed were initially found by radio tracking. A pilot/observer team classified each caribou as either a cow, calf, or bull. Bulls

were further classified as either small, medium, or large based on antler size. The Yukon government contributed staff and finances to these surveys.

Spring Composition Surveys: During 1987, 1988, 1991, and 1992, herd sex and age composition surveys were conducted between mid- and late June. Techniques followed were the same as those used during fall surveys, except bulls were not categorized by size, and large groups (i.e., >1,000) were usually classified from the ground with spotting scopes. The Yukon government contributed money and personnel to these surveys.

Herd Condition: During the report period, we used 4 indices to evaluate herd condition: (1) fall calf weights, (2) percentage of calves of radio-collared cows dying during the first 48 hours of life, (3) percent natality of radio-collared cows, and (4) median calving date. Fall calf weights were obtained during fall capture activities conducted in 1991 and 1992. We evaluated the other 3 indices by radio-locating 30 adult cows (3 years and older) on a daily basis during calving until 2 days following birth. Median calving date was determined as the day when 50% of the adult collared cows had given birth.

Radio-telemetry Data: We obtained herd distribution, movements, and estimates of annual mortality by radio-tracking 15-63 radio-collared animals approximately once every 6 weeks. We retrieved collars of dead caribou on an opportunistic basis.

Harvest

We estimated harvest using permit hunt reports (drawing and registration) and harvest report cards; the latter was corrected (divided by 0.62) for nonreporting by successful hunters (Kelleyhouse 1986, McNay 1990). We used this information to determine total harvest, hunter residency and success, harvest chronology, and transportation used. During 1991 and 1992, we used check stations to monitor the harvest to ensure that the harvest quota was not exceeded.

RESULTS AND DISCUSSION

Population Status and Trend

The FCH increased through the 1980s, reaching its estimated peak of 22,766 caribou in 1990 (intrinsic rate of increase between 1.05 and 1.10). Between 1990 and 1992 the herd declined by 3.9% and in June 1992 numbered 21,884. Since 1988 recruitment rates have declined, and since 1989 the adult female mortality rate has been high (16-17%). Wolf predation was the major cause of adult female mortality based on evidence collected from radio-collared animals that died during the report period. Weather conditions in Interior Alaska during 1988 to 1992 were probably unfavorable for caribou because most Interior herds declined simultaneously. Factors involved in these declines are being investigated.

It is not known how weather affected the Fortymile herd. Based on the sex and age composition data collected in fall 1992 the herd should increase by 1-3%.

In 1991 the ADF&G began a research study to evaluate limiting factors of the FCH. The principal investigator of the study is R. Boertje (ADF&G). The following paragraph summarizes the first year of his work.

The initial focus of the research program was on whether or not malnutrition was a significant limiting factor of the FCH. Indices used to evaluate the herd's nutritional condition were: (1) fall calf weights, (2) pregnancy rates, (3) percentage of calves dying within 48 hours of birth, and (4) median calving date. Nutritional status of Fortymile caribou during 1992 was found to be high and has improved since 1990 and 1991. Mean fall body weight of calves in 1992 was higher than in 1990 and 1991 ($t = 1.79$, df. = 26, $0.1 > P > 0.05$). In 1992, 86% of radio-collared females 3 years and older produced calves, and only 1 of 31 calves died during the first 48 hours after birth. A high loss of caribou calves (20-30%) during the first 48 hours of life would have indicated malnutrition (L. Adams *et al.*, in press). The median calving date was 22 May which was comparable with the 1980s when conditions were more favorable for caribou herd growth (Valkenburg and Davis 1989).

Population Composition: We classified 2,530 caribou (12% of the herd) on 26 September 1992 (Table 1). There were substantially more large and medium size bulls in the sample compared with other years. This was probably a result of the timing of the survey in relation to the rut. The 1987 survey was conducted on 28 September and also sampled a higher than normal proportion of large and medium size bulls. Both the 1987 and 1992 surveys were completed about 1-2 weeks earlier than other years. However, considering the low harvest of the past 2 years (2% of the herd), the FCH bull:cow ratio may be increasing. Population modeling predicted a bull:cow ratio closer to 40:100.

The 1992 fall calf:cow ratio was somewhat higher than in 1991 and 1990 (Table 1). It is similar to the fall ratios seen during the late 1980s when the herd was increasing at a rate of about 5%. However, the decline in calf:cow ratio from 46:100 in June (Table 2) to 30:100 in fall suggested substantial summer calf mortality. During the 1980s, June calf:cow ratios of 47 or 48:100 were accompanied by average fall ratios of 37:100. The estimated 1992 calf mortality rate between late June and 1 October was 35.2%, compared with the estimated calf mortality rate of 22.4% during the 1980s. The higher calf mortality during mid- or late summer 1992 was probably from wolf predation rather than bear predation (Adams *et al.* 1989).

Distribution and Movements: In 1991, the FCH summered from the upper Salcha River, south to Mount Harper, and east to Glacier Mountain. During late summer, approximately half the herd moved east to Taylor Mountain and Mount Warbelow. These caribou were available to hunters during 10-25 August, and 80% of the harvest quota was taken during

that time. By the end of August, the herd moved west and stayed in the Charley and Salcha River and Crescent and Copper Creek drainages.

In mid-October the herd began another easterly movement, but most of the herd did not cross the Taylor Highway as in past years. Most of the herd remained west of the Taylor Highway during winter, spreading out widely between the highway, Sixtymile Butte, the Upper Eisenmenger, Goodpaster, and Salcha Rivers, and the Middle and North Fork of the Fortymile River drainages.

Calving began in mid-May 1992 (peak was 22 May) within the Middle Fork drainage (Pittsburg and Portage creeks). By early June the herd had moved toward the North Peak area in large aggregations. By 21 June most of the herd was between VABM Copper and the upper Charley River and drifting west. During the July 1992 census over 95% of the herd (based on radio telemetry) were in upper Crescent Creek, Lost Creek, Gulch Creek, or Williams Creek. As in 1991, most of the herd moved east during early August and was concentrated on Mount Warbelow and Taylor Mountain at the start of the hunting season. The harvest quota was reached within 5 days. After mid-August the herd drifted back west. During mid-September the herd moved rapidly east and crossed the Taylor Highway en mass on 25 September.

The herd spent the rut between Boundary and Glacier Mountain, and many were concentrated around American Summit. By December the herd was distributed from east of Clinton Creek in Yukon Territory to Birch Creek south of Circle Hot Springs.

Seasonal distribution between summer 1991 and December 1992 was similar to the past 4 years except during winter 1991-92 when the herd scattered widely on the west side of the Taylor Highway.

Mortality

Harvest:

Season and Bag Limit. See Table 3.

Board of Game Actions and Emergency Orders. All Board of Game actions between 1987 and 1991 were described in detail in Kelleyhouse (1992). Since 1991 there have been no changes in the Fortymile caribou hunting seasons and bag limits. However, in July 1992 the Alaskan legislature adopted a revised subsistence law mandating a priority for nonwasteful subsistence uses over other uses. Furthermore, when populations cannot accommodate all subsistence demands, the Board of Game is required to distinguish among subsistence users through use of the following criteria: (1) customary dependence on the herd for human consumption, (2) proximity of subsistence user to the herd, and (3) ability of the user to obtain other food.

During November 1992 the Board of Game adopted a wolf management plan that incorporated the major population objectives for FCH. To meet these objectives, the plan called for a 70-80% reduction of the wolf population within a portion of the summer and winter ranges of the FCH. Implementation of the plan was to begin after 1 January 1993, but in December 1992 the plan was postponed by Governor Hickel to allow for greater public input. In January 1993, in response to public dissatisfaction, the Board of Game rescinded the plan. Wolf and caribou management objectives will be reconsidered at the June 1993 meeting. In early 1993, the state selected all remaining unreserved federal land within the range of the FCH. Presently, with the expiation of narrow Wild River corridors along the Fortymile and the remote Charley River drainage, the state now controls all lands accessible to hunters using the FCH.

Hunter Harvest. During 1991 the total reported harvest was 441 caribou (Table 4). Extrapolation for nonreporting (Kelleyhouse 1986, McNay 1992) resulted in an estimated total of 505 caribou harvested (Table 5). The harvest was 2.3% of the estimated population and exceeded the harvest quota of 460.

The preliminary reported harvest for the 1992 season was 385 caribou. This total is expected to be between 400 and 410 caribou. The season harvest quota was 395.

Illegal Harvest. The number of illegally harvested caribou has declined over the past 2 years. Hunters may be better at recognizing bull caribou. During 1992 most known illegal takings were reported by hunters. In one instance, the Division of Fish and Wildlife Protection was able to make a case based on the information collected by hunters.

Hunter Residency and Success. In 1991 only Alaskan residents were eligible for a Taylor Highway registration permit. During 1991, 392 (26.6%) of the hunt participants were local residents and 1,080 (73.4%) were nonlocals (Table 6). Overall, the success rate under the registration permit was 22.9% and under the general hunt it was 27.2% (Table 4). Nonresidents could only participate in the general hunt and were responsible for only 5.2% of the total Fortymile harvest.

Harvest Chronology. In 1991, a large proportion of the herd was near Poly Summit, Mount Warbelow, and Taylor Mountain at the onset of the hunting season. During the first and second week of the season, 221 and 83 caribou were harvested, accounting for 68.8% of the total annual harvest (Table 7). In 1992 harvest chronology followed the same pattern. During the first 4 days of the season, 10,000-14,000 caribou were available to hunters along the Chicken and Taylor Mountain trails, and hunters reported killing 262 caribou. Because of the possibility of overharvest, the 1991 and 1992 hunts had to be intensively monitored with check stations and field contacts.

Transport Methods. During 1991, in the Taylor Highway registration permit area, most successful hunters reported using either 3- or 4-wheelers (46%) or highway vehicles (28.2%). In past years, ORVs such as Tracksters or Argos have commonly been used by

successful hunters (23% in 1989). Airplanes are not often used for access into the permit area (3-5% of the successful hunters) because most of the access points for airplanes can also be reached by a 3- or 4-wheeler.

In the central portion of the Fortymile range over 90% of successful hunters used aircraft. Access into the western portion of the herd's range is primarily from the Steese Highway, from which hunters either walk or use 4-wheelers.

Other Mortality: Predation was the most significant limiting factor to the FCH from 1982 to 1987 (Valkenburg and Davis 1989). In Denali National Park, Adams *et al.* (1989) found grizzly bears to be the major predator on caribou calves during the late 1980s. However, between 1990 and 1992, wolves were the major predator. In the Fortymile herd, wolf predation has been the major cause of adult female mortality since 1982. Preliminary evidence indicates that the area's wolves may have switched from primarily consuming moose (Gasaway *et al.* 1992) to caribou over the past few years.

The impacts of predation, other sources of mortality (drowning, abandonment, disease, etc.), and harvest by humans on the growth of the Fortymile herd were estimated using a population model developed by M. McNay (ADF&G). The primary working components of the model are: (1) current composition, recruitment, and population data for the Fortymile herd; (2) the area's wolf and bear population size estimates; and (3) published bear and wolf predation rates on caribou. The model indicates that presently wolves and bears combined are removing 26% of the postcalving population (Figure 1). The model predicted that the Fortymile herd would increase by 14-19% annually if the wolf population was reduced by 70-80% and the bear population remained constant. Results from the population model were also supported by initial results from the predator/prey research program being conducted in the FCH's range (ADF&G, unpubl. data).

Habitat

Assessment: No direct range assessment work was conducted between 1987 and 1992. However, the current herd size compared with the historical levels of 25-30 years ago indicates that habitat should not be controlling herd growth (Davis *et al.* 1978). Other indices also suggested that the herd was in excellent nutritional condition in 1992. First, 4-month-old calves in 1992 were significantly heavier than calves in 1990 and 1991. Second, only 1 (3%) of 31 newborn calves died during the first 48 hours after birth, suggesting malnutrition was an insignificant cause of death among newborns. Third, pregnancy rates were high (87%, n = 39) among females >36 months old. Fourth, the median calving date had not changed in over 10 years (Skogland 1985, Valkenburg and Davis 1989).

Enhancement: The Alaska Interagency Fire Management Plan which was implemented in the early 1980s should ensure a near-natural fire regime necessary for the long-term management of caribou range in Interior Alaska.

CONCLUSIONS AND RECOMMENDATIONS

The FCH increased through the 1980s at an annual rate of 5-10%. Since 1990 the herd has declined by 3.9% and in spring 1992 was estimated at 21,884 caribou. The population objective of reaching 60,000 caribou by the year 2000 will not be realized unless the population begins increasing at a rate greater than 15% annually. Currently, the greatest limiting factor of the FCH is predation. Therefore, to reach a 15% growth rate some reduction in predator levels will be necessary.

On 1 July 1990 the federal government took over management of subsistence hunting on federal public lands, creating a system of dual management. The Federal Subsistence Board can authorize season and bag limits on federal public lands that supersede state regulations. There has been little cooperation at higher level administrative levels between the federal management agencies and the ADF&G in managing the Fortymile herd. The federal government apparently has little regard for the existing population and harvest objectives for the herd and for the management agreement with the Yukon Territory.

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Table 1. Fortymile caribou fall composition counts and population size, 1986-92.

Date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent small bulls (% of bulls)	Percent medium bulls (% of bulls)	Percent large bulls (% of bulls)	Percent bulls	Composition sample size	Total count of herd size
10/13/86	36	30	17	61	35	24	41	22	1,381	15,307
9/28/87	40	37	21	57	13	43	43	44	2,253	
10/2-3/88	36	30	18	59	29	41	30	30	1,295	19,975
10/13/89	27	24	16	66	34	41	25	18	1,781	
9/27-28/90	44	29	17	58	42	39	19	26	1,742	22,766
10/10/91	39	16	10	64	41	34	26	25	1,445	
9/26/92	49	30	17	56	37	36	27	27	2,530	21,884

Table 2. Fortymile caribou mid- to late June composition counts, 1985-92.

Date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent bulls	Composition sample size
6/19/85	18	48	29	60	11	3,803
6/26/87	46	47	25	52	24	3,596
6/30/88	54	36	19	53	29	1,799
6/14/91	35	25	16	62	22	2,998
6/21/92	41	46	25	54	22	3,313

[a] No counts were done in 1986, 1989, and 1990.

Table 3. Seasons and bag limits for the Fortymile caribou herd, 1987-92.

Regulatory year	GMU 20B SE of Steese		GMU 20D N of AK Hwy		GMU 20E		GMU 25C SE of Steese	
	State	Federal	State	Federal	State	Federal	State	Federal
	Season/ Bag limit	Season/ Bag limit	Season Bag limit	Season/ Bag limit	Season/ Bag limit	Season/ Bag limit	Season/ Bag limit	Season/ Bag limit
1987-88	8/10-9/20 one bull	[a]	8/10-9/20 8/10-9/30[b] 12/1-2/28[b] one bull	[a]	8/10-9/20 8/10-9/30[b] 12/1-2/28[b] one bull	[a]	8/10-9/20 one bull	[a]
1988-89	8/10-9/20 one bull	[a]	8/10-9/20 8/10-9/30[b] 12/1-2/28[b] one bull		8/10-9/20 8/10-9/30[b] 12/1-2/28[b] one bull		8/10-9/20 one bull	[a]
1989-90	8/10-9/20 one bull	[a]	8/10-9/20 one bull 8/10-9/30[b] 12/1-2/28[b] one caribou	[a]	EAST: 8/10-9/20[d] one bull 8/10-9/30[bc] 12/1-2/28[bc] one caribou WEST: 8/10-9/20 one bull 8/10-9/30[b] 12/1-2/28[b] one caribou	[a]	8/10-9/20 one bull	[a]
1990-91	8/10-9/20 one bull	[a]	8/10-9/20 one bull	[a]	EAST: 8/10-9/30[ce]	[a]	8/10-9/20 one bull	[a]

Table 3. Continued.

Regulatory year	GMU 20B SE of Steese State Season/ Bag limit	GMU 20B SE of Steese Federal Season/ Bag limit	GMU 20D N of AK Hwy State Season Bag limit	GMU 20D N of AK Hwy Federal Season/ Bag limit	GMU 20E State Season/ Bag limit	GMU 20E Federal Season/ Bag limit	GMU 25C SE of Steese State Season/ Bag limit	GMU 25C SE of Steese Federal Season/ Bag limit
1990-91 (Cont.)	2/15-3/15 one caribou				WEST: one bull 12/1-2/28[ce] one caribou 8/10-9/20 one bull 8/10-9/30[e] 12/1-2/28[e] one caribou			
1991-92	8/10-9/20 one bull	No open season	8/10-9/20 one bull	No open season	EAST: 8/10-9/30[ce] one bull 12/1-2/28[ce] one caribou WEST: 8/10-9/20 one bull 8/10-9/30[e] 12/1-2/28[e] one caribou	Same as state	8/10-9/20 one bull	8/10-9/20 2/15-3/15 one bull

[a] No separate season
[b] Subsistence hunters or residents domiciled in communities or units in rural areas as defined by joint game boards
[c] Registration hunt
[d] Drawing permit for resident hunters only
[e] Definition of subsistence hunter changed to include any resident of the state, December 1989.

Table 4. Reported Alaskan Fortymile caribou harvest by type of hunt, 1989-92.

Hunt number	Regulatory year	Permits issued	% Did not hunt	% Successful hunters	% Unsuccessful hunters	Harvest Bulls	Cows	Unk	Total harvest[a]	Notes
572 Drawing permit	1989-90	750	31	11	89	57	0	0	57	
575 Registration permit	1989-90	681	28	n/a	n/a	148	98	0	246[b]	
	1990-91	1,478	29	25	75	238	18	8	265	
	1991-92	1,864	21	23	77	335	1	1	337	
General hunt	1987-88	n/a	n/a	25	75	142	0	0	142	561 hunter reports
	1988-89	n/a	n/a	42	58	399	2	0	401	964 hunter reports
	1989-90	n/a	n/a	47	53	121	0	0	121	255 hunter reports
	1990-91	n/a	n/a	10	90	47	2	0	49	467 hunter reports
	1991-92	n/a	n/a	27	73	95	4	1	100	424 hunter reports
	1992-93	n/a	n/a	n/a	n/a	37	0	0	37	
Federal hunt (575)	1991-92	20	n/a	n/a	n/a	4	0	0	4	

Table 4. (Cont.).

Hunt number	Regulatory year	Permits issued	% Did not hunt	% Successful hunters	% Unsuccessful hunters	Harvest Bulls	Cows	Unk	Total harvest[a]	Notes
Total for all hunts	1987-88	n/a	n/a	25	75	142	0	0	142	561 hunter reports
	1988-89	n/a	n/a	42	58	399	2	0	410	965 hunter reports
	1989-90	n/a	n/a	37	63	32	98	0	424	1264 hunter reports
	1990-91	n/a	n/a	21	79	295	20	8	313	1520 hunter reports
	1991-92	n/a	n/a	23	77	434	5	2	441	1919 hunter reports
	1992-93									

[a] Total harvest does not include harvest occurring in Canada. Canadian harvest since 1973 has been less than 20 caribou per year.
[b] Harvest may include 44 Nelchina/ Mentasta caribou taken from southern portion of GMU 20E and one Macomb caribou from Northern GMU 12.

Table 5. Fortymile caribou harvest and accidental death, 1985-93.

Regulatory year	Hunter harvest							Yukon harvest	Total
	Reported[a]				Estimated				
	M	F	Unk	Total	Unreported[b]	Illegal	Total		
1985-86	261	0	0	261	160	20	180	0	441
1986-87	223	0	0	223	137	20	157	0	380
1987-88	142	0	0	142	87	20	107	0	249
1988-89	399	2	0	401	244	150[c]	394	0	795
1989-90	326	98	0	424	74	0	74	3	498
1990-91	285	20	8	313	28	2	30	0	343
1991-92	434	5	2	441	59	5	64	0	505
1992-93	304	14	4	322	--	--	--	--	322

[a] Includes all Alaskan harvest reporting systems.
[b] Unreported harvest calculated by dividing reported general hunt harvest by 0.63 to compensate for non-reporting by successful hunters.
[c] Forty cows found abandoned within 50 yards of trails; 150 assumed taken.

Table 6. Fortymile caribou hunter residency and success of hunters reporting residency, 1989-92.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	
1989-90	291	56	n/a	347 (35)	182	453	n/a	635 (65)	982
1990-91	105	157	n/a	262 (25)	273	517	n/a	790 (75)	1,052
1991-92	91	260	23	374 (21)	339	1,052	34	1,425 (79)	1,799

[a] Resident of Unit 12 north of Wrangell/St. Eliras Subunit 20E or Subunit 20D

Table 7. Fortymile caribou fall harvest by time period, 1987-92.

Regulatory year	Harvest periods 8/10-8/16	8/17-8/23	8/24-8/30	8/31-9/6	9/7-9/13	9/14-9/20	9/21-9/22	9/28-9/30	n
1988-89				189[a]					
1989-90[b,c]	5	8	5	8	0	1	1	1	29
1990-91	48	61	35	50	19	14	7	10	244
1991-92	187	67	17	9	17	22	closed by E.O.		319
1992-93[d]	254	1	0	1	1	0	7	0	317[e]

[a] Between 1 September and 10 September 189 caribou were harvested
[b] Data from registration permit only
[c] An additional 231 caribou were harvested between 1 October and 31 December
[d] Season was closed by emergency order 14 August 1992
[e] Includes three caribou taken during an unknown period in fall 1992

Table 8. Fortymile caribou harvest percentage by transport method, 1987-92.

Regulatory year	Percent of harvest Airplane	Horse	Boat	3-or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walking	Unknown	n
1987-88[a]	58	1	3	19	3	3	13	0	0	142
1988-89[a]	29	1	2	36	1	4	27	0	0	401
1989-90[b]	27	0	0	10	6	5	52	0	0	424
1990-91[c]	1	1	0	43	10	1	43	1	0	313
1991-92[d]	16	1	2	53	5	4	23	5	0	441
1992-93										

[a] General hunt numbers only.
[b] Drawing and registration permit hunt results.
[c] Registration permit hunt results only.
[d] Registration permit and general hunt results.

LOCATION

Game Management Units: 20F, 21C, 21D, and 24 (48,000 mi^2)

Herd: Galena Mountain, Ray Mountains, Wolf Mountain

Geographical Description: Galena Mountain, Kokrines Hills, and Ray Mountains

BACKGROUND

Caribou are distributed throughout the Kokrines Hills and Ray Mountains north of the Yukon River from the West Fork Chandalar River, across the Dalton Highway, to the lowlands northwest of Galena Mountain. Galena Mountain is a local name for the 3,274–foot un-named mountain northeast of Galena.

The origin of these herds is unknown, but some residents believe these animals are feral reindeer from a commercial reindeer operation in the Kokrines Hills. The reindeer venture ended around 1935, and there is no evidence of reindeer characteristics in the population. Others believe the herd originated from the Western Arctic caribou herd (WACH), which occasionally migrates to this area during winter. The mid-May calving dates indicate that the animals are caribou. Local residents have been aware of these *Rangifer* herds for many years, but the herds were not surveyed by the ADF&G until 1977.

There are three distinct calving areas and three recognized herds. Each herd is associated with and named for a mountain peak or mountains where the animals calve. The western group of approximately 250-500 animals typically calves east of Galena Mountain and winters west of the mountain. The middle group calves on Wolf Mountain and winters to the north and east in the Melozitna and Little Melozitna River drainages, overlapping with the Galena Mountain herd. The Wolf Mountain herd contains approximately 250-500 animals. The eastern group calves on the north side of the Ray Mountains and winters throughout the Ray Mountains but primarily in the Kanuti-Kilolitna drainage. The 1984 population estimate for the Ray Mountains herd was 500-1,000 animals.

The Galena and Wolf Mountain herds have been difficult to survey or to census during fall and winter because they are rarely in large aggregations and they are primarily in black spruce forest where sightability is poor. The Ray Mountains herd is also difficult to survey because clouds, fog, and winds often limit survey opportunities there in fall.

These caribou herds have been lightly hunted because the areas are inaccessible during open season and few people outside the local area are aware of them. Since the early 1970s hunting seasons have been from 10 August to 30 September on the Galena and Wolf Mountain herds, principally to keep harvest low but also to discourage harvest of cows. In 1984-85, additional protection was given to the Ray Mountains herd in southern

Unit 24 to prevent overharvest near the Dalton Highway. That area had previously been under Western Arctic herd regulations. Total reported and known unreported harvest from all 3 herds combined has averaged less than 10 caribou per year over the last 10 years.

MANAGEMENT DIRECTION

The management objective established in 1988 was to determine population size, trend, and identity of caribou in the Ray Mountains and Kokrines Hills. The goals listed below were established in 1990.

Management Goals

- To ensure that harvest does not greatly restrict growth or cause a decline in population size.

- To provide increased opportunity for people to participate in caribou hunting.

Management Objectives

- To determine the population size, trend, and identity of caribou herds in the Ray Mountains and Kokrines Hills by 1992.

- To allow expansion of the caribou herds in the Ray Mountains and Kokrines Hills until they are large enough that their movements make them available to hunters in the fall.

- To identify herd range, calving areas, and rutting areas by 1994.

METHODS

Caribou from the Galena Mountain herd were monitored through a cooperative radio-telemetry study involving USFWS, Bureau of Land Management (BLM), and ADF&G (Robinson 1988*a*). In April 1992, 8 adult females, 2 female calves, and 10 adult male caribou were radio-collared on the winter range north of Galena.

We conducted annual surveys with a Super Cub and a Robinson-R22 helicopter on the Galena Mountain herd in October. No surveys were conducted in the Ray Mountains, but we counted caribou near Caribou Mountain coincidental to a moose census in 1991. We monitored hunting mortality from caribou harvest reports and interviews with local residents.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The Galena Mountain herd has never been censused but it probably contains from 300 to 500 caribou. The highest number of caribou seen was 260 in December 1991 (Table 1). Its population trend is unknown, but is suspected to be stable. Although collaring caribou in this herd was expected to help locate caribou for census during the October rut aggregation, use of the collars has not helped to find more caribou. However, collars revealed that during the rut the herd uses habitat comprised of fairly dense black spruce where it is difficult to count caribou. Surveys or censuses of summer or postcalving aggregations may provide the best estimates of population size.

No winter surveys in the Wolf Mountain area have been conducted since 1983 (Table 2). The highest count during two June surveys was 595 caribou. Based on these counts I estimate the population of the Wolf Mountain herd to be 500-750 caribou, which is higher than previous estimates. The population trend is unknown and the increase in estimated population could be because of better surveys.

Based on an October 1987 survey, Robinson (1988*b*) estimated the population size of the Ray Mountains herd at slightly more than 500 caribou (Table 3). This survey was designed to be a complete count, and all known upland ranges of the herd were flown. The presence of caribou around Caribou Mountain in October suggests the number of animals in this herd is larger than Robinson (1988*b*) estimated. I estimate the present Ray-Caribou Mountain population to be 1,000-1,500 animals. The population trend of the herd is unknown. Harvest is low and predation is probably the main limiting factor (Robinson 1985).

Population Composition: Previous counts were done by fixed-wing aircraft, and only calf percentages were obtained (Tables 1-3). We did the October 1992 survey on the Galena Mountain herd by helicopter which allowed precise composition counts. The bull:cow ratio was 40:100 and the calf:cow ratio was 7:100. Like other interior herds, recruitment in this herd was very low in 1992.

Distribution and Movements:

Galena Mountain Herd. Caribou usually migrate toward alpine areas east of Galena Mountain in April. All radio-collared caribou were in alpine areas from June to September in all years. During October caribou usually migrate from alpine areas across Galena Mountain toward the lake country around Hozatka Lakes where they winter.

During late October and early November in 1988, 1990, and 1992, approximately 3,000-10,000 caribou from the Western Arctic caribou herd migrated from the Nulato Hills onto the Koyukuk lowlands north of Galena. Most of these caribou were slightly

west of the wintering area of the Galena Mountain herd, but mixing occurred. The caribou remained in the area at least until March during the first 2 years of the incursion.

Wolf Mountain Herd. Based upon tracks encountered during surveys in the early 1980s, a general migration pattern for the Wolf Mountain herd can be surmised. The herd calves on the slopes of Wolf Mountain and spends most of the summer in the surrounding alpine habitat. During October it moves northward toward Lost Lakes on the Melozitna River. The location of the herd during midwinter has not been recently determined, but in 1978 caribou were seen on the mountains north of the Melozitna River. During May caribou were observed strung out in a 30-mile long line from Gold Hills toward the calving areas on Wolf Mountain. There were old tracks leading from the middle Little Melozitna River toward the Gold Hills.

Ray Mountains Herd. There have never been any radio-collared caribou in the Ray Mountains, and the movements of the Ray Mountains herd are not well known. Robinson (1988*a*) found them north of the Ray Mountains and south of the Tozitna River. Based on the trails he found, he suspected that this herd makes seasonal migrations between the two areas. Also, during late October 1984 and 1991, several hundred caribou were seen along the Dalton Highway near Old Man. Small groups of 10-20 male caribou are regularly seen in March near Sithylemenkat Lake. In March 1991, 200 caribou were seen in the Kanuti Lake area, but it is unknown if they were Ray Mountains caribou or Western Arctic caribou.

Mortality

Harvest: During the 1990-92 hunting seasons, 4 caribou were reported taken (Table 4), 2 from the Ray Mountains and 2 from the Melozitna River. Hunter access to the Ray Mountains herd during the open season in early March is limited to lengthy snowmachine trips. The Galena Mountain herd is most accessible for hunting when it crosses the Galena-Huslia winter trail during winter. The season there has been closed during this time to limit the potential for a serious overharvest. The Wolf Mountain herd is almost never accessible for hunting because of the scarcity of aircraft landing areas. Success of hunters in all 3 herds is limited (Table 5).

The total harvest averages less than 10 caribou per year. Each year 1 or 2 caribou are taken but not reported along the Yukon River near Ruby and 3 to 5 caribou are taken along the Yukon River in the Rampart-Tanana section. These caribou are usually bulls that occasionally wander to the river during September. In addition, 5 to 7 caribou are thought to be taken by hunters using snowmachines from Tanana.

Season and Bag Limit.

Units and Bag Limit	Resident/ Subsistence Open Seasons	Nonresident Open Seasons
Unit 20(F) Tozitna River Drainage		
Subsistence and resident hunters: One caribou; only bull caribou may be taken during the Aug. 10-Sept. 30 season, or a caribou of either sex may be taken during the Mar. 1-Mar. 15 season.	Aug. 10-Sept. 30 Mar. 1-Mar. 15	Aug. 10-Sept. 30 Mar. 1-Mar. 15
Nonresident hunters: One bull.	Aug. 10-Sept. 30	
Unit 21, except Unit 21(D) west of the Yukon and Koyukuk Rivers. One caribou, however, 2 additional caribou maybe taken during a winter season to be announced.	Aug. 10-Sept. 30	Aug. 10-Sept. 30
Unit 24, the Kanuti River drainage upstream from Kanuti, Chalatna Creek, and the Fish Creek drainage, including Bonanza Creek, and that portion of Unit 25(D) drained by the west fork of the Dall River, west of 150° W. long. One bull.	Aug. 10-Sept. 30	Aug. 10-Sept. 30

The Unit 21 and 24 seasons were restricted to those portions recently occupied by the resident herds not in the traditional range of the WACH.

Board of Game Actions and Emergency Orders. When the WACH entered the eastern portion of Subunit 21D in 1990 the Alaska Board of Game issued an emergency regulation opening the season east of the Koyukuk River and west of the Galena-Huslia

winter trail. A bag limit of two caribou was added. This action allowed hunters the opportunity to take caribou while protecting the smaller Galena Mountain herd which was intermixed with the WACH. The season was closed by Emergency Order 1 March 1991 when it looked like the WACH was moving back north. At the March 1991 Alaska Board of Game meeting ADF&G was authorized to announce an open season in a portion of Unit 21 during winter months if the WACH was present. A bag limit of two caribou was established. In November 1992 the WACH entered the area and a winter season was held.

Other Mortality: Judging from fall calf percentages (Tables 1-3), natural mortality of caribou calves is high in all three herds. Grizzly bears and wolves are probably the primary summer predators; however, during the June 1991 survey 20 black bears were seen from 1/4 to 1 mile from calving groups of Galena Mountain caribou. In 1990-92, there were 79-92 wolves in 11-12 packs in the Unit 24, Subunit 21C, and Subunit 21D Galena and Wolf Mountain caribou ranges. At least 2 packs with 16 wolves were in the southern Unit 24 and Subunit 20F Ray Mountains caribou range.

Of 20 caribou collared north of Galena in April 1992, 3 were killed by wolves in the first month and 1 died of unknown causes in September.

CONCLUSIONS AND RECOMMENDATIONS

The mountains between Galena and the West Fork Chandalar River on the north side of the Yukon River contain from 1,800 to 2,750 caribou in 3 herds centered around 3 main calving areas. Although open caribou hunting seasons exist, few caribou are taken by hunters. The management objectives for these caribou herds include expansion of the herds until they are large enough that their movements make them more accessible to hunters during fall. Predation is probably restricting herd growth; lichen ranges are lush, and the early calving date and large body size and weight of calves and adults for the Ray Mountains herd indicate good nutrition. The large body size and heavy weight of calves and adults in the Galena Mountain herd also indicate good nutrition.

To allow harvest from the WACH in Subunit 21D east of the Koyukuk River and protect the Galena Mountain and Wolf Mountain caribou herds, we need to maintain a restricted season when the WACH is not present. The recollaring of caribou in the Galena and Wolf Mountain herds should help to facilitate separation from the WACH. In addition, radiocollars should help obtain better population estimates. Because of the small number of caribou in the Galena, Wolf Mountain, and Ray Mountains herds and the insignificant harvest, other management work on these herds will remain a low priority.

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Table 1. Aerial counts of caribou from the Galena Mountain herd, 1988-92.

Date	Adults	Calves (%)	Bulls	Total
October 1988	81	14 (12)	22	117
No surveys 1989 or 1990				
June 1991	97	11 (8)	27	135
December 1991	--	--	--	260
June 1992	227	12 (5)	--	239
October 1992	172	9 (5)	49	230

Table 2. Aerial counts of caribou from the Wolf Mountain herd, 1988-92.

Date	Adults	Calves (%)	Total
No surveys 1988-90			
June 1991	128	18 (12)	146
June 1992	--	--	595

Table 3. Aerial counts of caribou from the Ray Mountains herd, 1988-92.

Date	Adults	Calves (%)	Total
May 1988	158	21 (12)	179
No surveys 1989 or 1990			
June 1991	353	93 (21)	446
June 1991	245	58 (24)	303
October 1991[a]	--	--	140

[a] Caribou Mountain portion only.

Table 4. Reported harvest of caribou by unit residents in Subunits 20F, 21C, 21D, and 24, 1988-92.

Year	Ray Mountains[a]	Galena Mountain	Wolf Mountain
1988	4	4	2
1989	4	1	0
1990	3	0	1
1991	2	0	1
1992	2	0	2

[a] Includes Caribou Mountain.

Table 5. Galena Mountain, Wolf Mountain, and Ray Mountains caribou hunter residency and success, 1988-92.

	Successful[a]				Unsuccessful[a]				
Regulatory year	Local resident	Nonlocal resident	Nonresident	Total	Local resident	Nonlocal resident	Total Nonresident	Total	hunters
1988-89	4	6	0	10	1	12	0	13	23
1989-90	3	1	1	5	3	14	0	17	22
1990-91	0	4	0	4	3	23	3	29	33
1991-92	0	3	0	3	2	28	0	30	33
1992-93	0	2	2	4	1	7	2	10	14

LOCATION

Game Management Units: 21D, 22A, 22B, 23, 24, and 26A (140,000 mi^2)

Herd: Western Arctic

Geographical Description: Northwest Alaska

BACKGROUND

The Western Arctic caribou herd (WACH) currently ranges over 140,000 mi^2 of remote mountainous, boreal, and tundra habitats in northwest Alaska. In recent years, the main body of the herd has calved north of the Brooks Range in Subunit 26A, and large numbers of WACH caribou have ranged into Subunit 21D, Units 23, 24, and the eastern portion of Unit 22 during the remainder of the year.

Historically, the WACH has fluctuated greatly in size. Herd size was estimated at 240,000 caribou during the early 1970s (Hemming 1971). However, herd size had declined to about 75,000 caribou by 1976 (Davis and Valkenburg 1978). Results of biennial photocensuses conducted since 1976 indicate that the WACH has grown steadily in size at rates varying from 7 to 22% annually (Machida 1991, Larsen *et al.* 1990). Results of the most recent photocensus conducted during July 1990 indicated that the herd numbered at least 415,692 caribou. Although hunter harvest reporting rates have remained low in recent years, we believe that harvests have remained well below sustained yield limits.

MANAGEMENT DIRECTION

Management objectives for Western Arctic herd caribou are to:

1) maintain a post-calving population of at least 200,000 caribou.

2) minimize conflicts with the reindeer herding industry.

3) monitor the size and composition of the population and use this information to predict population trends.

4) develop an information and education program to improve harvest reporting and public understanding of management of the WACH.

5) encourage public involvement in the regulatory process and in the formulation of management guidelines.

6) advocate measures to minimize the impact of industrial development on caribou habitat and movement patterns.

METHODS

We used VHF radiotelemetry to facilitate the collection of most WACH demographic data. We have attempted to maintain a minimum of 100 functioning VHF radio collars on WACH animals since 1987. During late August and early September 1990, 16 female caribou crossing the Kobuk River near Onion Portage were captured and instrumented with VHF radio collars manufactured by Telonics, Inc. (Mesa, AZ). During early September 1991 an additional 16 caribou were radio-collared at the same location. Details about collaring procedures have been previously described by Larsen and Machida (1989).

Three radio collars were also equipped with platform satellite transmitters (PTTs) manufactured by Telonics, Inc. in addition to a VHF transmitter. The life expectancy of the PTTs was 18-24 months, and all collars were programmed to transmit location, temperature, and activity data. Information concerning collar specifications and duty cycles, previous use of PTTs on WACH animals, and data retrieval has been provided by Fancy *et al.* (1988) and Larsen and Machida (1989).

During late April and early May of 1991 and 1992, we conducted short yearling composition surveys in Unit 23 using a Piper PA-18 aircraft while caribou were migrating from wintering areas in Units 22 and 23 to calving areas in Subunit 26A. Radio-telemetry was used to locate collared animals, and up to 200 caribou in the immediate vicinity of the collared animal were classified as either adults or short yearlings. The use of radiotelemetry allowed us to distribute sampling effort more effectively among the many thousands of migrating caribou encountered.

Calving ground surveys using a Cessna 185 aircraft were conducted during early June 1992 to assess parturition rates. Calving ground surveys were not conducted during June 1991 because of poor weather. Radio-collared female caribou were first located using radiotelemetry, and we classified each by the presence/absence of hard antlers and whether she was accompanied by a newborn calf. The size of the group accompanying the collared animal was estimated to the nearest 10,000 if the group was large, and to the nearest 1,000 if the group was small. In addition, up to 200 caribou (except large bulls) in the immediate vicinity of each collared animal were classified as either adult or calf.

At periodic intervals during fall and winter, ADF&G staff in cooperation with U. S. Bureau of Land Management (BLM) staff conducted radiotelemetry flights to assess herd distribution on winter ranges. In most cases, flights were conducted at altitudes of 8,000 to 10,000 ft to obtain maximum signal reception range, and only general locations were obtained. Flights were conducted in Units 21D, 22A, 22B, 23, 24, and 26A.

We collected information about the number of WACH animals killed by hunters using the statewide caribou harvest reporting system, and the local WACH harvest registration system. We gathered and catalogued harvest data from both systems at our Nome office.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The WACH has increased dramatically in size since 1976 when the herd was estimated to contain at least 75,000 caribou (Table 1). The most recent photocensus conducted in 1990 indicated the herd contained a minimum of 415,592 caribou, an increase of 5-fold during a 14-year period. The annual rate of increase averaged 14% and has varied from 7 to 22% during the 14-year period.

The 1990 photocensus was logistically difficult to complete because the herd did not aggregate in one day. Portions of the herd aggregated over the course of several days in widely scattered areas on the coastal plain and in the foothills of western Subunit 26A. Fortunately, animals from the different aggregations did not mix together, and we were able to photograph the aggregations as discrete units. If the herd continues to grow in size, we anticipate that future photocensuses using current techniques may become increasingly difficult or even impossible to complete. Use of sampling procedures for estimating herd size may become a necessity in such situations.

We are commonly asked how large we anticipate the WACH will grow before decline inevitably occurs. Current management objectives stipulate that we will try to maintain a minimum population size of 200,000 caribou, but no upper size limit is specified. We do not currently have the necessary demographic and range capacity information to accurately predict an upper population size limit. If we use 140,000 mi^2 as reported in our previous management reports to approximate a probable minimum size of the overall range of the WACH, herd density has increased from 0.5 caribou/mi^2 in 1976 to about 3.0 caribou/mi^2 in 1990. The George River caribou herd in northern Quebec attained a density of 2.8 caribou/mi^2, a density investigators believed was excessive (Messier *et al.* 1988). Because the range of the WACH has probably expanded concurrent with population growth, the actual size of the range is probably larger than 140,000 mi^2 with herd density less than 3.0 caribou/mi^2. However, reports of some overwinter mortality caused by starvation have come in from the North Slope in Subunit 26A indicating that WACH densities may become excessive in at least some portions of its range.

Even if we could adequately predict an upper size limit for the WACH, we could not effectively reduce herd size using the management tools currently available because of the large size and remoteness of the herd. Hunting seasons and bag limits are extremely liberal, and hunter harvest opportunity cannot be liberalized without increasing the incidence of wanton waste.

Population Composition: Spring composition surveys were conducted in portions of Unit 23 during late April and early May 1991 while caribou were migrating north to the calving grounds. We classified 8,482 caribou yielding a composition count of 19 short yearlings:100 adults (Table 2). Short yearling surveys conducted during the same period in 1992 yielded a count of 9,338 caribou, and a recruitment ratio of 22 short yearlings:100 adults. The areas surveyed included the Kobuk River and some associated drainages (Ambler, Redstone, Shungnak, and Kogoluktuk Rivers), portions of the Noatak River drainage and the Baird Mountains, portions of the Selawik drainage, the Selawik Hills, and the western Purcell Mountains. Survey and snow conditions were good to excellent during both years.

The proportion of short yearlings observed is within or near the range of 22 to 32 short yearlings:100 adults observed since 1977. No trend in short yearling survival is apparent from reviewing recent years' data. However, some investigators have pointed out that several factors affect the usefulness of short yearling composition data for making year-to-year comparisons of recruitment. Variations in the proportion of bulls occurring in the sample, and how the sample units are selected can cause variations in the size of the ratios and percentages observed (McLean and Heard 1988). Although short yearling composition data is probably inadequate for detecting small changes in recruitment, it does appear useful for detecting large-scale changes in recruitment, and as a red flag identifying areas where more refined demographic data are needed. The George River caribou herd which attained high population densities similar to the WACH experienced a decline in short yearling recruitment (8%) which apparently was measurable using standard techniques (Couturier *et al.* 1988).

We did calving ground surveys in Subunit 26A during early June 1992. The areas surveyed included the Noatak River drainage downriver of the Cutler River, the Wulik and Kivalina drainages, the Kobuk River drainage between Ambler and Kiana, the Squirrel River drainage, and the North Slope between the Lisburne Hills and the headwaters of the Colville River. Survey conditions were fair to good in all areas covered. Most radio-collared cows were located 40-50 miles west of Carbon and Disappointment Creeks in the same areas they were located in recent years. Seventy-six collared cows were located, and we saw a calf:cow ratio of 76 calves:100 cows. Calving appeared to be completed as of survey time. Calving success appeared similar to rates observed during 1989 and 1990, and no obvious trends are apparent (Machida 1991).

Distribution and Movements: During October 1990 through March 1991, we completed 12 radiotelemetry flights in cooperation with BLM staff to assess winter distribution of WACH caribou in Unit 22, and in the southern portion of Unit 23. We obtained 223 relocations. As observed during the previous 5 years, most collared animals concentrated in the Ungalik, Inglutalik, and Shaktoolik River drainages in eastern Unit 22. Caribou remained in this area during winter before moving north during early April 1991.

Ten radiotelemetry flights were conducted in Units 21D, 22, 23, and 24 from October 1991 through April 1992 to assess winter distribution of caribou, and 194 relocations were obtained. Unlike previous years, only moderate numbers of caribou wintered in eastern Unit 22, and many more caribou wintered in other units to the north.

On September 1990 we collared 2 cow caribou with PTTs when they crossed the Kobuk River near Onion Portage. Both animals subsequently wintered in the Nulato Hills east of Shaktoolik in Subunit 22A, and calved on the North Slope in Subunit 26A (Figure 1 and 3). One animal (PTT 7908), however, spent the following winter of 1991-92 on the North Slope in Subnit 26A and died near Carbon Creek in the Utukok River drainage (Figure 1). The other animal (PTT 10906) again wintered in the Nulato Hills during 1991-92 (Figure 3).

During September 1991 we collared 1 additional cow caribou with a PTT near Onion Portage. The animal wintered in the Nulato Hills in Subunit 22A, and migrated to the North Slope calving grounds during spring (Figure 5).

At the end of the reporting period, approximately 100 WACH radio collars were believed to be functional. Only about 2 caribou per 10,000 animals were radio-collared if we assume that herd size has changed little since 1990. If we wish to improve our ability to assess caribou distribution, particularly during winter, additional caribou should be collared at other locations in addition to Onion Portage. Because we have collared caribou only at Onion Portage during the last 10 years, only caribou enroute to southerly wintering areas were available for collaring. I recommend additional collaring of animals in the Noatak drainage and on the North Slope.

Mortality

Seasons and Bag Limits: The hunting season for bulls in Units 22A, 22B, 23, 24, 26A and western 21D was open all year. The season for cows in the same area was open only from July 1 to May 15. The bag limit for Alaska residents was 5 animals per day, and only 5 animals may be transported south of the Yukon River. The bag limit for nonresidents was 5 animals.

Human-induced Mortality: The 1990-91 reported harvest is 1,926 caribou, 30% more than the 1,485 caribou reported in 1989-90 and 52% less than the high harvest of 4,047 caribou reported in 1985-86 (Table 4). The number of local hunters residing within the range of the WACH who reported their harvest using the WACH registration system increased from 573 reported during 1989-90 to 810 during 1990-91 (Table 5).

During the 1991-92 season, 1,707 caribou were reported harvested, an 11% decline from the previous year. Of the 962 individuals who reported hunting, 682 were local hunters residing within the range of the WACH.

Reasons for the decline in reported harvest from the mid-1980s are not clear. Reported harvests in all 5 units encompassing the range of the WACH declined. The number of caribou harvested annually is normally related more to caribou distribution than population size. Harvests tend to increase when caribou move near population centers. Caribou may not have always been available to hunters at opportune times because caribou have wintered further south and east than previously reported. We cannot be certain whether declines in reported harvests represent an actual harvest decline or poorer reporting rates because harvest reporting rates have remained poor in northwest Alaska.

Hunter Residency: Most of the harvest reported on the WACH registration system is attributable to local hunters (85%) residing within the range of the WACH. Harvests reported by non-local hunters through the statewide harvest ticket system remained remarkably stable during the past 5 years.

Harvest Chronology: Because harvest dates are not requested on the WACH harvest report form, we have no detailed data about harvest chronology. We believe that harvest patterns documented in past progress reports have not changed significantly. Caribou taken during fall are harvested primarily during late August through early October, and caribou taken during winter are harvested primarily during January through April.

Habitat

Assessment: As the WACH continues to increase in size, many individuals are concerned about the possibility of deteriorating habitat conditions. Reports of sporadic starvation among caribou wintering on the North Slope during recent years heightens our concerns of deteriorating range conditions. Because of the enormous expense involved and the remoteness of most WACH ranges, extensive range inventory work has not been conducted in recent years. Future prospects of declining budgets and reduced staffing make it unlikely that meaningful range assessment work will begin in the immediate future.

Assessment of animal body and physiological condition can also provide data for monitoring herd nutritional status, and, indirectly, range condition. A body condition research study for the WACH began during 1992, and a progress report will be published separately this year.

CONCLUSIONS AND RECOMMENDATIONS

The WACH has grown at a rate of 7 to 22% annually since 1976. A photocensus conducted in 1990 indicated that the herd attained a minimum size of 415,692 caribou, and survey and anecdotal information collected during the report period indicates the herd probably continued to increase in size.

A management problem that has not been adequately resolved is continued poor harvest reporting. Anderson and James (1986) estimated that reported harvest may account for as little as 25% of the actual harvest. Anecdotal reports from local Unit 23 residents suggest that even 10% may be optimistic. If herd size declines substantially, significantly improved harvest data will be required for making meaningful management decisions. I recommend additional efforts to improve harvest reporting rates.

As the WACH has increased in size, conflicts with the reindeer herding industry have become more substantive. Department staff should continue to work with the herders and industry representatives to minimize conflicts between caribou and reindeer informing them of known significant caribou movements in and adjacent to reindeer ranges.

Nutritional and range status are becoming important concerns as herd size increases. Because range studies have traditionally been conducted by various land management agencies such as the BLM, the Department should encourage the development of an adequate range assessment program by these agencies. These types of studies tend to be costly, and a range assessment program will probably need to be a multi-agency effort. In addition, continued development of cost-effective techniques to track body condition of WACH animals is recommended.

As previously mentioned, use of radio-collared animals has greatly enhanced our ability to conduct survey/inventory work on the WACH. Collaring additional animals will improve our ability to conduct the photocensus if herd size continues to increase. Additional collared animals will also improve our assessment of winter range distribution. If we wish to better account for winter range use in northern Unit 23 and the North Slope, I recommend collaring more animals in the Noatak drainage and on the North Slope.

Current hunting seasons and bag limits for the WACH are extremely liberal, and we believe most hunters who wish to harvest caribou have adequate hunting opportunity. Although the herd can sustain additional harvests, further liberalization of the regulations will probably not significantly increase the number of caribou harvested. I recommend no changes in seasons or bag limits at this time.

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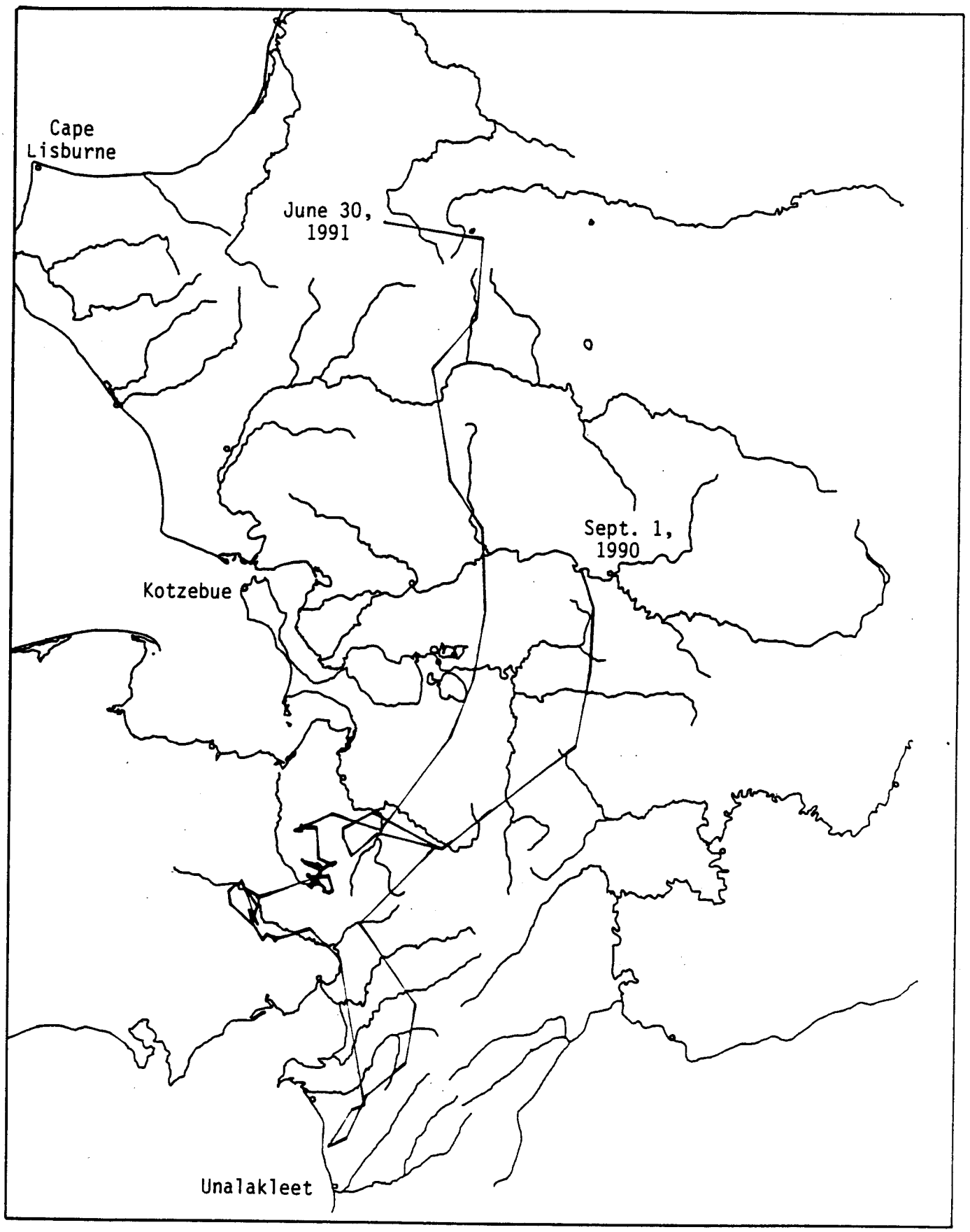

Figure 1. Movement of satellite-collared cow caribou (PTT 7908) from early September 1990 through June 1991.

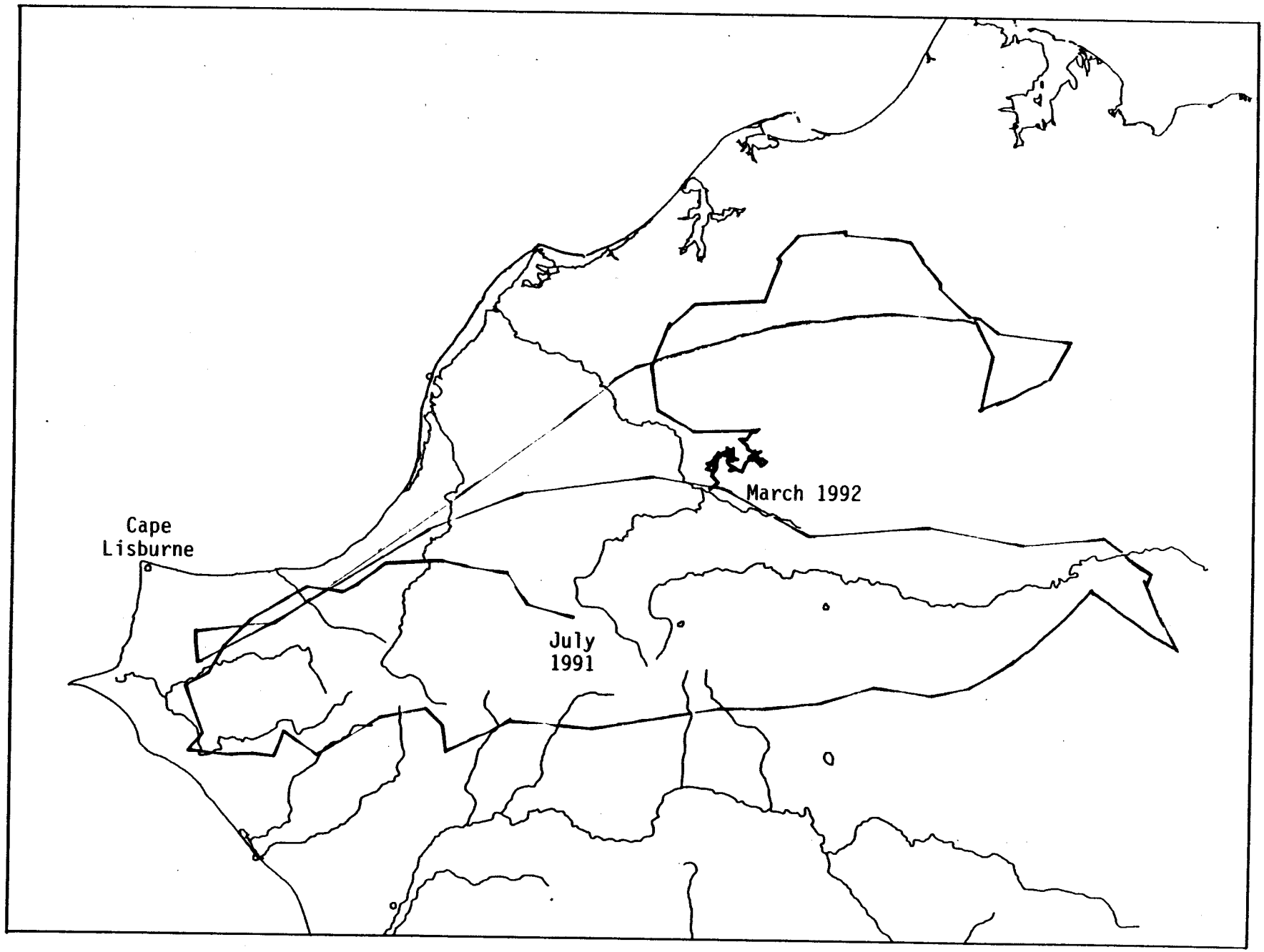

Figure 2. Movement of satellite-collared cow caribou from early July 1991 through March 1992.

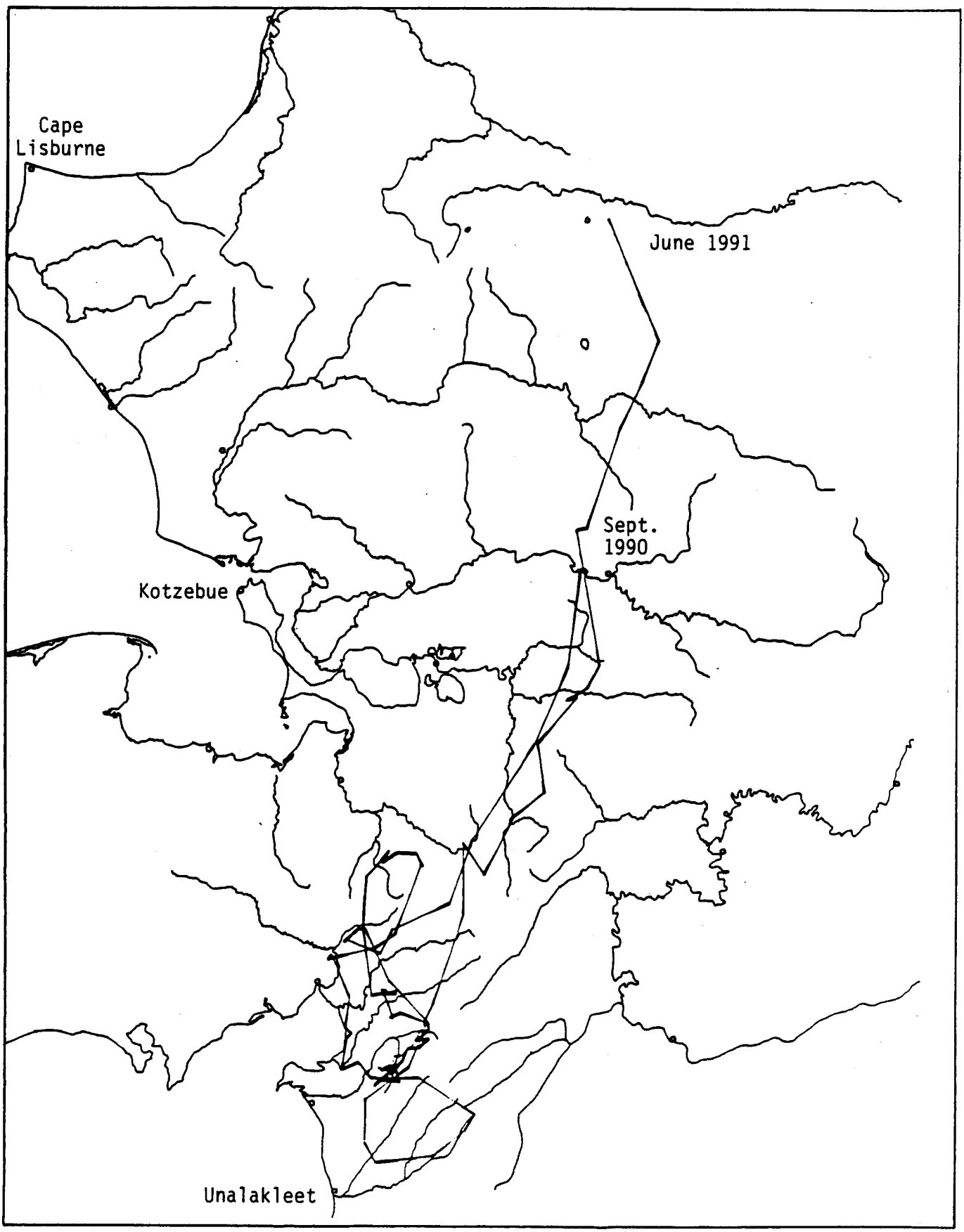

Figure 3. Movement of satellite-collared cow caribou (PTT 10906) from early September 1990 through June 1991.

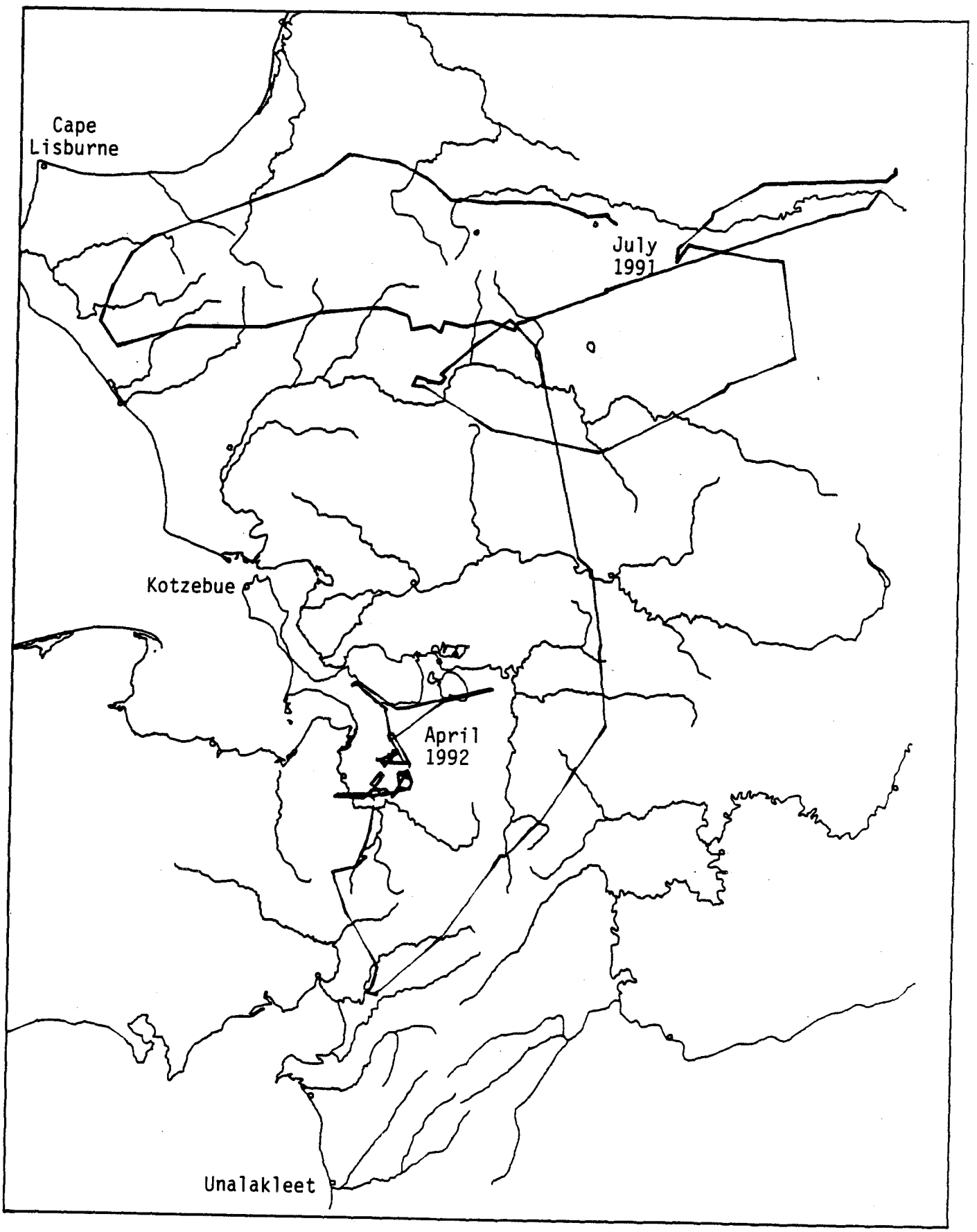

Figure 4. Movement of satellite-collared cow caribou from early July 1991 through April 1992 (PTT 10906).

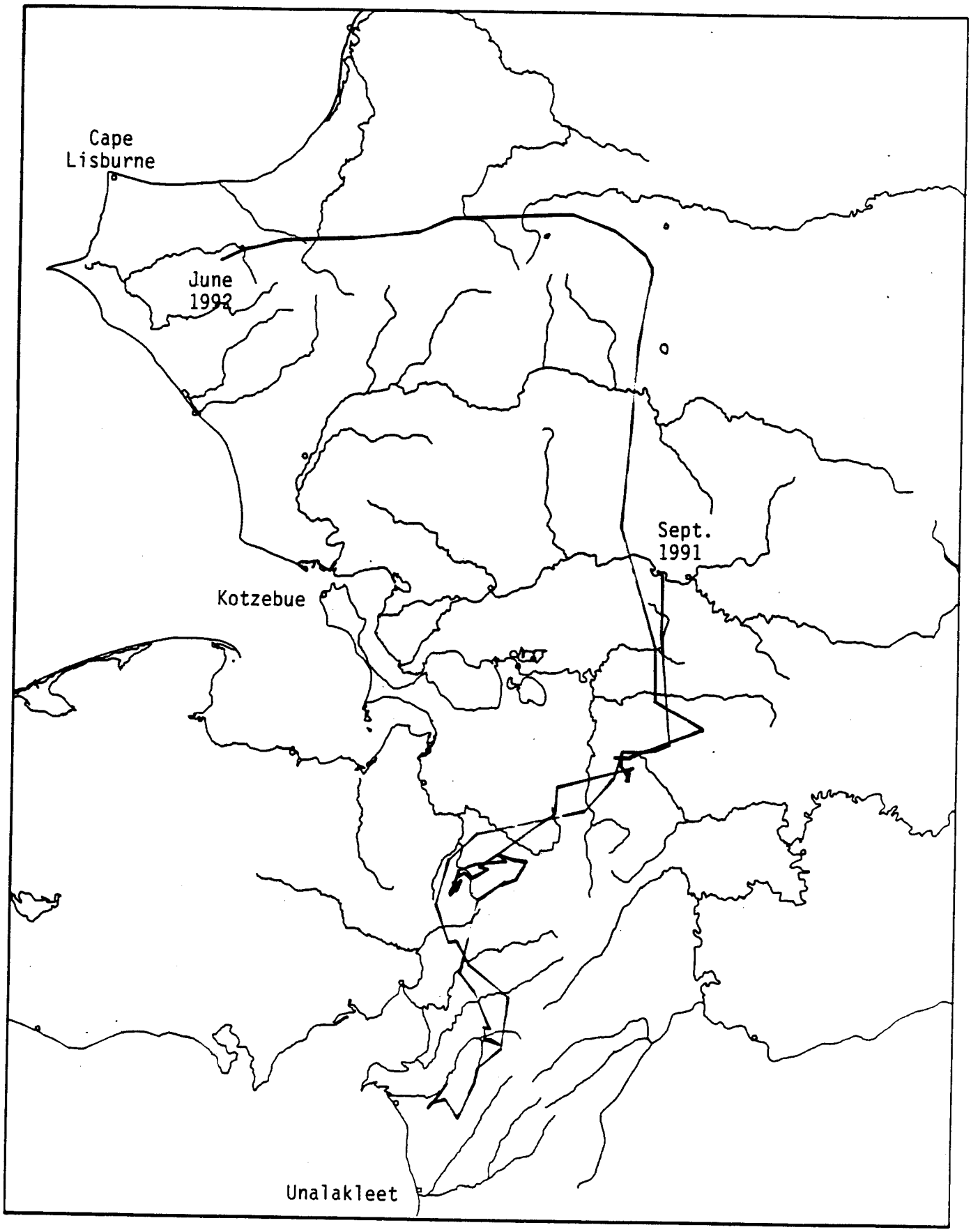

Figure 5. Movement of satellite-collared cow caribou (PTT 7870) from early September 1991 through June 1992.

Table 1. Population estimates, average annual rates of change, and density of the Western Arctic caribou herd, 1976-1990.

Year	Population estimate	Average annual rate of change (%)[a]
1976	75,000[c]	
1978	106,635	19.5
1980	138,000	13.8
1982	171,699	11.5
1986	229,433	7.5
1988	343,167	22.3
1990	415,692	10.0

[a] $\frac{\ln[Nt + t,1] - \ln[Nt]}{t} = r$ e^r = annual rate of change.

[b] Davis and Valkenburg 1978.

Table 2. Spring composition data for the Western Arctic caribou herd, 1986-1992.

Year	Adults	Short yearlings	Total	Short yearlings: 100 adults
1986	5,372	1,227	6,599	23
1987	7,981	2,150	10,131	27
1988	6,047	1,312	7,359	22
1989	5,330	1,718	7,048	32
1990	5,231	1,198	6,429	23
1991	7,111	1,371	8,482	19
1992	7,660	1,678	9,338	22

Table 3. Number of radio-collared cows visually observed with calves during calving ground surveys, 1988-1992.

Year	Cows w/calf	Cows wo/calf	Total cows	% cows w/calf
1988	26	27	53	49
1989	34	16	50	68
1990	51	20	71	72
1992	58	18	76	76

Table 4. Reported harvest of Western Arctic herd caribou for 3 non-overlapping harvest reporting systems, 1985-1992.

Year	WACH registration system		Harvest from Eastern Arctic reporting system[a]	Harvest from statewide report system	Total
	Overlays issued	Reported harvest			
1985-86	1,179	3,827	96	124	4,407
1986-87	1,154	3,686	46	122	3,854
1987-88	931	2,427	189	124	2,740
1988-89	994	1,924	178	124	2,226
1989-90	660	1,287	---	198	1,485
1990-91	885	1,861	---	65	1,926
1991-92	723	1,210	---	497	1,707

[a] The Eastern Arctic reporting system was eliminated during 1989.

Table 5. Western Arctic herd caribou harvests reported by local residents from fall 1985 to spring 1992.

Year	No. of successful hunters	(%)	No. of unsuccessful hunters	(%)	Total hunters	Total harvest
1985-86	513	(52)	480	(48)	993	3,668
1986-87	454	(45)	544	(55)	998	3,545
1987-88	315	(40)	463	(60)	778	2,337
1988-89	302	(35)	550	(65)	852	1,828
1989-90	192	(34)	381	(66)	573	1,198
1990-91	313	(57)	234	(43)	548	1,861
1991-92	154	(48)	166	(52)	320	1,210

LOCATION

Game Management Units: 25A, 25B, 25D, and 26C (59,400 mi^2)

Herd: Porcupine

Geographical Description: Eastern portions of the Arctic Slope, Brooks Range, and northeastern interior Alaska

BACKGROUND

The Porcupine caribou herd (PCH) migrates between Alaska and the Yukon and Northwest Territories of Canada. The herd range covers approximately 130,000 mi^2, most of which is remote roadless wilderness. The major portion of the PCH calving ground lies along the coastal plain within the Arctic National Wildlife Refuge (ANWR). The coastal plain also contains the best known onshore petroleum prospect in the United States, which both industry and government are eager to exploit (Clough *et al.* 1987). Exploitation of this petroleum reserve will result in habitat alterations. Baseline ecological studies of the PCH and other wildlife resources are being done by various state, federal, and private agencies, as well as their Canadian counterparts. These studies are expected to guide development and provide the basis for mitigation measures should development occur.

An International Porcupine Caribou Board was established to coordinate management and research among the governmental and user groups in Alaska and Canada. Results of board recommendations, research studies, and the actions of Congress about the opening of ANWR to further exploration and/or development will all influence how the herd is managed to provide for a variety of uses.

The PCH remained more stable than other Alaskan herds during the 1960s and 1970s at about 100,000 caribou (Table 1). However, in 1979 the population began a steady increase and reached 178,000 caribou by 1989. Annual rates of growth averaged about 5% from 1979 to 1989.

MANAGEMENT DIRECTION

Despite its large size, the PCH was a low priority for management and research because of its remote location and the small number of Alaskans who harvested it. In the early 1980s the increasing possibility of oil development in northeast Alaska and increasing international interest in the herd resulted in a higher management priority and heightened attention from biologists (Garner and Reynolds 1986). The ADF&G's existing management goals are to provide for optimal harvest and the greatest opportunity to participate in caribou hunting. These goals will probably be modified if a joint

Canada/Alaska management plan is adopted. The following goals were proposed by the International Porcupine Caribou Board.

1) To conserve the PCH and its habitat through international cooperation and coordination so that the risk of irreversible damage or long-term adverse effects as a result of the use of caribou or their habitat is minimized.

2) To ensure opportunities for customary and traditional uses of the PCH.

3) To enable users of the PCH to participate in the international coordination of conservation of the PCH and its habitat.

4. To encourage cooperation and communication among governments, users of the PCH, and others to achieve these objectives.

METHODS

We estimated population size by an aerial photocensus conducted in July 1992. A census attempt in 1991 failed because some photographs did not overlap, thus missing caribou. Movements, productivity, mortality, and seasonal distribution were determined from observations of radio-collared caribou. Composition counts were conducted during the 1992 census and also during the incomplete census in 1991, but were confined primarily to the cow/calf segment of the herd. We estimated overwinter survival of calves from composition counts conducted in March 1991 and 1992.

Reports submitted by nonsubsistence hunters provided most data on harvest in Alaska. We gathered subsistence harvest data opportunistically through field interviews. We obtained harvest figures from Canada from the Yukon Department of Renewable Resources.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Preliminary census results indicate that the PCH numbered about 160,000 caribou in July 1992. Final adjustments may raise the count very slightly. In contrast to the two most recent censuses in 1987 and 1989 (Golden 1990, Whitten 1992), no known Central Arctic caribou herd (CACH) caribou were included in the 1992 count. There is no indication from movements of radio-collared caribou that emigration occurred since 1989. The lower count in 1992 undoubtedly represents a real decline.

Population Composition: Calf:cow ratios observed in July 1991 and 1992 (62:100 and 55:100, respectively) were equal to or higher than the long-term mean of 54.3 calves:100

cows compiled from midsummer composition counts from 1972 to 1989 (Table 2). The calf:cow ratio in March 1990 was about 60:100 cows (C. Smits, Yukon Wildlife Branch, pers. commun.); while not considered to be a representative sample of the herd, this estimate was thought to indicate good calf survival. The March 1992 count was only 22 calves:100 cows (C. Smits, Yukon Wildlife Branch, pers. commun.) and would indicate relatively poor survival. In contrast, 10 of 11 calves collared in November 1991 survived through June 1992, indicating excellent survival.

During the July sex and age composition counts in both 1991 and 1992, no data were obtained for some large aggregations of caribou on the south slopes of the Brooks Range. It was clear from aerial observation and the distribution of radio-collared animals that these groups were mostly bulls. Therefore, the bull:cow ratios from the July counts were unreliable. Presumably the bull:cow ratio remains about 60:100 (Whitten 1992).

Distribution and Movements: Previous movements and distribution of the PCH have been summarized by Garner and Reynolds (1986), Whitten (1987), Whitten and Regelin (1988), Fancy *et al.* (1989), Golden (1989, 1990), Whitten and Fancy (1991), and Whitten (1992). In July 1990 some bull groups remained in the mountains on the south side of the Brooks Range and never joined the cow segment of the PCH on the coastal plain. Some PCH animals mixed with CACH animals and moved west of the Canning River toward Prudhoe Bay, as they did in 1987 through 1989. During August and September, most PCH caribou were in Canada, where they moved in a clockwise direction around Old Crow Flats. Most of the herd wintered in the northern Richardson Mountains in Canada, and relatively few stayed in the Central Arctic area in Alaska.

Low to moderate snow depths on winter range and migration routes and early melt on the arctic coastal plain resulted in early arrival of cows on the calving grounds in 1991. Calving was distributed farther west than any time since 1974. No calves were born to collared cows east of the Aichilik River, and calving extended west to the Katakturuk River. Large postcalving aggregations formed on the coastal plain in early July, but some bulls aggregated separately on the south slopes of the Brooks Range. In 1991, PCH animals did not remain on the coastal plain either in ANWR or farther west past about mid-July, and overlap with the CACH was brief. By November most of the herd had moved south to the Ogilvie Mountains in the Yukon Territory.

Late winter snow accumulations in 1992 were the deepest ever recorded at many stations in the northern Yukon. Spring melt was also very late, and extensive flooding occurred in most drainage systems. Some PCH cows still managed to reach the traditional high-density calving area on the coastal plain in Alaska, but others were spread out along migration routes as far south as the Porcupine River at calving time. By late June all radio-collared cows in the PCH had reached the coastal plain in Alaska and postcalving aggregations began to form. In early July, some coastal plain groups moved into the northern Brooks Range, some stayed on the plain, and many bulls aggregated separately

on the south side of the Brooks Range. No overlap with the CACH was known to occur on summer range in 1992.

Mortality

Harvest:

Season and Bag Limit. The State of Alaska hunting season for all hunters during this report period was 1 July to 30 April. The bag limit for nonresidents was 5 caribou. The bag limit for all Alaska residents was 10 caribou, provided that no more than 5 could be transported out of Subunits 25A, 25B, 25D, and 26C per regulatory year.

Board of Game Actions and Emergency Orders. In March 1992 the Board of Game, at the request of residents of Kaktovik, authorized an additional bulls-only season from 23 to 30 June to allow residents to harvest caribou before July.

Hunter Harvest. Total harvest for the PCH has ranged from about 1,500 to 4,800 over the past few years (Table 3), or about 1-3% of estimated population size (Table 1). Although a few PCH animals may have wintered in Subunit 26B during this report period, that area is inhabited predominantly by CACH caribou. Therefore, only caribou reported taken in Subunits 26C and 25A were considered to be from the PCH in 1990-91 and 1991-92.

Harvests by local residents and nonlocal hunters are reported differently. Nonlocals use general statewide caribou harvest report cards. Harvest by nonlocal hunters has typically been a minor part of the overall PCH harvest and has shown no definite trend over the past 5 years. Nonlocal hunters have never killed many PCH cows. Most of the take by nonlocal hunters is by Alaska residents.

Standardized reporting of harvest by those hunters living north of the Yukon River was not required beginning in 1989, and in previous years local residents did not report even though it was required. Subsistence harvests have therefore been estimates. Caribou were available to Kaktovik residents only during early summer during this report period and were available to villages south of the Brooks Range briefly during late summer and fall. Subsistence harvests in Alaska were very low compared with most years. Harvest in Canada was relatively high because caribou moved through the Old Crow area several times each year and also spent time in the Richardson Mountains or along the Dempster Highway, where residents of Aklavik, Ft. MacPherson, and many road-connected communities had easy access.

Hunter Success. Nonlocal hunter effort and success depends on herd distribution. Word travels quickly when the PCH is scarce in Alaska, as in fall 1990 (Table 4). When this happens, few hunters travel to the PCH range. Perhaps because of its uncertain

distribution and the difficulty and expense of traveling to its range, the PCH has never become very popular with nonlocal hunters.

Local subsistence hunters have seldom cooperated in reporting their effort and success. Based on the summer and winter availability of caribou near villages, subsistence hunter success during this report period was probably high for Kaktovik, but very low for Arctic Village and other communities south of the Brooks Range.

Harvest Chronology. Nearly all nonlocal harvest of the PCH in Alaska occurs during August and early September. This pattern normally reflects when hunters prefer to be afield, but during this report period it was also the only time when caribou were available. Subsistence harvest chronology depends much more on caribou distribution and harvest occurs whenever caribou are present. The exception is during June at Kaktovik where caribou may be present but inaccessible because travel conditions are poor.

Transport Methods. Traditionally, nonlocal hunters fly into the PCH range, with very few traveling by boat up the Porcupine River. Local residents use boats in summer and snowmachines in winter.

Other Mortality: The pregnancy rate of 74 radio-collared adult PCH females in June 1990 was 82%. Mortality of those calves during June was 9%. In 1991, 54 of 73 (74%) collared cows gave birth, and June calf mortality was 18%. In 1992, 67 of 78 (86%) collared cows gave birth, and June calf mortality was 43%. Annual mortality of adult females was about 18-19% in 1990-91 and 1991-92. This is slightly higher than the 1983-89 mean of 15% cow mortality.

Habitat

Assessment: Carrying capacity of the PCH range is not known. Population density is approximately 1.3 caribou per mi^2 (0.5/km^2). Several studies are currently assessing habitat availability and quality, primarily on the calving grounds and summer ranges.

Enhancement: No habitat enhancement programs are under way or planned on PCH range. Much of the herd's range within Alaska is designated wilderness, and the northern portion of the Yukon Territory is a national park.

CONCLUSIONS AND RECOMMENDATIONS

Routine annual monitoring of natality, early calf survival, and adult female mortality gave little indication that the PCH had stopped growing. The few observations that suggested changes were far from conclusive. Low recruitment of the 1991 calf cohort was apparent from the March 1992 composition count, but not corroborated by radio-collared calf survival. Low early survival of the 1992 cohort was coupled with a high initial birth rate,

so the calf:cow ratio in July 1992 was not unusually low in either composition counts or in the radiocollar sample. Additional adult mortality may have occurred during the past two winters, but the increase was not statistically significant. Severe snow conditions in late winter 1992 would be consistent with higher neonatal calf mortality and lower overwinter survival, but the incomplete census attempt in 1991, although impossible to objectively analyze, suggests that numbers may have already been down in 1991. The severe winter of 1991-92 undoubtedly contributed to the recent decline of the PCH from 178,000 caribou in 1989 to approximately 160,000 in 1992. However, confidence intervals around our estimates of most population parameters are large enough that they could have masked other subtle changes which combined synergistically to result in a change in population trajectory which we failed to detect. If this is true, it underscores the fact that presently conducted surveys and radiocollar data are not sufficient for detecting small changes in population size and trend.

The PCH remains lightly hunted and harvest was probably not a factor in the recent decline. There is little possibility of increasing harvest in Alaska above recorded levels. Even when caribou are abundant in Alaska, lack of road access and the cost of air charter services limit hunting effort despite long seasons and large bag limits. Local harvest for subsistence use is governed by caribou availability. The only factors that could alter this pattern would be some drastic change in caribou distribution or some new form of access to the caribou. Access along the Dempster Highway has changed harvest patterns in Canada, and the potential for greatly increased harvest exists there. Canadian agencies have allowed only a conservative harvest.

Relative to many other Alaskan caribou herds, PCH females have shown lower pregnancy rates, higher adult mortality, higher calf survival, and a slower population increase rate (5%). The herd remains large, and assuming that the recent decline is a temporary adjustment to adverse weather, it should be able to withstand continued harvest at traditional levels.

The ADF&G is cooperating with the USFWS and Canadian government agencies in assessing the importance of the ANWR coastal plain to the PCH. The department has identified a portion of the coastal plain between the Hulahula and Aichilik Rivers as being of special value to calving and postcalving caribou and has recommended that the area should receive special consideration in any plans to develop ANWR. Those recommendations still stand. However, data from the past 3 years demonstrate that the entire area between the Hulahula and Aichilik Rivers is important to the herd. The department should continue to work with other agencies to identify the potential risks associated with developing the coastal plain and possible means of mitigating negative impacts to caribou and other wildlife.

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Table 1. Population estimates of the Porcupine caribou herd, 1961-92.

Year	Population estimate[a]	Type of estimate
1961	110,000	Calving ground census[b]
1972	99,959	APDCE[c]
1977	105,000	APDCE
1979	105,683	Modified APDCE
1982	125,174	Radio census[d]
1983	135,284	Radio census
1987	165,000	Radio census
1989	178,000	Radio census
1992	160,000	Radio census

[a] All estimates include calves except for the 1961 estimate.
[b] Data presented by R. O. Skoog at the 1962 Alaska Science Conference.
[c] Aerial photo-direct count-extrapolation (APDCE) (Davis *et al.* 1979).
[d] Valkenburg *et al.* 1985.
[e] Preliminary results.

Table 2. Porcupine caribou herd postcalving composition counts and estimated population size, 1971-92.

Approximate survey date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent yrlgs	Percent small bulls (% of bulls	Percent large bulls (% of bulls)	Percent bulls	Composition sample size
7/71	24	38	21	56	10	--	--	13	29,197
7/72	23	49	26	53	9	--	--	12	11,721
7/73	16	47	27	58	6	--	--	9	19,101
7/74	9	67	37	55	3	--	--	5	14,127
7/75	23	52	27	52	9	--	--	12	18,814
7/76	5	58	32	55	10	--	--	3	13,762
7/77	7	39	24	61	11	--	--	4	25,520
7/78	30	68	32	47	7	--	--	14	18,669
7/79	15	55	30	55	7	--	--	8	19,154
7/80	59	66	26	39	11	--	--	23	9,046
7/82[a]	95	43	15	36	15	--	46	34	19,718
7/83	9	73	38	52	5	61	39	5	2,583
7/86[a]	57	52	22	42	12	--	--	24	19,499
7/87[a]	72	62	24	38	10	49	51	28	33,044
7/88	28	54	27	50	10	57	43	14	6,420
7/89	17	46	25	55	11	77	23	9	23,242
7/90[a]	--	--	--	--	--	--	--	--	--
7/91	36	46	28	46	10	--	--	17	16,060
7/92	27	55	27	49	10	62	38	13	18,217

[a] Only these surveys sampled all portions of the herd, including bull groups.

Table 3. Porcupine caribou herd harvest, 1984-92.

Regulatory year	Hunter harvest							Total
	Reported				Estimated unreported			
	M	F	Unk	Total	Alaska	Canada	Total	
1984-85	49	4	0	53	500-700	4,000	4,500-4,700	4,553-4,753
1985-86	52	12	1	65	500-700	4,000	4,500-4,700	4,565-4,765
1986-87	70	14	0	84	1,000-2,000	500-1,000	1,500-3,000	1,584-3,084
1987-88	106	22	1	129	<500	2,000-4,000	2,500-4,500	2,629-4,629
1988-89	82	7	0	89	<500	2,000-4,000	2,500-4,500	2,589-4,589
1989-90	104	8	0	112	500-700	2,000	2,500-2,700	2,612-2,812
1990-91	19	1	0	20	100-150	1,680	1,780-1,830	1,800-1,850
1991-92	101	3	0	104	100-150	2,774	2,874-2,904	2,978-3,028

Table 4. Hunter success in the Porcupine caribou herd from 1987-88 to 1991-92.

Hunters	Unit/Subunit 25A	25B	25D	Total 25	26C	Total 25 & 26C
1987-88						
Total hunters	88	16	2	106	62	168
Successful	60	8	0	68	38	106
% Successful	68	50	0	64	61	63
1988-89						
Total hunters	71	26	8	105	68	173
Successful	29	8	0	37	52	89
% Successful	41	31	0	35	76	51
1989-90						
Total hunters	71	3	7	81	32	113
Successful	53	2	3	58	24	82
% Successful	75	67	43	72	75	73
1990-91						
Total hunters	--	--	--	--	--	29
Successful	--	--	--	--	--	13
% Successful	--	--	--	--	--	45
1991-92						
Total hunters	62	8	2	72	22	94
Successful	43	1	0	44	7	51
% Successful	69	13	0	61	32	54

LOCATION

Game Management Units: Western half of Subunit 25C and small portions of northern Subunit 20B and eastern Subunit 20F

Herd: White Mountains (WMH)

Geographical Description: White Mountains Area North of Fairbanks

BACKGROUND

Historically, the Fortymile caribou herd calved in the White Mountains and moved southeast across the Steese highway to wintering areas (Davis *et al.* 1978). As recently as 1960, 30,000 Fortymile caribou crossed the Steese Highway to summer in the White Mountains (Jones 1961). As the Fortymile herd declined throughout the 1960s they abandoned the traditional White Mountains calving area and remained southeast of the Steese Highway. However, in the late 1970s, public reports and incidental observations by biologists confirmed the year-round presence of caribou in the White Mountains, implying a small resident herd had existed for many years (Valkenburg 1988). White Mountains caribou now maintain a distinct calving area mostly east of Beaver Creek and are considered a separate herd.

The White Mountains National Recreation Area (WMNRA) is managed by the Bureau of Land Management (BLM) and was created by Alaska National Interest Lands Conservation Act (ANILCA) in 1980. In 1982, BLM and ADF&G initiated a cooperative project to determine the identity and distribution of caribou in the White Mountains. Caribou collared during that project provided information on movements and distribution of the herd. On 28 and 29 September 1988, new collars were placed on 6 previously collared cows, and 10 additional collars were placed on 4-month-old female calves to determine first age of reproduction, and to aid in conducting censuses and composition counts. Six of nine 2-year-old cows calved in 1990 suggesting that nutrition was not limiting growth of the herd. On 11 October 1991, nine female calves were radio-collared to continue research on population dynamics, range use and movement patterns, and to provide a low-density comparison population for the long-term Delta herd research project.

From 1987 to 1992 reported harvests averaged 14 bull caribou annually. Public interest in the White Mountains is increasing especially during early and late winter. The BLM continues to improve access and increase recreational opportunities through development and implementation of its recreational plans.

MANAGEMENT DIRECTION

Management Goals and Objectives:

- To ensure that increased recreational use and mining development do not adversely affect the White Mountains herd.
- To provide the greatest sustained opportunity for hunting caribou.
- To provide an opportunity to view and photograph caribou.
- Annually monitor information on recreational use, mineral development and plans for improving access into the White Mountains.
- Cooperate with the BLM annually to identify seasonal ranges that are frequently used by the White Mountains herd.
- Determine the effects of fire on caribou movements.
- Estimate annual harvest and hunting pressure.
- Estimate herd size, composition, and trend annually.
- Establish population objectives.
- Cooperate with the BLM to provide information to the public about caribou viewing and photographic opportunities.
- Minimize potential conflicts between hunters and nonhunters, especially in winter.

METHODS

Population Size

On 6 July 1992, J. Herriges (BLM) estimated herd size using a radio census technique (Valkenburg *et al.* 1985) with extrapolation for missing radios. He recorded locations of caribou and counted smaller groups. He photographed all groups of caribou too large to count precisely using a 35mm camera. He used direct counts combined with photo counts to develop a minimum population estimate.

Composition

We flew full sex and age composition surveys in 1991 and 1992 using a fixed wing aircraft to locate radio-collared caribou. A helicopter was used to classify individuals by sex and age. We classified caribou into six categories: cow, male calf, female calf, small bull, medium bull, and large bull. In addition to the fall surveys in 1990 and 1992, we also classified samples of caribou in late May 1990-92. The BLM and ADF&G biologists located radio-collared caribou via helicopter to determine natality ratio (Appendix A).

Harvest Estimation

We estimated harvest using data from returns of harvest ticket report cards and drawing permit report cards.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The WMH appears to be stable or increasing slowly (Table 2). In 1990, W. Hobgood (BLM pers. commun.) estimated the WMH at 750 to 1,000 caribou. During the 1991 photocensus 761 caribou were counted and all radio-collared caribou were located. In 1992 we counted 832 caribou and located all radio-collared caribou.

Population Composition: Fall calf:cow ratios in the WMH have declined since 1989 (Table 1), although they have remained higher than in other interior herds (see other caribou reports in this volume).

The bull:cow ratio has varied and may reflect unrepresentative sampling because of segregation of bulls after the rut. Early surveys (i.e., 29 September - 6 October) yielded higher bull:cow ratios than later surveys (Table 1).

In 1991, staff classified 314 caribou in 8 groups, including 9 of 10 radio-collared individuals. In 1992 staff classified 247 caribou in 3 groups containing 3 of 16 radio-collared caribou.

Natality: At least 70% of radio-collared WMH cows calved, although most of the cows were 2-4 years old. Pregnancy rates in the WMH were high during 1990-92 (Table 1). In 1990 at least 5 of 7 two-year olds produced calves as evidenced by hard antlers, distended udders, or accompanying calf. All 5 of those cows were also pregnant the next year, and 4 of the 5 were known to be pregnant as 4-year olds in 1992 (Table 2). There were no indications that females that bred as yearlings had any "negative pulse" in calving as 3-year olds. These data agree with findings from the Delta herd (Davis *et al.* 1990).

In the April 1992 survey staff classified 248 cows, 60 bulls, 35 male calves, and 42 female calves. The calf:cow ratio was 31:100 and the bull:cow ratio was 24:100. The data indicated relatively low overwinter mortality in 1990-91. Since this was the only April composition count ever done on the WMH, between year comparisons are not possible.

Distribution and Movements: The WMH exhibited consistent seasonal range use from 1982 until fall 1992 as described by Durtsche and Hobgood 1990 (Figure 1). Between 11-20 September 1992, caribou from the Delta, Denali, Chisana, Nelchina and Mentasta herds made unusual movements, possibly because of the unseasonably early deep snow experienced throughout the Interior. To some extent, the WMH also made some unusual movements. Radio-collared caribou (6 of 16) were located for the first time in the Preacher Creek drainage from late September on. The remainder of the radio-collared animals (10/16) was located in traditional wintering areas (J. Herriges pers commun.).

Board of Game Actions and Emergency Orders: No Board of Game actions were taken during this report period.

Mortality

Harvest:

Season and Bag Limit. The fall hunting season was 10 August -20 September throughout the herd's range (Subunits 20B, 20F south of the Yukon River, and 25C).

The winter drawing permit hunts were open for caribou hunting north and east of the Elliott and Dalton Highways, and north and west of the Steese Highway. Hunt 577 (50 permits available) was 15-28 February and Hunt 578 (50 permits available) was open 1-15 March. Use of motorized vehicles for hunting was prohibited for hunt 578 permittees. The bag limit for both winter hunts was 1 caribou.

Other Mortality: Two calves that were radiocollared in October 1991 and one old female were found dead in November 1991. The calves were probably capture related mortalities. The cause of death was unknown for the female.

Human-induced mortality. The reported fall harvest of WMH caribou has ranged from 12-18 over the last 5 years (Table 3). Fall harvest appears to be increasing but remains relatively low.

Relatively few hunters take caribou during winter permit hunts, but the level of interest is high (Table 4). Winter hunt participation is significantly effected by weather and traveling conditions.

The WMH harvest is delineated from the neighboring Fortymile caribou herd by using the Steese Highway as the dividing line. Caribou harvested north of the Steese Highway

are considered WMH caribou; caribou harvested south of the Steese Highway are considered Fortymile caribou. To separate the WMH from Ray Mountains herd harvest in Subunit 20F, animals killed south of the Yukon River are considered WMH caribou.

Hunter Residency and Success: Most hunting pressure on the WMH during fall was from Fairbanks area residents. In 1992, 66% (12/18) of successful hunters were from the Fairbanks area, 16% 3/18 were nonresidents, 11% (2/18) were local residents of Circle or Central, and 5% (1/18) were other Alaska residents. In 1991, Fairbanks area hunters were most successful at 63% (12/19), 21%(4/19) were from the Anchorage area, 10% (2/19) were other Alaska residents, and 5% (1/19) were nonresidents. In 1990 and 1991 overall success rates were 18% and 12% respectively (Table 4).

Two drawing permit hunts (577 and 578) were established to give people an opportunity to hunt caribou in winter near Fairbanks. Although many people have applied to hunt, by the time the season approaches, prospective hunters have already filled their bag limit elsewhere or are no longer interested.

The success rate of the few that did hunt has been low but it depends on caribou distribution (Table 4). As the area becomes better known, the success rate and level of participation will probably increase.

Transportation: During the fall hunting season, 55% (10/18) of successful hunters primarily used 3- or 4-wheelers to transport them afield. Secondarily, successful hunters used highway vehicles 22% (4/18), and 5% (1/18) each utilized airplanes, boats ORVs, or walked (Table 6).

In the 1992-93 winter season, two-thirds of the successful permittees used snowmachines, and the one successful during the nonmotorized season used a dog team. During the 1990-91 season all successful hunters used snowmobiles for access and no nonmotorized permittees were successful. Winter travel in the White Mountains can be difficult. Developed trails and cabins provided by the BLM are making winter access easier, however, these aids to access have not been well developed in caribou wintering areas.

Habitat

No data were collected during this report period.

CONCLUSIONS AND RECOMMENDATIONS

The WMH is stable or increasing. Harvests are below the sustainable yield. Remoteness and inaccessibility are the major contributors to low harvest. Increased hunter effort and harvest during fall can be expected considering the present decline of other Interior caribou hunting opportunities.

Because of low hunter participation and increased demands for hunting opportunities, the number of winter drawing permits for the 1993/94 season should be increased to 75 permits per hunt for a total of 150 permits.

The protection of key seasonal ranges from mining and recreational development should be considered during any land use planning, including known and historic calving areas, summer ranges, wintering areas, and movement corridors.

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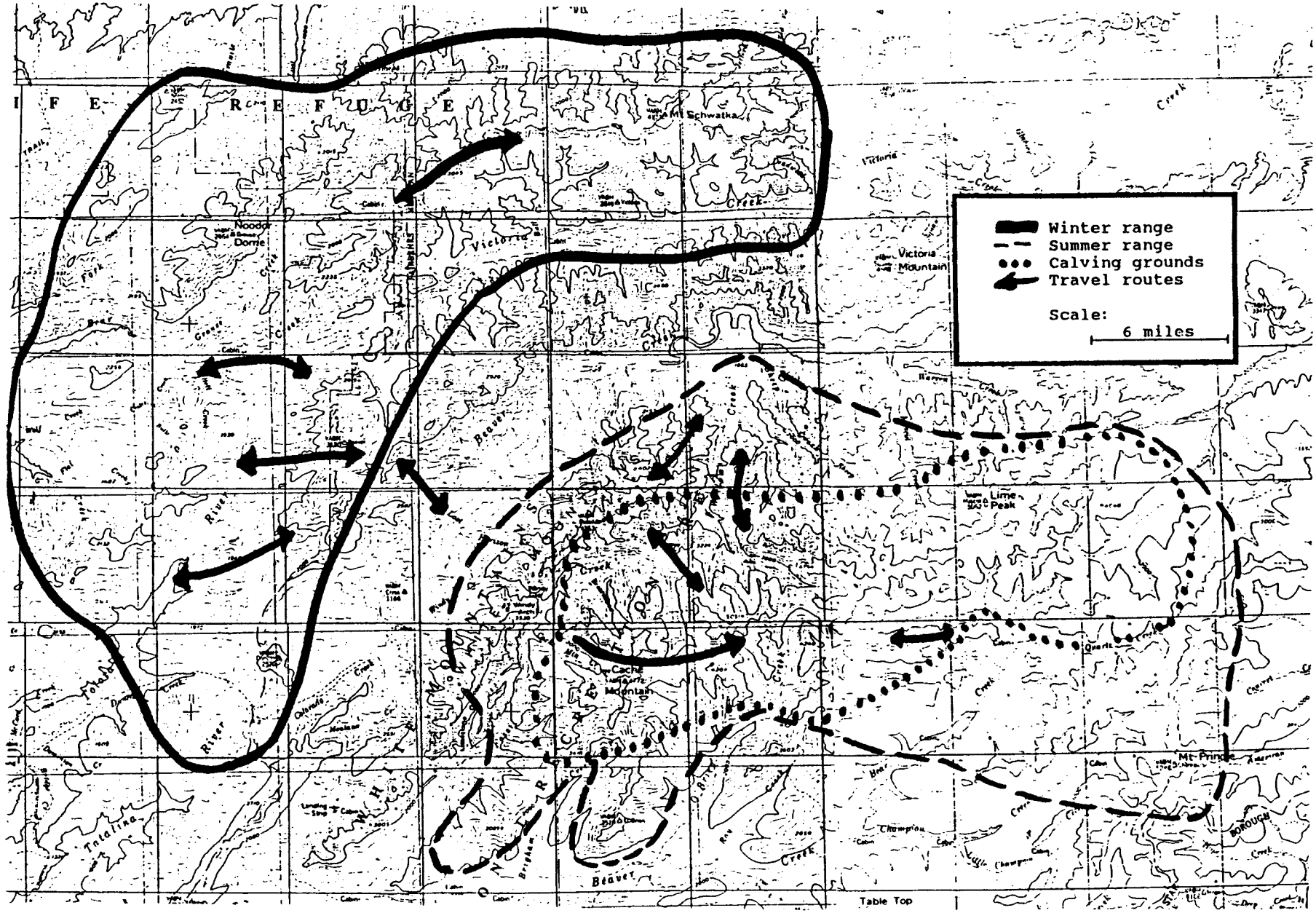

Figure 1. Approximate range of the White Mountains Caribou Herd (based on Durtsche and Hobgood 1988, and Hobgood, pers. commun.).

Table 1. White Mountains (WM) caribou fall composition counts and estimated population size 1983-92.

Date	Bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls (%)	Composition sample size	Estimate of herd size
09/29/83	44	31	18	57	26	29	44	25	135	
10/85	36	31	18	60	0	0	0	22	65	
9/29/88	43	33	19	57	51	16	33	24	211	
10/06/89	50	36	19	54	46	33	22	27	744	750-1,000
10/11/91	23	24	16	68	44	35	21	15	312	
10/29/91[b]	--	--	15	--	--	--	--	--	324	761[a]-1,000
10/13/92	39	23	14	62	52	18	30	24	247	832[a]-1,000

[a] Actual count of herd size
[b] Fixed wing aircraft

Table 2. Reproductive status of radio-collared cow caribou in the White Mountain herd, 1990-92.

Frequency	Date	Antlers?	Distended udder	Calf present?	Age of cow (years)
1235	5/17/90	Y	Y	Y	2
	5/16/91	Y	Y	N	3
	5/24/91	U	U	Y	3
	5/21/92	Y	--	N	4
	5/28/92	Not observed			4
	6/04/92	N	--	Y	4
1390	5/17/90	Y	Y	Y	10-15
	1991	No data			
	1992	Not observed			
1400	5/17/90	Y	Y	Y	15
	5/16/91	Y	U	N	16
	5/24/91	N	U	Y	16
	5/21/92	Y (1 antler)	--	N	17
	5/28/92	U	--	N	17
	6/04/92	N	--	Y	17
1420	5/17/90	Y	Y	N	2
	5/16/91	Not observed			
	5/24/91	Y	U	Y	3
	5/21/92	Y	--	Y	4
	5/28/92	N	--	N	4
	6/04/92	N	--	N	4
1430	5/17/90	1-velvet	N	N	2
	5/16/91	Y	U	N	3
	5/24/91	N	U	Y	3
	5/21/92	Y	--	N	4
	5/28/92	Y	--	Y	4
	6/04/92	N	--	Y	4
1640	5/17/90	Y	Y	N	2
	5/16/91	Y	Y	N	3
	5/24/91	Y	U	N	3
	5/21/92	Y	--	N	4
	5/28/92	Y (1 antler)	--	N	4
	6/04/92	N	--	N	4

Table 2. (Cont.)

Frequency	Date	Antlers?				Distended udder	Calf present?	Age of cow (years)
1740	5/17/90	Y?	Y	N	2			
	5/16/91	N	Y	N	3			
	5/24/91	N	U	Y	3			
	5/21/92	U	--	N	4			
	5/28/92	U	--	Y	4			
	6/04/92	U	--	Y	4			
1760	5/17/90		Y			Y	N	2
	5/16/91		Y			Y	N	3
	5/24/91		Not observed					
	5/21/92		Y			--	N	4
	5/28/92		Y			--	Y	4
	6/04/92		N			--	Y	4
1800	5/16/91		Y			Y	N	Old
	5/24/91		N			N	N	
	5/21/92		Y			--	N	
	5/28/92		Y			--	Y	
	6/04/92		N			--	Y	
1850	5/16/91		Y			Y	N	Very old
	5/24/91		N			U	Y	
1780	5/17/90		Not observed					2
	5/16/91		Not observed					
	5/24/91		N			U	N	3
	5/21/92		Y			--	N	4
	5/28/92		Y			--	Y	4
	6/04/92		U			--	Y	4

Table 3. White Mountains herd caribou harvest 1987-92.

Regulatory year	General season				Permit hunts 577 & 578				Total
	M	F	Unk	Total	M	F	Unk	Total	
1987-88	6	0	0	6					6
1988-89	12	0	0	12					12
1989-90	14	0	0	14					14
1990-91	17	0	1	18	2	1	0	3	21
1991-92	19	0	0	19	0	0	0	0	19
1992-93	14	0	0	14	1	2	0	3	17

Table 4. Results of White Mountains caribou herd late winter drawing hunts 577 and 578, regulatory year 1990-92.

Regulatory year	Number of permits available	Number applicants	Number of permits issued	Harvest			Hunted unsuccessful	Did not huntreport	Did not
				Cow	Bull	Total			
1990	100	229	89	1	2	3	18	66	2
1991	100	409	100	0	0	0	12	88[a]	
1992	100	537	100	2	1	3	19	76	2

[a] Includes those that did not report

Table 5. White Mountains caribou herd hunter residency and success during the fall hunting season, 1985-92.

Regulatory year	Successful				Unsuccessful	(%)	Total hunters
	Resident	Nonresident	Total	(%)			
1985-86	--	--	12	(20)	48	(80)	60
1986-87	--	--	2	(33)	4	(67)	6
1987-88	--	--	6	(12)	43	(88)	49
1988-89	--	--	13	(17)	64	(83)	77
1989-90	12	2	14	(23)	46	(77)	60
1990-91	15	3	18	(18)	80	(82)	98
1991-92	18	1	19	(12)	143	(88)	162
1992-93	15	3	18				

Table 6. Fall White Mountains caribou harvest by transport method 1988-92[a].

Regulatory year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Other/ unknown	n
1988-89	4	0	0	4	0	2	2	0	12
1989-90	0	0	0	4	0	4	4	2	14
1990-91	1	0	1	10	0	1	4	1	18
1991-92	3	1	0	8	0	4	3	0	19
1992-93	2	0	0	4	0	2	5	1	14

[a] Excludes winter permit hunts 577 and 578.

Appendix A. Aerial surveys of the White Mountains caribou herd, 1990-92.

Activity	Date	Pilot	Observer(s)	Aircraft	Comments
Spring Comp.	4/15/91	F. Fredrickson	M. McNay	Bell 206	
		D. Miller	None	PA-18	Located caribou
Calving survey	5/16/91	P. Valkenburg	None	Scout 88417	
Calving survey	5/24/91	M.McNay	R. Eagan	Scout 88417	
Photocensus	6/28/91	M. McNay	E. Lenart	Scout 88417	Conditions = Fair
Fall Comp.	10/11/91	M. Kato	P. Valkenberg	Bell 206	Condiitons = excellent
			R. Eagan		
			W. Hobgood		
		B. Lentsch	K. Woodward	PA-18	Located caribou
Radiotracking Flight	10/29/91	P. Valkenburg	None	Scout 88417	
Spring Calf Surveys	5/21/92	B. Lentsch	BLM staff	PA-18	
	5/28/92				
	6/4/92				
	6/10/92				
Photocensus	7/6/92	B. Lentsch	J. Herriges	PA-18	
Fall Comp.	10/13/92	P. Valkenburg	None	Scout 88417	Conditions = Poor
		L. Larrivee	R. Boertje	Robertson R-22	

LOCATION

Game Management Subunit: 26A (56,000 mi^2)

Herd: Teshekpuk Lake

Geographical Description: Western North Slope

BACKGROUND

The presence of old drive sites near Teshekpuk Lake indicates that caribou have been hunted in the area since at least late prehistoric times (Silva 1985). The area was used extensively for reindeer herding in the 1930s and 1940s, and local residents report having seen caribou in the area throughout the year since the 1930s. The Teshekpuk Lake caribou herd (TLH) was documented in the mid-1970s as a separate herd from the Central Arctic caribou herd (CACH) and the Western Arctic herd (WACH) by Davis and Valkenburg (1978). The TLH is considered an important subsistence resource to hunters from Barrow and Nuiqsut and, to a lesser degree, other North Slope villages. Collection of TLH harvest data has traditionally been incorporated into the WACH harvest reporting system because of range overlap between the two herds.

The department and BLM staff conducted visual counts from 1978 to 1982, and estimated that 3,000 to 4,000 caribou inhabited the Teshekpuk Lake area (Davis and Valkenburg 1979, Reynolds 1981, and Silva 1985). In an effort to better assess the size and distribution of the TLH, radio collars were attached to 12 cows and 8 bulls in 1980, and monitored jointly by the Department and BLM. The ADF&G and BLM conducted the first photocensus using a modified aerial photo-direct count-extrapolation (APDCE) technique during July 1984, and counted 11,822 animals (Davis *et al.* 1979). Trent and Toovak made a visual count in 1985, and counted 13,406 caribou (ADFG files). As part of a joint project, ADF&G North Slope Borough Department of Wildlife Management (NSB), and BLM collared 17 cow caribou with VHF collars during 1986. During July 1989 we again conducted a photocensus and counted 16,649 caribou (Carroll 1992).

MANAGEMENT DIRECTION

The overall population management goal is to maintain stable or increasing numbers of caribou in the TLH, and provide for continued hunting opportunity on a sustained yield basis.

Operational management objectives defined in a draft cooperative management agreement between the ADFG, NSB, and BLM are as follows:

1) Determine the herd population size every 2 to 3 years;
2) Determine the percentage of calves surviving their first winter;
3) Delineate the boundaries of the calving grounds annually;
4) Identify and map the herd's movements and distribution throughout the year using survey and radiotelemetry data;
5) Develop a system to capture caribou for radio-collaring without the use of drugs;
6) Encourage local participation in research and management decisions;
7) Determine the extent of the harvest using methods that are acceptable to hunters as well as the participating agencies;
8) Determine sources of significant, non-hunter mortality.

METHODS

We attempted to photocensus the TLH in both 1990 and 1991, but unfavorable weather conditions prevented successful completion of the project.

Short yearling recruitment surveys were conducted during April of 1991 and 1992. We flew transects using a Cessna 185 south of Teshekpuk Lake, and randomly chose groups to survey. We classified caribou as either adults or short yearlings.

We conducted calving ground surveys in 1991 and 1992 during the first 10 days of June at the peak calving period using a Cessna 185. At the same time, we re-located all cows with radio collars. We also flew transects looking for pregnant and postparturient cows to determine the location of the calving area. During 1991 we used landmarks, and in 1992, a Global Positioning System (GPS) receiver to delineate the boundaries of the calving areas.

We completed calving success surveys on 22 June 1991 and 19 July 1992 using a Hughes 500 helicopter. Caribou with radio collars were located, and we categorized approximately 150 animals near each radio-collared animal as cows, calves, or bulls.

We instrumented 6 cow caribou with Platform Transmitter Terminal collars (satellite radio collar transmitters or "PTTs") on 30 June and 1 July 1990 in a joint project with the NSB. We used a tranquilizer gun fired from a helicopter to capture the animals. The caribou were accompanied by calves, and were collared between Teshekpuk Lake and the Beaufort Sea coast to minimize chances that WACH or CACH caribou would inadvertantly be collared. One transmitter was recovered from a dead caribou, refurbished, and placed on another cow on 4 October 1991.

We chose a 6-hour per 48-hour transmission duty cycle for 11 months of the year to prolong battery life, and a 6-hour per 24-hour cycle for the month of July to monitor caribou movements more closely during the post-calving aggregation period.

We received satellite location data from the Argos Data Collection and Location System computer in Landover, Maryland in 2 different ways. Current location information could be retrieved at any time using a computer modem, and microcomputer diskettes were sent monthly with information for the preceding month.

In another cooperative project with the NSB, we collared 12 caribou captured on 23 June 1991 using a helicopter with a skid-mounted net gun. We attached VHF radio collars to aid in future population, productivity, distribution, and movement studies. We also measured and weighed these caribou to assess body condition. We collected blood, fecal, and hair samples to evaluate the presence of diseases, parasites, trace elements, contaminants, and nutrient deficiencies.

We conducted VHF radio-tracking flights August and October of 1990; March, April, June, July, and November of 1991; and April 1992 to determine distribution.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Weather conditions prevented us from completing a successful photocensus during the report period. The most recent photocensus was completed in July of 1989 when 16,649 caribou were counted. The count was 41% higher than the 1984 census, and would indicate a mean annual rate of increase of 7.1% during the 5-year period (Table 1).

Population Composition: We conducted short yearling recruitment surveys on 24 April 1991 and 29 April 1992. In 1991 we counted 24 short yearlings:100 adults (sample size of 700), and in 1992 we counted 26 short yearlings:100 adults (sample size of 858).

We conducted a calving success survey on 22 June 1991. Of 3,573 caribou observed, we classified 488 as bulls; 1,814 as cows; and 1,271 as calves. Composition ratios of the sample were 71 calves:100 cows, 55 calves:100 adults, and 27 bulls:100 cows. We completed this survey less than 3 weeks after peak calving, and most bulls were apparently still segregated from the cows and calves.

Another survey was conducted on 19 July 1992. Though we completed this survey after the report period, the results are relevant to the status of the herd during 1991-92. Of 3,047 caribou observed, 1,036 were bulls; 1,118 were cows; and 893 were calves. The composition ratios are 80 calves:100 cows, 41 calves:100 adults, and 93 bulls:100 cows. Most bulls had rejoined the remainder of the herd by mid-July.

Distribution and Movements: Radio collars and direct observations have been used during the last decade to develop a generalized description of movement patterns of TLH

caribou. During mid-May to late June, most females are found north and east of Teshekpuk Lake while most males are south and west of the lake. During most of the summer (late June through July), caribou of both sexes can be found seeking relief from insect harassment along the Beaufort Sea coast from Dease Inlet to the mouth of the Kogru River; around the edges and on islands of Teshekpuk Lake; and on sand dunes along the Ikpikpuk River and south of Teshekpuk Lake. During fall and winter, the herd disperses as small groups in all directions. The TLH does not appear to follow any clearly defined migration routes, particularly during fall and winter (Silva 1985, ADFG files).

We have monitored caribou movements using PTTs since 1990. During winter 1990-91, all 6 females collared with PTTs traveled considerable distances from the Teshekpuk Lake area. One animal wintered near the southern Seward Peninsula in Subunit 22A, 2 animals wintered on the south side of the Brooks Mountain Range between Anaktuvuk Pass and Wiseman, and 3 wintered between Barrow and Wainwright. We conducted radio-tracking flights during April 1991, and we found 6 out of 20 active TLH VHF collars south of the Brooks Range, and we found 5 between Barrow and Wainwright.

One caribou collared with a PTT died near Wainwright during winter, and 2 animals died while migrating north over the Brooks Range during spring 1991. The 3 remaining animals returned to the Teshekpuk Lake area before calving, and remained north of the lake during summer.

In contrast, the 4 caribou with PTTs traveled comparatively short distances during 1991-92, and wintered within 40 miles of the southern shore of Teshekpuk Lake. During radio-tracking flights conducted on 13 and 28 April 1992, 18 of active 23 VHF radio collars were located within 50 miles of Teshekpuk Lake. The other 5 caribou with functional VHF collars were between Dease Inlet and Atqasuk.

We completed calving ground surveys during the first 10 days of June in 1991 and 1992. During both years, most calving occurred northeast and east of Teshekpuk Lake, but some calving also occurred southeast, south, and west of the lake. In a survey flown on 5 June 1992, we observed ratios of 77 calves:100 adults east and northeast of the lake, 15 calves:100 adults southeast of the lake, and 4 calves:100 adults south and west of the lake. The peak calving period occurred between 2 and 8 June during both years.

Mortality

Season and Bag Limit:

Subsistence/Resident Hunters:	Five caribou per day; however, cow caribou may not be taken May 16-June 30.	1 July-30 June

Nonresident Hunters:	Five caribou; no cow caribou may be taken May 16-June 30.	1 July-30 June

Harvest:

Human-induced Mortality: Most of the TLH harvest is attributable to local subsistence hunting because the area is remote and largely inaccessible to nonlocal hunters. Hunting pressure comes primarily from the residents of Barrow, Nuiqsut, and, to a lesser degree, other North Slope villages.

At this time, it is impossible to determine exactly how many TLH caribou are harvested because: 1) most hunters that harvest TLH caribou also harvest caribou from other herds, and there is no easy way to distinguish between animals from different herds; 2) the TLH harvest is reported using the WACH harvest reporting system, and it is impossible to determine whether the reported Subunit 26A harvest is from the TLH or the WACH; and 3) only a small proportion of North Slope hunters actually report their harvest.

Carroll (1992) used subsistence harvest data from Braund (1991) and Pedersen (1991), and radio-tracking information to estimate that approximately 808-1,084 TLH caribou were harvested during 1989-90. Accurate subsistence harvest information has not been available since 1990, but current harvest patterns appear unchanged.

Satellite radio collar information indicated that during 1990-91 TLH caribou ranged over a wider area than previously believed. The TLH caribou were probably exposed to hunting pressure from the villages of Wainwright, Point Lay, and Anaktuvuk Pass in addition to Atqasuk, Barrow, and Nuiqsut. Harvest levels of TLH caribou may be strongly influenced by where they are distributed during fall and winter.

Hunter Residency and Success: Most hunters are local residents of Subunit 26A. Only a few TLH caribou are taken by non-local resident and nonresident hunters, primarily from the Colville River drainage. No quantitative data are available on hunter success, but we believe success rates are high.

Harvest Chronology: Most of the harvest occurs during July through October. Few caribou were taken during early winter, but harvests increased during February and March. Braund and Associates (1989) have summarized harvest chronology for Barrow (Table 2), and the harvest pattern for other villages is believed to be similar. More spring caribou hunting occurs in Nuiqsut and Atqasuk, because hunters are not occupied with spring whaling as they are in Barrow.

Transportation Methods: Caribou hunters in Subunit 26A use a variety of transport methods. Most people use boats to hunt TLH caribou during July, August, and September. They use snowmobiles the rest of the year. Some use of aircraft and ATVs occurs

throughout the year. Hunters occasionally use highway vehicles when caribou are near limited road systems associated with villages, particularly the gas well road near Barrow.

Other Mortality: A sizeable die-off of caribou attributable to starvation occurred during the late winter and spring 1990 within the range of the TLH (Carroll 1992). However, we did not observe any other unusual mortality for the TLH during the report period. Some predation by wolves and bears undoubtedly occurred, but the density of predators in the range of the TLH is not high and predation is probably not a major factor affecting population growth.

Habitat

Assessment: No efforts were made to quantitatively assess the quality of TLH range. As mentioned above, many caribou appeared to starve south of Teshekpuk Lake during 1990 suggesting that area may have been over-grazed. No die-offs were reported during the winters of 1991 and 1992, and TLH caribou appeared in reasonably good body condition. The caribou probably used a different area.

Oil development is the main threat to habitat in the range of the TLH. Extensive development has taken place a short distance to the east, and portions of the TLH range may eventually be developed for drilling or transporting oil. Much of the TLH calving area is within an area that BLM has designated as the Teshekpuk Lake Special Area which will be given a greater level of protection than the surrounding area. However, we need to complete more survey and telemetry work to delineate other critical habitat areas that require additional protection.

CONCLUSIONS AND RECOMMENDATIONS

Photocensuses conducted in 1984 and 1988 indicated that the TLH population increased from 11,822 to 16,649 at an annual rate of increase of 7.1%. Continued census and composition work will be necessary to adequately monitor the population.

The amount of range overlap between the TLH, CAH, and WACH is presently unknown. If considerable exchange is occurring among the herds, changes in population size of the TLH may reflect immigration or emigration rather than actual productivity. Long-term studies, particularly telemetry surveys, of all 3 herds are needed to better understand the relationship among them.

As discussed previously, it is difficult to determine accurate harvest levels for the TLH. It will be even more difficult in the future because the North Slope Subsistence Study ended after the 1989-90 season. We need to develop a method of determining harvest, which would involve hiring village monitors to interview hunters.

Satellite radiotelemetry has been very useful in increasing our understanding of TLH movements. The great variability in movements among years has been striking. The extensive movements made during winter 1990-91 would have been impossible to track using standard VHF survey techniques. During fall and winter 1990-91, TLH caribou ranged widely, scattering as far as the Seward Peninsula, Wiseman, and Wainwright. During 1991-92, however, most of the herd remained within 50 miles of Teshekpuk Lake. Hunting pressure probably also varies from year to year depending on whether the animals' movements take them near villages. We need to learn more about TLH movements and where they are exposed to hunting pressure. In order to continue this activity, we should continue with satellite telemetry studies for at least 3 more years in addition to VHF telemetry surveys.

In keeping with the goal to capture caribou without the use of drugs, we used a helicopter with a skid-mounted net gun to capture 12 caribou each year in 1991 and 1992. In 1991, we used xylazine as a sedative for some of the larger animals after capture. In 1992, hobbles and masks proved very effective for controlling the caribou, and no sedatives were used even when measuring, weighing, and collecting blood from the animals. Each year we had 1 mortality when the caribou fell and broke their necks after becoming tangled in the net. The carcasses were donated to the Senior Citizen's Center in Barrow. Although the skid-mounted net gun is an effective alternative to using tranquilizer darts, it would be desirable to find an area where caribou could be captured while making a water crossing to eliminate the cost of a helicopter and reduce the number of mortalities.

Because the TLH population appears to be increasing in number, we do not recommend any regulatory changes. However, the TLH is relatively small compared to other arctic caribou herds and receives substantial hunting pressure. If hunting pressure increases, or oil exploration or development affects the population size of the TLH, or if another large natural die-off occurs, regulatory restrictions may be necessary in the future. Because the TLH mixes with caribou from the WACH and CACH, it would be impossible to create regulations that would impact the TLH only. If a separate bag limit and/or season was established and enforced for the core area of the TLH range between Dease Inlet and the Colville River, the TLH harvest could be significantly reduced.

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Table 1. Population estimates and average annual rate of change of the TLH.

Year(s)	Population Estimate	Average Annual Rate of Change
1978-1982	3000-4000[a]	N/A
1984	11,822[b]	N/A
1985	13,406[a]	N/A
1989	16,649[b]	7.1%[c]

[a] Derived from visual estimate.
[b] Derived using aerial photocensus.
[c] Rate of change calculated using only numbers derived from photocensus.

Table 2. Annual caribou harvest and chronology, percent by time period, for Barrow hunters, 1987-1990[a].

	Harvest periods						
Year	March-April	May-June	July-Aug	Sept-Oct	Nov-Dec	Jan-Feb	Annual Harvest
1987/88	5%	5%	40%	44%	1%	5%	1,595
1988/89	5%	6%	38%	41%	4%	6%	1,533
1989/90	6%	2%	49%	29%	3%	11%	1,656

LOCATION

Game Management Unit: 26B and 26C (26,000 mi^2)

Herd: Central Arctic

Geographical Location: Central Arctic Slope and Brooks Range

BACKGROUND

In the previous management report, Valkenburg (1992) reviewed historical data on the Central Arctic caribou herd (CACH) through 1990. This report summarizes harvest data from 1990 to 1992; and population size, sex and age composition, and movement data for 1991 and 1992. Additionally, three scientific papers (Cameron, in press; Cameron *et al.* 1992[a], Cameron *et al.* 1993), technical reports (Cameron and Smith 1992, Smith *et al.* in prep.), and one independent review of Alaskan arctic caribou research by the Wildlife Management Institute (Wildlife Management Institute 1991) were completed. In 1991 and 1992, an interagency hunter check station was operated (Smith 1991).

MANAGEMENT DIRECTION

Management goals and objectives for the CACH have not changed since the last report.

METHODS

Population Size

Because of numerous, unsuccessful attempts to photocensus the CACH during 1987-90, we estimated population size and composition in June 1991 by extrapolation from observations along stratified random quadrats. Evenly spaced east-west transects were flown between the Canning and Colville Rivers between 69°N latitude and the arctic coast to determine relative densities of caribou within the region. Subsequently, a 10,961 km^2 area was chosen and stratified into high and low density categories. Sampling effort was allocated and results were analyzed using techniques developed for censusing moose (Gasaway *et al.* 1986). Because much of the area is relatively featureless arctic coastal tundra, "quadrats" were 1-mile radius circles centered on Loran-C coordinates. We flew in a Bell Jet Ranger helicopter, Super Cub, and Bellanca Scout to count and classify all caribou within the quadrats. Virtually all high-density quadrats were assigned to the helicopter to minimize errors in classification.

In July 1992, postcalving aggregations of CACH caribou were not mixed with those of the Porcupine herd and we photographed both herds with a large-format Fairchild T-11 camera.

Population Composition

We completed 3 surveys since the last report. Composition was estimated during the census in June 1991, from standard June transect surveys in 1992, and from fall composition counts conducted from a helicopter on 16-18 October 1992.

Harvest

Harvest of caribou by nonlocal hunters was estimated from returns of harvest ticket report cards during 1990-92 and from a check station in place on the Dalton Highway during most of August and September in 1991 and 1992.

Movements and Distribution

We determined movements of CACH caribou from relocations of radio-collared females during June/July and in early October and late April.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Results of the June 1991 census estimate confirmed previous suspicions that the growth rate of the CACH has decreased considerably since 1985 (Valkenburg 1992) (Table 1). Primary reasons for the reduced growth rate were reduced survival of calves to yearling age and reduced fecundity of adult females. Also, higher mortality of adults from wolf predation appears likely. In recent years, progressively more caribou have wintered in the central Brooks Range where wolf numbers are probably higher than in the foothill coastal plain habitats.

During the 1992 census, 8,602 caribou were found along the coast east of the Prudhoe Bay oil field and 14,842 were found west of the oil field or within it. Based on the 1991 and 1992 censuses, it appears that the CACH is slowly increasing or stable.

Population Composition: Composition data for the CACH indicate a general decline in recruitment beginning with the 1986 cohort (Table 1). Since 1988, fecundity in radio-collared cows has been relatively low (e.g., 75% in 1992) (ADF&G Files, Cameron, unpub. data). Survival of calves to 2 weeks has varied but was particularly low in 1989. Variability in calf numbers and fecundity is apparently related to nutrition (Cameron *et*

al. 1993). Wolf and grizzly bear predation is low because wolves and bears are rare within the summer range of the CACH.

Fall 1992 composition data for the CACH indicate the bull:cow ratio continues to be high (Table 2). Bulls from the Western Arctic herd may mix with the CACH during fall. In any event, harvest of bulls could be increased within the range of the CACH.

Distribution and Movements: Calving and summer distribution of CACH caribou has been similar to previous years. A major change in winter distribution occurred in 1990-91, however. A large segment of the herd crossed the Brooks Range divide and wintered in the upper West Fork Chandalar River. In the following two winters, many CACH caribou were mixed with Western Arctic caribou in the upper North Fork Koyukuk and Tinayguk drainages. In 1991-92, at least 5 caribou collared near Galbraith Lake in April were later found either on the WACH calving area or on WACH winter range south of the Kobuk River. Variable numbers of Western Arctic caribou have ranged as far east as the pipeline in fall, and it is not uncommon for CACH caribou to be mixed with caribou from the Western Arctic, Porcupine, and Teshekpuk herds at various times during winter.

Mortality

Harvest:

Season and Bag Limit. In Subunits 26B and 26C the 1990-91 open season for all hunters remained 1 July-30 April. The bag limit for resident hunters was 2 caribou (nonresidents could only take 1), but only 1 bull could be taken from 1 July to 30 September. The bag limit for Subunit 26C was 10 caribou for residents (although only 5 could be transported out of the subunit) and 5 for nonresidents. Seasons and bag limits remained the same for the 1991-92 season except that the opening date was changed in Subunit 26C for bulls only to June 23.

Board of Game Actions and Emergency Orders. At their March 1991 meeting, the Board of Game passed a proposal by Kaktovik residents to open the bulls-only season a week earlier. The change was requested to allow hunting when caribou first become available near the coast in late June. The new regulation applies only to Subunit 26C.

Hunter Harvest. To curtail a rapidly increasing harvest, more restrictive regulations were adopted in 1986. Since then reported harvest declined steadily until the 1991-92 season (Table 3), largely because caribou hunting opportunities in the Delta, Macomb, and Fortymile herds were progressively reduced beginning in fall 1990. Increasingly more hunting has occurred along the Dalton Highway. Estimated harvest of caribou by residents of Kaktovik and Nuiqsut was similar to that in previous years and, as in the past, was highly dependent on herd distribution. Despite the lower recruitment in recent years, the bull:cow ratio in the CACH is high and summer predation losses are relatively low. The herd could sustain a harvest of at least 1,000 bulls or more.

Hunter Success. Success rates for bow hunters and rifle hunters were similar in Subunit 26B (44% and 43%, respectively of 535 hunters interviewed). Bowhunter success is high because visibility is good, caribou are numerous, and the Dalton Highway north of the Brooks Range provides excellent access over a large area.

Harvest Chronology. Of 618 total hunters reporting during the 1991-92 season, 528 hunted during 2 August-27 September when the Dalton Highway check station was operated. However, hunting outside this period is probably more popular than the data indicate because more hunters fail to report when the check station is not operating.

Transport Methods. The Dalton Highway north of Dieterich Camp is officially closed to private vehicles, and after 31 August the corridor north of the Yukon River is also officially closed to private vehicles. However, in recent years, few people have obeyed these closures, and the statute is not enforced. In fact, the ADF&G no longer relies on these restrictions to limit the take of caribou, and management decisions presume that the Dalton Highway is totally open.

Because of restrictions on the use of off-road vehicles along the Dalton Highway and the remoteness of Subunit 26B, hunters use either aircraft, highway vehicles, and/or boats for access (Table 4). Check station and/or harvest report data may underestimate the use of aircraft because many Fairbanks-based hunters fly directly to the subunit. Most rifle hunters used both aircraft and highway vehicles, while most bow hunters used only highway vehicles. Use of boats on the Ivashak and Sagavanirktok Rivers is increasing.

Natural Mortality. Summer natural mortality of CACH caribou (especially calves) is low, primarily because calving takes place in relatively wolf-free and bear-free areas near the coast. Until 1990 most CACH caribou wintered in the northern foothills and arctic coastal plain. Wolves in this area have been hunted effectively by Nuiqsut residents for many years and by aircraft hunters before 1987. Wolf numbers have probably been periodically reduced below natural levels. Since 1990 many CACH caribou have wintered in the central Brooks Range and winter mortality may now be higher. Radio-collared caribou are tracked infrequently during winter, making it difficult to estimate adult mortality.

Habitat

Assessment: Habitat of the CACH has been more intensively studied than any other Alaskan arctic herd. Caribou/habitat/development relationships are the subject of ongoing long-term research by ADF&G and the USFWS.

CONCLUSIONS AND RECOMMENDATIONS

Although growth rate of the CACH has decreased in recent years, the low level of predation on calves and high bull:cow ratio will make it possible to harvest at least 1,000

caribou/year for several years. The presence of Western Arctic and other caribou in Subunit 26B in some years in fall and winter may also relieve harvest pressure on the CACH. Harvest (particularly of bulls) could be liberalized without compromising management goals and objectives.

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Table 1. Central Arctic herd caribou calving composition counts and estimated population size, regulatory years 1978-92.

Survey date	Yearlings: 100 cows	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent yearling	Percent cows	Percent bulls	Composition sample size	Population size
6/78	--	19	68	36	--	53	10	950	5,000
6/79	24	6	80	38	12	47	3	1,865	--
6/80	48	4	69	31	22	45	2	787	--
6/81	22	9	87	40	10	46	4	3,337	8,537
6/82	--	20	62	34	--	55	11	1,101	--
6/83	--	16	86	42	--	50	8	1,879	12,905
6/12/84	25	9	89	40	11	45	4	2,692	--
6/13-14/85	35	16	88	37	14	42	7	2,357	--
6/12-13/86	33	7	56	29	16	51	4	891	--
6/13/87	19	4	74	37	10	51	2	4,839	--
6/10-15/88	32	7	66	32	16	49	3	4,892	--
6/11-15/89	16	6	48	28	9	59	4	2,520	--
6/11-15/90	11	31	75	35	5	46	14	6,543	--
6/17-20/91[a]	29	73	45	18	12	40	30	2,500	19,046[b]
6/11-14/92	12	6	73	38	6	53	3	5,556	23,444

[a] Estimated from random stratified quadrat survey of entire caribou distribution. Results not directly comparable with other years.

[b] Ninety percent confidence interval was 14,677-23,414.

Table 2. Central Arctic herd caribou fall composition counts, regulatory years 1976-92.

Survey date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent small bulls (% of bulls)	Percent medium bulls (% of bulls)	Percent large bulls (% of bulls)	Percent bulls	Composition sample size
10/76	122	44	17	38	--	--	--	46	1,223
10/77	118	55	20	37	--	--	--	43	628
10/78	96	58	23	39	--	--	--	38	816
10/80	132	49	18	35	--	--	--	47	1,722
10/81	81	64	26	41	22	41	36	33	1,712
10/16-18/92	96	47	19	41	37	27	40	40	2,469

Table 3. Harvest of caribou and hunter success in Subunit 26B, 1984-92.

Regulatory year	Reported harvest				No. of hunters	Estimated % success	unreported harvest[a]	Total harvest
	Male	Female	Unk	Total				
1984-85	313	55	0	368	--	--	100-200	468-568
1985-86	482	177	3	662	--	--	100-200	762-862
1986-87	311	34	0	345	287	76	100-200	445-545
1987-88	176	2	3	181	225	77	100-200	281-381
1988-89	179	7	0	186	255	73	100-200	286-386
1989-90	132	8	0	140	221	63	100-200	240-340
1990-91	96	16	0	112	173	55	100-200	196-296
1991-92	383	24	1	408	618	57	100-200	508-608

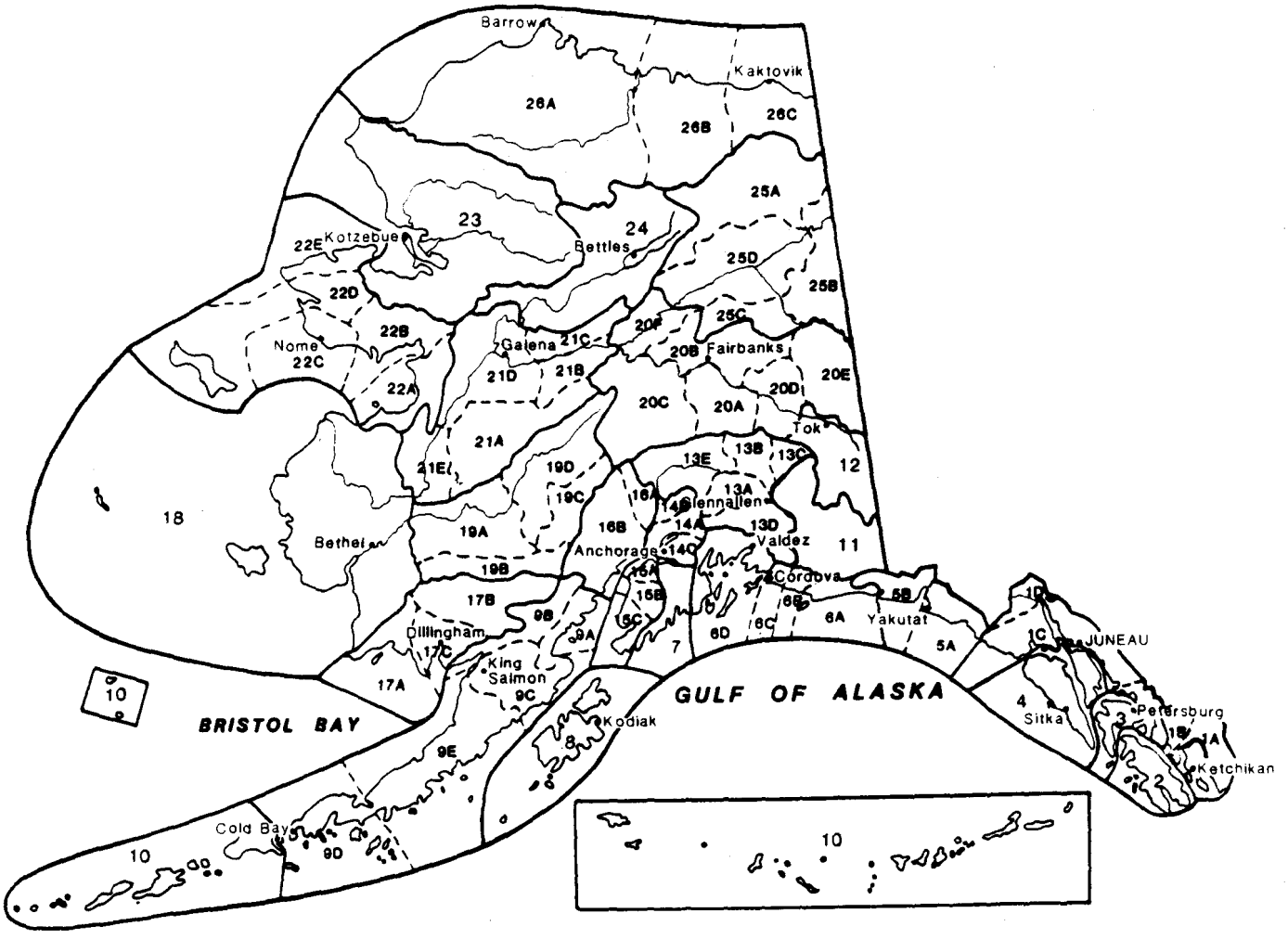
[a] Estimate by area biologist based on distribution of caribou.

Table 4. Transport methods of successful caribou hunters reporting from Subunit 26B, 1984-92.

Regulatory year	Airplane	Horse	Boat	Snowmachine	Off-road vehicle	Highway vehicle	Total
1984-85	40	--	--	--	--	140	180
1985-86	61	--	--	--	--	22	283
1986-87	85	--	--	--	--	133	218
1987-88	83	1	11	2	1	71	169
1988-89	69	1	17	0	1	88	176
1989-90	--	--	--	--	--	--	--
1990-91	--	--	--	--	--	--	--
1991[a]-92	56	3	110	--	16	343	528

[a] Check station data only.

Alaska's Game Management Units



Federal Aid in Wildlife Restoration

The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program then allots the funds back to states through a formula based on each state's geographic area and the number of paid hunting licenseholders in the state. Alaska receives 5% of the revenues collected each year, the maximum allowed. The Alaska Department of Fish and Game uses the funds to help restore, conserve, manage, and enhance wild birds and mammals for the public benefit. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes necessary to be reponsible hunters. Seventy-five percent of the funds for this project are from Federal Aid.