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CARIBOU

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LOCATION

Game Management Unit: 7 (3,520 mi^2)

Herd: Kenai Mountains

Geographical Description: Kenai Mountains

BACKGROUND

There are 4 small caribou herds on the Kenai Peninsula following reintroductions of caribou in 1965-66 and 1985-86 (Spraker 1989). The Kenai Lowland Caribou Herd (KLCH) summers in the area north of the Kenai airport to the Swanson River and winters on the Moose River Flats near Bear Lake. The Kenai Mountains Caribou Herd (KMCH) occupies the area drained by the Chickaloon River, Big Indian Creek, and Resurrection Creek in Unit 7. The Killey River Caribou Herd (KRCH) is found in the upper drainages of Funny and Killey Rivers in Subunit 15B. The Fox River Herd (FRCH) occupies the area between upper Fox River and Truuli Creek in Subunit 15C. The 1990 population sizes of the KLCH, KMCH, KRCH, and FRCH are 117, 310, 154, and 37 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. Little was known concerning the carrying capacity of their range. Hunting permits were unlimited with an extended season that was closed by Emergency Order when necessary. In 1977 a limited permit system began, resulting in an annual success rate of 14% to 33% for all permit holders. The KMCH began declining after 1985 for unknown reasons. Harvest has been reduced since 1987, especially in 1990 which was a year when population status was not verified. The herd was located in fall 1990 and appears to be stable at approximately 300 animals.

MANAGEMENT DIRECTION

Management Objectives

Maintain the post-hunting herd at 400 animals until the carrying capacity is determined for the winter range.

METHODS

Aerial surveys were flown to determine the number, distribution and composition of the KMCH. A Piper Super Cub aircraft was used to locate the herd. After locating the herd, a Bell-206B helicopter was used to conduct a sex and age composition survey. Caribou were classified as calves, cows, or bulls and ratios were calculated. Harvest data have been collected since 1977 through the mandatory reporting requirements of the drawing permit process.

RESULTS AND DISCUSSION

Population Status and Trend

The KMCH population peaked twice in its 25-year history. The original introduction of 15 caribou in 1965-66 grew to a minimum of 339 animals by 1975. The population was reduced to 194 by 1977, reaching another peak of 434 caribou in 1985. The KMCH has declined in numbers over the past 6 years and has apparently stabilized around the present population of 310 animals (Table 1).

Population Size: In October 1990, 303 caribou were counted in the KMCH. Hunters killed an additional 7 bulls during the autumn hunt. The total fall 1990 minimum population estimate was 310 caribou. Previous fall estimates were 434, 347, and 305 in 1985, 1987 and 1988, respectively (Table 1).

Population Composition: There were 34 calves:100 cows and 39 bulls:100 cows; and calves composed 20% of the herd in 1990. Calf production improved during this period compared to the previous five years. Production appears to have declined in the late 1980s then increased in 1990. The mean percentage of calves in the herd between 1979 and 1983 was 22.8%, with a peak of 29% in 1982. The average percentage of calves in the herd between 1985 and 1990 was 15.5% with a high of 20% in 1990.

Mortality

Harvest:

Season and Bag Limits. The open season for resident and nonresident hunters in Unit 7 north of the Sterling Highway and west of the Seward Highway is 10 August to 30 September; the bag limit is 1 caribou by drawing permit only; up to 250 permits are issued.

Board of Game Actions and Emergency Orders. Although no Board action was taken for the report period, the number of permits issued was reduced to 50 with a bag limit of one bull because of a lack of survey data for fall 1990.

Hunter Harvest. Hunters reported killing 14 caribou during the 1989 drawing-permit hunt and 7 caribou during the 1990 permit hunt. The 7 bulls harvested in 1990 represent the lowest reported harvest. The harvest also indicates reduced permit availability and a declining harvest trend over the last 3 years (Table 2). Harvests have ranged from 7 to 52 caribou since 1977 when permit numbers began to be limited. The largest harvest occurred in 1975, when 87 hunters each reported killing 1 caribou while participating in an unlimited registration hunt.

Permit Hunts. Hunting of this small introduced population is regulated by drawing permit. The number of permits issued were unlimited between 1972 and 1976; between 50 and 250 permits have been issued each year since. Fifty permits were issued during fall 1990, a decrease from 150 issued in 1989. There were 1,030 applicants for 150 permits in 1989 and only about one-half (76) of the permit holders hunted in 1989 (Table 3). A record number of people (1,039) applied for the 50 available permits in 1990, and 29 (58%) of the permit holders reported hunting. The reduced number of permits in 1990 reflects management concerns about decreasing population size and productivity.

Hunter Residency and Success. In 1989, 14 (18%) of the 76 hunters were successful and only 2 hunters that reported were nonresidents (Table 4). In 1990, 30 permittees hunted (all residents) and 7 hunters (23%) were successful. Two (29%) successful hunters were residents of Unit 7.

Harvest Chronology. Harvest chronology was similar in 1989 and 1990; the majority of the caribou were taken before 1 September and there was only 1 animal harvested after 15 September (Table 5). Four (57%) of the 7 caribou harvested in 1990 were killed during the first week of the season. All reported harvest occurred before 14 September.

Transport Methods. The majority of successful hunters hiked into the areas they hunted in both years. In 1989, 12 hunters (86%) walked while 2 (14%) rode horses. The following year 5 successful hunters (71%) were on foot while 2 hunters (29%) relied on horses. Unsuccessful hunters followed a similar pattern of traveling on foot.

Habitat

Assessment: Habitat components of this herd's range have not been thoroughly investigated. Concerns of habitat limitations were first discussed in the mid-1980s when the herd started to decline. Between 1980 and 1984 the KMCH had high calf:cow ratios and was growing in size. The subsequent decline in the calf:cow ratios and reduction in herd size between 1985 and 1990, stimulated concern over habitat adequacy. Hunter harvest mortalities probably contributed to the decline around 1985, and while they may have accelerated the decline, they probably protected the remaining habitat. The herd size has remained at approximately 300 since 1988 and the calf:cow ratio improved with 34\100 in 1990 fall counts.

CONCLUSIONS AND RECOMMENDATIONS

Data from 1990 suggests the KMCH is currently about 100 below the Department's post-season population size objective of 400 caribou. Limited habitat, harsh environmental conditions, predation, and human harvests are all plausible explanations for the herd's decline from 434 in 1985 to 310 in 1990. Recent harvest reductions may encourage the herd to increase, if other factors do not change. If neonate mortality continues to be moderately high, I recommend we reduce the population size objective to 300 caribou, until factors influencing calf recruitment are identified. Capture, radio-collaring and examination of caribou on late winter range is planned for spring 1991.

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Table 1. Kenai Mountains caribou fall composition counts and estimated population size, 1985-1989.

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	44	25	15	--	--	--	--	--	401	434
1986/87	--	--	--	--	--	--	--	--	--	--
1987/88	44	20	12	--	--	--	--	--	303	347
1988/89	37	23	15	--	--	--	--	--	280	305
1989/90	39	34	20	--	--	--	--	--	303	310[a]

[a] This survey was completed in October 1990, after the report period, 30 June 1990.

Table 2. Kenai Mountains caribou harvest and accidental death, 1986-90.

Regulatory year	Hunter harvest							Accidental death	Grand total
	Reported				Estimated				
	M (%)	F(%)	Unk.	Total	Unreported	Illegal	Total		
1986/87	--	--	--	--	--	--	--	--	--
1987/88	--	--	--	--	--	--	--	--	--
1988/89	--	--	--	--	--	--	--	--	--
1989/90	12 (86)	2 (14)	0	14	0	0	0	0	14
1990/91	7 (100)	0	0	7	0	0	0	0	7

Table 3. Kenai Mountains caribou harvest data by permit hunt, 1986-90.

Hunt No./ Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
501/	1986/87	250	46%	37%	63%	72%	22%	--	50
Unit 7	1987/88	250	37%	28%	72%	48%	52%	--	44
	1988/89	150	47%	31%	69%	60%	40%	--	25
	1989/90	150	49%	23%	77%	86%	14%	--	14
	1990/91[b]	50	42%	24%	76%	100%[a]	0	--	7

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

[b] Harvest occurred 10 August to 30 September 1990, after the report period.

Table 4. Kenai Mountains caribou annual hunter residency and success, 1986-90.

	Successful				Unsuccessful				
Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Total (%)	Total hunters
1986/87	--	--	--	--	--	--	--	--	--
1987/88	--	--	--	--	--	--	--	--	--
1988/89	--	--	--	--	--	--	--	--	--
1989/90	1	13	0	14 (18)	9	50	2	62 (82)	76[b]
1990/91	2	5	0	7 (23)	3	20	0	23 (77)	30

[a] Local resident resides in Unit 7.

[b] Total includes an unsuccessful hunter of unknown residence.

Table 5. Kenai Mountains caribou annual harvest chronology percent by time period, 1986-90.

Regulatory year	Harvest periods				n
	8/10-8/15	8/10-8/31	9/1-9/15	9/16-9/30	
1986-87					
1987-88					
1988-89					
1989-90	29%	36%	29%	7%	14
1990-91[a]	57%	14%	29%	--	7

[a] Harvest occurred 10 August to 30 September 1990, after the report period.

LOCATION

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

Herd: Mulchatna

Geographical Description: Northern Bristol Bay and the Nushagak Hills

BACKGROUND

Little 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, the Innoko River and the Taylor Mountains. During the 1800s caribou calf hides were a major trading item with 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 (Alaska Game Commission Reports 1925-39) and remained relatively stable 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.

Aerial surveys of the Mulchatna area were first conducted in 1949, when the population was estimated at 1,000 caribou (ADF&G files 1974). The population increased to approximately 5,000 by 1965 (Skoog 1968). In 1966 and again in 1972 relatively small migrations across the Kvichak River were recorded, but no major movements of this herd were 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 census this herd accurately. A total of 13,079 caribou was counted at that time, providing a basis for an October estimate of 14,231 caribou.

Photocensusing was used to monitor the herd as the population declined through the 1970s. Seasons and bag limits were reduced continuously that decade. The problem of locating caribou during surveys often led biologists to underestimate the number of animals in the herd.

Twenty radio transmitters were attached to Mulchatna caribou in 1981. This assisted in locating postcalving aggregations. During a photocensus on 30 June 1981, 18,599 caribou were counted. Photocensus estimates of the MCH since then have documented a 17% annual rate of increase.

MANAGEMENT DIRECTION

Management Objectives

Maintain a minimum population of 25,000 adults with a minimum bull:cow ratio of 35:100.

METHODS

A photocensus of the MCH was conducted during the postcalving aggregation period in cooperation with personnel from Lake Clark National Park. Surveyors, using a Super Cub, Cessna 185, and 206 aircraft, estimated the number of caribou observed and photographed large (> 100 animals), discrete groups using hand-held, 35-mm cameras. The herd size estimate was generated from adding 3 survey components: the number of caribou counted in photographs, the corrected observed caribou estimate but not photographed, and the estimated number of animals in areas not surveyed during the census. The corrected observed caribou estimate was derived by multiplying the estimated number observed by a correction factor to reduce observer bias in estimating group sizes. This correction factor was calculated by dividing the actual number of caribou counted in photographs by the number of animals the observer estimated were in the picture.

Aerial surveys to estimate the herd's sex and age composition are conducted in June and/or October. Eleven additional radio collars were placed on caribou on wintering areas near Lake Clark National Preserve in May 1990. Monthly radio-tracking flights were made by the National Park Service (NPS) to continue the demographics study that began in 1981. Harvest monitoring and enforcement presence was maintained along the Mulchatna and Nushagak Rivers in the first half of September when hunting pressure was most intense. Harvest data were collected from statewide harvest reports. Hunter "overlay" information was not keypunched, and reminder letters were not sent 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%. This increase is attributed to a succession of mild winters from the late 1970s to 1988, low predation rates, and an estimated annual harvest rate of less than 5% of the population since 1976.

Population Size: A photocensus of the MCH was conducted on 1 July 1990; 70,652 caribou were observed. Based on photo-counts and caribou observations during the aerial survey and a subjective estimate of the number of caribou suspected in areas not surveyed, an extrapolated estimate of 82,000 caribou was derived (Table 1). On 28 June 1989, the extrapolated estimate for the MCH was 70,000. These data indicate the herd continued to increase in size despite deep snow conditions in the winters of 1988-89 and 1989-90.

Population Composition: Population composition surveys were not conducted this report period. Data from previous surveys (Table 1) suggest high bull:cow ratios in spite of increasing harvest pressure, particularly on male caribou.

Distribution and Movements: The cooperative effort between ADF&G and NPS continued during this report period. There were 41 caribou with radio collars in the MCH in July 1990. These included 7 radios deployed in 1981 and 1982, 28 transmitters placed on caribou from 1986 to 1988, and another 11 deployed in May 1990.

Intermingling of the MCH and the Northern Alaska Peninsula Caribou Herd (NAPCH) on winter ranges appeared to increase during recent years. Winter range use expanded southeast across the Kvichak River as far south as the Alagnak River drainage and to the east as far as Kokhanok. Since 1986 over 300 caribou have wintered on the west side of the Nushagak River between Kemuk Mountain and the Muklung Hills. Use of this winter range appears to increase each year.

Summer and fall range use has expanded primarily to the northwest as far as the Taylor Mountains and the Stony River drainage. Over 20,000 caribou were observed near Nishlik Lake during the July 1990 census. Most of these caribou appeared to head west and several were seen crossing into the Aniak River drainage. NPS personnel noted an obvious decline in the number of caribou using areas near Lake Clark National Preserve in summer 1990.

Several peripheral caribou groups seem independent of the MCH. A group of 100-300 caribou is located between Portage Creek and Etolin Point, and Rainy Pass has an estimated 200-400 that may remain in that vicinity all year. Caribou in the Kilbuck Mountains are distinct from the MCH, but there is some overlap in summer. Radiotelemetry data suggest another group resides in the upper Stuyahok and Koktuli River drainages. In winter these caribou intermingle with the main herd, but they do not migrate with the main herd in spring.

Mortality

Harvest:

Season and Bag Limit. Hunting is prohibited in Subunit 17A and that portion of Subunit 17C west of the Nushagak River. The open season for Alaska resident, subsistence, and non-resident hunters in Subunits 9A, 9B, 17B, and the remainder of 17C is 10 August to 31 March. The bag limit for resident hunters is 4 caribou; however, not more than 1 (2 for subsistence hunters) may be taken from 10-31 August, 1 may be taken from 1 September to 30 November, and up to 4 may be taken from 1 December to 31 March. The bag limit for nonresidents is 1 caribou.

Board of Game Actions and Emergency Orders. No changes in seasons or bag limits occurred nor were any Emergency Orders issued this report period.

Hunter Harvest. The reported harvest from the MCH was 1,201 caribou in the 1989-90 hunting season (Table 2). This total was lower than that reported in 1988-89 (1,471), but comparable to the 5-year average (1,129). As in previous years, the majority of the harvest was male (88%).

The estimated unreported harvest was 1,500, yielding an estimated total harvest of 2,701 caribou. Most of the unreported harvest is attributed to villagers living along the Nushagak River. Caribou harvest reports were not received from any residents of these villages during 1989-90 hunting season. Consequently, any conclusions drawn from the reported harvest data alone should be viewed with caution.

Field observations indicate that hunter density in the units during the fall season has increased steadily since the early 1980s. However, harvest levels remained less than 5% of the total population, and harvests do 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 contributes to the increased use of this area by caribou.

Hunter Residency and Success. Nonresidents made up 54% of the reporting hunters (n = 1,279) during the 1989/90 season. Nonlocal Alaska residents accounted for 42%, and local residents 4% of the total hunters who returned harvest reports. Eighty-five percent of the hunters who reported, successfully harvested at least 1 caribou (Table 3).

Harvest Chronology. Most (82%) of the reported harvest (1,201 caribou) occurred in August and September. Harvest chronology were not available for 1986-1988 (Table 4).

Transport Methods. Aircraft were the most common (85%) means of hunter transport (Table 5). Boats (9%), snowmachines (3%), ATVs (1%) and horses (0.2%) were other means of transportation reported.

Other Mortality: Natural mortality was not documented this report period. Snow depths were abnormally high throughout the area in the winters of 1988-89 and 1989-90, but there was no evidence of significant winter mortality in the MCH. The body condition and pregnancy rate of adult females handled during radio-collaring work in May 1990, suggested that most individuals in the herd were not severely affected by winter conditions.

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

In 1988 serological surveys of blood samples collected from 8 MCH caribou indicated no evidence of epizootic hemorrhagic disease, bluetongue, contagious ecthyma, infectious bovine rhinotracheitus, bovine viral diarrhea, parainfluenza 3, respiratory syncytial virus, or brucellosis. Serological evidence of Q fever (*Coxiella burnetta*) was noted in 4 of 5 samples tested. Serological surveys have demonstrated the presence of this disease agent in Alaska caribou herds for years with no quantifiable negative impacts (R. Zarnke, ADF&G-Wildlife, pers. comm.).

Habitat

Assessment: The condition of the MCH winter range was not assessed this report period. Taylor (1989) reported the carrying capacity of traditional wintering areas was surpassed by 1986-87 and it was necessary for the MCH to use other winter range to continue growing. The herd has apparently used different areas at an increasing rate since that time. Casual observations about winter range near the west end of Lake Illiamna, suggest abundant lichens.

Mount Redoubt erupted several times in winter 1989-90, depositing significant amounts of volcanic ash on eastern portions of the MCH range. Caribou were observed in ash covered areas in late winter and spring, but specific data on effects of ash on caribou were not collected.

CONCLUSIONS AND RECOMMENDATIONS

The MCH has experienced exceptionally rapid growth since 1980. The postcalving population estimates increased from 20,618 in 1981 to 82,000 in 1990. Annual harvests remained at less than 5% of the population throughout this period but increased at a rate exceeding the population increase during most years.

Concurrent with this population growth, the MCH expanded into "new" ranges north and west in summer and fall, and to the south and east during winter months. The herd had

difficulty establishing long-term use of habitat west of the Nushagak River before hunting closed in that area in 1987-88. Since then there has been a noticeable increase in the number of caribou using this area throughout the year.

The use of "new" range by the MCH has lessened the probability that it will experience a population crash caused by overusing winter range. There may, however, be an increased probability of localized overuse in portions of the range which are now used by both the MCH and the NAPCH.

The MCH presents new management challenges as it expands its size and range. Since 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.

Increased harvest pressure on the MCH also affects other area big game populations. Moose populations near villages are experiencing less pressure and illegal moose harvests are decreasing as local hunters increase their use of caribou meat. The increased number of caribou has also attracted more nonlocal hunters interested in "combination hunts." The reported moose harvest by nonlocal hunters in Subunits 17B and 17C increased from 23 in 1982-83 to 111 in 1989-90 (ADF&G files).

MCH harvest data are of limited value because there is no objective method to determine the rate of return of harvest tickets. Overlay data were not keypunched and reminder letters were not sent to non-respondents since 1986. Important management decisions were based on assumptions rather than objective data. The Department should strive to improve the quality of the harvest data so that we can better manage the MCH as well as smaller herds on the same range. Improved harvest data would also be vital if it becomes necessary to limit harvest pressure.

The current management objective for the MCH is still valid, even though the size and range of this herd has changed substantially in recent years. This current objective could be augmented with the following objectives to manage and monitor the herd:

1. Conduct an annual photocensus of the MCH during postcalving aggregations in late June or early July;

2. Conduct composition surveys during October on a biennial basis. 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 radio-collared caribou at least 6 times per year;

4. Maintain at least 50 active radio collars in the MCH;

5. Develop an improved method of collecting harvest data and implement the method before the 1992-93 hunting season;

6. Develop a Memorandum of Agreement with the NPS (Lake Clark and Katmai National Parks), the U.S. Fish and Wildlife Service (Togiak and Yukon Delta National Wildlife Refuges), and ADF&G to collect population data jointly and develop management recommendations for the MCH; and,

7. Work with other land and resource management agencies and land owners and managers to develop a caribou management plan which addresses the MCH and the NAPCH as well as the Kilbuck, Nushagak Peninsula, and other smaller herds that occur within the MCH range.

All these objectives should be organized under two broad goals: 1) manage the MCH for maximum opportunity to hunt caribou and 2) manage the herd in a manner that encourages range expansion west and north of the Nushagak River.

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Table 1. Mulchatna caribou fall composition counts and estimated population size, 1985-1989.

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[a]
1985/86	--	--	--	--	--	--	--	--	--	--
1986/87	56	37	19%	--	--	--	--	--	2,171	50,000
1987/88	68	60	26%	--	--	--	--	--	1,858	52,527
1988/89	66	54	24%	--	--	--	--	--	536	70,000[b]
1989/90	--	--	--	--	--	--	--	--	--	82,000

[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 (47,931), corrected estimates, and subjective estimate of the number of caribou in areas not surveyed during the census.

Table 2. Mulchatna caribou harvest and accidental death, 1985-89.

Regulatory year	Hunter harvest							Accidental death	Grand total
	Reported				Estimated				
	M (%)	F(%)	Unk.	Total	Unreported	Illegal	Total		
1985/86	79%	20%	1%	962	1020	--	1020	--	1982
1986/87	82%	17%	0.9%	1026	1470	--	1470	--	2496
1987/88	88%	11%	0.4%	985	1270	--	1270	--	2255
1988/89	78%	19%	3%	1471	1500	--	1500	--	2971
1989/90	88%	11%	0.9%	1201	1500	--	1500	--	2701

Table 3. Mulchatna caribou annual hunter residency and success, 1985-89.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local resident	Nonlocal resident	Nonresident	Total (%)	
1985/86	--	--	--	--	--	--	--	--	--
1986/87	--	--	--	--	--	--	--	--	--
1987/88	--	--	--	--	--	--	--	--	--
1988/89	--	--	--	83%	--	--	--	17%	1781
1989/90	46	424	621	85%	1	117	70	15%	1279

[a] Includes residents of Game Management Unit 17

Table 4. Mulchatna caribou annual harvest chronology percent by time period, 1985-89.

Regulatory year	Harvest periods									n
	August	September	October	November	December	January	February	March	Unk.	
1985/86	18%	43%	6%	4%	2%	4%	5%	17%	1%	962
1986/87	--	--	--	--	--	--	--	--	--	--
1987/88	--	--	--	--	--	--	--	--	--	--
1988/89	--	--	--	--	--	--	--	--	--	--
1989/90	23%	59%	4%	0.6%	0.9%	0.8%	1%	11%	0.3%	1201

Table 5. Mulchatna caribou harvest percent by transport method, 1985-89.

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	n
1985/86	70%	--	6%	--	3%	--	--	22%[a]	962
1986/87	--	--	--	--	--	--	--	--	--
1987/88	--	--	--	--	--	--	--	--	--
1988/89	--	--	--	--	--	--	--	--	--
1989/90	85%	0.2%	9%	1%	3%	0%	0%	2%	1398[b]

[a] Unknown category for 1985/86 includes (n=25; 3%) and "other" (n=185; 19%).

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

LOCATION

Game Management Unit: 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 turn of this century and again in the early 1940s (i.e., 20,000 caribou). The last population low occurred in 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 since then.

MANAGEMENT DIRECTION

Management Objectives

Maintain the mid-summer population between 15,000 and 20,000 caribou and an October sex ratio of 40 bulls:100 cows.

METHODS

A radiotelemetry-aided aerial photocensus was conducted in late-June on postcalving concentrations. In April 1990, 20 adult females were captured using a helicopter-mounted net gun to assess body size and condition, and 12 were radio-collared. Fall sex and age composition surveys were conducted with a helicopter in October 1990, and Piper Super Cub in October 1989. Reconnaissance flights (using radiotelemetry) were conducted periodically to monitor herd movement. The harvest was monitored by harvest ticket reports.

RESULTS AND DISCUSSION

Population Status and Trend

The NAPCH has grown since the early 1950s. Photocensuses from 1981-1990 have ranged between 15,000-19,000. Annual count variations may reflect actual changes in herd size, but more probably are a result of sampling error and restricted coverage because of weather and similar difficulties. Despite these fluctuations in numbers, the NAPCH has been relatively stable at the desired population magnitude for the past decade.

Population Size: Survey conditions in June 1990 were suitable, although clouds and winds near mountains prevented total coverage. The June 1990 photocensus of post-calving aggregations accounted for 15,700 caribou which represented the minimum herd size. Sex-age composition classification and extrapolation for estimating the portion of the herd (mostly bulls) not associated with the postcalving aggregations were not completed. The total herd was estimated at 17,000 animals.

Population Composition: A sample of 2,934 caribou was classified in October 1989 and had 20% calves (Table 1). A sample of 5,348 caribou classified from the June 1990 photocensus showed 23% calves in the herd. K. Pitcher classified 1,484 caribou from a helicopter in October 1990 and found 41 bulls and 29 calves:100 cows. Calves made up 17% of the sample (Table 1). Since fall 1987, NAPCH productivity has declined.

Distribution and Movements: The NAPCH's primary calving grounds are in the Bering Sea flats between the Cinder and Sandy Rivers. In recent years the postcalving migration north has begun earlier, and for the past 3 years a majority of the herd has been 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. In winter 1989-90 an estimated 1,500-2,000 NAPCH animals migrated north of the Naknek River. A radiotelemetry flight on 15 March 1990 found no radios from NAPCH animals north of the Naknek River. All radio-collared caribou were widely distributed between the Naknek River and Upper Ugashik Lake, and by 24 April caribou had moved as far south as Black Lake.

Mortality

Harvest:

Season and Bag Limits. The open season for all hunters in Subunits 9C and 9E is 10 August to 31 March. The bag limit for subsistence and resident hunters is 4 caribou; however, for subsistence hunters not more than two may be taken from 10-31 August and

the September-November bag limit is 1; for resident hunters not more than 1 may be taken from 10 August-30 November. The bag limit for nonresident hunters is 1 caribou.

Board of Game Actions and Emergency Orders. Uniform seasons and bag limits were adopted for the NAPCH and Mulchatna herd for the 1988-89 season. No changes were made for the 1989-90 season, however the State Supreme Court's decision on the McDowell case allowed any resident to take two caribou from 10-31 August 1990. The effect of this change in the bag limit for 1990 may have been reduced by an open registration hunt in August for the Nelchina herd which attracted several thousand hunters.

At the fall 1990 Board of Game meeting, a Naknek drainage controlled use proposal was passed. This proposal will restrict the use of ATVs prior to 1 December to several designated trails. The effect of this proposal on caribou harvest next year will need to be assessed.

Hunter Harvest. The 1989-90 reported harvest from the NAPCH was 903 caribou (Table 2), including 766 males (85%) and 137 females (15%). Most local and some nonlocal hunters did not report killing caribou. The nonsubsistence reporting rate is estimated at 60% (Sellers 1989) and unreported subsistence harvest has been estimated at 900-1,000 (Morris 1985, Morris 1987). Consequently, the total human harvest is estimated at 2,300.

Hunter Residency and Success. Only 15 (2%) hunters reported being unsuccessful (Table 3), but it is believed the reporting rate for unsuccessful hunters is substantially lower than for successful hunters. A change in the caribou harvest report allowed classification of residency in 1989-90, the first time since centralized data processing was discontinued in 1982-83. From 1980-81 through 1982-83 an average of 456 hunters were successful (7% local residents, 56% other Alaskans and 37% nonresidents) (Sellers and McNay 1984). In 1989-90 the percentages for successful hunters were 7%, 46% and 48% for locals, other Alaskans and nonresidents, respectively. The larger bag limit for residents, probably accounts for 60% of the number of caribou reported harvested by Alaskans in 1989-90. Considering unreported harvest, it is estimated that Alaskans actually accounted for 75-80% of the harvest in 1989-90.

Harvest Chronology. The majority of the reported harvest for the NAPCH occurred between 10 August and 31 October (Table 4), which corresponded with the best weather conditions, best chance for success at taking a trophy bull, and relatively easy access by boat and aircraft from King Salmon and Naknek. Up until 1988-89 the reported caribou harvest on the Alaska Peninsula was significantly higher during odd-numbered years having concurrent October brown bear seasons. During the past 4 winters, a significant number of caribou have crossed the Naknek River, making themselves more readily available to hunters using vehicles to access hunting grounds. This easy access combined with low air fares from Anchorage and a liberal bag limit resulted in a higher winter

harvest than before 1987. The subsistence harvest is primarily opportunistic, and peak harvests vary between villages depending upon caribou availability.

Transportation Methods. Most of the successful hunters reported using aircraft (68%), with the remainder split between boat, highway vehicle, 3 or 4-wheelers and snowmachine (Table 5). In 1989-90, more snowmobile use was reported than occurred in the previous years with deeper than normal snow cover. Subsistence users, who did not report, make less use of aircraft and more use of boats and "3 and 4-wheelers" than indicated in Table 5.

Other Mortality: Although specific data on natural mortality is lacking, it is believed much lower than that for the Southern Alaska Peninsula herd (SAPCH). The 1989-90 winter had more snow accumulation than any winter since the early 1970s and followed the record cold winter of 1988-89; however, no evidence of an abnormally high winter mortality was noted. The past 2 winters may have affected calf recruitment as the percentage of calves in fall has been below normal (Table 1).

Habitat

Assessment: No quantitative data is available to assess range conditions; however, preliminary analysis of data (i.e., weights, and body size) from the caribou transplanted in 1988 and from animals captured in April 1990 showed that NAPCH adult females are intermediate in body size and condition between the SAPCH and Mulchatna herd animals (Pitcher et al. 1990). The drop in productivity noted in 1989 and 1990 combined with the expansion of winter range north of the Naknek River may indicate depletion of the herd's winter range.

Nonregulatory Management Problems/Needs

Because the NAPCH has been relatively stable at a moderately high density for the past decade and because of its importance to hunters, this heard was nominated by a panel of caribou biologists for experimental management. 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 functional radios on adult females to accomplish this objective.

CONCLUSIONS AND RECOMMENDATIONS

The NAPCH remained within management objectives the past decade. No change in objectives or in hunting regulations are presently recommended. Intensive monitoring of population parameters will be needed to meet the experimental management objective recommended above.

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Table 1. Northern Alaska Peninsula Caribou Herd fall composition counts and estimated population size, 1985-1990.

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	NA	NA	NA	NA	NA	NA	NA	NA	NA	20,000
1986/87	51	34	18	54	NA	NA	NA	27	2,540	17,000
1987/88	54	51	25	49	51	32	17	26	1,536	17,000
1988/89	49	48	26	51	46	34	20	25	1,156	20,000
1989/90[a]	NA	NA	20	NA	NA	NA	NA	NA	2,934	20,000
1990/91[b]	41	29	17	59	NA	NA	NA	24	1,484	17,000

[a] Composition survey from fixed-wing aircraft
[b] Composition survey from helicopter, after the report period.

Table 2. Northern Alaska Peninsula caribou harvest, 1985-89.

Regulatory year	Hunter harvest: Reported M (%)	Reported F (%)	Reported Unk.	Reported Total	Estimated Unreported	Grand total
1985/86	612 (84%)	133 (16%)	18	763	1,200	1,950
1986/87	602 (84%)	118 (16%)	31	751	1,200	1,950
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

[a] Grand total is rounded off.

Table 3. NAP caribou annual hunter residency and success, 1980 and 1989.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[b] resident	Nonlocal resident	Nonresident	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Total (%)	
1980-82	34	254	168	456	--	--	--	--	--
1989-90	49	345	358	752 (98%)	4	6	5	15 (2%)	767

[a] Local residents means residents of Subunits 9(A), 9(B), 9(C) and 9(E).
[b] Data not available between 1983-1988; data from 1980-82 is averaged.

Table 4. NAP caribou annual harvest chronology percent by time period, 1985-89.

Regulatory year	Harvest periods						n
	August	September	October	November	December	Jan.-March	
1985-86	12	38	22	13	1	13	745
1986-87	26	36	13	10	5	10	721
1987-88	13	31	23	19	6	8	999
1988-89	11	37	19	7	7	20	981
1989-90	10	37	21	5	9	19	899

Table 5. Northern Alaska Peninsula caribou harvest percent by transport method, 1985-89.

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk.	n
1985/86[a]	--	--	--	--	--	--	--	--	--
1986/87[a]	--	--	--	--	--	--	--	--	--
1987/88[a]	--	--	--	--	--	--	--	--	--
1988/89[a]	--	--	--	--	--	--	--	--	--
1989/90	68	0	13	7	4	1	8		758[b]

[a] Data not available.
[b] Successful hunters

LOCATION

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

Herd: Southern Alaska Peninsula

Geographical Description: Alaska Peninsula (Subunit 9D) Unimak Island (Unit 10)

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 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 (Johnson, 1990). Numbers of caribou on Unimak Island have also varied substantially, ranging from 5,000 in 1975 (Irvine 1976) to about 300 in 1983.

Harvest of the SAPCH was fairly high from 1980-1985, probably exceeding 1,000 in several years; however, with more restrictive regulations and reduced herd size, the annual harvest declined to approximately 200 caribou. Poor nutrition is playing a role in the SAPCH decline. 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

Maintain a minimum population of 5,000 to 6,000 caribou in mid-summer with an October sex ratio of 40 bulls:100 cows.

METHODS

A post-calving, aerial radiotelemetry survey in late-June or early-July has been conducted in most years since 1984. Fall sex and age composition surveys are periodically flown by helicopter in October. Occasional radio-tracking flights are used to monitor herd distribution. A late-fall aerial census along systematic transects is attempted annually by

staff of the Izembek National Wildlife Refuge (INWR). Hunter harvests are monitored by harvest tickets and supplemented by field checks by INWR staff around Cold Bay. Studies began on causes of low calf recruitment in the SAPCH (Pitcher et al. 1990) in 1989-1990.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: We counted post calving aggregations from 12-16 June and on 25 June 1990 with total counts of 3,375 and 3,022, respectively. Total herd size was estimated at 4,000. Similar surveys in 1988 and 1989 tallied 3,407 and 3,386 caribou respectively. Although the 1990 count was only slightly lower than the previous two years, other population parameters such as continued low production and an old age structure indicate a continuing population decline that began in 1984.

Population Composition: Calf recruitment in 1989 was the lowest reported for this herd. A fixed-winged aerial survey on 14 October 1989 showed 5% calves (Table 1). During the 2 post-calving surveys in 1990, 12% and 16% of the caribou observed were calves. On 13 October 1990 a helicopter survey classified 1,051 caribou. Ratios were 19 bulls and 12 calves per 100 cows. Calves made up 9% of the herd (Table 1).

Distribution and Movements: Data from radio-tracking surveys conducted by staff from both INWR and ADF&G suggest that SAPCH calves are in two main subgroups in separate areas (Pitcher et al. 1990). Approximately 25% of the herd appears to calve on the Caribou River flats. Many of these animals appear relatively sedentary and remain in the area throughout winter. However, some have been located around Cold Bay in winter. The remainder of the herd calves in the Black Hill-Trader Mountain area and winters near Cold Bay. Further radio telemetry studies are needed to clarify the discreetness of the two major calving components. Additionally, a few caribou calve in the mountains east of the Caribou River flats. No caribou traveling between Unimak Island and the mainland has been documented in recent years.

Mortality

Harvest:

Season and Bag Limit. The 1989/90 open season in Subunit 9D and Unimak Island (Unit 10) for subsistence hunters was 1 September to 31 March with a bag limit of 2 caribou. For resident and nonresident hunters the season was 1 September to 31 October; the bag limit was 1 caribou.

Board of Game Actions and Emergency Orders. Regulatory change made since 1986 by the Board of Game and by Emergency Order are summarized by Johnson (1990). In response to the continued decline in this herd, the Board of Game 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 dropped below 2,500 caribou. In October 1990 the U.S. Fish and Wildlife Service (FWS) exercised its regulatory authority under ANILCA by announcing an emergency closure of nonsubsistence hunting on federal lands. This closure was made to insure 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. Under the recent State Supreme Court ruling, all Alaskans were classified as subsistence users and were eligible to hunt through 31 March 1991.

Hunter Harvest. The 1989-90 reported harvest of the SAPCH was 59 caribou, including 50 males and 9 females (Table 2); however, when unreported sport and subsistence harvests are considered, the total harvest probably approached 200 animals. The reported harvest was split about equally between local subsistence hunters and nonresidents (Table 3). Only 3 nonlocal Alaskans reported taking caribou. The general season closed before caribou became available along the Cold Bay road system, and few residents found it attractive to travel to Cold Bay and then charter out for one caribou. There was a fall brown bear hunt in October, and some additional harvest resulted from combination hunters (Table 4). 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 or 3- or 4-wheelers (Table 5). Boats were used by 10% of the hunters who reported, but are used more frequently by nonreporting subsistence hunters.

Other Mortality: Annual survival of radio-collared adult females from the SAPCH was estimated at 0.61, extremely low compared to other Alaska caribou herds (Pitcher et al. 1990). Causes of death were not determined, although predation by wolves and bears was suspected. Both predators are relatively abundant on the SAPCH range.

Calf survival in the SAPCH was low throughout the 1980s; The percentage of calves in the herd averaged 14% in mid- to late June, less than 1 month after calving. Undernutrition is thought to be a factor in low survival, although predation is also probably involved (Pitcher et al. 1990).

Habitat

Assessment: No formal assessment of habitat has been made on the SAPCH range. Habitat on the Caribou River flat is substantially different than in the Black Hill-Trader Mountain area; i.e., the Caribou River flat is a wet, lowland area with abundant sedge meadows interspersed with willow shrublands. The Black Hill-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 that adult female caribou from the SAPCH were smaller and lighter than cows from either the NAPCH or Mulchatna herds. In April 1990, 12 caribou were captured, weighed, measured and tested for body fat. Nine of these same animals were recaptured in October to measure changes in condition.

A graduate student from the University of Alaska is scheduled to begin a range analysis study under the advisement of D. Cline, and with cooperative support from ADF&G and the FWS.

CONCLUSIONS AND RECOMMENDATIONS

It is difficult to make specific management recommendations for the SAPCH without knowing if the continuing decline in numbers is a result of (1) rangewide density dependent food limitation, (2) a shift into inferior winter range, (3) high predation rate and past excessive harvests, or (4) some combination of these. Since we lack precise answers to these questions, hunting mortality should be reduced to the greatest extent possible, particularly for females. 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 supporting a different approach, every effort should be made to prevent the herd from declining below 2,500 animals (i.e., a density of about 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 sole 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 meeting in Anchorage on 10 December 1990 between FWS and ADF&G staff was useful in coordinating management objectives and in agreeing upon a mutually acceptable regulatory proposal for the 1991 hunting season. Both agencies agreed that all hunting will be stopped if the population drops below 2,500 animals or if the sex-ratio drops below 10 bulls:100 cows. We will recommend to the Board of Game that there not be a nonresident season and that the resident season extend from 10 August-30 September and from 1 December-31 March with a 1 bull limit. It is believed that this split season will provide reasonable opportunity for local subsistence users but will reduce the influx of nonlocal hunters into the Cold Bay area when caribou usually migrate close to the road system. In addition, by the October closure, hunters will avoid harvesting bulls at the peak rutting period when meat quality is poor. It is expected that this split season will preclude the need to administer either a state or federal subsistence permit hunt.

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Table 1. Southern Alaskan Peninsula caribou composition counts (fall) and estimated population size (spring), 1985-1990.

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	NA	NA	9	NA	NA	NA	NA	NA	1,460	7,500+
1986/87	32	20	13	66	59	28	13	21	2,307	5,000
1987/88	36	26	16	62	54	25	21	22	1,769	6,400
1988/89	41	19	12	62	NA	NA	NA	26	886	4,000
1989/90[a]	NA	NA	5	NA	NA	NA	NA	NA	1,708	4,000
1990/91	19	12	9	76	na	na	na	15	1,051	4,000

[a] Percent calves obtained from fixed-wing aerial survey.

Table 2. Southern Alaskan Peninsula caribou harvest and accidental death, 1985-89.

Regulatory year	Hunter harvest: Reported M (%)	Reported F(%)	Reported Unk.	Reported Total	Estimated Unreported	Grand total
1985/86	180 (53)	162 (47)	3	345	300	650
1986/87	36 (64)	18 (36)	0	56	150	200
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

[a] Grand total is rounded off.

Table 3. Southern Alaskan Peninsula caribou annual hunter residency and success, 1985-89.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	
1985/86[b]									
1986/87[b]									
1987/88[b]									
1988/89[b]									
1989/90	21	3	24	48 (92%)	1	2	1	4 (8%)	52

[a] Local means residents of Subunit 9D or False Pass.
[b] Data not available

Table 4. Southern Alaskan Peninsula caribou annual harvest chronology percent by time period, 1985-89.

Regulatory year	Harvest periods						n
	August	September	October	November	December	January-March	
1985-86	1	5	9	28	37	22	345
1986-87	2	15	15	15	20	33	54
1987-88	2	0[a]	0[a]	26	17	54	81
1988-89	2	23	8	27	16	25	48
1989-90	0	26	28	20	12	16	59

[a] Season temporarily closed by emergency order; reopened in Nov.

Table 5. Southern Alaska Peninsula caribou harvest percent by transport method, 1985-89.

Regulatory year	Percent of harvest								n
	Airplane	Horse	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	
1985/86[a]									
1986/87[a]									
1987/88[a]									
1988/89[a]									
1989/90	41	0	10	10	0	0	27	3	59

[a] Data not available.

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 extreme southeastern Unit 12, and adjacent Yukon Territory, Canada

BACKGROUND

Skoog (1968) estimated the Chisana Caribou Herd (CCH) contained about 3,000 animals in the early 1960s. By the mid- to late 1970s, the herd declined to an estimated 1,000 caribou. Since then, the herd has increased, but remained nonmigratory. Harvest by humans probably played a minor role in population fluctuations since the 1950s.

Human use of CCH caribou dates from the last century when there was a permanent Athapascan settlement at Cross Creek on the Chisana River. During the 1913 Chisana gold stampede, more Native people from both the Copper and Tanana River drainages came to Chisana to find employment. Gold miners also used the CCH as a food source. After 1913, the primary Athapaskan village was Cooper Creek on the Nabesna River (Record 1983). In 1929, the store at Chisana closed and relatively little activity occurred there afterward.

After 1929, the area was primarily used for guided hunting except that caribou within the present CCH range were hunted regularly by a few Native people until the village at Cooper Creek burned down in the mid-1950s (Record 1983). Guided hunting continues as the primary use of the CCH; 5 guide/outfitters operate in the area. Some Alaskan residents fly into the area to hunt. Use of the area during the summer tourism season is very light, and Native people now living at Northway and Tetlin no longer hunt in CCH range.

The CCH has not been a high management priority because of its small size, the area's remoteness, and the light and selective (for mature males) hunting pressure it received over the last several decades. During the mid-1980s, interest in the area increased because the area was classified as a National Park Preserve and more money became available for work on the herd.

A cooperative study of the CCH in the Wrangell-St. Elias National Park and Preserve began in October 1987. Fifteen adult female caribou were darted, radio-collared and

periodically monitored to determine seasonal movements and facilitate spring and fall composition surveys. The National Park Service (NPS) has provided most of the funding for radio—location flights since the radio-collaring.

MANAGEMENT DIRECTION

Management Goals and Objectives

The original draft goal in the 1976 Alaska Wildlife Management Plans for the CCH was to provide "the greatest opportunity to participate in caribou hunting." This initial goal was revised slightly in 1980 and was called a strategic management objective. To meet the original goal and restated objective I recommend the following management objectives:

1. Maintain a population of 2,000-2,500 caribou unless food becomes limiting.

2. Maintain a post-hunt bull:cow ratio of no less than 30:100 and a ratio of more than 6 large bulls:100 cows.

3. Avoid the use of restrictive permit hunts to control harvest.

These population objectives are designed to maintain a herd of moderate density somewhat below historically high densities, and to maintain a sufficiently high ratio of large bulls to meet prevailing harvest demand for large bulls. The number and size of bulls needed to achieve maximum breeding benefit to the population are unknown. Providing for subsistence use of caribou was not selected as a management goal because there has been insignificant subsistence use as defined by the Alaska Board of Game for at least 30 years. Residents of Chisana are either in the guide/outfitter industry or are primarily recently arrived residents without a tradition of subsistence use of CCH caribou.

METHODS

Herd trend was determined through reports from local Chisana residents, population size estimates obtained during spring and fall surveys, and indices of recruitment and adult mortality derived from composition surveys. In October 1989, the fall composition survey was conducted using PA-18 Super Cubs as a helicopter was unavailable. On this survey it was only possible to classify caribou as adults and calves, as was done on spring surveys. Fixed—wing surveys funded by the NPS were conducted in June 1990 to determine calf percentage in the herd. Helicopter surveys were conducted in October 1990 to determine calf:cow ratios and the age structure of bulls. Caribou were classified as calves, cows, small bulls, medium bulls, and large bulls.

Seasonal distribution and movements were determined by radio telemetry, incidental observations during surveys for other species, and reports from Alaskan and Yukon residents.

In late August and early September 1989, I rode 100 miles on horseback through the summer range and primary winter range of the CCH. During this trip I estimated the relative abundance of lichens on the range and the extent to which drought may have influenced the production of forbs in the Beaver, Flat, Ophir, and Divide Creek drainages.

In early October 1990, in cooperation with the NPS, we radio-collared 15 4—month-old female caribou to help conduct censuses and composition counts of the CCH. This young female sample will enable us to determine age at first breeding, which correlates with body condition (Skogland 1985).

RESULTS AND DISCUSSION

Population Status and Trend

I estimated the CCH at approximately 1,700-2,000 animals based upon a direct count of 1,660 in June 1989. Indications are that the herd grew slowly in the 1980s. However, the poor calf survival observed in 1989 and 1990 means that the herd has declined. Weather conditions were severe during winters 1988-89 and 1989-90, and summer drought reduced forage quality and quantity during summers 1989 and 1990. Horses owned by area outfitters could not be overwintered on the range without supplemental food in 1989-90 (T. Overly, pers. commun.).

Population Composition: Of the 625 caribou classified in October 1989, only 55, or 8.8%, were calves (Table 1). This compares with 10.4% calves in a sample of 1,540 caribou classified in late June 1989. Poor calf recruitment in this sample could be a result of summer drought conditions in 1988, deep snow and cold temperatures throughout the range of the CCH in winter 1988-89, and/or an unseasonably severe snowstorm which occurred during calving in late May 1989.

During the June 1990 survey, calves composed only 12.5% of 1,179 caribou classified (Table 2). Because calf production in caribou is typically high and generally shows little variation, I assumed extensive mortality of CCH calves occurred the first month of life. Poor survival of calves born in 1990 was also confirmed by the October 1990 composition counts (Table 1).

Distribution and Movements: During the past 12 years, the CCH has been nonmigratory, making only short seasonal movements within the herd's normal range. Winter and summer ranges overlap extensively. General movements beyond these seasonal ranges appear in response to local snow conditions. Since 1987, radio-collared caribou have not

crossed the Nabesna River, but several crossed the White River in winter 1990-91. The CCH moved northeast in winter 1988-89 to the vicinity of Beaver Creek, Yukon Territory in response to snow depths in excess of 2 feet on their normal range in the Nutzotin and northern Wrangell Mountains. The herd was sedentary during the severe 1989-90 winter because snow depth in their core range was less than 1 foot most of the winter. However, one radio-collared caribou was located near King City on the fringe of a large group of Nelchina and Mentasta caribou in early December 1989. The few radio-tracking flights made were insufficient to thoroughly document the extent of herd movements.

One large group of 500-600 caribou was observed near the White River, Yukon Territory in October 1989, but no radio-collared animals were present to identify these caribou conclusively as CCH caribou.

On 20-21 June 1990 caribou were concentrated in the Solo Creek Flats similarly as they had been in spring 1989, but they were not as tightly aggregated. We found caribou distributed from Cooper Pass on the west to the Klutlan Glacier in the Yukon Territory on the east. Caribou observed south and east of the White River in June may not be from the Chisana Herd.

Mortality

Harvest:

Season and Bag Limit. The 1989-90 hunting season within the range of the Chisana Herd in Unit 12 was 1-20 September with a 1—bull bag limit.

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

Human-induced Mortality. Only 34 bull caribou were reported taken from the CCH in fall 1989, and only 29 were taken in 1990 (Table 3). This harvest represents a 31% decline in harvest from the 49 bulls reported in 1987 and 1988. An additional 12-15 bulls were taken in the nearby Yukon Territory each fall, but it is not known whether or not this harvest should be presumed from the Chisana Herd.

Hunter Residency and Success. No data were available concerning the residency status of caribou hunters because harvest reports were not computer cross-referenced with harvest ticket overlays. However, I think most hunters of the CCH are guided nonresidents with a lesser number of nonlocal Alaskan and Chisana resident hunters.

Transport Methods. All hunters of the CCH must use aircraft to reach the Chisana area initially. Alaskan residents often use three- or four-wheelers for hunting or hunt on foot from float and wheel plane access points, while guided nonresidents hunt almost exclusively with horses.

Of the 34 successful hunters reporting in fall 1989, 17 (50%) used horses, 11 (32%) used aircraft, 4 (13%) used three- or four–wheelers, and 2 (6%) did not indicate means of transportation. Transport methods used during the 1990 season were similar to 1989.

Natural Mortality: During the 12-month period from 21 June 1989 to 21 June 1990, only 1 of 11 caribou died from natural but unknown causes. Known caribou predators are common in the range of the CCH including wolves, grizzly bears, golden eagles, coyotes, and wolverines. I think that predation is responsible for most natural mortality on this herd.

Habitat

Assessment: The most frequently used overlapping winter and summer range of the CCH is predominantly grass-sedge habitat with few lichens. Lichens do exist, however, in timbered habitat farther down the Chisana River and Beaver Creek drainages, and both of these areas were used during the relatively severe winters of 1988-89 and 1989-90.

Enhancement: The entire range of the CCH is located in the Wrangell-St. Elias National Park and Preserve. It is against NPS policy to conduct wildlife habitat improvement projects. For this reason, no habitat improvement projects are being considered. Habitat enhancement for CCH caribou will depend on the near–natural occurrence of wildland fires under terms of the Alaska Interagency Fire Management Plan (1984).

CONCLUSIONS AND RECOMMENDATIONS

The CCH is a small nonmigratory caribou herd which grew slowly throughout the late 1980's. Current hunting regulations permit the maximum allowable harvest of bulls and probably do not influence herd growth. Low recruitment in 1989 and 1990 caused the herd to decline during this period. If the bull:cow ratio falls below 30:100, harvest restrictions will be considered.

An intensive census effort should be undertaken to provide an accurate estimate of herd size. Close cooperation should be maintained between ADF&G and the NPS to conduct the required monitoring of this caribou herd.

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Table 1. Chisana Caribou Herd fall composition counts and estimated population size, 1977-90.

Survey date	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
9/29/77[a]	42	44	22	51	--	--	--	21	273	--
10/20/78[a]	34	18	11	62	--	--	--	21	100	--
10/80[b]	--	--	14	--	--	--	--	--	582	--
10/13/82	36	21	13	64	34	45	22	23	409	--
10/14/86	43	33	19	57	18	51	31	23	507	--
10/9/87	39	28	17	60	53	26	21	23	760	--
9/27/88	36	31	19	60	28	46	26	21	979	--
10/16-17/89[b]	--	--	9	--	--	--	--	--	625	1,660
10/4-5/90	36	8	5	69	40	43	18	25	851	--

[a] Yearlings were classified in these surveys; ratios need to be adjusted.
[b] Classification accomplished from fixed-wing aircraft rather than from a helicopter.

Table 2. Summary of June sex-age composition surveys of the Chisana Caribou Herd, 1976-90.

Year	% Yearlings (n)	% Calves (n)	% Adults[a] (n)	Unidentified	Total caribou
1976	--	20 (41)	80 (167)	--	208
1978	--	9 (30)	91 (286)	--	316
1980	--	12 (16)	88 (121)	--	137
1981	--	15 (66)	85 (360)	--	426
1983	--	16 (26)	74 (136)	100	263
1984	--	15 (49)	85 (268)	--	317
1987	--	17 (88)	83 (436)	--	524
1988[b]	27 (84)	15 (46)	85 (267)	--	313
1989	--	10 (160)	90 (1,380)	120	1,660
1990	--	12 (147)	88 (1,032)	--	1,179

[a] Includes yearlings, unless reported in "Yearlings" column.
[b] May survey, calving not yet completed.

Table 3. Reported caribou harvests from the Chisana Caribou Herd, 1984–1990.

Year	Reported harvest of bulls	Total hunters reporting	% Success
1984	31	43	72
1985	65	90	72
1986	41	54	91
1987	49	58	84
1988	49(+15 in Canada)	58	84
1989	34(+15 in Canada)	38	89
1990	30	44	67

LOCATION

Game Management Units: Portions of Unit 12 and Subunit 20D (1,300 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 and received little sport harvest before 1972 (Jennings 1974). Herd size was then estimated at 350-400 caribou. Hunting pressure increased on the MCH in 1972 when restrictions were placed on hunting the Fortymile, Nelchina, Delta, Denali, and Mentasta herds which were accessible from the road system.

As use of the MCH increased, the bag limit was reduced from 3 caribou to 1 in 1973, and the Macomb Plateau Management Area (MPMA) was established in 1974. Except for float planes at Fish Lake, the MPMA regulations prohibited motorized vehicle use for hunting from 10 August through 20 September. The MPMA included the southern drainages of the Tanana River south of the Alaska Highway, from the east bank of the Johnson River upstream to Prospect Creek, to 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 onto the plateau in October and November to rut.

By 1975, the MCH was estimated at 700-800 caribou. This apparent increase in estimated herd size from 1972 to 1975 was probably because of increased knowledge about the herd rather than an actual increase in caribou numbers. Hunting pressure and harvest increased 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 still equalled or exceeded 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. The large harvest, which exceeded estimated recruitment, combined with predation by wolves and bears, led to the conclusion that harvest should 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. Conversion to a drawing permit hunt reduced the reported harvest from 93 caribou in 1977 to 16 in 1978.

In addition to concern about excessive harvest by humans, there was 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. Coincident 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 reflect the access restrictions in effect there more accurately. Boundaries and access restrictions remained the same.

MANAGEMENT DIRECTION

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, the MCH population estimate was at 800 caribou. Information gathered from local residents suggested there may have been more caribou between the Robertson and Delta Rivers in the 1960's than in 1988. Therefore, a population size objective was established to increase MCH size to 1,000 caribou by 1993. Other goals and objectives were established and discussed at the Division of Wildlife Conservation's caribou workshop in January 1990.

Management Goals and Objectives

Provide for continued consumptive use of caribou.

1. Increase the size of the MCH to 1,000 caribou by 1993, unless food beg ins 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.

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

Sex and age composition data were collected on 26 October 1989, 14 June 1990, and 9 October 1990 using a Hughes 500 helicopter. A pilot/observer team classified caribou as either calves, females >1 year old, or males >1 year old.

Eleven adult cows and 11 yearling cows were radio-collared on 9 and 25 April 1990. A net gun mounted on the skid of a Hughes 500 helicopter was used to capture caribou on 9 April. On 25 April, caribou were immobilized by darting with 3 mg carfentanil and 50 mg Rompun from a Hughes 500 helicopter. Data collected from each caribou included sex, an estimate of age, weight, neck circumference, total length, heart girth, metatarsal length, hind foot length, an estimate of general body condition, and an estimate of warble larvae infestation. Blood was also drawn for a serologic survey.

A population estimate was conducted on 9 October 1990. We attempted to find and count all caribou in the herd by locating radio-collared caribou from fixed-wing aircraft and by tracking groups in snow from a Hughes 500 helicopter and fixed-wing aircraft. During the survey, caribou were classified as calves, cows, or bulls. Bulls were classified by antler size as either large, medium, or small.

Radio-collared caribou were located from fixed-wing aircraft on 13 and 19 May 1990 to determine pregnancy rates based on antler retention and presence or absence of an extended udder. Pregnant radio-collared caribou were located at 2- to 6-day intervals from 19 May to 8 June 1990 to determine calving distribution and survival of calves. These data were collected as part of a predator research study conducted on the Macomb Plateau during May and June 1990 (Boertje et al. 1990).

Radio-collared caribou were located from fixed-wing aircraft on 30 August 1990 to determine if MCH animals had moved east out of the MPCUA and into Unit 12 during the hunting season. Movement of this type would have necessitated closing the hunting season for Macomb caribou in a portion of Unit 12 by Emergency Order.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The MCH size apparently held stable at approximately 800 caribou from October 1988 to October 1990 (Table 1). It is unclear why herd growth has stopped; however, predation is the most likely factor limiting herd growth at this time. Other

factors that may be limiting herd growth include food availability and weather (i.e., the harsh winter of 1989—90).

Population Composition:

October 1989 and 1990 Composition Data. Sex and age were recorded for 617 caribou on 26 October 1989 (Table 1). The 1989 estimate of 33 bulls:100 cows was below the management objective of 40 bulls:100 cows after the hunting season; however, data were collected fairly late in the season and some bulls were separated from the groups (Table 1). The 1990 ratio was obtained earlier in October and was closer to previous figures, indicating that the number of bulls in the herd has not declined.

Calf survival to fall 1989 was average, but in fall 1990 after the hard 1989-90 winter there were only 17 calves:100 cows (Table 1). High summer mortality of calves was characteristic of most Alaska Range caribou herds in 1990, suggesting that the cause was more probably the harsh 1989-90 winter (underweight calves were produced in both the Delta and Macomb herds in May 1990) than high summer predation.

June 1990 Composition Data. The 14 June 1990 composition count resulted in 600 caribou classified and produced an estimate of 32 calves:100 cows (Table 2). Initial mortality of MCH calves was similar to other herds in interior Alaska; approximately 50% of the MCH calves died before 14 June (Boertje et al. 1990).

October 1990 Composition Data. Composition data collected on 9 October 1990 resulted in an estimate of 17 calves:100 cows and 9% calves in the herd (Table 1), indicating significant calf mortality from 14 June to 9 October 1990. This represents a significant decline from fall calf:cow ratios of 32 and 34 calves:100 cows in 1988 and 1989, respectively, and may be considered as further evidence that predation is most probably limiting herd growth. The ratio of 44 bulls:100 cows met the management objective of 40 bulls:100 cows after the hunting season (Table 1).

Distribution and Movements: Adult radio-collared caribou were located 8 times during calving from 13 May to 14 June 1990. From 73% to 80% of them were located between the Johnson and Robertson Rivers (Table 3), with the core calving area located on the Macomb Plateau between the Johnson River and Berry Creek. The remaining adult radio-collared cows (20-27%) were located in the upper Little Gerstle River and upper McCumber Creek. No radio—collared caribou were located east of the Robertson River or west of the Jarvis Creek in spring.

Macomb caribou made no significant movements from the Subunit 20D permit hunt area in the 1989 or 1990 hunting seasons. On 30 August 1990, 15 of 23 radio-collared cows were located in the southern Subunit 20D permit area; however, 8 radio-collared cows were not located. Macomb caribou were located as far west as Ober Creek and as far east as Knob Ridge. However, there were reports of small numbers of caribou, thought

to be Macomb caribou, in Unit 12 between the Robertson River and Yerrick Creek during the 1990 hunting season.

Mortality

Harvest:

Season and Bag Limit. See Table 4.

Board of Game Actions and Emergency Orders. Because of the McDowell vs. Alaska decision, the Board of Game changed permit drawing hunt 530 to a registration permit hunt for the 1990 hunting season. The Board decided that even with the controlled use area in place, subsistence hunters still would have a "reasonable opportunity" to hunt caribou.

Human-induced Mortality. During the 1989 hunting season, the total reported harvest was 44 caribou (Table 5). Permit hunters reported killing 42 and subsistence hunters reported killing 2. Based on reported harvest, approximately 5% of the MCH was harvested during the 1989 hunting season, but since the harvest is almost entirely bulls, it has no significant effect on herd growth. The 1989 harvest was significantly higher than the mean of 27 caribou harvested per year for the previous 5 years.

During the 1990 hunting season, hunters reported killing 42 caribou (Table 5). This is similar to the 1989 harvest and continues the trend of increased harvest since 1987.

No other hunting mortality was documented for the MCH during this time. Illegal harvest is estimated to be minimal with 1-2 caribou shot and left in the MPCUA each year (Table 6). Three caribou were killed accidentally while being immobilized with a net gun.

Hunter Residency and Success. During the 1989 hunting season, Alaska residents and nonresidents received 90% and 10% of the MCH drawing permits, respectively. This was similar to 1988 when Alaska residents received 97% of MCH permits.

Nonlocal residents (residents residing outside Subunit 20D) received 71% and local residents (residents residing in Subunit 20D) received 29% of the drawing permits. This distribution of permits continues the trend of increased interest in hunting the MCH by nonlocal Alaska residents.

Macomb permit hunters had an overall success rate of 54% (Table 7), equal to the 54% success rate reported in 1988. This is the third consecutive year hunters had a high success rate hunting the MCH.

Local residents were 37% of the permittees who actually hunted and reported killing 28 caribou (Table 7), for a success rate of 69%. Nonlocal residents comprised 63% of the

hunters and killed 20 caribou (Table 7), for a success rate of 45%. There were no nonresident hunters.

During the 1990 hunting season, Alaska residents received all of the registration permits because nonresidents were ineligible to hunt the MCH because of a changed interpretation of the state subsistence law. Local residents were issued 56% of the permits and nonlocal residents received 44% of the permits. However, there was no residency-based preference and the random drawing probably reflects application ratios between local and nonlocal Alaska residents. If so, interest has shifted away from the MCH as a statewide caribou harvest opportunity. Macomb permit hunters had an overall success rate of 23% in 1990 (Table 7), which is significantly lower than the previous 3 years. Local residents killed 28 caribou (Table 7) for a success rate of 26%. Nonlocal residents killed 14 caribou (Table 7) for a success rate of 18%. Both resident and nonresident success rates were lower than in 1989. Many people obtained Macomb permits but were probably not as serious about hunting as those who previously obtained permits through lottery.

Hunter Effort. During the 1989 hunting season, successful hunters hunted a mean of 3.1 days and unsuccessful hunters hunted a mean of 3.5 days (Table 8). Few hunters plan to spend more than 3 days hunting whether they are successful or not.

Hunter effort has been relatively high during the last 3 years. Hunter effort is primarily influenced by herd distribution during the hunting season because there are relatively few good access points onto the Macomb Plateau and most hunters do not walk very far from those points. Therefore, hunter effort increases when caribou are not readily accessible from one of the Macomb Plateau access points.

The 1990 hunting season was similar in hunting effort to 1989. Successful permittees hunted a mean of 3.0 days. Unsuccessful permittees hunted a mean of 3.7 days (Table 8).

Permit Hunts. In 1989, interest in permit hunt number 530 was the highest since 1979, with 534 people applying for permits. This resulted in 3.6 applications per permit (Table 9).

During the 1990 hunting season, hunt number 530 was initially scheduled as a drawing permit hunt and 702 people applied for permits. This significant increase in applications resulted in 4.7 applications per permit (Table 9). However, before the season opening, the permit drawing hunt was canceled because of changes in the subsistence law and the hunt was changed to a registration permit hunt for Alaska residents only. Registration permits were issued to 351 people (Table 9).

Harvest Chronology. In the 1989 and 1990 hunting seasons, there were no significant changes in patterns of harvest chronology. Caribou were killed in the entire hunting

season (Table 10). However, in the 1990 season, harvest peaked during week 4. Changes in harvest chronology usually reflect a changing distribution of caribou.

Transport Methods. During the 1989 hunting season, transportation methods used by successful hunters were similar to previous years. Horses replaced highway vehicles as the most commonly used mode of transportation by successful hunters (Table 11).

In 1990 the permit report included "walking" as a new mode of transportation that could be selected for hunting the MCH. Therefore, 1990 data are not directly comparable with previous years (Table 11). Those who walked to the hunt area are generally people who reside in the Dry Creek community at the base of the Macomb Plateau.

Caribou Harvest Locations. During the 1989 hunting season, location of harvest was similar to previous years with 95% of the harvest occurring east of the Johnson River in the MPCUA. There was a significant change in harvest locations in 1990. Fifty—five percent of the 1990 harvest occurred west of the Johnson River and outside the MPCUA, compared with only 5% in 1989.

The shift in 1990 harvest occurred for the following 2 reasons: (1) MCH distribution shifted to the west and numerous animals were located outside the MPCUA, and (2) the registration permit hunt allowed anyone, particularly local residents and residents of Ft. Greely Military Reservation, the opportunity to hunt with motorized vehicles outside the MPCUA. Most of the harvest occurred in the Jarvis Creek drainage, which is an area readily accessible to hunters using three- or four—wheelers and other off-road vehicles.

Natural Mortality: Radio-collaring of Macomb caribou in April 1990 will allow a calculation of natural mortality rates for the MCH which will be reported in the next management report. In May and June 1990, carcasses of train-killed moose were distributed around the calving area in an attempt to prevent predators from killing caribou calves. The June 1990 calf:100 cow ratio was no different than in previous years, indicating either that the attempt was unsuccessful or that most calves died from other causes.

Habitat

Assessment and Enhancement: There has been no formal evaluation of the quality of the MCH range. Casual observations indicate that the Macomb Plateau portion has been heavily grazed and few lichens are present. More lichen exists in low-lying forested areas surrounding the plateau and in the southern Granite Mountains to the west. Both areas receive more use by caribou.

In late May 1990, none of 4 radio-collared 2-year-old female caribou gave birth, indicating that they were not as robust as some 2-year-old females from other Interior herds (i.e., Denali, White Mountains). In May 1991, there will be 8 2—year—olds that can

be observed. Further evidence that the MCH is not on a particularly high nutritional plane is the relatively late peak calving dates: 22 May 1986; 24 May 1989; 21 May 1990.

CONCLUSIONS AND RECOMMENDATIONS

The MCH appears stable and is no longer growing at the previous herd objective of 5% per year. Severe weather or a combination of predation and severe weather are probably responsible for the significant decline in calf survival to fall 1990. Cow harvest should be avoided until calf survival improves.

Increased interest in hunting the MCH continues as indicated by increased drawing permit applications in 1989 and 1990. Some people have suggested removing permit hunt restrictions for the MCH, but I feel it is necessary to retain a permit hunt for the MCH because of its small size, its increasing popularity with hunters, and its accessibility from the road system.

The MCH uses a relatively small range (3,500 km^2), the condition of which appears to be relatively lichen-poor. Whether the herd will expand its range and continue growing, be limited by other factors (i.e., weather or predation), or regulated by density–dependent food stress is unknown.

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Table 1. Macomb caribou fall composition counts and estimated population size, 1985-90.

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]
10/30/85	45	31	17	57	43	38	20	26	518	--
10/16/88	49	32	18	56	41	31	28	26	671	772[b]
10/26/89	33	34	20	60	54	31	15	20	617	617[c]
10/09/90	44	17	9	51	34	34	32	22	734	734

[a] Best total estimate of herd size in fall was 800 in 1988, 1989, and 1990.
[b] Radio-census and search of Macomb Plateau and Granite Mountains. There was complete snow cover.
[c] An additional 80-100 caribou were not included in this count, as indicated from fresh tracks of small banks in low forested areas.

Table 2. Macomb caribou spring composition counts, 1986-90.

Date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent bulls	Composition sample size
6/18/86	1	32	24	76	0	468
6/11/87	1	48	32	66	1	158
6/11/89	25	37	23	62	15	507
6/14/90	30	32	20	62	18	600

Table 3. Number radio-collared adult Macomb caribou cows located in different areas of southern Subunit 20D from 13 May to 14 June 1990.

Date[a]	West of Johnson River	Johnson River to Robertson River
13 May	7	22
19 May	7	20
22 May[b]	4	13
29 May	4	11
3-4 June	4	11
8 June	4	16
14 June	6	23

[a] Only cows thought to have been pregnant were located on 22 May-8 June 1990.
[b] Peak of calving.

Table 4. Seasons and bag limits for the Macomb Caribou Herd, 1972-90.

Year	Season	Bag limit	Comments
1972	10 Aug-31 Mar	3 caribou	
1973	10 Aug-31 Mar	1 caribou	Season closed 30 Sep by emergency order
1974	10 Aug-20 Sep	1 caribou	Macomb Plateau Management Area established
1975	10 Aug-20 Sep	1 caribou	
1976	10 Aug-20 Sep	1 caribou	
1977	1-15 Sep	1 caribou	Season closed 8 Sep by emergency order
1978	10 Aug-30 Sep	1 bull	70 drawing permits
1979	10 Aug-30 Sep	1 bull	70 drawing permits
1980	10 Aug-30 Sep	1 bull	70 drawing permits
1981	10 Aug-30 Sep	1 bull	70 drawing permits
1982	10 Aug-30 Sep	1 bull	140 drawing permits
1983	10 Aug-30 Sep	1 bull	140 drawing permits
1984	10 Aug-30 Sep	1 bull	140 drawing permits
1985	21-30 Sep	1 bull	140 Tier II drawing permits
1986	10 Aug-30 Sep	1 bull	Subsistence registration permit and 100 drawing permits
1987	10 Aug-30 Sep	1 bull	Open subsistence season and 150 drawing permits for nonsubsistence hunters
1988	10 Aug-30 Sep	1 bull	Open subsistence season and 150 drawing permits for nonsubsistence hunters
1989	10 Aug-30 Sep	1 bull	Open subsistence season and 150 drawing permits for nonsubsistence hunters
1990	10 Aug-30 Sep	1 bull	Registration permit, 50 harvest quota

Table 5. Macomb caribou harvest data by permit hunt, 1985-90.

Hunt No.	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Harvest			Total harvest
						Bulls	Cows	Unk	
530	1985-86	140	61	22	78	12	0	0	12
	1986-87	100	62	26	74	10	0	0	10
	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	55	45	44	0	0	44[b]
	1990-91	351	42	21	79	42	0	0	42
570	1986-87	15	53	14	86	1	0	0	1
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

[a] 33 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.

[b] Non-permit subsistence harvest = 2 (not included in 1988 and 1989).

Table 6. Macomb caribou harvest[a] and accidental death, 1985-90.

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
1986-87	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

[a] Includes permit hunt harvest.

Table 7. Macomb caribou hunter residency and success of permit hunters, 1986-90.

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

[a] Resident of Subunit 20D.

[b] Not all hunters reported their residency so totals are lower than totals in Table 6.

Table 8. Mean days hunted for successful and unsuccessful Macomb caribou permit hunters, 1982-90.

Year	Mean days hunted		
	Successful hunters	Unsuccessful hunters	Total hunters
1982	3.0	4.6	3.8
1983	2.1	2.9	2.8
1984	3.7	3.5	3.5
1985	2.4	2.8	2.7
1986	1.9	2.8	2.5
1987	3.1	4.3	3.7
1988	3.8	3.4	3.6
1989	3.1	3.5	3.4
1990	3.0	3.7	3.6

Table 9. Number of applications, number of drawing permits issued, and number of applications per permit for Macomb permit hunt, 1979-90.

Year	No. applications	No. permits issued	Applications/ permit
1979	218	70	3.1
1980	170	70	2.4
1981	192	70	2.7
1982	254	140	1.8
1983	341	140	2.4
1984	359	140	2.6
1985	135	140	1.0
1986	184	100	1.8
1987	199	150	1.3
1988	511	150	3.4
1989	534	150	3.6
1990	702[a]	351[b]	4.7[c]

[a] 702 applications were received for an initial drawing permit hunt. The drawing was canceled and changed to registration permit hunt.

[b] Number of registration permits issued after the drawing hunt was canceled.

[c] Applications/permit for the original 150 drawing permits.

Table 10. Macomb caribou harvest by time period, 1987-90.

Regulatory year	Harvest periods								Unk	n
	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		
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

Table 11. Macomb caribou harvest by transport method, 1986-90.

Regulatory year	Percent of harvest									n
	Airplane	Horse	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Walking[b]	Unknown	
1986-87	5	5	0	1	0	0	13	--	0	24
1987-88	4	25	0	4	0	2	33	--	0	68
1988-89	10	16	0	4	0	3	32	--	0	65
1989-90	2	20	0	0	2	17	3	--	0	44
1990-91	1	2	0	10	0	6	7	16	0	42

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

LOCATION

Game Management Units: Portions of 13E and 20C (4,000 mi^2)

Herd: Denali

Geographical Description: Central Alaska Range, primarily in Denali National Park and Preserve

BACKGROUND

The Denali Caribou Herd (DCH) contained 20,000-30,000 caribou in 1941 (Murie 1944). The population declined to approximately 8,000 caribou in the late 1940s (Murie 1961), stabilized, and then declined again to 1,500 caribou between 1968 and 1972 (Haber 1977). Biologists did not agree on causes for the declines, but explanations included heavy snowfall, emigration, low reproduction, and overgrazed range. After the second decline, the herd reportedly stabilized at 1,200-1,500 caribou between 1972 and 1980 (Troyer 1980). Since the late 1970s the herd has grown to its present size of approximately 2,800 caribou (Adams et al. 1989).

There has been little harvest of Denali caribou since at least the mid—1960s. Mean annual reported harvest from 1967 through 1975 was 50 caribou (Buskirk 1976). The hunting season closed in 1977 and has remained closed ever since.

Since the hunting closure, the primary human use of the DCH has been for viewing, photography, and research. The herd is accessible to visitors of Denali National Park and Preserve (DNPP), and it provides people with a greater opportunity to see large bulls than is possible in many hunted caribou herds. However, as the DCH has grown in recent years, local residents have expressed an interest in reopening a limited hunt for Denali caribou.

MANAGEMENT DIRECTION

Management Goals and Objectives

1. Manage the Denali Caribou Herd to provide a largely unhunted population of caribou and their predators for study and observation.

2. Conduct cooperative research programs with the National Park Service (NPS) comparing population dynamics of the Denali and Delta Caribou Herds.

3. Manage the Denali herd to provide for small annual harvests.

4. Allow a harvest of 1% or less of the herd once the population exceeds 4,000.

METHODS

The DCH was censused in 1987 and 1990, using aerial photocensus techniques described by Davis et al. (1979) and Davis and Valkenburg (1985). Fall composition counts were not conducted in 1989, but were conducted in 1990. Late winter counts were conducted from 1984 to 1989, but were discontinued after 1989. In both types of surveys, radio-collared caribou were used as an aid in finding the herd and caribou were classified from a helicopter.

To study neonatal mortality, NPS biologists have radio-collared caribou neonates annually since 1984 (Adams et al. 1989). Grizzly bears and wolves were also monitored in conjunction with the neonate mortality study and as part of a separate study of Denali wolves (Mech et al. 1989). In 1986, NPS biologists began radio-collaring adult female caribou to investigate reproductive and mortality rates and to improve composition counts and population estimates (Adams 1986).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: During a photocensus of the Denali herd on 23 July 1987, a direct count of 2,318 caribou provided a minimum population estimate. Extrapolations (based on fall herd composition) to account for caribou absent from the postcalving aggregations resulted in an estimate of 2,700 caribou (Shults 1988).

A photocensus was not conducted in 1988 or 1989, and results of the 1990 census were not available as of this writing (April 1991).

Population Composition: Between 1984 and 1989, calf:cow ratios ranged from 28:100 to 38:100 (Table 1). However, in 1990 calf:cow ratios dropped to 17:100. Poor calf recruitment (to fall) was characteristic of caribou herds across the central and eastern Alaska Range in 1990 and probably reflects the severity of the 1989-90 winter.

The bull:cow ratio was 50:100 in September 1990; well above ratios found in the adjacent, heavily hunted Delta-Yanert herd (Table 2). The absence of hunting in the DCH was also reflected in the proportion of large bulls in the bull population. From 1987 to 1990 large bulls made up an average of 35% of the bulls in the DCH. In the Delta-Yanert herd, large bulls represented an average of 15% of the bulls during the same period.

Late winter calf:cow ratios between 1984 and 1989 (Table 3) compared favorably with calf:cow ratios from the previous fall counts, indicating good overwinter survival of calves those years. A late winter DCH survey was not flown in 1990, but in the Delta herd, calf:cow ratios dropped from 36:100 to 17:100 between October 1989 and April 1990, suggesting a 50% overwinter loss of calves. Similar overwinter mortality may have occurred in the DCH.

Distribution and Movements: The DCH range is centered within DNPP and was described by Boertje (1981). Herd movements and distribution have changed in recent years. Summer range is now farther east, the eastern wintering area is used infrequently, and the Cantwell calving area is less preferred. Calving has occurred primarily north of the Alaska Range since 1981, although in 1988 a few hundred caribou calved in the Cantwell area (J. Van Horn, pers. commun.)

Some interchange takes place between the DCH and the Tonzona herd immediately to the west. Valkenburg (1987) reported that in 1985 a radio-collared calf left the DCH and wintered with a separate group of caribou in the Tonzona drainage, remaining there through the calving season. The Tonzona herd currently numbers at least 400 caribou. Interchange between the DCH and the Delta herd has not been documented.

Mortality

Harvest:

Season and Bag Limit. The hunting season for Denali herd caribou in Subunit 20C has been closed since 1977.

Board of Game Actions and Emergency Orders. A proposal by the Middle Nenana Advisory Committee to open Subunit 20C to the hunting of bull caribou was considered by the Board of Game at their March 1990 meeting. The proposal would have allowed 30 permits to be issued for bulls-only hunting between 1 and 15 September. ADF&G recommended against passing the proposal because ADF&G's objective specifies a limited harvest only after the herd has reached 4,000 caribou. Before the Board of Game took specific action, the Middle Nenana Advisory Committee withdrew the proposal.

Other Mortality: Predation appears to be the primary factor limiting growth of the DCH. Mortality of neonatal caribou has been studied by NPS biologists since 1984 (Adams et al. 1989). During the first 4 years of the study, 40% of 225 calves radio-collared as neonates died before reaching 15 days of age. An additional 15-20% died by 1 October. After 1 October, mortality rates among the radio-collared calf sample were similar to those experienced by adults.

Composition surveys suggested the pattern of moderate summer calf mortality and low overwinter calf mortality continued through 1989. Between May and September, calf:cow

ratios declined from 43:100 to 37:100 in 1987, from 43:100 to 33:100 in 1988, and from 40:100 to 33:100 in 1989. However, in 1990 approximately 50% of the Denali calf crop was apparently lost during summer. Calf:cow ratios dropped from 37:100 on 1 June to 17:100 by 27 September. Causes of death among radio-collared calves in 1990 are still being analyzed by NPS biologists and will be presented in the next report.

From 1984 to 1987, grizzly bears accounted for 49% of the neonatal (first 15 days) deaths and wolves for 26%. Overall, predators (including golden eagles, wolverines, and undetermined predators) accounted for 98% of the mortality among radio-collared caribou calves during their first 2 weeks of life.

Dean (1987) estimated 32 grizzly bears/1,000 km^2 within DNPP, which is among the highest density estimates for interior Alaska. Wolf densities have increased substantially since 1986 and were estimated at 10 wolves/1,000 km^2 within DNPP in 1989 (Mech et al. 1989). Wolf predation is a significant mortality source among adult Denali caribou. According to Bergerud and Elliot (1986), caribou populations exposed to comparable predator densities probably would not maintain growth or stable numbers over time.

Habitat

Habitat use by the DCH was summarized by Boertje (1984, 1985), who concluded that nutrition was not limiting its growth. Mineral exploration has occurred at the Dunkle Mine and in the Kantishna Hills, which are in, or adjacent to, the DCH calving grounds. If development seems probable, the possibility of impact-related disturbance will have to be considered.

CONCLUSIONS AND RECOMMENDATIONS

The DCH grew at an annual average rate of 9.4% between 1977 and 1987. If that growth rate had continued to the present, there should have been about 3,500 caribou in 1990.

Management objectives are being met. The herd has provided extensive viewing and photographic opportunities for visitors to DNPP and has provided valuable comparisons with the adjacent, intensively managed Delta herd. The DCH is currently unhunted, but if herd size increases beyond 4,000 caribou we will recommend a harvest of about 1% of the herd to accommodate some hunting.

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Table 1. Denali caribou fall composition counts and estimated July population size, 1985-90.

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	Estimate of herd size
9/25-26/85	56	28	15	54	--	--	--	31	1,205	--
9/27/86	56	38	20	52	--	--	--	29	1,062	--
9/25/87	56	37	19	52	28	39	33	29	1,221	2,800[a]
9/27-28/88	67	33	16	50	27	34	39	33	1,350	--
9/26-27/90	50	17	10	60	39	28	33	30	1,294	--

[a] Extrapolated estimate, actual count was 2,318 caribou.

Table 2. Comparison of composition counts on Denali and Delta Caribou Herds, 1984-90.

	April Calves:100 cows		Fall Calves:100 cows		Fall Bulls:100 cows	
Year	Denali	Delta	Denali	Delta	Denali	Delta
1984	46	49	36	36	47	42
1985	34	51	28	36	56	49
1986	25	44	38	29	56	41
1987	46	--	37	31	56	32
1988	32	29	33	35	67	33
1989	42	21	--	36	--	27
1990	--	17	17	17	50	38

Table 3. Denali caribou late winter composition counts, 1984-89.

Survey date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent bulls	Composition sample size
4/25-26/84	21	46	28	60	12	614
4/22-23/85	58	34	18	52	30	1,520
4/19/86	16	25	18	71	11	506
4/14/87	10	46	30	64	6	595
4/18/88	27	32	20	63	17	476
3/25-26/89	26	42	25	60	15	1,416
No data in 1990						

LOCATION

Game Management Unit: 15A (1,314 mi^2)

Herd: Kenai Lowlands

Geographical Description: Kenai Peninsula Lowlands

BACKGROUND

The Kenai Lowland Caribou Herd (KLCH) was established through transplants of 15 and 29 animals from the Nelchina herd in 1965 and 1966, respectively. Since the late 1960s caribou have been observed in both Subunit 15A (KLCH) and Unit 7 (Kenai Mountains herd). The KLCH (117-130 caribou) summers in the area north of the Kenai Airport to the Swanson River and winters on the Moose River Flats near Bear Lake. Although range for the KLCH is not suspected as a limiting factor at the current population size, growth since the mid-1970s has been slow. Predation, including free-ranging domestic dogs and wild predators, is believed to control growth. Although hunting was allowed in 1981, 1988, 1989 and 1990 it has not significantly influenced this small caribou herd.

MANAGEMENT DIRECTION

Management Objectives

Increase the herd to a minimum of 150 animals by 1990.

METHODS

An aerial survey was flown to determine the number, composition and distribution of caribou in the KLCH. The survey was completed in a PA-18 aircraft, flown at reduced speeds and varying altitudes. Caribou were classified as adults, large bulls, or calves.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Population growth of the KLCH since the mid-1970s was slow, and since 1987, growth appears to be static (Table 1). The KLCH was estimated between 117

and 130 caribou. Over the past decade, the herd has grown more slowly than other caribou herds transplanted on the Kenai Peninsula. Low annual recruitment was the primary reason for this slow herd growth.

Population Composition: One-hundred-seventeen caribou, including 20 (17%) calves, were located on 13 June 1990 (Table 1). A 12% minimum of observed adults (97) were large antlered bulls. Observed calf production and survival in 1990 increased almost two-fold over the 1989 spring survey data.

Distribution and Movements: The KLCH has traditionally calved in the Beaver Creek drainage, immediately northeast of the Kenai airport. The post-calving summer\fall range also includes the wetlands at the mouth of the Kenai River and recently the wetlands between the Kenai and Kasilof Rivers, which are in Subunit 15B.

Fall migration begins in early October when the herd moves northeast towards the wetlands along the upper Moose River. Breeding occurs in this area, generally near Bear Lake. In winter, caribou distribution expands to include most of the southeastern portion of Subunit 15A.

Mortality

Harvest:

Season and Bag Limits. The open season for resident and nonresident hunters in that portion of Subunit 15A within the Kenai National Wildlife Refuge was 1 to 20 September. The bag limit was 1 bull by drawing permit only; three permits were issued.

Board of Game Action and Emergency Orders. The Board of Game reestablished the hunting season in 1988 to allow for a limited harvest. No Board actions or emergency orders affected the hunt this report period.

Hunter Harvest. The KLCH contained trophy-size bulls and offered hunters a high probability of success. Interest in obtaining a permit (Hunt No. 506) was high and 795 applications were received in 1990. Three permits were issued resulting in the harvest of two bulls in the 1990 season (Table 2). The third permit holder reported hunting unsuccessfully. Permit holders were all unit residents and highway vehicles were their primary method of transportation.

Other Mortality: Predation from free-ranging domestic dogs and wild carnivores on caribou of all age classes may be limiting herd growth.

Habitat

Assessment: The KLCH occupies a large summer and winter range relative to the herd size, and habitat is apparently not limiting population growth at this time. Additionally, observations of the herd by staff biologists suggest the animals are healthy, and their calves appear to grow faster than calves observed in the Kenai Mountain herd.

CONCLUSIONS AND RECOMMENDATIONS

The small size, slow growth and close proximity to the communities of Kenai-Soldotna presently distinguishes this caribou population from others in Alaska.

The management objective of increasing the KLCH to a minimum of 150 caribou by 1990 was not accomplished. Low recruitment has been the primary management concern for this herd for the past decade. Predation is suspected; however, until key mortality causes are conclusively identified, appropriate management actions cannot be initiated. A study involving radio-collared neonate calf caribou is recommended to determine specific causes of calf mortality. A complete review of population status and management objectives will also be undertaken in FY92. The current management objective should be changed to reflect a more accurate assessment of this herd's potential growth. I recommend a herd size of 150 caribou by 1995 as a revised management objective.

Since one of the purposes of reestablishing caribou on the Kenai Peninsula was for hunting, the Department should support a limited harvest of bulls only during years that adequate numbers of caribou are observed. If this population indicates a declining trend, hunting will be curtailed. KLCH caribou, especially some of the large bulls, are often visible from the road system near Kenai. These caribou provide significant wildlife viewing opportunities to both visitors and local residents.

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Table 1. Kenai Lowlands caribou summer composition counts and estimated population size, 1985-1989.

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	--	--	--	--	--	--	--	--	--	--
1986/87	--	--	27%	--	--	--	--	--	--	98
1987/88	--	--	11%	--	--	--	--	--	--	115
1988/89	--	--	9%	--	--	--	--	--	--	117
1989/90	--	--	17%	--	--	--	12%	--	117	117

Table 2. Kenai Lowlands caribou harvest data by permit hunt, 1985-89.

Hunt No./ Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
506/	1985/86	--	--	--	--	--	--	--	--
GMU 15A	1986/87	--	--	--	--	--	--	--	--
	1987/88	--	--	--	--	--	--	--	--
	1988/89	3	--	100	0	66	33	--	3
	1989/90	3	0	66	33	100	--	--	2

LOCATION

Game Management Unit: 15B and 15C (3,563 mi^2)

Herd: Fox River and Killey River

Geographical Description: Central and Southern Kenai Peninsula

BACKGROUND

Historically, caribou were found on the Kenai Peninsula (Porter 1893; Seton-Karr 1887; and Schiefner 1874 cited in Lutz 1960; Palmer 1938) and although reports indicate their distribution was widespread, estimates of population size were not given. This species was probably never numerous because suitable habitat is limited on the peninsula. Caribou antlers, dated from the early 1900s have been found in only two areas on the Kenai Peninsula in the past two decades, the Caribou Hills; and the Skilak-Tustemena Benchlands. Caribou were extirpated from the Kenai by 1912 (Palmer 1938).

The FWS first considered reintroducing caribou to the area in 1951. However, a reintroduction was not attempted until 1965 and 1966 when ADF&G released 15 and 29 caribou, respectively, on the Kenai National Wildlife Refuge. These two reintroductions resulted in the establishment of the Kenai Mountains herd and the Kenai Lowlands herd, approximately 300 and 130 animals, respectively. After these reintroductions two principal historic ranges, Caribou Hills and Skilak-Tustemena Benchlands, remained unoccupied.

In 1985 and 1986 caribou were reintroduced to these ranges in a cooperative effort by ADF&G and FWS. Caribou from the Nelchina herd, in Unit 13, were selected as the donor population for two reasons: 1) caribou previously reestablished on the Kenai Peninsula originated from this herd; and 2) a segment of the herd wintered near the Glenn Highway near Lake Louise which reduced capture and transportation costs.

MANAGEMENT DIRECTION

Management Goals

The primary goal is to reestablish a viable caribou population throughout suitable and/or historic, but unoccupied, caribou habitat in Subunits 15B and 15C (Spraker, in press.). Another goal is to provide additional opportunities to hunt caribou on the Kenai Peninsula.

Management Objectives

Maintain a bull to cow ratio of 35:100.

METHODS

Aerial surveys were flown to determine the number, distribution, and composition of the caribou herd. A fixed-wing PA-18 aircraft was used to locate Killey and Fox River caribou herds and immediately following this survey, a Bell 206B Jet Ranger was used to conduct a sex and age composition survey on the Killey River herd. Caribou were classified as calves, cows or bulls and ratios were calculated. The Fox River herd was not surveyed with the helicopter because of the cost.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Relocation of caribou from the Nelchina Basin in 1985 and 1986 provided the nucleus for two herds, the Killey River herd in Subunit 15(B) and Fox River herd in Subunit 15(C). A census conducted on 2 November 1990 revealed 154 Caribou in the Killey River herd and 37 in the Fox River herd.

Of the 80 caribou released in 1985 and 1986, approximately 25% of the animals died shortly after release due to predation and unknown mortality, or dispersed into other areas. The scattered animals either joined existing herds or traveled to the west where they are occasionally observed along the coast of Cook Inlet, in Subunit 15(C). Realistically, these two new herds started from about 60-70 caribou, counting calves born in spring of 1985. Assuming 65 caribou were present, prior to calving in 1986, suggests a 1.25 recruitment rate or about a 25% average growth per year for both herds combined.

Population Composition: The sex and age composition survey conducted on 2 November 1990, on the Killey River herd included 154 animals (Table 1). The herd was comprised of 36 calves, 53 bulls and 65 cows. Ratios were: 55 calves:100 cows, 82 bulls:100 cows and calves represented 23% of the total animals observed and classified.

A fixed-wing aerial survey revealed that calves comprised 27% of the 37 animals counted in Fox River caribou herd.

Distribution and Movements: The Killey River herd uses an area of about 40 mi^2 between upper Killey River and the headwaters of Funny River. Summer range also includes the headwaters of Moose Creek, which flows south into Tustemena Lake. Only one major movement outside this area has been observed. In mid-June 1990, FWS

biologists observed 18 caribou from the Killey River herd in the headwaters of the west fork of Benjamin Creek. This group was comprised of 14 adults and 4 calves.

The Fox River herd is in approximately 20 mi^2 between Fox River and Truuli Creek in Subunit 15(C), throughout the year.

Mortality

Harvest: Hunting has not been approved by the Board of Game at this time.

Other Mortality: Seven caribou died from known causes and at least 2 died shortly after initial release from unknown causes (Table 2). The 7 known causes of mortality include: 1 from motor vehicle collision, 2 preyed upon by wolves, and 4 harvested during open hunting season in Unit 7.

Habitat

Assessment: These newly established herds appear small in relation to available habitat and nutritional limitation is not a concern at this time.

CONCLUSIONS AND RECOMMENDATIONS

It appears the joint effort of ADF&G and FWS to reestablish caribou into Subunits 15B and 15C have been successful. The 80 caribou relocated in 1985 and 1986, despite initial losses, have increased at an average annual rate of 25%, and expanded to 191 animals in two herds. The Killey River herd found between the upper portions of Killey River and Funny River includes 154 caribou while the Fox River herd located between Fox River and Truuli Creek contains 37 animals. The high percentages of calves in these herds suggest adequate habitat exists at current population levels. The bull to cow ratio in Killey River herd currently exceeds the minimum management objective of 40:100.

Since the Killey River herd now satisfies management objectives, I recommend proposing an open hunting season regulated by a permit drawing system. Initially, only bulls should be harvested to allow for near maximum herd growth. Herd growth should be gradually reduced through regulated hunting by adjusting permit numbers and by limits commensurate with objectives for habitat protection.

Two reports detailing the relocation of caribou on the Kenai Peninsula are in preparation. The initial report details all aspects of capture and release, and will be published as a Department report. The second manuscript outlining 5 years of distribution and movement data is being edited prior to submission to the *Journal of Wildlife Management*.

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Table 1. Transplanted caribou fall composition counts and estimated population size, 1985-1989.

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	--	--	--	--	--	--	--	--	--	65[a]
1986/87	--	--	--	--	--	--	--	--	--	81[b]
1987/88	--	--	--	--	--	--	--	--	--	102[b]
1988/89	--	--	--	--	--	--	--	--	--	127[b]
1989/90	82	55	23%	42%	--	--	--	34%	154	191[c]

[a] Estimated herd size prior to calving in 1986.
[b] Estimated herd size based on 25% average growth per year.
[c] This survey was completed in November 1990, after the report period, 30 June 1990.

Table 2. Transplanted caribou harvest and accidental death, 1985-89.

Regulatory year	Hunter harvest							Accidental death	Grand total
	Reported				Estimated				
	M (%)	F(%)	Unk.	Total	Unreported	Illegal	Total		
1985/86	--	2	--	2[a]	--	--	--	3	5
1986/87	--	2	--	2[a]	--	--	--	2	4
1987/88	--	--	--	--	--	--	--	--	--
1988/89	--	--	--	--	--	--	--	--	--
1989/90	--	--	--	--	--	--	--	--	

[a] Harvested during open season in Unit 7.

LOCATION

Game Management Unit: 18 (41,000 mi^2)

Herd: Andreafsky, Kilbuck

Geographical Description: Yukon-Kuskokwim Delta

BACKGROUND

Historically, caribou ranged over much of the Yukon-Kuskokwim (Y-K) Delta, including Nunivak Island, and populations probably peaked during the 1860s (Skoog 1968). However, by the early 1900s, few caribou were found in the lowlands of the Y-K Delta. Today only 2 small herds occur in Unit 18, the Kilbuck and Andreafsky Mountains herds.

The Andreafsky herd is found primarily in the remote northern Andreafsky Mountains near the border of GMU 18 and 22A. No survey and inventory activities were conducted for the Andreafsky caribou herd this report period.

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 estimate for the Kilbuck herd is 1,400-1,500 animals, based on aerial surveys conducted in fall 1989. The caribou hunting season in the Kilbuck Mountains was closed in June 1985 because of excessive harvests. Since the closure, ADF&G and the USFWS have conducted a cooperative study of the KCH. This study which included using repetitive aerial surveys and radio-collared animals resulted in a better understanding of the KCH population status.

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

The caribou population in the Kilbuck Mountains has been surveyed regularly by ADF&G staff since 1984. A cooperative study began in 1986 with the USFWS and has continued to the present. Repeated aerial surveys and radio-collared animals were used to help locate caribou groups. The study also sought to determine if the Kilbuck herd is a distinct herd requiring separate management from the Mulchatna herd.

Thirteen radio-tracking flights using fixed-wing aircraft were conducted monthly by the USFWS and ADF&G to monitor 12 active radio collars. Caribou locations were determined using LORAN C and subsequently mapped. Detailed methodology for the radiotelemetry study is available in Hinkes (1989). Of the 13 flights, 3 were flown in late October and early November to conduct an aerial census and composition count of the Kilbuck caribou population. Also, 3 flights took place in May using 1 fixed-wing aircraft to survey the calving grounds.

RESULTS AND DISCUSSION

Population Status and Trend

Since the hunting closure in June of 1985, the KCH appears to be increasing. Increased caribou sightings between 1986 and early 1990 as well as caribou census results indicate the herd population is expanding. This increase can be attributed to a succession of mild winters from 1985 through 1988, low predation rates, and elimination of legal harvests from 1985 to 1990.

Repeated aerial surveys and radio-tracking flights also revealed that the KCH is a distinct, resident population requiring separate management from the Mulchatna herd. Evidence supporting this conclusion included the presence of discreet calving areas and the observed fidelity of radio-collared animals to the study area. Recent evidence indicates that some overlap of Mulchatna and Kilbuck caribou range occurs at certain times of year. However, they do not mix during calving and are rarely in close proximity at other times of the year.

Population Size: An aerial census was completed on 30 October and 1 November 1989 and determined the KCH population at a minimum of 1,384 caribou.

Population Composition: Sex and age composition information were also collected during the 30 October and 1 November 1989 aerial census. Of 922 caribou classified, 327 were males, 489 were females, and 106 were calves. Composition for small groups was determined visually from fixed-wing aircraft during low level flight. Black and white photography was used for the larger groups and classification was completed later. Composition counts conducted on the smaller groups were generally considered adequate. However, some younger bulls and cows may have been misclassified as they are more difficult to identify. Data from surveys conducted during the last 2 years suggest bull:cow ratios remain high, as is indicative of a non-hunted population (Table 1).

Distribution and Movements: The cooperative survey-inventory effort between ADF&G and the USFWS to assess distribution continued this report period. As of July 1989, 12 active radio collars were deployed on KCH caribou, including those deployed in 1987 and 1988.

Radiotelemetry data indicate that Kilbuck caribou calved on high ridges in the western portion of the Kuskokwim Mountains, summered in alpine meadows, and wintered in valleys, wind-blown slopes and ridge tops. Their range includes the eastern portion of GMU 18, encompassing the edge of the lowlands of the Y-K Delta, and the montane western border of GMU 19B and 17B.

All radio-collared caribou remained in the western and central Kuskokwim Mountains and southern Kilbuck Mountains. Portions of the herd expanded their winter range to the south and west near Three Step Mountain, the Eek River, and the Great Ridge. A single radio-collared male from the KCH also moved north and east near Aniak Lake in October 1989.

Sufficient evidence suggests that range overlap between Mulchatna and Kilbuck caribou occurs occasionally near the southern Kuskokwim and Kilbuck Mountains. Much of this overlap occurs in mountain passes between GMU 19B, 17B, and 18.

Mortality

Season and Bag Limit:

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

Harvest:

Human-Induced Mortality The KCH did not sustain a legal hunter harvest from 1985 to 1990. Some illegal harvest was documented in 1986, and some undocumented illegal harvests were reported in 1987-88. A major poaching incident was discovered by USFWS biologists in March 1989, and up to 30 Kilbuck caribou may have been illegally taken. On 5 April 1990, a Federal District Court ordered ADF&G to allow the harvest of 50 antlerless male caribou by Kwethluk residents only. The hunt was monitored by ADF&G and 39 caribou were harvested during a 10-day season (5 April - 15 April 1990).

We have no harvest information 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 very few or no caribou were taken in the 1989-90 season. Many hunters believed that the caribou traveled into GMU 22A with the Western Arctic Caribou Herd (WACH) or moved further west and mixed with the growing reindeer herds near Stebbins.

Natural Mortality: Little information is available concerning natural mortality. A female caribou was killed by a pack of 7 wolves in the southern Kilbuck Mountains in February 1988 and another was killed during November 1988. A pack of 7 animals and another pack of 5 animals ranged over the study area the last 4 years, and caribou were probably important prey species.

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 calving surveys conducted in May 1988, and 9 were observed in 1989 (Hinkes 1989). Bear kill sites were also observed during the 1989 survey and caribou calves may be important prey for grizzly bears during calving. No bears were observed on the 1990 calving ground survey. However, turbulent weather conditions during the 1990 survey made visibility more difficult.

Habitat Assessment and Enhancement

As previously reported, the lichen range in the Kilbuck and southern Kuskokwim mountains appears in excellent condition. 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 believe that both areas could support much higher numbers of caribou. The KCH range currently has an estimated density of only 0.2 caribou/km^2.

Board of Game Actions and Emergency Orders

The Board of Game closed the caribou hunting season in Unit 18 south of the Yukon River in June 1985 because it was believed that harvests exceeded sustained yield limits. 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. The village of Kwethluk petitioned the Board of Game on 2 April 1990 to reopen the Kilbuck caribou herd to hunting, but the Board did not approve the request. On 4 April 1990, Kwethluk took the petition to Federal Court, and on 5 April 1990 the Court ordered ADF&G to allow residents of Kwethluk to harvest 50 antlerless male caribou.

CONCLUSIONS AND RECOMMENDATIONS

The KCH has been studied on a cooperative basis by the USFWS and ADF&G since 1986. The KCH, currently estimated at 1,400-1,500 animals, comprises a distinct herd resident in the Kilbuck and southern Kuskokwim Mountains. These caribou have calved for at least 5 consecutive years on high ridges in the vicinity of 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 apparent decline of the KCH in the early 1980s was partially because of inadequate population monitoring. In the future, conducting an annual aerial census to determine herd size should be high priority. Composition counts should also be completed in spring and fall to determine the herd's sex/age structure and to ensure that sex ratios and recruitment remain within acceptable ranges. Aerial surveys and radio-tracking flights should be continued to help locate groups for census efforts, composition counts, and calving ground surveys. Also, radio collars should be retrieved periodically and replaced with refurbished ones when radio collars are dropped, lost to mortality, or their batteries wear out. Demographic data gathered from the aerial surveys could be incorporated into a basic simulation model to predict population changes.

Range overlap between the Kilbuck herd and the expanding Mulchatna herd needs further investigation. Additional radio collars may be needed when the 2 herds overlap in range use. This will help clarify the overall range of both herds.

The season for Kilbuck caribou has remained closed since June 1985 because previous annual harvests exceeded recruitment. In fall 1989, knowledge of increasing caribou numbers sparked interest among local politicians, the media, subsistence hunters, and various agencies about the possibility of future KCH hunting. Unfortunately, no formalized management goals were in place. During this time, the Association of Village Council Presidents (AVCP) as well as the USFWS continued to support the season closure until population levels increased further. Continued research on the KCH was necessary to determine if hunting could be allowed in the future.

Area hunters were frustrated and concerned that the season remained closed and that there was a lack of alternative hunting opportunities available to local villages. On 2 April 1990, the village of Kwethluk petitioned the Board of Game and later the Federal District Court to open the caribou season in the Kilbuck Mountains. On 5 April 1990 the Court ordered ADF&G to allow residents of Kwethluk to harvest 50 antlerless male caribou. Thirty-nine animals were subsequently harvested during a 10-day season.

The ADF&G realized early on that a management problem existed with respect to Kilbuck caribou. The problem was that annual harvests before 1985 exceeded recruitment. More restrictive management measures were made to help the herd recover. However, ADF&G also realized that these measures could never succeed without support from these caribou users. In spring 1990, ADF&G made a commitment to the Board of Game and user groups that they would take the lead in future management planning.

Management planning efforts should continue as a priority. Contacts with village leaders from the Kuskokwim region as well as the Togiak area have already been made to discuss goals and objectives for KCH management at future meetings. Support from KCH users will be important to future conservation efforts.

The status of the Andreafsky herd is of significant concern. Additional survey flights, radiotelemetry work, a census, and composition counts should be conducted. There also may be a conflict with adjacent reindeer herds owned by Stebbins residents. Hunters have reported seeing reindeer herds within or near the Andreafksy Mountains. Recently, the WAH has rapidly expanded south and may occur seasonally in southern GMU 22A near the Andreafsky Mountains. Range overlap with WAH caribou and reindeer herds needs to be documented to determine if the Andreafsky herd is a discreet herd that may benefit from separate management.

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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, Kilbuck Mountains, Kuskokwim Mountains, Rainy Pass, Sunshine Mountains, Tonzona

Geographical Description: Drainages of the Kuskokwim River upstream from the village of 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 played an important historic role in this area. Although documentation is poor, discussions with village elders and reports of early explorers (cited in Hemming 1970) support the idea that caribou existed in far greater numbers and over a greater range in the 1800s than they presently do. 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 here for use as implements and tools by surrounding Native communities. Caribou no longer 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 1990 summer estimate was 82,000 animals), it appears to be expanding its range northward to portions of Unit 19.

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. Radio-collared 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, only 2 groups of caribou exist in the Kuskokwim Mountains that warrant herd status, Beaver Mountains and Sunshine Mountains. These groups may frequently interbreed and interchange.

Herds which are presently recognized south of the Kuskokwim River include the Tonzona, Big River-Farewell (previously called Big River), and Rainy Pass herds. Radio collaring confirmed the largely separate identity of the Tonzona herd although there is some interaction with the Denali Herd (L. Adams, pers. commun.). Caribou in the Big River herd were radio-collared near Farewell in the early 1980s by Pegau (1986). During the study's first year the radio-collared caribou remained in the Farewell area. However, some of these radio-collared caribou moved near Swift Fork the following year and did not return for at least 2 years. These observations raised as many questions as they answered, and the discreteness and extent of the range of the Big River-Farewell herd is still poorly understood.

The Rainy Pass area and drainages at the South Fork head of the Kuskokwim and surrounding area 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/relationship to Mulchatna herd caribou.

South of the Kuskokwim River there has been little use of caribou by Native hunters in recent times, except that residents of Nikolai occasionally hunt Tonzona caribou. Mulchatna caribou increasingly were hunted along the Hoholitna River. 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 Herds) and sheep and moose hunting (Rainy Pass Caribou Herds). 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 (and harvest probably was mostly from the Sunshine Mountains herd). The caribou harvest from the Kuskokwim Mountains (north of the Kuskokwim River) totaled less than 15 caribou per year since the winter hunting season ended.

MANAGEMENT DIRECTION

The herds north of the Kuskokwim River are small, sparingly 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 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 were reviewed and tabulated annually and incidental observations of caribou numbers and calving areas were made. Additionally, surveys of the Beaver Mountains, Sunshine Mountains, and Rainy Pass herds were made on 7-9 June 1990. In those surveys, P. Valkenburg and I surveyed all alpine areas on the north side of the Kuskokwim River from Flat to Von Frank Mountain in a Bellanca Scout. Caribou were concentrated near snow beds and all caribou were counted and classified as adults or

calves. On 9 June, we surveyed the drainages of the upper South Fork Kuskokwim and again classified all caribou seen as adults or calves.

RESULTS AND DISCUSSION

Population Size, Status, and Trend

We tallied 19 groups or single animals in the Beaver Mountains area for a total of 649 caribou. Fourteen percent of the herd were calves. Only alpine caribou range was surveyed, but I think about 75% of the caribou were counted. Consequently, I estimate the population at 865 animals. This is considerably lower than Pegau's (1986) estimate of 1,600 animals, and far below Skoog's (1963) estimate of 3,000. The population of the Beaver Mountains Caribou Herd appears to have declined.

During the same survey, 617 caribou were counted in what has been considered the range of the Sunshine Mountains herd (Cloudy Mountains, 106; Cripple Creek Mountains, 53; Page Mountain, 56; Sunshine Mountain, 400; Mystery Mountain, 1; Nixon Fork Flats, 1). I again assumed that approximately 75% of the herd was accounted for, bringing the total for the northern Kuskokwim Mountains to 823. This is considerably larger than the previous estimate of 500-600 (Pegau 1986). The total estimated population north of the Kuskokwim River is now almost 1,700, which is still 400 less than Pegau estimated in 1986.

We saw 231 caribou (including 48 calves) during the survey of the Rainy Pass Caribou Herd on 9 June 1990, but strong winds precluded a thorough survey.

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.

A summer census of the Mulchatna Caribou Herd (see Unit 17 Management Report) was conducted in 1990. This herd typically resides in Unit 17, but recent herd growth to an estimated 82,000 caribou in 1990 precluded a northward range expansion into Unit 19. Mulchatna caribou are now regularly hunted along the Hoholitna River in Unit 19. As this herd continues to expand, I suspect additional range expansion will occur.

Mortality

Season and Bag Limit:

Units and Bag Limits	Subsistence/ Resident Open Seasons	Nonresident Open Seasons
Subunit 19A north of the Kuskokwim River: 1 caribou.	10 Aug-30 Sep 1 Nov-28 Feb	10 Aug-30 Sep
Subunit 19A south of the Kuskokwim River, and Subunit 19B Subsistence hunters residing in Lime Village: 5 caribou;	10 Aug-31 Mar	
Other subsistence hunters and residents: 3 caribou; however, not more than 1 caribou may be taken before Nov. 1.	10 Aug-31 Mar	
Nonresident hunters: One caribou.	10 Aug-31 Mar	
Subunit 19C: One caribou.	10 Aug-10 Oct	10 Aug-10 Oct
Subunit 19D south and east of the Kuskokwim River and North Fork of the Kuskokwim River: one caribou	10 Aug-30 Sep 1 Nov-31 Jan	10 Aug-30 Sep
Remainder of Subunit 19D: One caribou.	10 Aug-30 Sep	10 Aug-30 Sep
Unit 21, except Subunit 21D west of the Yukon and Koyukuk Rivers: One caribou.	10 Aug-30 Sep	10 Aug-30 Sep

Harvest:

Human-induced Mortality. Harvests in Unit 19 and Subunits 21A and 21E have apparently increased over the past 5 years (Table 1). Even discounting those animals harvested from the expanding Mulchatna herd, the reported harvest has more than quadrupled since the 1986-87 season (44 vs. 202). The number of hunters participating in the hunt has quadrupled as well. The greatest increase in harvest has come from the Rainy Pass Caribou Herd. I suspect that unreported take is high throughout the area, with the documented take probably only 50-75% of the actual harvest.

Hunter Success and Residency. Reported hunter success has averaged about 80% during the past 5 years. Because of disproportionate returns, I believe the actual success rates are probably much lower, averaging about 50%. Reported success rate on all Unit 19 and Subunits 21A and 21E herds in the 1989-90 season was 78%.

Hunters reporting from Unit 19 and Subunits 21A and 21E hunters are predominantly nonresidents (58%). I assume that resident hunters are probably underrepresented by the harvest ticket returns, and that the harvest is nearly equally distributed in the resident and nonresident classes. Hunters (both successful and unsuccessful) reported hunting an average of 6.2 days, with hunts lasting from 1 to 21 days.

Harvest Chronology. Seventy percent of the reported 1990-91 caribou harvest occurred in September, about 26% in August, and the remainder in December and January. I do not think harvest chronology has changed significantly over the past 5 years.

Transport Methods. Five hundred sixty-three of 641 (88%) caribou hunters who reported transportation method on their harvest report cards used airplanes. The remaining transport methods were distributed among horse, boat, snowmachine, and off—road vehicle.

Natural Mortality: Although no specific data have been collected on natural mortality rates or factors, I suspect that wolf predation is relatively high within most Unit 19 and 21 caribou herds. The low proportion of calves (14% of 448 caribou) and the early calving dates suggest that the Beaver Mountains herd is highly productive but has high calf mortality. The Sunshine Mountains herd may also suffer high mortality with only 19% calves of 216 caribou classified. Winter severity was relatively high in the past 2 years and contributed substantially to natural adult and calf mortality.

CONCLUSIONS AND RECOMMENDATIONS

To meet the objectives stated previously, additional effort must focus on basic understanding of the Big River-Farewell and Rainy Pass herds. Present escalation in harvest during the either-sex fall season could be resulting in an overharvest of the Rainy

Pass herd. This herd should be the highest study priority. Some caribou in the Rainy Pass herd should be radio-collared, and an estimate of herd size and recruitment (fall composition count) completed.

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Table 1. Caribou harvest ticket returns for Game Management Unit 19 and Subunits 21A and 21E for regulatory years 1986-87 through 1990-91.

Herd	Total harvest[a]				
	1986-87	1987-88	1988-89	1989-90	1990-91[b]
Beaver Mountains	5	10	3	12	4
Big River-Farewell	12	26	50	49	69
Kilbuck Mountains	1	5	3	1	0
Kuskokwim Mountains	0	0	0	0	0
Rainy Pass	21	51	56	84	110
Sunshine Mountains	3	1	0	2	2
Tonzona	1	27	7	12	15
Unspecified Herd	1	7	5	8	2
Totals	44	127	124	168	202

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

[b] Data for the 1990-91 season are preliminary based on harvest reports received up to 15 February 1991.

LOCATION

Game Management Unit: 20A (4,800 mi^2)

Herd: Delta-Yanert

Geographic Description: Central Alaska Range and Tanana Flats

BACKGROUND

During the past 20 years the Delta-Yanert Caribou Herd has experienced large fluctuations in population size. The lowest population level was estimated at 2,300 caribou in 1973 (Davis et al. 1982). In 1989 the population was estimated at 10,690, the highest population on record. A thorough review of Delta and Yanert caribou population fluctuations was given by Davis et al. (1988a).

Before 1974, liberal either-sex general hunting seasons occurred within the Delta and Yanert herds' range. Between 1974 and 1979, hunting seasons were closed because recruitment was very low from 1972 to 1974 (2-10 calves:100 cows) and the population was at a low point. 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 1974, but over 400 caribou were taken in the first 3 days of the season and an emergency closure was implemented. Since then, regulations have become increasingly complex. Controlled use areas exist in the Yanert, upper Wood River, and Tatlanika drainages and hunting has been controlled in the accessible western portion of Subunit 20A with a permit drawing hunt. Historical harvest and hunting seasons were thoroughly reviewed by Davis et al. (1991).

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 no biological basis for herd distinction exists and the herds have been managed as a single herd.

MANAGEMENT DIRECTION

During the mid-1970s when the Delta herd was relatively small, 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.

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 recent Board proposal to consider the Delta herd as a "subsistence designated herd" failed. Therefore, subsistence use has not been a major consideration in management planning.

Management Goals and Objectives

1. 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. 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. Gather information on the quantitative relationship of wolves and grizzly bears to caribou.

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

    Maintain a bull:cow ratio of at least 30:100 and a large bull:cow ratio of at least 6:100.

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

    A. 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. Gather information on the quantitative relationship of wolves and grizzly bears to caribou.

METHODS

Fall and Spring Composition Counts

Both spring and fall sex and age composition counts were conducted in 1990. On 18 April, R. Beasley and J. Davis classified caribou in 10 randomly selected groups. The sample was selected by first randomly picking 10 of 43 functioning radio collars, then locating the radio-collared animals with a fixed-wing aircraft. A helicopter was directed to the radio—collared caribou and up to 200 caribou near the selected radio collar were classified.

In late September, J. Davis and M. McNay classified caribou in large rutting aggregations from a helicopter. Concentrations of caribou were located by radio-tracking from a fixed-wing aircraft. The sample consisted of caribou grouped around 36 of the 43 functioning radio-collared animals. These caribou were located during 2 consecutive days of radio-tracking; the day before the composition survey as well as the day of the composition survey itself.

During the fall survey, classifications were based on the following criteria:

Cow	External genitalia visible; 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, probably all 2-year-olds, and some 3—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, including most 3-year-olds, many 4-year-olds, and unknown numbers of older bulls.
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.

The small bull category should not be construed as a direct indicator of yearling bulls or yearling recruitment because yearlings and many 2- and 3-year-olds are included. Medium and large bull categories also contained 2 or more cohorts.

Calving Composition: On 22 and 23 May 1990, ground-based surveys were conducted on the calving grounds of the Delta herd to estimate pregnancy rate. J. Davis assisted by L. Tutterrow and W. Martin classified caribou in Wells Creek on the southern slope of the Alaska Range in Subunit 13E. M. McNay assisted by N. Ihlenfeldt classified caribou in Dick Creek, a tributary of the Yanert River in Subunit 20A. Caribou were classified with the aid of spotting scopes using the following criteria:

Adult Pregnant Females. Full body-sized females with hardened antlers and distended udders; or full body-sized adult females with distended udders without antlers and with no new antler development present; or full body-sized females accompanied by a neonate.

Adult Nonpregnant Females. Full body-sized females without hardened antlers and without distended udders. New antler growth was usually apparent.

Subadult Pregnant Females. Females smaller than full size adults with hardened antlers, distended udders, or accompanied by a neonate. Hardened antlers of subadult females were of smaller size than on most adult females. The subadult category included both 24-month-old and 36-month-old females.

Subadult Nonpregnant Females. Females smaller than associated full sized-adults without hardened antlers, distended udders, or associated neonate. New antler growth was apparent. This category may have included some adult, nonpregnant females.

Yearlings. Small caribou without antlers or with small diameter spikes or forks, often with previous years "velvet" still attached. Yearlings represented both sexes of 12-month-old caribou. Some older, nonpregnant females may have been included in this class.

Bulls. Bull classification was based on external genitalia and included all bulls older than yearlings.

1990 Census. On 26 June 1990, the combined Delta herd was censused from 3 fixed-wing aircraft. Most large postcalving aggregations were located by tracking radio-collared caribou. Photographs were taken of the largest groups using hand-held 35mm cameras from a Bellanca Scout aircraft, and duplicate photos of most groups were taken from a belly-mounted 9"x 9" camera in a DeHaviland Beaver. The total population estimate was derived by counting individual caribou on the photographs and adding those caribou in small groups that were counted visually from the search aircraft. No correction factor was used to account for caribou missed during the search. Growth rates for the combined Delta and Yanert caribou herds were calculated from 1985 and 1989 census results.

Harvest Reporting: From 1986 through 1990 ADF&G personnel interviewed hunters each year during the first 2 weeks of September to determine the frequency of harvested

caribou not being reported through the harvest ticket system. We contacted hunters in hunting camps by landing at most known landing areas daily. We also operated a check station on the Parks Highway near the Yanert River. To reduce reporting bias, biologists did not reveal the purpose of the interviews to hunters. Interviews were conducted as if they were a simple license check.

To estimate actual hunter numbers and actual harvest, the interview and harvest report data were treated as a mark-recapture sample. Confidence limits were determined for the estimates using a binomial confidence limit computer program (J. Venable, ADF&G, Fairbanks, 1987 pers. commun.; McNay 1990).

Calculating Mortality: Mortality of 0- to 10-month-old caribou was estimated from the change in ratio of calves:100 cows from early June through April. Adult female mortality was calculated by the method of Trent and Rongstad (1974).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The 1990 photocensus was completed on 26 June. The census centered around Copper Creek, Last Chance Creek, Dry Creek, and the West Fork of the Little Delta River. Systematic searches of the Yanert River, Dry Creek, the Tatlanika River, and the Totatlanika River drainages revealed additional small groups without radio collars.

The unadjusted population estimate was 7,886 caribou, but 4 of 43 functioning radio collars were not located during the census. Therefore, additional caribou were probably present but not counted. The magnitude of error in underestimating population size with the photocensus technique cannot be measured, but assuming each radio-collared caribou represents approximately 200 caribou (39/7,886), the actual population may have been approximately 8,700 if the missing radio-collared caribou are considered.

The 1989 population estimate was 10,690 caribou. Compared to 1990, calves were a larger proportion of the 1989 population. Excluding calves, the June 1989 adult population probably declined by approximately 7% by June 1990.

Between 1973 and 1989, the Delta herd continued to grow. In recent years (1985-89) the estimated annual finite growth rate of the adult (>1 year) population was 6.6%. During that growth period the herd experienced moderate but consistent calf recruitment. Following the failure of the 1989 and 1990 calf cohorts, the population declined. It appears that although increasing adult natural mortality may have contributed, poor calf recruitment was most significant in reducing herd growth.

Population Composition: The April 1990 calf:cow ratio (17:100) was approximately half that observed during the previous fall composition survey (36:100) (Table 1). This was the first indication of high overwinter calf mortality among Delta caribou since spring composition surveys began in 1983. The severity of the 1989-90 winter was greater than average in terms of snow depth. Environmental conditions probably contributed to the relative failure of the 1989 calf cohort.

The bull:cow ratio in the Delta-Yanert herd declined continuously from 1980 through 1989 (Davis et al. 1991) (Table 2). The decline was most dramatic between 1985 and 1987 and resulted from selective hunting of bulls in the fall season and lower calf recruitment to fall in 1986 and 1987.

In 1987 the bag limit was changed from either sex to bulls only and the October bull:cow ratio dropped from 41:100 in 1986 to 27:100 in 1989. The 1989 population contained only 2 large bulls:100 cows. Because the management objective called for a minimum bull:cow ratio of 30:100 and a minimum of 6 large bulls:100 cows, the fall 1990 caribou season was shortened by 5 days to reduce harvest of large bulls.

A composition count flown on 4 October 1990 suggested that reduced bull harvests occurred in fall 1990 (the 1990–91 harvest data were not available for this report) (Table 2). In September 1990 bull:100 cow ratios were 37:100 and the large bull:cow ratio met the management objective of 6:100.

Distribution and Movements: Before 1979, the Delta herd showed strong fidelity to traditional calving areas along upper Delta Creek in southeastern Subunit 20A. As the Delta herd increased in numbers its calving range expanded. Between 1980 and 1987, the Delta herd calved along the eastern foothills of Subunit 20A between Dry Creek and the Delta River (Valkenburg et al. 1988). The Yanert Caribou herd calved between the upper Yanert River and upper Wood River during the 1980-87 period.

Radiolocations demonstrated increasing overlap between the 2 herds during calving periods since 1987 and a southeastern shift away from the traditional calving area. In 1990 the combined Delta-Yanert herd calved in the Yanert drainage and in Wells Creek, a tributary of the Nenana River in Unit 13.

In the last 4 years, the Delta-Yanert herd exhibited the following general seasonal distribution:

1. Calving concentrations in the eastern foothills between Dry Creek and the Delta River and in the upper Wood River during May and early June. In 1990 calving occurred well to the south in Dick Creek and Wells Creek.

2. Postcalving aggregations in the upper Wood River drainages and along the Wood River/Yanert River divide during late June and early July.

3. Dispersal over the eastern half of the Subunit 20A foothills and mountains from mid-July through August.

4. Westward movement across the Wood River to the Gold King benches and westward from late August through September.

5. Rutting aggregations in the western foothills of Subunit 20A during October.

6. Dispersal over the western foothills, Gold King benches, and northward onto the western Tanana Flats from October through February. However, in late December 1990 caribou abandoned the Tanana Flats portion of their winter range which was under heavy snow cover (up to 45 inches). At least one-third of the herd wintered in the Yanert drainage in winter 1990-91.

7. Eastward movement across the Wood River to the eastern foothills and southeastern Tanana Flats in March and April.

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 moved west across the Wood River toward rutting and wintering areas. During 1988, in the absence of significant snow, caribou were distributed throughout the eastern and western foothills until late September. A second example occurred in 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.

Mortality

Harvest:

Season and Bag Limit. The fall 1989 general hunting season was restricted to bulls only and was open from 1 September through 15 September. A drawing permit (Hunt 570) was available to 200 hunters in the Ferry Trail Management Area for the taking 1 caribou of either sex from 10 August through 25 August and from 21 September through 31 December. A winter drawing permit (Hunt 571) was available to 25 hunters for taking caribou of either sex in the Yanert Controlled Use Area from 1 January through 28 February.

During the 1990-91 regulatory year the general hunting season allowed taking bulls from 1 September through 10 September. A drawing permit (Hunt 570) was available to 100

hunters that allowed the taking of caribou of either sex in the Ferry Trail Management Area from 10 August through 10 September.

Four new winter hunts were implemented in the 1990-91 regulatory year; in each hunt the bag limit was restricted to 1 antlered caribou. A general season hunt from 1 January to 15 January replaced Hunt 571 in the Yanert Controlled Use Area. A registration hunt (Hunt 569) was scheduled for 75 permit holders in the Ferry Trail Management Area from 1 February through 28 February, and a registration hunt (Hunt 574) was scheduled for the remainder of Subunit 20A, also from 1 February through 28 February. Both Hunts 569 and 574, however, were closed by Emergency Order on 13 February. A drawing hunt (Hunt 573) was scheduled for the remainder of Subunit 20A for 250 permit holders to begin 1 March and end 31 March.

In both regulatory years 1989-90 and 1990-91 the seasons and bag limits were the same for resident and nonresident hunters.

Board of Game Actions and Emergency Orders. The Board of Game made no changes in regulations for Subunit 20A caribou for regulatory year 1989-90.

In March 1990, the Board of Game reduced the fall general season from 15 to 10 days in Subunit 20A, reduced the number of permits in Hunt 570 from 200 to 100, and implemented 2 winter registration permit hunts (Hunts 569 and 574) and 1 winter drawing hunt (Hunt 573). Permit Hunt 571 for either sex of caribou in the Yanert River Controlled Use Area was eliminated and a 15–day January season for antlered caribou was implemented. Those changes fulfilled an ADF&G proposal to reduce the harvest of large bulls and to provide hunting opportunity during winter.

The regulation changes became effective 1 July 1990. Preliminary estimates of the September 1990 harvest indicate regulation changes effectively reduced fall bull harvests.

The quota of 250 cows originally proposed for winter hunts was reduced to 100 cows before Hunts 569 and 574 began. That quota cutback was prompted by severe winter weather and evidence from census and composition surveys that recruitment and population numbers were declining. The new quota allocated 50 cows to Hunts 569 and 574 combined and 50 cows for harvest in Hunt 573. Hunts 569 and 574 were closed by Emergency Order on 13 February to prevent an over harvest of cows. Hunt 573 is scheduled to proceed as planned beginning 1 March.

Hunter Harvest. The total reported caribou harvest from both the general season and permit hunts in Subunit 20A during 1989 was 475 (Table 3). However, reporting rates were low in recent years for both successful and unsuccessful hunters. The total estimated harvest, including Hunts 570 and 571, was 681 caribou taken by an estimated 1,325 hunters in 1989. The estimated caribou harvest was derived from a comparison of

harvest reports with 124 hunter interviews collected between 1 and 15 September 1989 (Table 4).

In 1986 and 1987, when there was no advertising effort to encourage hunter reporting, the estimated reporting rates by successful hunters were 56% and 57%, respectively. In 1988, after radio and television advertising encouraged voluntary reporting, the reporting rate among successful hunters increased to 74%. In 1989 no advertising was used and the rate of voluntary reporting among successful interviewed hunters dropped to 63%. Apparently radio and television advertising immediately after the hunting season substantially improves voluntary reporting.

Permit Hunts. Between 1985 and 1989, 200 either-sex permits were issued annually for Hunt 570 in southwestern Subunit 20A (Ferry Trail Management Area). In 1989, 156 hunters participated in Hunt 570 and killed 117 caribou, 101 bulls and 16 cows (Table 5). Twenty-five permits were issued for Hunt 571 in 1989 and 13 hunters took 5 bulls (Table 6).

Beginning in 1990 the number of Hunt 570 permits was reduced to 100, and the 21 September through 31 December portion of the season was eliminated. Those changes were part of an overall management action to reduce the harvest of mature bulls throughout Subunit 20A. The 1990 harvest in Hunt 570 was 63 caribou, 51 bulls and 12 cows taken by 87 participating hunters. Other 1990 harvest data will be presented in the next report.

Hunter Residency and Success. Between 1986 and 1989 hunter success rates ranged between 44% and 49% among general season hunters. Among permit holders for Hunt 570, success rates ranged between 75% and 82% for those who hunted.

Other Mortality: Mortality of calves born in 1989 and 1990 was much higher than in previous years (Tables 1 and 2). Although the calves born in 1989 experienced average survival to fall, most died by April 1990. Those born in 1990 had unusually high mortality through summer (only 17:100 cows remained in fall) and winter (only 9:100 cows remained in April 1991). The severe winters of 1989-90 and 1990-91 were probably the primary cause of the lower calf:100 cow ratios. There is some indication, however, that there may also have been lower than normal pregnancy in 36-month-old females. During the 1990 calving season, 21 of 23 radio-collared cows older than 3 years were pregnant, but only 6 of 10 3-year-olds were pregnant ($x^2 = 4.59$, $P < 0.05$).

Further evidence of the influence of the severe winters of 1989—90 and 1990-91 comes from the analysis of weights of 10—month-old females. Those recaptured in 1990 and 1991 weighed substantially less than previous cohorts reported by Davis et al. (1991). The 10-month-old females captured in 1990 had a mean weight of 53.9 kg ($n = 10$, SD = 4.2, range = 44-58 kg), and the 10 captured in 1991 had a mean weight of 53.0 kg ($n = 10$, SD = 3.2, range = 49-57). Most previous mean cohort weights were over 60 kg.

Mortality of females older that 10 months was estimated by Davis et al. (1991) between 1979 and 1986. Using similar methods, P. Valkenburg (ADF&G files) recently calculated mortality rates since 1986. Until 1982, no mortality among radio-collared caribou occurred; this was a period of rapid herd growth for the Delta herd.

Between September 1982 and September 1984 mortality of radio—collared females averaged 6% annually (Davis et al. 1991). An unusually high mortality rate of 22% among radio-collared caribou was recorded for the period October 1985 through September 1986. Between October 1986 and September 1991 average annual mortality was 9%.

Wolf predation is also a major mortality source for Delta caribou. Daily monitoring of 4 wolf packs over a 30-day period in March and early April 1989, revealed that wolves killed 16 moose, 18 caribou, 2 sheep, and 1 wolf; a kill rate of 1 caribou/6.9 days/pack in that multi-prey system. Wolf predation could be substantially higher during severe winters.

CONCLUSIONS AND RECOMMENDATIONS

Excluding calves, the Delta Caribou Herd grew at an annual finite rate of 6.6% between 1985 and 1989. Between 1989 and 1990 the population probably declined by approximately 6%. Low calf recruitment (to 10 months) in 1990 and 1991, given current mortality estimates, will probably result in further decline in caribou numbers between June 1990 and June 1991.

Changes in fall hunting regulations and poor weather prevented further decline in the bull:cow ratio and the management objectives (30 bulls:100 cows including 6 large bulls:100 cows) were met. However, lowered calf recruitment to spring in 1989-90 resulted in a population decline. Therefore, the quota for the cow harvest scheduled for winter 1990-91 was reduced from 250 cows to 100 cows. I recommend that for the 1991 caribou season the harvest of cows should remain below 100 in Subunit 20A.

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Table 1. Delta caribou late winter composition counts, 1983-90[a].

Survey date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent bulls	Composition sample size
4/20/83	23	29	19	66	15	1,079
4/10/84	10	49	31	63	6	628
5/03/85[b]	1	51	34	66	1	759
4/20/86	21	44	26	61	13	1,141
4/06/88	22	29	19	66	14	1,473
4/18/89	15	21	15	74	11	1,053
4/18/90	17	17	10	78	11	835

[a] A survey was not conducted during 1987.
[b] Fixed-wing survey (some bulls included with cows).

Table 2. Delta caribou fall composition counts and estimated July population size, 1985-90.

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	Minimum total count of herd size
10/9-12/85	49	36	20	54	57	24	19	26	1,164	8,083
10/22/86	41	29	17	59	49	30	21	24	1,934	7,804
10/05/87	32	31	19	61	53	23	24	20	1,682	8,380
10/14/88	33	35	21	60	49	38	13	20	3,003	8,338
10/10/89	27	36	22	62	64	28	7	16	1,965	10,690
10/04/90	37	17	11	65	46	38	15	24	2,411	7,886

[a] These figures are caribou actually counted on photos and from the air. Censuses in 1986, 1988, and 1990 are probably considerably lower than the true herd size.

Table 3. Summary of combined Delta and Yanert Caribou Herd harvest and hunters, 1986-89.[a]

Harvest components	1986	1987	1988[b]	1989
Based on general season harvest reports only				
Reported harvest	413	305	325	358
Reported hunters	592	528	540	573
Reported % success	70	58	60	62
Based on general season harvest reports and field interviews				
Estimated harvest	734	522	439	564
90% C.I. on harvest[c]	539-1,032	381-768	374-527	443-748
Estimated hunters	1,684	1,195	927	1,156
90% C.I. on hunters[c]	1,393-2,101	955-1,558	807-1,081	953-1,443
Estimated total reporting rate (TRR)	35%	44%	58%	49%
90% C.I. on TRR[d]	29-41%	35-52%	52-64%	41-57
Estimated successful reporting rate (SRR)	56%	57%	74%	63%
90% C.I. on SRR[d]	43-69%	43-71%	66-81%	52-73%
Estimated reporting rate by unsuccessful hunters	19%	33%	44%	36%
Estimated success rate	44%	44%	47%	49%
Permit hunts				
Harvest	107	122	116	117
Hunters who hunted	146	155	158	169
Total permits issued	200	200	225	225
Estimated total harvest				
General season and permit combined	841	644	555	681
90% C.I. on harvest	646-1,139	503-890	490-643	560-865
Estimated total hunters				
General season and permit combined	1,830	1,350	1,085	1,325
90% C.I. on hunters	1,539-2,247	1,110-1,713	965-1,239	1,122-1,612

[a] In 1986 the bag limit was 1 caribou of either sex; 1987 and 1988 the bag limit was 1 bull (see McNay 1988).

[b] In 1988 a radio/television campaign was conducted for 10 days after the hunting season to encourage hunters to return harvest reports.

[c] Based on binomial confidence limits around m_2 / n_2

[d] Based on binomial confidence limits around m_2 / n_1

Table 4. Summary of results of field interviews and hunter reports for Subunit 20A, 1986-89.

Interviews and harvest reports	1986	1987	1988	1989
Total interviews n_{1t}	178	103	186	124
Interviews of successful caribou hunters n_{1s}	48	40	103	62
Harvest reports returned by interviewed hunters m_{2t}	62	45	108	61
Harvest reports returned by hunters who were successful when interviewed m_{2s}	27	23	76	39
Total harvest reports returned n_{2t}	592	528	540	573
Successful harvest reports returned n_{2s} (i.e., reported harvest)	413	305	325	358

Table 5. Summary of results of Delta Caribou Herd permit hunt 570, 1985-90.

Regulatory year	Harvest			Hunted but unsuccessful	Did not hunt	Did not report	Total permits
	Male	Female	Unknown				
1985	86	15	1	42	21	35	200
1986	90	17	0	36	54	3	200
1987	88	33	1	30	45	3	200
1988	95	17	2	25	56	5	200
1989	101	16	0	39	44	0	200
1990	55	12	0	16	14	3	100

Table 6. Summary of results of Yanert Caribou Herd permit hunt 571, January 1989 and January 1990.

Regulatory year	Harvest			Hunted but unsuccessful	Did not hunt	Did not report	Total permits
	Male	Female	Unknown				
1988	1	1	0	12	10	1	25
1989	5	0	0	8	12	0	25

LOCATION

Game Management Units: 20B, 20C, 20D, 25C, and adjacent Yukon Territory (20,000 mi^2)

Herd: Fortymile

Geographical Description: Charley, Fortymile, Salcha, Goodpaster, Ladue River, and Birch Creek and Shaw Creek drainages between the Tanana River and the south bank of the Yukon River; the Fortymile Caribou Herd presently ranges up to 30 miles eastward into the Yukon Territory

BACKGROUND

The Fortymile Caribou Herd (FCH) is an international herd and at one time was the most economically significant herd in Alaska and the western Yukon Territory. Murie (1935) estimated the FCH at 528,000 animals in the 1920s; at that time it was one of the largest herds in North America. For unknown reasons, the FCH declined to only 10,000-20,000 by the 1940s (Skoog 1956). Aided by, or perhaps as a result of, a federal predator control program, the herd began a spectacular increase and numbered over 50,000 by 1953 (Skoog 1956). By 1961 the herd numbered about 60,000, before declining again during a period of severe winters, a large wolf population, and high harvests (Davis et al. 1978).

Historically, the FCH has been an important source of food for Native and non-Native people in the western Yukon and Alaska. The herd was also very important to miners in the Fairbanks, Circle, Fortymile, and Klondike mining districts. Despite market hunting and the boom in mining during the early 1900s, the FCH thrived and reached a peak in the early 1930s well after mining began declining. Before the Taylor Highway was constructed in the mid-1950s, most hunting was concentrated along the Steese Highway and along the Yukon River above Dawson. Before 1910 Native people also used caribou fences near Kechumstuk and Joseph to take caribou (Murie 1935). During the 1960s, hunting was concentrated along the Steese and Taylor Highways in Alaska and along the Top of the World Highway (Canadian segment of the Taylor Highway) in the Yukon. Caribou stopped crossing the Steese Highway in 1967, but hunting remained good along the Taylor Highway until the season was closed by Emergency Order in 1973. Since the mid-1970's there has been no significant harvest in the Yukon.

The FCH increased from 5,740 to 8,610 caribou in summer 1975 and then to about 10,000 in summer 1981 (finite rate of annual growth of about 1.10 to 1.03). Conservative caribou hunting seasons, a natural decline in wolf numbers in the mid-1970's, and a wolf

control program conducted from 1981 to 1983 helped reduce caribou mortality and led to herd growth. By 1988 the herd had increased to about 20,000.

MANAGEMENT DIRECTION

Representatives of the Yukon Department of Renewable Resources, Canadian Wildlife Service, and ADF&G met in Whitehorse, Yukon Territory in April 1990 and drafted the following revised management goals and objectives for the FCH. Previous goals and objectives were established without consultation with Canadian biologists.

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 of 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 caribou nutritional status 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 of 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

The herd was censused in late June 1990 with 3 spotter planes and a Beaver aircraft (equipped with a 9-inch format aerial camera). The Yukon government paid for half the census cost ($6,000). Population status and trend were determined by comparing results of the 1990 photocensus with results of the 1988 census. Herd sex and age composition was estimated by helicopter survey on 13 October 1989 and 27-28 September 1990. Caribou were located initially with radio-telemetry techniques using either a Bellanca Scout or PA-18 Super Cub and then using a Hughes 500D helicopter to accomplish the survey itself. Knowledge of herd distribution and movements was based upon radio-tracking 15-20 radio-collared females once in August, October, December, May, and during the census in late June as well as on hunter reports.

Harvest was estimated from permit hunt reports (drawing and registration permits) and harvest report cards (general open season), the latter corrected for non-reporting by successful hunters. Neither caribou harvest ticket reports or harvest ticket overlays were entered into the computer by the Statistics Section, harvest report cards were hand–tallied. Data on hunter residency were not readily available for those hunters reporting with harvest ticket report cards. Subsistence demand was estimated from the number of subsistence registration permits issued during fall 1989. Subsistence need was estimated from reported harvest because caribou were readily available to subsistence hunters on the Taylor Highway during the 1989 fall migration. Preliminary harvest results for the 1990-91 season were available for this report but were not analyzed in detail. Residency, success, transport means, and harvest chronology of these hunters will be given in the next report.

Fifteen radio collars were placed on 4-month-old female caribou in late September 1990 to maintain numbers of active radio collars in the herd at about 30. These 15 caribou will also enable us to determine age at first reproduction, an indicator of body condition. The Yukon government and National Park Service contributed funds to this project.

RESULTS AND DISCUSSION

Population Status and Trend

The FCH numbered at least 22,766 animals in summer 1990. The census results support a previously suspected lower recruitment and herd growth rates since 1988 (Table 1). Severe winter conditions during winters 1988–89 and 1989-90 and increased wolf predation because of deep snow are believed responsible for lower calf recruitment and

herd growth. The computed growth rate since 1988 has slowed to about 7% annually from about 10% annually between 1983 and 1988.

Population Composition: On 13 October 1989, 1,781 caribou were classified in the vicinity of American Summit on the Taylor Highway. The calf:cow ratio was the lowest recorded since 1974 (Table 1). Winter 1988–89 was more severe than most winters during the 1980's and may have caused lower calf survival in summer 1989. The observed sex ratio of only 27 bulls:100 cows is probably an underestimate of the true herd sex ratio because post-rut segregation was observed during the survey. The 1990 fall composition counts (Table 2) demonstrated that recruitment (at least to fall) was still slightly below normal, but the severe recruitment decline seen in the Alaska Range herds did not occur in the FCH.

Distribution and Movements: The FCH summered in the central part of its core range from Mount Harper north and east to Glacier Mountain, and west to the upper Salcha River in 1989. However, summer and early fall distribution did not extend east to Taylor Mountain and Mount Warbelow near the Taylor Highway as in 1988. Scarcity of caribou in those popular hunting areas resulted in an extremely low hunter success rate near the Taylor Highway during the 1989 fall hunting season.

The easterly fall migration began in early October 1989 and caribou crossed the Taylor Highway near American Summit. Several thousand animals had crossed the highway by 13 October. A subsistence caribou hunt opened on 15 October to provide local residents an opportunity to take caribou while the herd crossed the road. The easterly movement continued across the highway between American Summit and Mount Fairplay until mid-November. Once again, the herd did not arrive in the Yukon until late September after the Yukon's hunting season ended.

About 25% of the FCH wintered on the Tanana-Fortymile divide south of Mount Fairplay while the remainder of the herd moved northwest to the Birch Creek drainage where caribou stayed most of the winter. Some caribou also may have crossed the Steese Highway and wintered in the Little Crazy Mountains, but this was not confirmed by radio-tracking.

Calving occurred in late May 1990 (peaking about 21 May) along the eastern slopes of Mount Harper and in the upper portion of the Middle Fork drainage. The 1990 calving distribution was the most concentrated since 1977 when calving occurred much farther to the west in the Birch Creek drainage. By 11 June caribou were moving northeast toward the Glacier Mountain-North Peak area in large aggregations of 300 to 800. During the 27 June census most caribou were concentrated along the divide between Crescent Creek and the Salcha River, but one group was photographed near Mount Sorenson and another was found in the mountains south of Copper Creek.

During fall 1990 the herd remained primarily in the Salcha River and Crescent Creek drainages and was not available to hunters. In early October, most caribou moved rapidly east and crossed the Taylor Highway near American Summit. From there the caribou traveled into the Yukon to within 10 miles of the Yukon River upstream from Dawson. By December most caribou had returned to Alaska and spread out over the herd's range. The only drainages within the previous winter range that were not used were Birch Creek and the Goodpaster River.

Mortality

Harvest:

Season and Bag Limit.

Units and Bag Limit	Subsistence Open Seasons	Resident/ Nonresident Open Seasons
Units 12 and 20(D) north of the Alaska Highway.		
Subsistence hunters[1]: One caribou.	10 Aug-30 Sept 1 Dec-28 Feb	
Resident and nonresident hunters: One bull.	10 Aug-20 Sept	
Unit 20(E), that portion drained by the Yukon River downstream from and including the Seventymile and Charley Rivers, the North Fork of Fortymile River upstream from and including Independence Creek, the Middle Fork Fortymile River upstream from Fish Creek, and the Mosquito Fork Fortymile River upstream from and including Kechumstuk Creek.		
Subsistence hunters[1]: One caribou.	10 Aug-30 Sept 1 Dec-28 Feb	

Units and Bag Limit	Subsistence Open Seasons	Resident/ Nonresident Open Seasons
Resident and nonresident hunters: One bull.	10 Aug-20 Sept	
Remainder of Unit 20(E) (accessible by the Taylor Highway and associated trails).		
Subsistence Hunters[1]: One caribou by registration permit only. Season will be closed when 325 caribou have been taken.	10 Aug-30 Sept 1 Dec-28 Feb	
Resident hunters: One bull by drawing permit only. Up to 750 permits will be issued.	10 Aug-20 Sept	

Board of Game Actions and Emergency Orders. The Board of Game took action to establish 2 separate permit hunts in the Taylor Highway area for the 1989-90 season in addition to the general hunt in the remote western portion of the herd's range. This change was in response to an overharvest of caribou in fall 1988 when there was no regulation of hunter numbers. One of the new hunts (#572) was a drawing permit hunt for nonlocal State residents and the other (#575) was a registration permit hunt for local subsistence hunters with a quota of 325 caribou. I recommended an overall 1989-90 harvest quota of no more than 3% of the herd, or 600 caribou (300 of these for subsistence hunters) based on management objectives and the 1988 estimate of 19,975 caribou in the herd and the estimated 10% growth rate. However, because the 1990 census and the 1989 and 1990 fall recruitment indicated a herd growth below 10%, I recommend a harvest quota of 2% (450 caribou) for the 1990-91 and 1991-92 seasons.

The FCH was largely unavailable to hunters near the Taylor Highway the entire fall 1989 season, and subsistence hunters had taken only 29 caribou as of 30 September. Therefore, an Emergency Order (EO) was issued for 15 October to 14 November 1989 reopening the season under registration permits for subsistence hunters as the herd reached the Taylor Highway near American Summit. The regularly scheduled season reopened on 1 December. A subsequent EO was issued on 31 December 1989, closing the season when an assessment

[1] Qualified subsistence hunters were determined by the Board of Game to be residents of Unit 12 north of the Wrangell-St. Elias Park and Preserve and rural residents of Subunit 20D and 20E.

of permit reports and field observations indicated that the subsistence harvest was approximately 300 caribou. These orders allowed subsistence hunters reasonable opportunity to hunt caribou as intended without exceeding either the subsistence hunter or overall harvest quotas.

After the McDowell decision by the State Supreme Court in late December 1989, the Board of Game was compelled to treat all Alaskan residents as subsistence hunters. In August 1990, the Board established a registration permit hunt for residents only in the road-accessible portion of Unit 12 and Subunit 20E within the range of the FCH with a harvest quota of 500 (subsequently lowered to 450). In the remainder of Subunit 20E the Board maintained the general open season with a bag limit of 1 caribou for residents and 1 bull for nonresidents. In both areas the season was 10 August-30 September and 1 December-28 February for residents and 10 August-20 September for nonresidents.

Hunter Harvest. The total reported harvest from the FCH during the 1989-90 season was 424 caribou (Table 2). Assuming only a 62% reporting rate (Kelleyhouse 1986) by successful hunters (n = 121) in the general hunt, the total actual harvest was probably closer to 498 (400 bulls, 98 cows). This represents a harvest rate of approximately 2.3% based on an interpolated herd size estimate of 21,370 caribou (midpoint between estimates of 19,975 and 22,766 made in 1988 and 1990, respectively). This harvest met objectives of holding the harvest below 3% of the herd and keeping the harvest of females below 1.5% of the herd's females.

The total reported harvest for drawing hunt #572 (Taylor Highway Corridor) was only 57 bulls (Table 3). With 516 of 750 permittees hunting, hunter success was a low 11% because of the general unavailability of caribou near the Taylor Highway and associated trails in August and September 1989.

Subsistence hunters (hunt #575W) reported taking 246 Fortymile caribou (148 bulls, 98 cows), but these permittees also harvested 44 caribou (31 bulls, 13 cows) from the Nelchina-Mentasta herds north of the Alaska Highway near Northway within the described Fortymile herd hunt area (Table 3).

Preliminary harvest results for the 1990-91 season (Table 2) were similar to 1989-90. Harvest by hunters in the remote portion of Subunit 20E was low (only 45 caribou reported taken) because fall caribou movements and distribution were similar to 1989. Despite the long winter season in which any Alaskan resident could participate, the harvest quota of 450 was never reached.

Illegal Taking. Until the 1988-89 season, illegal caribou taking was believed insignificant, limited to residents of Subunit 20E taking a few caribou in October and November when the herd crossed the Taylor Highway and a few taken during the fall hunt. However, in fall 1988 between 100 and 150 cows were taken by large numbers of hunters competing against each other along the Chicken Trail. This situation was corrected with the inception of permit hunts

in the road corridor and educating permitters about the differences in appearance of bull and cow caribou.

The Emergency Order opening the subsistence season again on 15 October 1989 curtailed nearly all illegal taking of caribou by locals. There is strong demand by local hunters to take caribou when they are most available and vulnerable to road hunters during fall migration across the Taylor Highway.

Hunter Residency and Success. It was not possible to determine the residency of the 258 hunters taking part in the 1989-90 general hunt, but local air taxi operators reported that most of their clients were nonlocal Alaskan residents and most of the rest were nonresidents. Forty-seven percent of all hunters who chartered aircraft were successful.

All 750 permittees for drawing permit hunt #572 were nonlocal residents and experienced a success rate of only 11% in the Taylor Highway area. Hunter success for this hunt is expected to vary highly in the future depending upon the proximity of caribou to the highway and associated trails in fall.

Only local residents were eligible for subsistence hunt #575W, and the hunter success rate was quite high (Table 4). I believe that the number of permittees in Tok, Eagle, Chicken, and Boundary represents an accurate estimate of the maximum number of people interested in hunting caribou in those communities. I also believe that the reported harvests for each of those communities accurately reflects actual demand for caribou. Both permits and caribou were readily available to hunters. In many cases, entire families would pick up permits but would be satisfied when 2 or 3 family members took caribou. Also, many spouses and children obtained permits, but did not go hunting at all. Actual demand for caribou for the communities of Northway and Tetlin may be estimated based upon the issuance of 72 Fortymile subsistence permits and 152 Nelchina permits with a combined reported harvest of 110 caribou for both communities from both herds. These data may not reflect the subsistence demand for caribou by residents of Dot Lake or Tanacross, however.

Harvest Chronology. The harvest peaked during the first week of the season in August and then again during the first week of September when moose season opened. One hundred twenty-one caribou were taken from 10 August through 30 September, mostly by fly-in hunters.

Harvest chronology depends primarily on caribou distribution. If caribou are away from the road, few are taken. When they cross the road from late September to mid-October they are generally concentrated and very vulnerable as long as the road remains open. This year, the herd reached the road near American Summit on 13-14 October. From 10 August to 30 September only 86 caribou were taken by all hunters (permit and general) using the Taylor Highway for access, but from 15 October to 14 November, 198 caribou were killed. Many caribou turned south from American Summit and remained near the road several weeks.

Snow made travel on the road more difficult for hunters after 20 October. Only 9 caribou were taken from 15 November until 1 December.

Excessive harvests are highly possible during the road crossing unless hunter numbers can be controlled. Such excessive harvests contributed heavily to the herd's rapid decline in the late 1960s and early 1970s.

Transport Methods. In the general hunt area (west of the Taylor Highway Corridor), 115 (95%) of 121 successful hunters used aircraft. The remaining 6 used off-road vehicles (ORVs) to reach the Kechumstuk Creek drainage 28 miles off the Taylor Highway.

In the Taylor Highway drawing permit hunt, most successful residents used three- or four-wheelers (46%), ORVs such as Tracksters or Argos (23%), highway vehicles (16%), aircraft (5%), and boats (4%). Four (7%) successful hunters did not specify access mode.

Successful subsistence hunters reported using highway vehicles (72%), walking (11%), snowmachines (8%), three- or four-wheelers (6%), aircraft (2%), or ORVs (1%). In recent years when a season was not open for the October road crossing, most successful subsistence hunters used three- or four-wheelers to hunt the Taylor Mountain, Chicken Ridge, and 103 Mile Trail systems in the early season.

Other Mortality: Predation remains the greatest source of mortality-controlling growth of the Fortymile Herd. Predation is responsible for the extremely conservative harvest rates (2-3%) prescribed to achieve stated population objectives for this important international herd. The herd did not begin to recover from its most recent historic low until the mid-1970's when a significant natural correction in the wolf population occurred. Deep snow accumulations during winters 1988-89 and 1989-90 reduced herd growth from 10% to 7%. Deep snows make caribou more vulnerable to wolf predation (Davis and Valkenburg 1985), thus increased losses to wolf predation during the past 2 winters probably contributed to the observed decline in the herd's growth rate. Incidental observations indicate increased wolf numbers in the past 2 years and pup production appears good in May 1990. If the growth rate of the Fortymile herd does not increase to 10% within the next 2 years, control of wolf predation should be considered to achieve the 50,000 population objective by the year 2000.

Habitat

Assessment: No direct range assessment work was conducted this report period. However, the current herd size compared with historical levels of 25-30 years ago indicates that habitat should not be controlling herd growth (Davis et al. 1978). Mean lengths of mandibles from caribou cows collected from hunters along the Taylor Highway in fall 1989 and relatively early calving dates (Table 5) indicate animals in good nutritional condition (Skogland 1985).

Enhancement: Implementing the Alaska Interagency Fire Management Plan in the early 1980s should assure a near-natural fire regime necessary for the long-term management of caribou range in interior Alaska.

Nonregulatory Management Problems/Needs

The greatest management problem with the Fortymile herd is the declining rate of herd growth and increasing demand for consumptive use of the herd by hunters. Whereas the annual increments to the herd available for herd growth and consumptive use averaged approximately 10% or more before 1988, the mean annual increment has declined to 7% this report period. If this trend continues, harvest quotas will be reduced, and the herd will not reach 50,000 by 1999. Necessary harvest reductions will contribute to greater controversy over allocation of a smaller harvest quota.

All residents of Alaska are now considered potential subsistence hunters. The demand for caribou by local residents (Northway, Tetlin, Tok, Eagle, Tanacross, and Dot Lake) alone is about 450. Although some of this demand can be met by the Nelchina herd, if residents of Fairbanks, Anchorage, and other roadside communities are included, the "subsistence" demand would greatly exceed the annual FCH increment.

The remoteness and inaccessibility of the FCH's range further complicates harvest management. If caribou are away from the road in the fall hunting season (as in 1989-90 and 1990-91), harvests fall far short of the quota and hunters (especially local residents) complain that they have no "reasonable opportunity" to hunt. If seasons are open during the Taylor Highway crossing in October, unacceptably high numbers of females may be harvested particularly if the female harvest quota remains at 0.5% because of a low herd growth rate.

The best solution to these related problems is to manage the FCH and its predators for a greater growth rate. Because predation is the main factor limiting herd growth (Valkenburg and Davis 1989), effective short-term wolf control and liberal grizzly bear seasons, especially on the caribou summer range, would result in faster herd growth. Presently wolves are "allocated" several-fold more caribou from the herd each year than are humans. As has been our experience in the past, especially in Subunit 20A, such a management program would be expected to provide remaining wolves with a much larger prey base which ultimately would support similar or greater numbers of wolves after a successful control effort.

Another nonregulatory problem with the FCH is that funding for basic herd monitoring is insufficient without continued supplementary funding from the NPS and the Yukon Department of Renewable Resources. Costs for annual fall composition surveys, photocensuses every other summer, and periodic radio-telemetry flights to determine seasonal concentrations and movement patterns increase more rapidly than base funding levels to the Tok area office. Neither the National Park Service nor the Yukon Department of Natural Resources has been willing to make long–term, stable funding commitments. Outside funds

are usually last-minute commitments of year-end monies left over from other projects. A recently completed study plan should provide better continuity and more stable outside funds.

Increased funding by ADF&G for necessary management activities and for management to increase herd size and associated human—use opportunities would be a good investment. Whereas the Nelchina and Delta caribou herds are close to or above long—term carrying capacity, the Fortymile herd is not. Full recovery of this herd to 50,000-100,000 or even higher levels could provide significantly increased use opportunities for Alaskan hunters, nonresident hunters, and nonconsumptive users who could enjoy a large, road-accessible caribou herd on both the Steese and Taylor Highways.

CONCLUSIONS AND RECOMMENDATIONS

The objective of maintaining a minimum growth rate of 10% until the herd reaches 50,000 was not met this report period. If the herd fails to achieve this objective in the future, I recommend initiating wolf control and implementing the reduced harvest quotas prescribed (2% of herd size and 0.5% of females).

The 3% harvest quota (641 in the 1989-90 season) was not exceeded and the reported cow harvest was also below the harvest quota for females (192), so these management objectives were achieved. The 1990-91 harvest quota was reduced to 450 in response to the diminished growth rate of the herd. It was not exceeded largely because of caribou distribution as caribou were accessible from the road for a short time in mid—October and late November.

The objective of providing subsistence harvest opportunities with a harvest quota when caribou are accessible from the Taylor Highway was achieved this report period by issuing an Emergency Order on 15 October 1989. Estimates of subsistence demand by local residents and harvest were obtained as a result of registration permit hunts #575W (Fortymile herd) and #562W (Nelchina-Mentasta herds). Caribou were readily available to nearly all local subsistence hunters along the Taylor (Fortymile herd) and Alaska (Nelchina-Mentasta herds) Highways for over a month in 1989-90, so presumably all subsistence hunters wanting caribou took one. Total subsistence demand (including all Alaskan residents) is unknown but is probably very large and varies from annually.

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Table 1. Fortymile Caribou Herd composition counts and estimated population size, 1985-89.

Date[a]	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
9/20-10/7/83	52	33	18	54	36	17	46	28	1,953	12,350
10/16/85	50	36	19	54	39	23	38	27	1,067	n.a.
10/13/86	36	30	17	61	35	24	41	22	1,381	15,303
9/28/87	40	37	21	57	13	43	44	22	2,253	n.a.
10/2-10/3/88	38	30	18	59	29	41	30	23	1,295	19,975
10/13/89	27	24	16	66	34	41	25	18	1,781	n.a.
9/27-9/28/90	44	29	17	58	42	39	19	26	1,742	22,766

[a] No fall data in 1984.

Table 2. Fortymile Caribou Herd harvest[a], 1985-90.

Regulatory year	Hunter harvest									Grand total
	Reported						Estimated			
	Total hunters	M (%)	F (%)	Unk	Total	Percent success	Unreported[b]	Illegal	Total	
1985-86	692	261 (100)	-	-	261	38	160	20	180	441
1986-87	582	223 (100)	-	-	223	38	137	20	157	380
1987-88	561	142 (100)	-	-	142	25	87	20	107	249
1988-89	965	399 (100)	2 (0)	-	401	42	244	150[c]	394	795
1989-90[d]	1,264	326 (77)	98 (23)	-	424	34	74	-	74	498
1990-91[e]	1,520	258 (92)	17 (6)	4 (2)	279	18	94	2	96	375

[a] Includes all harvests.

[b] Harvest from harvest reports corrected assuming 62% reporting rate for successful hunters based upon Taylor Highway patrols in 1984-85.

[c] Forty cows found abandoned within 50 yards of trails; 150 assumed taken.

[d] First year for drawing hunt #572 and registration hunt #575W in addition to the general hunt in western Subunit 20E and northern Subunit 20D. Hunter participation actually declined from 1988-89 levels according to field observations.

[e] Preliminary data (compiled 5 March 1991).

Table 3. Fortymile Caribou Herd harvest data by permit hunt, 1989-90.

Hunt No./ Area	Regulatory year	Permits issued	Total hunters (%)	Successful hunters (%)	Unsuccessful hunters (%)	Bulls (%)	Cows (%)	Unk	Total harvest
572 Taylor Highway Drawing	1989-90	750	519 (69)	57 (11)	459 (89)	57 (100)	0 (0)	-	57
575W Subsistence Registration	1989-90	681	490 (72)	290[a] (59)	200 (41)	148 (60)	98 (40)	-	246
Totals for all permit hunts	1989-90	1,431	1,006 (70)	347 (34)	659 (66)	205 (68)	98 (32)	-	303

[a] Includes successful permittees who took 44 Nelchina-Mentasta and a single Macomb caribou (31 bulls, 13 cows) in the hunt area in Unit 12 north of the Alaska Highway near Northway. These 44 caribou are not included in Fortymile harvest figures.

Table 4. Success by residency for subsistence hunters in Registration Permit Hunt #575W, Fortymile Caribou Herd[a], 1989-90.

Community	Total permittees	Number successful[a]	Number did not hunt or unsuccessful	Percent permittee success
Tok	378	151	227	40
Eagle	157	97	60	62
Northway	67	28	39	42
Chicken	24	5	19	21
Tanacross	23	3	20	13
Tetlin	5	0	5	0
Boundary	4	1	3	25
Dot Lake	4	2	2	50
Unknown/not returned	19	3	16	16
Total	681	290	391[b]	43[b]

[a] Includes harvest of 43 Nelchina-Mentasta caribou and 1 Macomb caribou in the Fortymile hunt area north of the Alaska Highway in Unit 12 near Northway (Macomb caribou near Cathedral Rapids).

[b] Of 391, 191 did not hunt and 200 were unsuccessful. Thus, 490 permittees actually hunted for a hunter success rate of 59%.

Table 5. Mandible length, peak calving date, and recruitment in the Fortymile Caribou Herd during recent population fluctuations.

	Population relatively high and declining (1960s and early 1970s)	Population low and increasing (late 1970s through 1990)
Mean female (older than 2 years) mandible length (mm)	277.0 (n = 19)	277.7 (n = 9)
Peak calving dates	21-23 May (1965) 28-29 May (1957) 25 May (1958) 23-27 May (1960) 25-27 May (1974)	22 May (1987) 22 May (1988) 20-21 May (1990)
Recruitment		
(calves:100 cows in fall)	19.3+1.1 SE, n = 4	32.3+2.0 SE, n = 10
(calves:100 cows in summer)	No data	40.0+1.9 SE, n = 9

LOCATION

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

Herds: Galena Mountain, Wolf Mountain, Ray Mountains

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 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 about 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 still occasionally migrates to this area in winter. The mid–May calving dates indicate that the animals are caribou. Local residents have been aware of these caribou herds for many years, but the herds were not surveyed by ADF&G until 1977.

There are 3 distinct calving areas, and therefore 3 recognized herds. Each herd is associated with and named for a mountain peak or mountains where the animals calve. The western group of 250-500 animals calves east of Galena Mountain and winters west of the mountain. The middle group calves on Wolf Mountain and winters north and east in the Melozitna and Little Melozitna Rivers overlapping with the Galena Mountain herd. The Wolf Mountain herd contains 250-500 animals. The eastern group calves on the north side of the Ray Mountains and winters throughout the Ray Mountains 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 in 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 frequently limit survey opportunities 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 cow harvest.

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 was previously under Western Arctic Caribou Herd regulations. Total reported and known unreported harvest from all 3 herds combined averaged less than 10 caribou per year over the last decade.

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

1. Ensure that harvest does not greatly restrict growth or cause a decline in population size.

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

Management Objectives

1. Determine the population size, trend, and identity of caribou herds in the Ray Mountains and Kokrines Hills by 1992.

2. 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.

3. 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 1988a). In April 1986, 11 female caribou were radio—collared on the winter range north of Galena.

Annual surveys with a Super Cub aircraft were conducted on the Galena Mountain herd in October from 1982 through 1988. In the Ray Mountains, fall and spring counts were conducted by S. Robinson from the Fairbanks BLM from 1983 through 1988. No surveys were conducted in 1989 or 1990. Hunting mortality was monitored from caribou harvest reports and interviews with local residents.

Wolf numbers were estimated during capture operations in April 1989 for a joint ADF&G/USFWS wolf study. The ranges of the Galena and Wolf Mountain herds were thoroughly searched for wolves. The Ray Mountains were not thoroughly searched because of poor snow conditions. Most of the area was out of the wolf project study area.

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 258 in June 1987 (Table 1). Its population trend is unknown. Although radio-collaring caribou in this herd was expected to help locate caribou for census during the October rut aggregation, use of radio collars has not helped find more caribou. However, radio collars revealed that during the rut, the herd uses habitat composed of fairly dense black spruce where counting caribou is difficult. Surveys or censuses of summer or postcalving aggregations may provide the best estimates of population size.

I estimate the population of the Wolf Mountain herd at 250-300 caribou, but the population trend is unknown. No winter surveys in the Wolf Mountain area have been conducted since 1983 (Table 2).

Based on an October 1987 survey, Robinson (1988b) estimated the population size of the Ray Mountains herd at slightly more than 500 caribou (Table 3). This survey was designed as a complete count, and all known upland ranges of the herd were flown. The herd's population trend 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).

Distribution and Movements:

Galena Mountain Caribou Herd. From the initial radio-collaring in 1986 to 18 December 1989, 30 aerial tracking flights of the 8 surviving radio-collared caribou were conducted, and 143 relocations were made. The movement data (Fig. 1) show that the Galena Mountain herd used a 2,542 mi^2 area. Males ranged farther west than most females, especially those with calves which stayed around the Holtnakatna Creek drainage. Caribou usually migrate toward alpine areas east of Galena Mountain in April. In May 1987 the radio–collared females without calves returned to lowland black spruce habitats, while those with calves were found in alpine areas. All caribou were in the alpine areas from June to September in all years. During October the caribou usually migrate from

the alpine areas across Galena Mountain toward the lake country around Hozatka Lakes. Most of this herd's previous fall population composition surveys have been conducted in the Upper Holtnakatna Creek area.

One radio-collared female behaved very differently from the other 7. In June 1987 it was found with a calf among a group of 100 caribou on Wolf Mountain, 75 miles east of its last location. In February 1988 the female was found west of Hozatka Lakes with the Galena Mountain Herd again. During summer 1988 it again calved on Wolf Mountain with about 100 other caribou. It appears, therefore, that Wolf Mountain and Galena Mountain winter ranges overlap.

Wolf Mountain Caribou Herd. Tracks encountered during surveys indicate a general migration pattern for the Wolf Mountain herd. The herd calves on the slopes of Wolf Mountain and spends most of summer in surrounding alpine habitat. During October it then moves north toward Lost Lakes on the Melozitna River. The herd's location during midwinter has not been determined recently, but in 1978 caribou were seen on the mountains north of the Melozitna River. In May caribou were observed scattered on a 30-mile track 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 Caribou Herd. There are no radio-collared caribou in the Ray Mountains, and movements of the Ray Mountains herd are not well known. Robinson (1988a) found the herd north of the Ray Mountains and south of the Tozitna River. Based on the trails he found, Robinson suspected that this herd migrates seasonally between the 2 areas. Also, during the joint BLM/ADF&G surveys in late October 1984, caribou were seen traveling south across the Dalton Highway near Old Man. Several hundred caribou had used the mountains north of the Dalton Highway during the rut, and tracking was continuous from there to the vicinity of Kilo Hot Springs. During a 4-hour survey on 20 May 1988, P. Valkenburg found 37 cows scattered within a 30-mile radius west, north, and east of Kilo Hot Springs. He estimated the calving peak at about 16 May because 21 of the cows were without antlers and 24 were accompanied by calves.

During late October and early November 1988 approximately 3,000 caribou from the WACH migrated from the Nulato Hills onto the Koyukuk lowlands north of Galena. The majority of these caribou were slightly west of the wintering area of the Galena Mountain herd. A radio-tracking flight on 25 November 1988 found 3 of the 4 radio-collared caribou east of WACH animals. One radio-collared animal was mixed with WACH animals. Caribou remained in the area at least until late February 1989.

Mortality

Harvest: During the 1989-90 hunting season, 5 caribou were reported taken (Table 4), 4 from the Ray Mountains and 1 from the Melozitna River. Hunter access to the Ray Mountains herd during 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 in winter. The season there has been closed during this time to limit potential for a serious overharvest. The Wolf Mountain herd is almost never accessible for hunting because of scarce aircraft landing areas. Hunter success in all 3 herds is limited (Table 5).

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

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 10 Aug-30 Sept season, or a caribou of either sex may be taken during the 1 Mar-15 Mar season.	10 Aug-30 Sept 1 Mar-15 Mar	10 Aug-30 Sept 1 Mar-15 Mar
Nonresident hunters: One bull.	10 Aug-30 Sept	
Unit 21, except Unit 21(D) west of the Yukon and Koyukuk Rivers. One caribou.	10 Aug-30 Sept	10 Aug-30 Sept

Units and Bag Limit	Subsistence Open Seasons	Resident/ Nonresident Open Seasons
Unit 24, the Kanuti River drainage upstream from Kanuti, Chalatna Creek, and the Fish Creek drainage,	10 Aug-30 Sept	10 Aug-30 Sept

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.

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. No action occurred within the report period.

Other Mortality: Judging from fall calf percentages (Tables 1-3), natural mortality of caribou calves is high in all 3 herds. Grizzly bears and wolves are probably the primary summer predators. In 1989-90, there were 60-75 wolves in 6-8 packs in the Unit 24, Subunit 21C, and Subunit 21D Galena and Wolf Mountain caribou ranges. There was a minimum of 1 pack of 5 wolves in the southern Unit 24 and Subunit 20F Ray Mountains caribou range.

Of 11 adult female caribou radio-collared north of Galena in late winter 1986, 3 died of drug-related problems during capture and 4 died of natural causes between April 1986 and April 1989. All 4 caribou died during the summer in the mountainous areas east of Galena Mountain. No dead caribou were necropsied. Ages of radio-collared caribou that died were unknown.

CONCLUSIONS AND RECOMMENDATIONS

The mountains between Galena and the West Fork Chandalar River on the north side of the Yukon River contain from 1,000 to 2,000 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 expanding the herds to a large enough size so that they become more accessible to hunters in fall. Predation probably restricts herd growth; lichen ranges are lush and the early calving date for the Ray Mountains herd indicates good nutrition.

If hunting seasons are liberalized to allow harvest from WACH in Subunit 21C east of the Koyukuk River, the Galena Mountain and Wolf Mountain Caribou Herds will need protection from overharvest. This can be done by maintaining a closed season when the WACH is absent from areas frequented by these 2 resident herds. To know when this separation from the WACH occurs, I recommend radio-collaring caribou again in the Galena and Wolf Mountain herds. In addition, once radio collars are in place, late June to early July censuses should be attempted to see if better population estimates can be obtained. 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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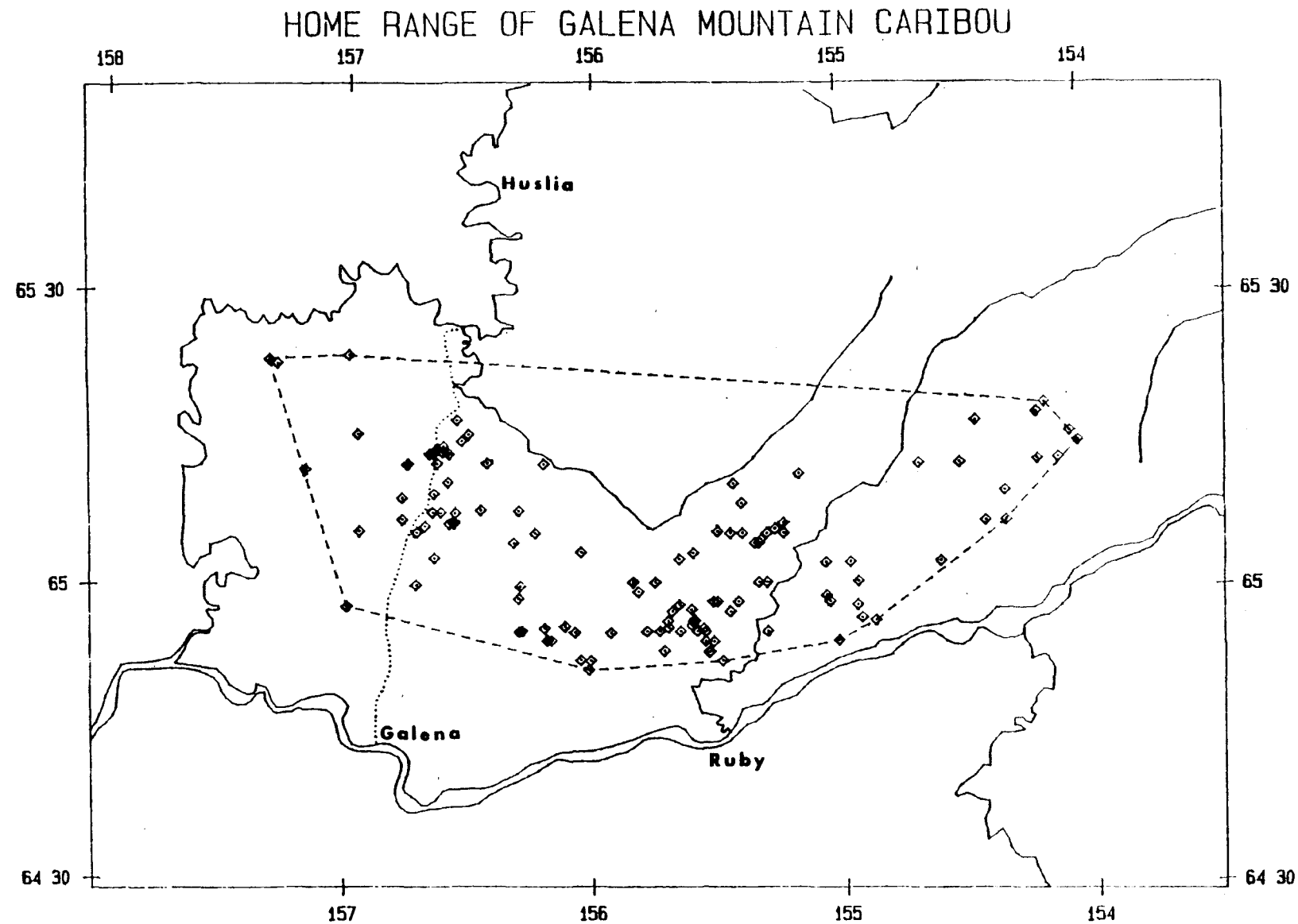

Figure 1. Home range of the Galena Mountain Caribou Herd, 1986-89.

Table 1. Aerial counts of the Galena Mountain Caribou Herd, 1978-90.

Date	Adults	Calves (%)	Bulls	Total
Aug 1978	--	--	--	50
Mar 1982	--	--	--	85
May 1982	--	--	--	77
Jul 1982	--	--	--	18
Feb 1983	--	--	--	85
Oct 1983	113	23 (17)	--	136
Nov 1983	47	8 (14)	--	55
Oct 1984	146	7 (4)	28	181
Jan 1985	--	--	--	20
Apr 1985	197	29 (13)	--	226
May 1985	66	26 (28)	--	92
Oct 1985	153	32 (17)	--	185
Oct 1986	21	8 (17)	18	47
May 1987	88	8 (9)	--	96
Jun 1987	214	44 (21)	--	258
Jul 1987	21	6 (22)	--	27
Aug 1987	7	1	--	8
Oct 1988	81	14 (12)	22	117
No surveys 1989 or 1990				

Table 2. Aerial counts of the Wolf Mountain Caribou Herd, 1978-90.

Date	Adults	Calves (%)	Total
Jan 1978[a]	170	13 (8)	183
Aug 1978	--	--	50
May 1982	111	--	19
Oct 1982	42	14 (18)	21
May 1983	15	--	15
Oct 1983	114	39 (24)	10
Nov 1983	18	2	11
Apr 1985	180	35 (16)	215
May 1985	46	6 (11)	52
May 1987	60	20 (25)	80
Jun 1987	118	32 (27)	150
No surveys 1988-90			

[a] From Hochandochtla and Zitna Mountains on the north side of Melozitna River.

Table 3. Aerial counts of the Ray Mountains Caribou Herd, 1977-90.

Date	Adults	Calves (%)	Total
Apr 1977	--	--	175[a]
Apr 1983	--	--	164
May 1983	29	8 (22)	37
Nov 1983	333	67 (17)	400
Apr 1984	338	49 (13)	387
May 1984	130	38 (23)	168
Oct 1984	444	63 (12)	507
Apr 1985	305	18 (10)	323
May 1985	93	5 (5)	98
May 1986	70	5 (7)	76
Oct 1986	--	--	200[a]
Nov 1986	148	19 (11)	167
May 1987	61	8 (12)	69
Oct 1987	457	54 (11)	511
May 1988	158	21 (12)	179
No surveys 1989 or 1990			

[a] Incomplete survey.

Table 4. Reported harvest of resident caribou in Subunits 20F, 21C, 21D, and 24, 1981-89.

Year	Ray Mountains	Galena Mountain	Wolf Mountain
1981	6	0	0
1982	0	1	1
1983	7	0	0
1984	0	2	0
1985	3	0	0
1986	0	0	0
1987	1	0	0
1988	2	6	0
1989	4	1	0

Table 5. Galena Mountain, Wolf Mountain, and Ray Mountains caribou hunter residency and success, 1985-90.

Regulatory year	Successful[a]				Unsuccessful[a]				Total hunters
	Local resident	Nonlocal resident	Nonresident	Total	Local resident	Nonlocal resident	Nonresident	Total	
1985-86	--	--	--	3	--	--	--	0	3
1986-87	--	--	--	0	--	--	--	0	0
1987-88	--	--	--	1	--	--	--	4	5
1988-89	--	--	--	10	--	--	--	12	22
1989-90	3	1	1	5	3	14	0	17	22

[a] No data for 1985-86 through 1988-89.

LOCATION

Game Management Unit: 21D, 22A, 22B, 23, 24, 26A (140,000 mi^2)

Herd: Western Arctic

Geographical Description: Northwest Alaska

BACKGROUND

The Western Arctic Caribou Herd (WACH) currently ranges over 140,000 square miles of remote, mountainous, boreal, and tundra habitats in northwest Alaska. In recent years, the main body of the herd has calved and summered on the North Slope in GMU 26A. Large numbers of WACH animals have wintered in the southern portion of GMU 23, and the eastern portion of GMU 22.

Historically, the WACH fluctuated greatly in size. Herd size was estimated at 240,000 caribou during the 1970s (Hemming 1971). By 1976, herd size had declined to about 75,000 caribou (Davis and Valkenburg 1978). Results of biennial photocensuses conducted since 1975 indicated that the WACH has grown steadily at rates varying from 7 to 22% annually (Larsen et al. 1990). Results of the most recent photocensus conducted in July 1988 indicated that the herd numbered at least 343,167 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

1. Maintain a postcalving 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 managing 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

As documented in past progress reports, VHF radiotelemetry was used to facilitate the collection of most WACH survey and inventory data. We have attempted to maintain a minimum of 100 functional radio collars on WACH animals since 1987. During late August and early September 1989, 42 female caribou crossing the Kobuk River near Onion Portage were captured and instrumented with VHF radio collars manufactured by Telonics, Inc. (Mesa, AZ). Details concerning the radio-collaring technique were described by Larsen and Machida (1989).

Two of the radio collars were also equipped with platform satellite transmitters (PTT) manufactured by Telonics, Inc. The life expectancy of the PTTs was 18-24 months, and both radio collars were programmed to transmit location, temperature, and activity data. Information concerning radio collar specifications and duty cycles, previous use of PTTs on WACH animals, and data retrieval was provided by Fancy et al. (1988) and Larsen and Machida (1989).

During late April and early May 1990, short yearling composition surveys were conducted in GMU 23 using a Piper PA-18 aircraft while caribou migrated from wintering areas in GMUs 22 and 23 to calving areas in GMU 26A. Radiotelemetry was used to locate radio-collared animals, and up to 200 caribou in the immediate vicinity of the radio-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 11-13 June 1990 to assess parturition rates. Radio-collared female caribou were first located using radiotelemetry, and each was classified by the presence or absence of hard antlers and whether accompanied by a newborn calf. The size of the group accompanying the radio-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. Up to 200 caribou (except large bulls) in the immediate vicinity of each radio-collared animal were classified as either adults or calves.

During fall and winter, ADF&G staff, in cooperation with NPS, USFWS, and BLM staff, periodically conducted radiotelemetry flights to assess herd distribution and winter range use. In most cases, flights were conducted at altitudes of 8,000 to 10,000 ft. to obtain maximum signal reception range and only generalized relocations were obtained. Flights were conducted in GMUs 22A, 22B, 23, 26A, and in portions of GMUs 21D and 24.

In late August and early September 1989, mandibles were collected from hunter-killed bull caribou on the Kobuk River to evaluate caribou nutritional status. Mandibles were also collected opportunistically during the 1989-90 winter. Mandible length, length of tooth rows, and diastema and mandible heights were later measured and catalogued.

Information concerning the number of WACH animals killed by hunters was collected using the statewide caribou harvest reporting system, and the local WACH harvest registration system. Harvest information from both systems was gathered and catalogued.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The WACH has increased dramatically in size since 1976 when the herd was estimated at a minimum 75,000 caribou (Table 1). The most recent photocensus conducted in 1988 indicated the herd contained a minimum of 343,167 caribou, an over 4-fold increase during a 12-year period. The photos obtained during the 1988 census were of good quality, and the population estimate is relatively accurate compared to previous photocensuses. The annual increase rate averaged 14% and has varied from 7.5 to 22% during the 12-year period.

One question we are commonly asked about is how large we anticipate the WACH will grow before decline occurs. Our current management objectives stipulate that we will attempt 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 to manage for. If we use 140,000 square miles as an approximate minimum size of the overall WACH range, herd density has increased from 0.5 caribou/mi^2 in 1976 to 2.4 caribou/mi^2 in 1988 (Larsen et al. 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). Reports of some overwinter mortality caused by starvation have come in from the North Slope in eastern GMU 26A indicating that WACH densities may be excessive in at least some range portions.

Even if we could adequately predict an upper size limit for the WACH, we could not effectively reduce herd size using the management tools we have available because of the large size and remoteness of the herd. Hunting seasons and bag limits are already extremely liberal and hunter harvests cannot be increased a significant amount.

Population Composition: Spring composition surveys were conducted in portions of GMU 23 in late April and early May 1990 while caribou migrated north to the calving grounds. A total of 6,429 caribou were classified, yielding a composition count of 23 short yearlings per 100 adults (Table 2). 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 excellent.

The proportion of short yearlings observed is within the range of 22 to 32 short yearlings:100 adults observed since 1977. No trend in short yearling survival appears from reviewing recent years' data. 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 inadequate for detecting small 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 populations densities similar to the WACH experienced a decline in short yearling recruitment (8%) which was measurable using standard techniques (Couturier et al. 1988).

Calving ground surveys were conducted in GMU 26A during 11-13 June 1990. 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. Although extensive areas south of the Brooks Range were surveyed, all radio-collared cows were found north of the Brooks Range in GMU 26A west of Driftwood Creek. Most of the radio-collared cows were located 40-50 miles west of Carbon and Disappointment Creeks in the same areas they were located in June 1989. Composition counts on the calving grounds yielded a total of 7,510 caribou (4,860 adults and 2,650 calves) and a calf:adult ratio of 55 calves per 100 adults.

Seventy-eight radio-collared caribou were located and 71 were observed during the 1990 calving ground survey (Table 3). Seventy-two percent of the radio-collared cows seen were accompanied by calves. During the June 1989 calving ground survey, 68% of the radio-collared cows located were accompanied by calves, a difference of only 4%. Substantially fewer calves were observed during surveys conducted in June 1988. Because the 1988 surveys were completed earlier in the month before peak calving, these data are not directly comparable. In 1989 and 1990, calving was largely completed at the time the survey began.

Distribution and Movements: In October and November 1989, 7 radiotelemetry flights were conducted to assess the early winter distribution of WACH caribou. One-hundred-twenty-six relocations were obtained in an area which encompasses GMU 23, the southern portion of 26A, and the eastern portion of GMU 22. As observed during the previous 5 years, over half the relocations (57% were south of the Selawik Hills indicating that

sizeable numbers of caribou continued to winter in the Buckland Valley and Nulato Hills. We did not conclude, however, that over half the WACH wintered south of the Selawik Hills. Because many relocated caribou were initially radio-collared while migrating to southerly wintering ranges in September 1990, the number of radio-collared animals subsequently found in the Nulato Hills was higher than expected. In addition, this area is surveyed more frequently by aircraft conducting radio-tracking flights thereby increasing the number of times radio collars could be located.

An additional 117 relocations were obtained during 6 telemetry flights conducted during January through March 1990. These flights were conducted primarily in the Buckland Valley and the Nulato Hills in southern GMU 23, western 21D, and portions of GMUs 22A and 22B. Most of the radio-collared animals were concentrated in the Ungalik, Inglutalik, and Shaktoolik River drainages. As observed in previous years, caribou remained in this area during winter before moving north in early April 1990.

On 2 September 1989, 2 caribou cows were radio-collared with PTTs while crossing the Kobuk River near Onion Portage. Both animals wintered in the Nulato Hills east of Shaktoolik (Figure 1 and 4). Only 1 of these animals (No. 10907) migrated to the North Slope calving grounds in spring 1990. The other animal (No. 7870) died in late May near the headwaters of the Tagagawik River in southern GMU 23. We could not determine cause of death.

Two other caribou (No. 7871 and 10906) were radio-collared with PTTs in previous years at Onion Portage. Caribou 7871 was radio-collared in September 1987 and caribou 10906 was radio-collared in September 1988. As noted in the last progress report, both animals wintered in the Nulato Hills east of Shaktoolik during the 1988-89 winter (Figures 5 and 6). However, during 1989-90, caribou 7871 wintered in the Brooks Range near the headwaters of the Kobuk and Noatak drainages (Figure 3). The PTT subsequently stopped transmitting after the animal arrived at the Utukok River calving grounds in late May 1990. Caribou 10906 wintered on the North Slope in the eastern portion of GMU 26A in the Colville River drainage, and died near Umiat in late February 1990. Again, we could not determine cause of death.

At the end of the report period, approximately 100 WACH radio collars were functional. If we assume that herd size has changed little since 1988, only about 3 caribou per 10,000 animals were radio-collared. If we wish to improve our ability to assess caribou distribution, particularly during winter, additional caribou should be radio-collared at other locations in addition to Onion Portage. Because radio-collaring has occurred only at Onion Portage in the last decade, only caribou en route to southerly wintering areas were available for radio-collaring. We recommend additional radio-collaring of animals in the Noatak drainage and on the North Slope.

Mortality

Seasons and Bag Limits: The hunting season for bulls in GMU 22A, 22B, 23, 24, 26A and western 21D was open all year. The season for cows in the same area was open only from 1 July to 15 May. The bag limits 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 1989-90 reported harvest is 1,485 caribou, 33% less than the 2,226 caribou reported in 1988-89 and 63% 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 used the local WACH registration system declined from 998 reported in 1986-87 to 573 in 1989-90 (Table 5). The success rate among local hunters also declined from 52% in 1985-86 to 35% in 1989-90.

Reasons for the steady decline in reported harvest, hunter participation and success during the past 5 years are not clear. Reported harvests in all 5 GMUs encompassing the range of the WACH have declined. The number of caribou harvested annually is related more to caribou distribution than population size. Harvests normally increase when caribou move near population centers. Because caribou have wintered further south and east than previously reported, caribou may not have always been available to hunters at opportune times.

Because harvest reporting rates remained poor in northwest Alaska, we cannot be certain whether declines in reported harvests represent either an actual harvest decline or poorer reporting rates. Because hunter success rates declined along with reported harvests, perhaps fewer people are actually hunting caribou.

Hunter Residency: The bulk of the reported harvest from the WACH registration system is taken predominantly by local hunters (85%) residing within the WACH range. An additional 198 caribou reported under the statewide harvest ticket system were taken by non-local hunters and accounted for 13% of the harvest. Harvests reported by the statewide system during the past 5 years remained remarkably stable through the 1988-89 regulatory year. The increase noted for 1989-90 was probably caused by eliminating the Eastern Arctic reporting system, and does not represent an actual increase in harvest by non-local hunters.

Harvest Chronology: Because harvest dates are not requested on the WACH harvest report form, detailed data concerning the harvest chronology is unavailable. We believe harvest patterns documented in past progress reports did not change significantly. Caribou taken in fall are harvested primarily in late August through early October. Caribou taken in winter are primarily harvested January through April.

Habitat Assessment

As the WACH increases in size, many individuals are concerned about possible habitat deterioration. Reports of sporadic mortality caused by starvation among caribou wintering on the North Slope in 1989-90 heightens our concerns of deteriorating range conditions. Because of the enormous expense involved and the remoteness of most WACH ranges, extensive range inventory work was not conducted in recent years. Future prospects of declining budgets and reduced staffing make it unlikely that meaningful range assessment work will be initiated in the immediate future.

However, assessment of various body characteristics such as mandible and diastema measurements can provide indications of herd nutritional status. During 1989-90, additional mandibles were collected from hunter-killed caribou during fall and winter as part of an ongoing project to document changes in nutritional status and body size which can occur over time. Preliminary evidence indicated that WACH animals may now be significantly larger than observed in the 1960s when mandibles were last collected. More complete reporting of the results of this project will be included in future progress reports.

Assessment of animal body and physiological condition can also provide data for monitoring herd nutritional status and range condition. DelGuidice et al. (1989) outlined a field technique using urinalysis for assessing body condition of deer and reindeer which may be applicable to caribou. Urinalysis can be conducted on samples of caribou urine deposited in snow. Animals that are nutritionally stressed will show declining ratios of potassium, sodium and urea to creatinine in their urine. These elements are increasingly recycled as the quantity and/or quality of forage declines in winter. The use of ratios compensates for the dilution effects of snow, and the technique is more sensitive to body condition than blood analysis. The technique certainly warrants comprehensive testing as a method for tracking body condition in caribou.

CONCLUSIONS AND RECOMMENDATIONS

The WACH has continued to grow at a rate of 7.5-22% annually since 1976. A photocensus conducted in 1988 indicated that the herd attained a minimum size of 343,167 caribou. Survey and anecdotal information collected during 1989-90 indicates the herd probably increased. Results of a photocensus conducted in July 1990 will be published in the next progress report.

A management problem that has not been adequately resolved is poor harvest reporting. Anderson and James (1986) estimated that reported harvests may account for as little as 25% of the actual harvest. Reports from local GMU 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. Additional efforts to improve harvest reporting rates are recommended.

As the WACH has increased in size, conflicts with the reindeer herding industry have become more substantive. ADF&G staff should continue to work with the herders and industry representatives to minimize conflicts between caribou and reindeer, informing herders of known significant caribou movements in and adjacent to reindeer ranges.

Herd nutritional and range status are becoming important concerns as herd size increases. Because range studies traditionally were conducted by various land management agencies such as the BLM and the USFWS, ADF&G should encourage the development of an adequate range assessment program among these and other land management agencies. Because these types of studies tend to be quite costly, a range assessment program will need to be a multi-agency effort. In addition, I recommend further development of a program to track body condition of WACH animals.

As previously mentioned, use of radio-collared animals has greatly enhanced our ability to conduct survey/inventory work on the WACH. Radio-collaring additional animals will improve our ability to conduct the photocensus if herd size continues to increase. Additional radio-collared animals will also improve our assessment of winter range distribution. If we wish to better account for winter use of northern GMU 23 and the North Slope, I recommend radio-collaring additional 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. No changes in seasons or bag limits are recommended at this time.

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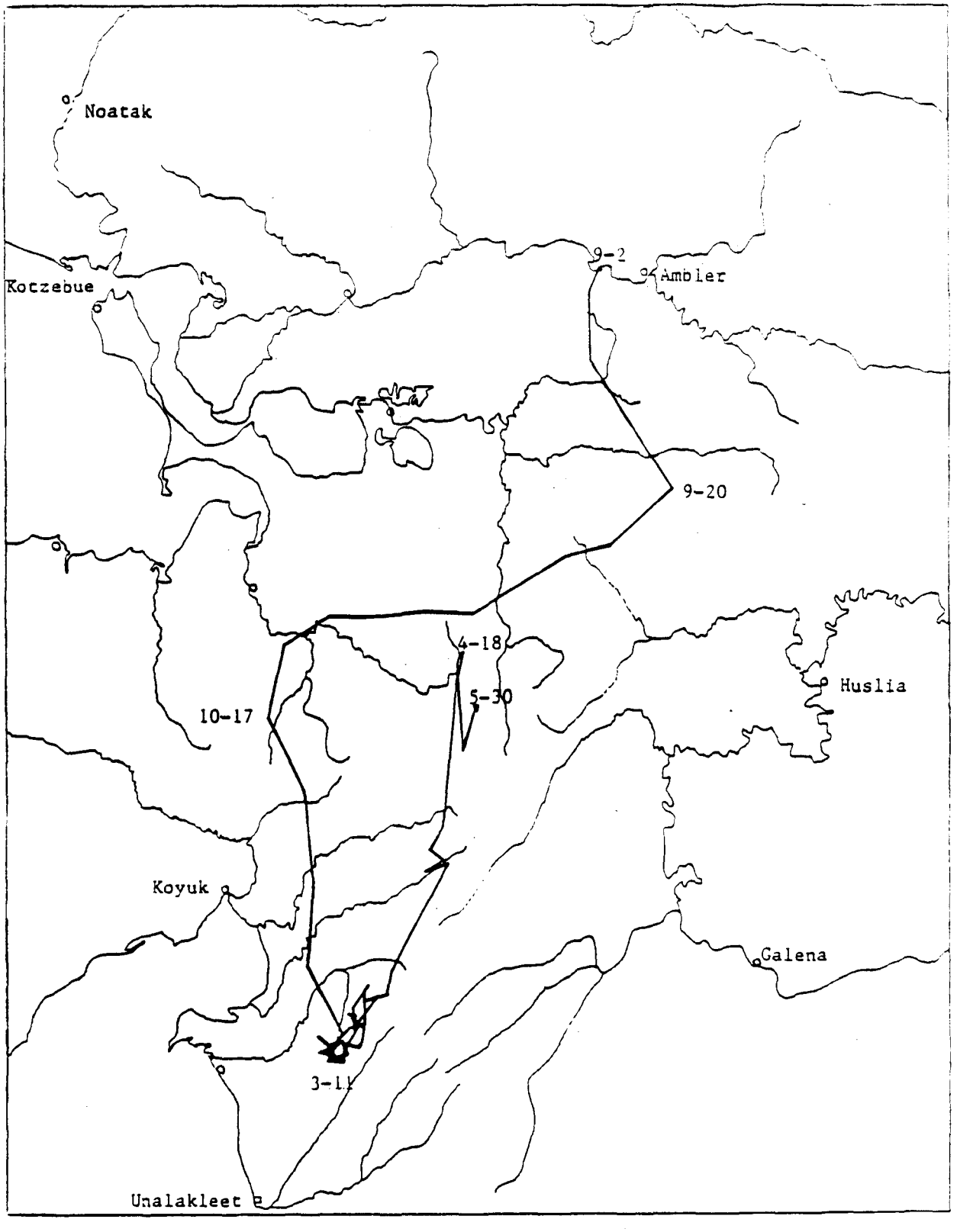

Figure 1. Movements of satellite radio-collared cow caribou (No. 7870) from September 2, 1989 to May 30, 1990.

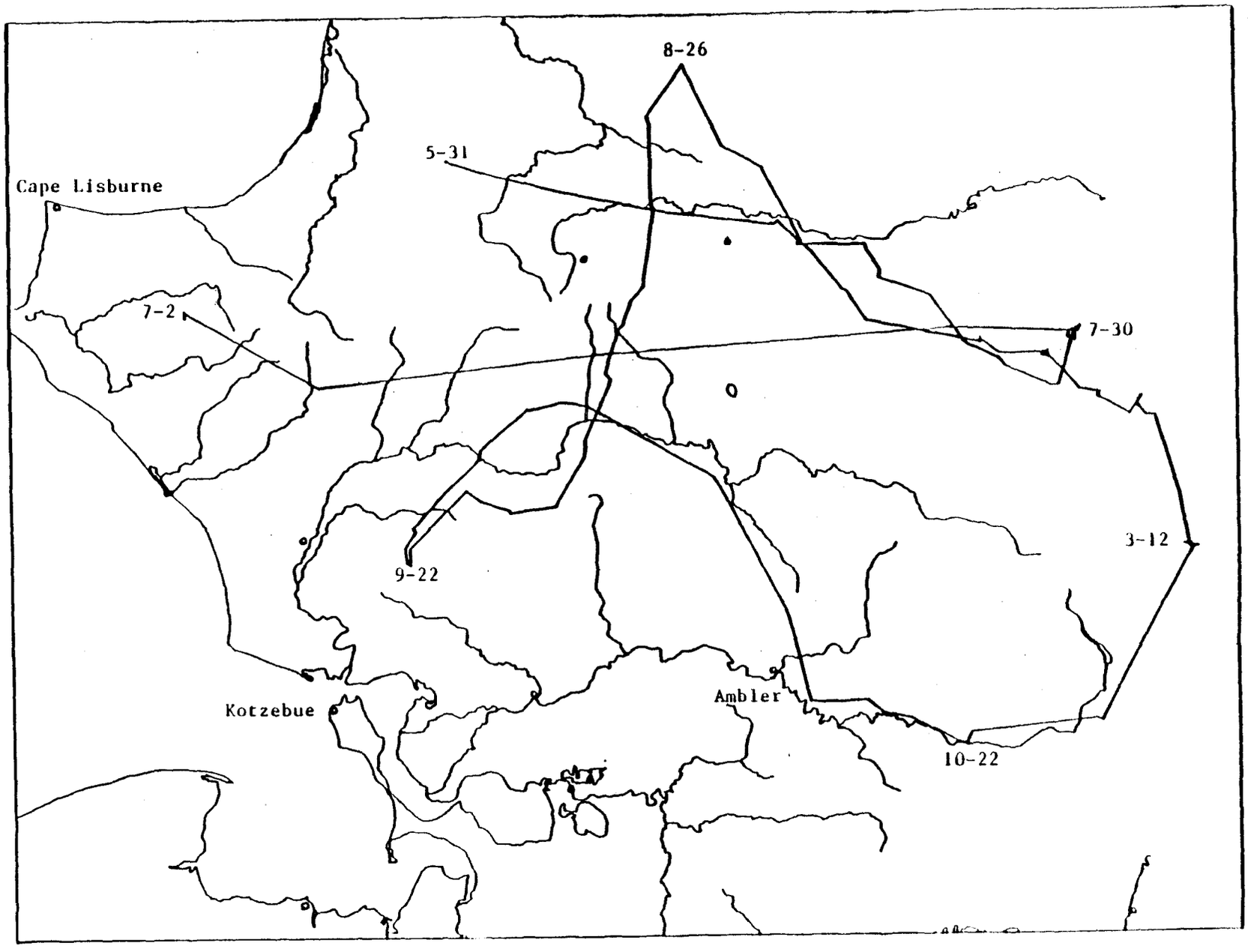

Figure 2. Movements of satellite-collared cow caribou (No. 7871) from July 2, 1989 to May 31, 1990.

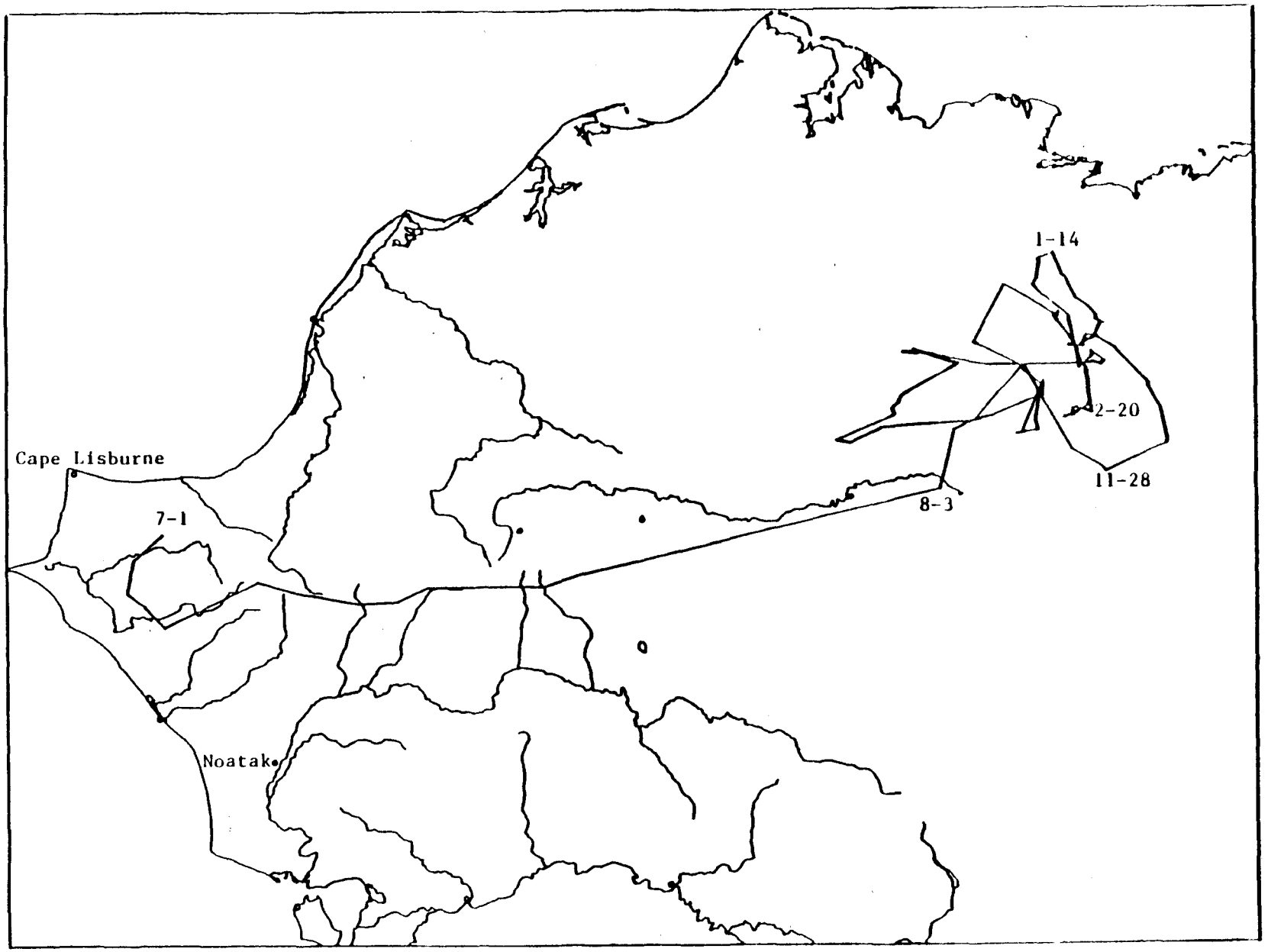

Figure 3. Movements of satellite-collared cow caribou (No. 10906) from July 1, 1989 to February 20, 1990.

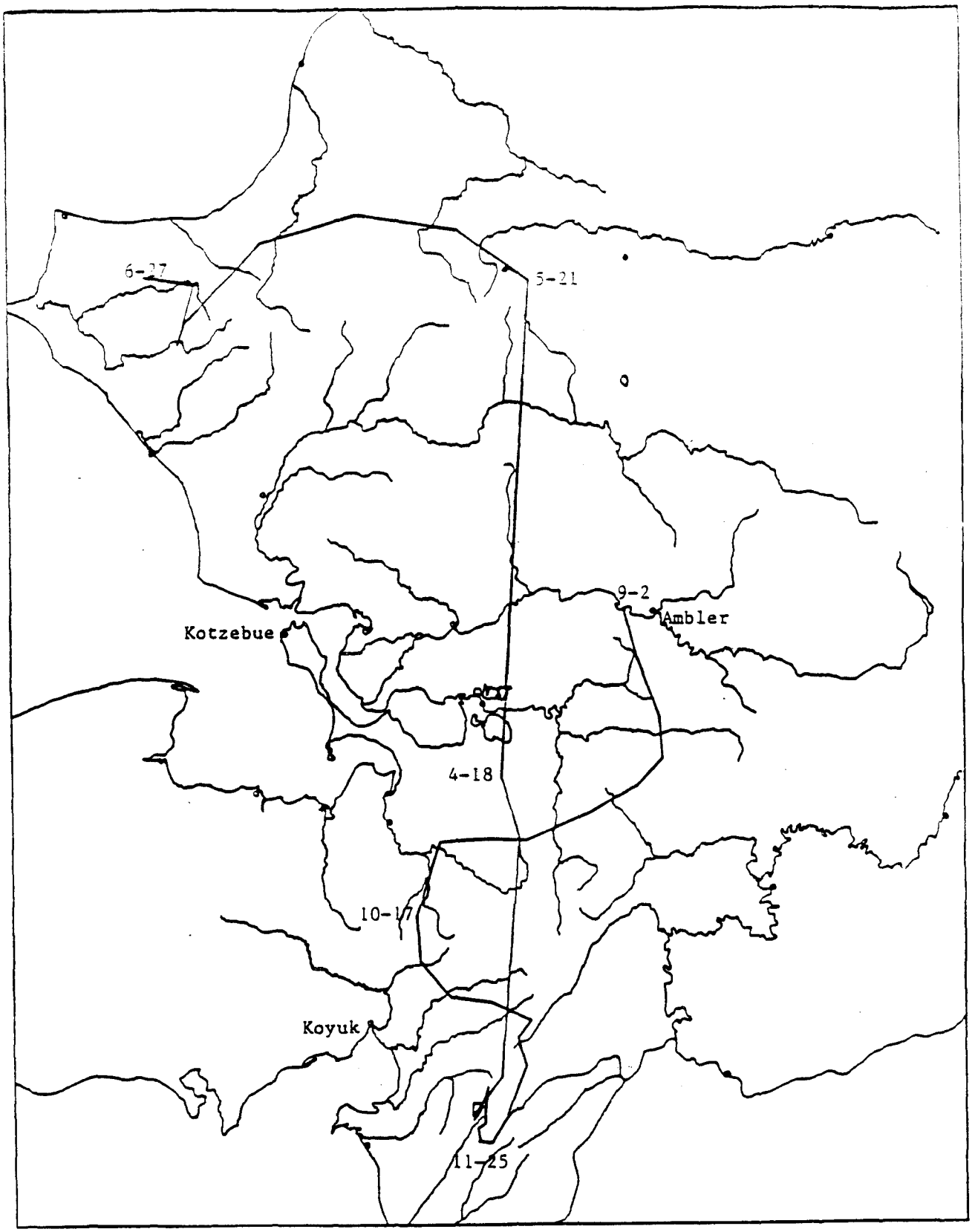

Figure 4. Movements of satellite-collared cow caribou (Np. 10907) from September 2, 1989 to June 27, 1990.

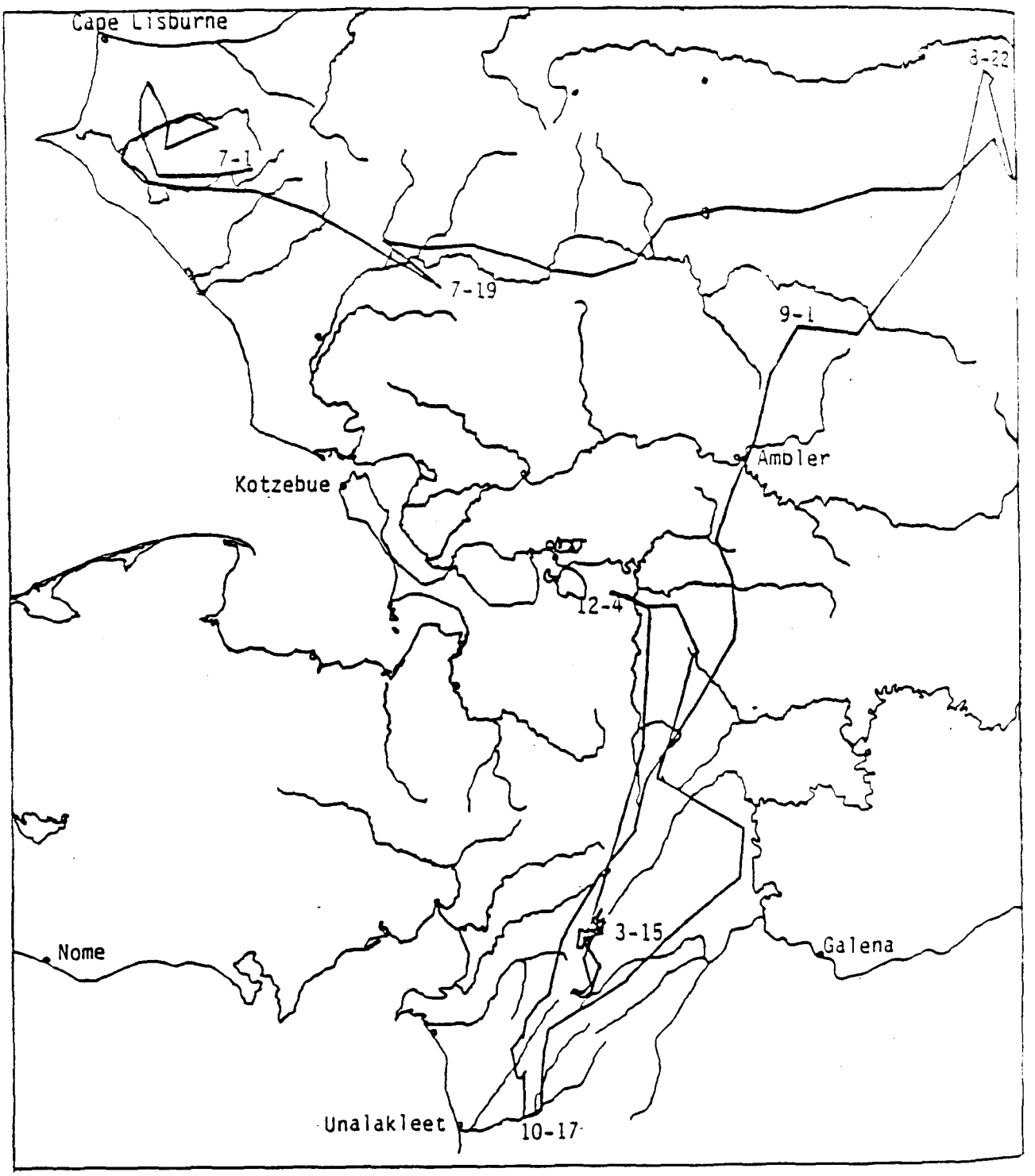

Figure 5. Movement of satellite-collared cow caribou (No. 7871) from July 1, 1988 to March 15, 1989.

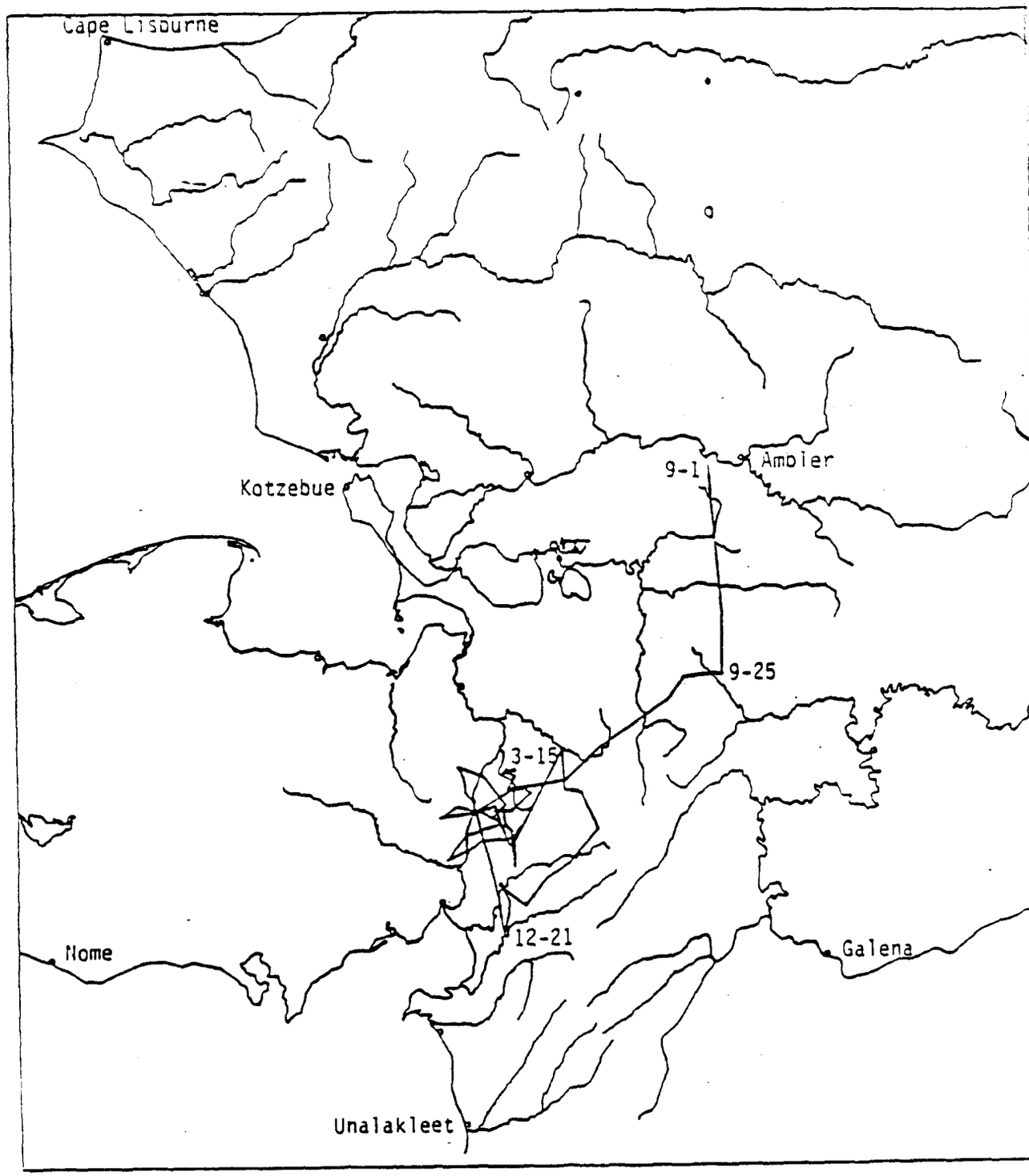

Figure 6. Movement of satellite-collared cow caribou (No. 10906) from September 1, 1988 to March 15, 1989.

Table 1. Population estimated, average annual rates of change, and density of the WACH, 1976-1988.

Year	Population estimate	Average annual rate of change (%)	Density (caribou/mi^2)[b]
1976	75,000[c]		0.5
1978	106,635	19.5	0.8
1980	138,000	13.8	1.0
1982	171,699	11.5	1.2
1986	229,433	7.5	1.6
1988	343,167	22.3	2.4

[a] $\frac{\ln [Nt + t_1] - \ln [Nt]}{t} = r$ e^r = annual rate of change.

[b] Based on an estimated range size of 140,000 mi^2.

[c] Davis and Valkenburg 1978.

Table 2. Spring composition data for the WACH, 1986-1990.

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

Table 3. Number of radio-collared cows visually observed with calves during calving ground surveys, 1988-90.

Year	Cows w/calf	Cows w/o calf	Total cows	% cows w/calf
1988	26	27	53	49
1989	34	16	50	68
1990	51	20	71	72

Table 4. Reported harvest of WACH caribou for 3 non-overlapping harvest reporting system.

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	123	2,226
1989-90	660	1,287	-	198	1,485

[a] The Eastern Arctic reporting system was eliminated in 1989.

Table 5. WACH harvests reported by local residents from fall 1985 to spring 1990.

Year	No. of successful hunters (%)	No. of unsuccessful hunters (%)	Total hunters	Total harvest	Caribou\ successful hunter
1985-86	513 (52)	480 (48)	993	3,668	7.2
1986-87	454 (45)	544 (55)	998	3,545	7.8
1987-88	315 (40)	463 (60)	778	2,337	7.4
1988-89	302 (35)	550 (65)	852	1,828	6.1
1989-90	192 (34)	381 (66)	573	1,198	6.2

Table 6. WACH caribou annual hunter[a] residency and success, 1985-89.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[b] resident	Nonlocal resident	Nonresident	Total	(%)	
1985-86	513	52	37	592	(51)	476	90	14	480	(49)	1,172
1986-87	453	39	21	513	(44)	544	70	26	640	(66)	1,153
1987-88	315	9	51	375	(40)	462	53	40	555	(60)	930
1988-89	302	30	18	350	(35)	550	63	31	644	(65)	994
1989-90	195	12	22	229	(35)	278	37	16	431	(65)	660

[a] Data taken from WACH hunter registration system.
[b] Resident of Unit 21, 22, 23, 24, or 26.

Note for use of table: Permit hunt harvest should not be excluded of nonpermit harvest is small. Use footnote to indicate whether tables includes permit hunt harvest.

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, the Yukon and Northwest Territories of Canada. The herd range covers approximately 130,000 mi^2, most of which is remote roadless wilderness. Most 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. Consequently, 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 should development occur.

An International Porcupine Caribou Board was recently established to coordinate management and research among governmental and user groups in Alaska and Canada. Results of Board recommendations, research studies, and the actions of Congress about opening ANWR to further exploration and/or development will probably influence how the herd is managed to provide for a variety of uses.

PCH size remained more stable than other Alaskan herds during the 1960's and 1970's at about 100,000 caribou (Table 1). However, in 1979 the population began a steady increase and reached 165,000 caribou by 1987. Annual growth rates averaged about 5% from 1979 to 1987.

MANAGEMENT DIRECTION

Despite its large size, the PCH's remote location and the small number of Alaskans who harvest from it resulted in the herd being a low management priority for ADF&G until recently. However, the increasing possibility of oil development in northeast Alaska and increasing international interest in the herd have resulted in higher management priority and increased attention from biologists (Garner and Reynolds 1986). ADF&G's existing management goals are to provide for optimum 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 have been proposed by the International Porcupine Caribou Board.

1. 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. Ensure opportunities for customary and traditional uses of the PCH.

3. Enable users of the PCH to participate in the international coordination of conservation of the PCH and its habitat.

4. Encourage cooperation and communication among governments, users of the PCH, and others to achieve these objectives.

METHODS

Population size was estimated by an aerial photocensus conducted in July 1989. Movements, productivity, mortality, and seasonal distribution were determined from observations of radio-collared caribou. Composition counts were conducted during the census, but were confined primarily to the cow/calf segment of the herd. Composition counts conducted in April 1990 estimated overall herd sex/age structure as well as overwinter survival of calves.

Reports submitted by nonsubsistence hunters provided most of the data on harvest in Alaska. Subsistence harvest data were gathered by Subsistence Division of ADF&G or opportunistically through field interviews. Harvest figures from Canada were obtained from the Yukon Department of Renewable Resources.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Population size of the PCH continues to increase; there were 187,944 caribou counted in the July 1989 census. However, some Central Arctic herd (CACH) caribou were mixed with the PCH (Golden 1990), and the final 1989 estimate for the PCH was revised to 178,000 (Table 1). The mean rate of increase from 1979 to 1990 was 5% per year.

Population Composition: The calf:cow ratio observed in July 1989 (45.5:100 cows) was lower than the long-term mean of 54.8:100 cows compiled from midsummer composition

counts from 1972 to 1988 (Table 2). The calf:cow ratio noted in April 1990 was 43:100 cows (Table 3).

No sex and age composition data were obtained for several large aggregations of caribou photographed in the mountains during the July census. It was clear from aerial observation and the distribution of radio-collared animals that these groups were predominantly bulls. Therefore, the bull:cow ratios from July were unreliable. In April, the herd was split into 3 wintering concentrations, and all were sampled for composition. Although composition varied from location to location within each wintering area, the overall composition in all 3 areas was nearly identical. The bull:cow ratio (63:100) was probably the most reliable estimate obtained since October 1980 (Tables 4 and 5). It is also identical to the mean bull:cow ratio for all composition counts which sampled the entire herd from 1972 to 1990, indicating that the adult sex ratio has probably remained fairly constant for nearly 20 years.

Distribution and Movements: Previous movements and distribution of the PCH were summarized by Garner and Reynolds (1986), Whitten (1987), Whitten and Regelin (1988), Fancy et al. (1989), Golden (1989, 1990), and Whitten and Fancy (1991). In July 1989, 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 and 1988. Many PCH animals remained on the coastal plain either in ANWR or farther west through the summer, while others moved eastward into Canada. During August and September, PCH caribou in Canada moved in a clockwise direction around Old Crow Flats, crossed the Porcupine River twice, and headed north along the border toward the northwest corner of Old Crow Flats. There they converged with other PCH animals moving southwest through the Brooks Range from Alaska. In October, roughly two-thirds of the PCH moved west into Alaska, where they remained through the winter in the Chandalar Basin. The remainder of the herd moved south to the Ogilvie Mountains in the Yukon Territory. In addition, several thousand PCH animals never left the North Slope and spent the winter west of the Canning River mingled with the CACH.

Snow depths were low to moderate in all wintering areas used in 1989-90 and presented no hindrance to spring migration, which was well underway by early April. All herd segments returned to calving areas near the coast. Snowmelt on the coastal plain during the calving season in 1990 was the earliest in memory. Most calving in 1990 occurred in ANWR in the area being considered for petroleum development. Calving occurred further north than normal because of the complete absence of snow on the coastal plain. This situation contrasted with the persistent snow cover in 1988, when the PCH calved primarily in the foothills to the south.

In early July 1990, the PCH formed large postcalving aggregations on the coastal plain between the Canning River and the Aichilik River. Extensive overlap with the CACH occurred in the Canning River delta. By mid-July, most PCH animals had moved east

into Canada or south across the Brooks Range. By early August only small, scattered bands remained in Alaska.

In September, the PCH moved clockwise around Old Crow Flats in the Yukon Territory with few if any returning to Alaska. Most of the herd wintered in the northern Richardson Mountains in the Yukon and Northwest Territories. Very few PCH caribou were available to subsistence or sport hunters anywhere in Alaska after early September 1990.

Mortality

Harvest:

Season and Bag Limit. The hunting season for all hunters in 1989-90 was from 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. Seasons and bag limits have remained the same for over 5 years.

Hunter Harvest. Total harvest for the PCH ranged from about 1,500 to 4,800 over the past few years (Table 6), or about 1-3% of estimated population size (Table 1). An independent harvest estimate based on hunter kills of radio-collared caribou, is very similar (2.6% for 1983-89).

PCH and CACH caribou were mixed together in portions of Subunits 26B and 26C during most of the 1989-90 hunting season. For the sake of convenience, all kills reported in 26B were considered CACH animals and all those in 26C were considered from the PCH.

Virtually all reported harvest was by nonlocals and in Subunit 26B the harvest came primarily from the pipeline corridor. For these two reasons few PCH caribou were probably included in the CACH harvest reported in 1989-90.

Harvests by local residents and nonlocal hunters are reported differently. Nonlocals use general statewide caribou harvest report cards. Harvest by nonlocal hunters has 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 (71% in 1989-90) was by residents.

Standardized harvest reporting by 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 most of the summer and were readily available near Arctic Village and Venetie most of the winter. Thus subsistence harvest was higher than the previous 2 years. Harvest in Canada was down from the past few years because relatively few caribou wintered in the Richardson Mountains or along the Dempster Highway, where residents of Aklavik, Ft. MacPherson, and other road-connected communities hunt.

Hunter Success. Hunter success highly depends on herd distribution. Nonlocal hunter success was relatively high in 1989-90 (Table 7) because caribou were widely distributed across popular hunting areas in August and September. Based on the summer and winter availability of caribou near villages, subsistence success was probably high; this impression was confirmed by field observations in Arctic Village in April.

Harvest Chronology. Nearly all nonlocal harvest of the PCH in Alaska occurs during August and early September. This apparently reflects when hunters prefer to be in the field rather than when caribou are present. Subsistence harvest chronology depends much more on caribou distribution and occurs whenever caribou are present. The exception is during June at Kaktovik where caribou are often present but inaccessible because of poor travel conditions.

Transport Methods. No data are available for this report period. Traditionally, nonlocal hunters fly into the PCH range, a few travel by boat. 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%. Nine percent of those calves died during June.

Preliminary analysis of data from radio-collared cows indicates that the mean pregnancy rate for 1982-90 was 81%. Survival of calves through June averaged 73%, and survival through the next 11 months was 74%, for a total first-year survival of 55%. Mean yearling survival was 96% for females and 90.0% for males. Mean 2-year-old survival was 93% for females and 88% for males. Adult female survival averaged 85% and male survival averaged 86%. The adult male survival rate may be biased toward high values because few older males were ever radio-collared. These figures include harvest by humans. All survival rates determined from radio-collared PCH caribou should be considered as approximations; confidence intervals have not yet been calculated. These data are currently being incorporated into a population dynamics model of the PCH, in cooperation with U.S. Fish and Wildlife Service (USFWS) and Canadian Wildlife Service biologists.

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: There are no habitat enhancement programs either 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

The PCH continues to increase slowly and is lightly harvested. The harvest in Alaska will probably not increase above recorded levels. Even when caribou are abundant in Alaska, lack of road access and the cost of air charter services limit hunting effort in spite of long seasons and large bag limits. Local harvest for subsistence use is governed by caribou availability. The only factors which could alter this pattern would be some drastic change in caribou distribution or some new form of access to caribou.

Access along the Dempster Highway has changed harvest patterns in Canada, and the potential for greatly increased harvest exists there. So far, Canadian agencies have allowed only a conservative harvest. Relative to many other Alaskan caribou herds, the PCH females have lower pregnancy rates, higher adult mortality, higher calf survival, and a slower growth rate (5%). However, because the herd is large it could easily withstand twice the harvest that now occurs.

ADF&G is cooperating with the USFWS and Canadian government agencies to assess the importance of the ANWR coastal plain to the PCH. ADF&G 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 is important to the herd. ADF&G 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, 1961-89.

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

[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.

Table 2. Porcupine Caribou Herd postcalving composition counts and estimated population size, regulatory years 1970-71 to 1989-90.

Approximate 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
7/71	24	38	21	56	--	--	--	13	29,197
7/72	23	49	26	53	--	--	--	12	11,721
7/73	16	47	27	58	--	--	--	9	19,101
7/74	9	67	37	55	--	--	--	5	14,127
7/75	23	52	27	52	--	--	--	12	18,814
7/76	5	58	32	55	--	--	--	3	13,762
7/77	7	39	24	61	--	--	--	4	25,520
7/78	30	68	32	47	--	--	--	14	18,669
7/79	15	55	30	55	--	--	--	8	19,154
7/80	59	66	26	39	--	--	--	23	9,046
7/82	95	43	15	36	--	--	46	34	19,718
7/83	9	73	38	52	61	--	39	5	2,583
7/86	57	52	22	42	--	--	--	24	19,500
7/4-10/87	72	62	24	38	49	--	51	28	33,044
7/1-2/88	28	54	27	50	57	--	43	14	6,420
7/89	17	46	25	55	77	--	23	9	23,242
7/90[a]	--	--	--	--	--	--	--	--	--

[a] No data collected

Table 3. Porcupine Caribou Herd late winter composition counts and estimated population size, regulatory years 1970-71 and 1989-90.

Approximate survey date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent bulls	Composition sample size
4/71	28	54	30	55	15	28,637
4/90	63	43	21	48	31	9,215

Table 4. Porcupine Caribou Herd calving composition counts and estimated population size, 1978, 1982, and 1983.

Approximate survey date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent bulls	Composition sample size
6/78	0	85	43	51	0	420
6/82	0	79	41	52	0	1,629
6/83	0	74	37	51	0	1,771

Table 5. Porcupine Caribou Herd fall composition counts and estimated population size, 1972, 1973, 1977, 1978, and 1980.

Approximate survey date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent bulls	Composition sample size
10/72	55	31	15	49	27	2,998
10/73	51	33	17	51	26	200
10/77	77	49	19	39	30	8,941
10/78	31	61	30	49	15	980
10/80	60	54	23	43	26	13,871

Table 6. Porcupine Caribou Herd harvest, 1984-90, and subunit harvest, 1989-90

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	4,554-4,754
1985-86	52	12	1	65	500-700	4,000	4,500-4,700	4,564-4,764
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
1989-90 Harvest by Subunit								
25A	64	3	0	67				
25B	5	3	0	8				
25D	5	0	0	5				
26C	30	2	0	32				

Table 7. Hunter success in the Porcupine Caribou Herd, 1987-89.

Hunters	Unit/Subunit 25A	25B	25D	Total 25	26C	Total 25 & 26C
1987						
Total hunters	88	16	2	106	62	168
Successful	60	8	0	68	38	106
% Successful	68	50	0	64	61	63
1988						
Total hunters	71	26	8	105	68	173
Successful	29	8	0	37	52	89
	41	31	0	35	76	51
1989						
Total hunters	71	3	7	81	32	113
Successful	53	2	3	58	24	82
% Successful	75	67	43	72	75	73

LOCATION

Game Management Unit: Western half of Subunit 25C and small portions of northern Subunit 20B and eastern Subunit 20F (approximately 4,000 mi^2)

Herd: White Mountains

Geographical Description: White Mountains Area

BACKGROUND

Historically, the Fortymile Caribou Herd calved in the White Mountains and moved southeast across the Steese Highway to summering and wintering areas as far east as Mt. Veta (Davis et al. 1978). As recently as 1960, this migration involved 30,000 caribou (Jones 1961). As the Fortymile Herd declined throughout the 1960s, these caribou abandoned the traditional White Mountains calving area and expanded their movements east, presumably leaving the White Mountains with no caribou.

However, in the late 1970s, public reports and observations by biologists confirmed the year-round presence of caribou in the White Mountains, prompting biologists to infer that a small resident herd had existed there for many years (Valkenburg 1988). Hence, the White Mountains Caribou Herd may be considered a remnant of the Fortymile Caribou Herd. Currently, the White Mountains caribou maintain a distinct calving area east of Beaver Creek and are considered and managed as a separate herd.

The White Mountains National Recreation Area (WMNRA), which is managed by the Bureau of Land Management (BLM), was created as part of the Alaska National Interest Lands Conservation Act in 1980. In 1982, BLM and ADF&G began a cooperative project to determine the identity and distribution of caribou in the White Mountains. Caribou radio-collared during that project provided information on herd movements and distribution. On 28 and 29 September 1988, new radio collars were placed on 6 of the previously radio-collared cows, and 10 additional radio collars were placed on 4-month-old cows to determine age at first reproduction, which is considered a sensitive indicator of caribou range quality. At least some of these cows calved in 1990 which suggests abundant range resources relative to present population levels.

The White Mountains herd currently contains approximately 1,000 caribou. Despite lengthy fall hunting seasons, reported harvests averaged only 10 caribou annually between 1985 and 1989. Harvests are low because the herd is generally inaccessible during open hunting season. Public interest in hunting, viewing, and photographing White Mountains caribou is expected to increase as the BLM develops and implements recreational plans.

MANAGEMENT DIRECTION

In 1989, ADF&G biologists established the following management goals and objectives after intra-department workshops/discussions and after discussions with the BLM biologist responsible for the WMNRA. These objectives were selected because of anticipated developments on the ranges of this growing caribou herd.

Management Goals and Objectives

1. Ensure that an anticipated increase in recreational use and mining development does not adversely affect the White Mountains Caribou Herd.

2. Annually monitor information on recreational use and plans for improving access to the White Mountains.

3. Cooperate with the BLM to annually identify seasonal ranges that are infrequently used by White Mountains caribou.

4. Provide increased opportunities for people to hunt caribou.

5. Determine the feasibility of establishing a winter caribou hunt to increase hunting opportunity by 1990.

6. Establish population objectives by 1992.

7. Provide an opportunity for people to observe caribou, especially during winter.

8. Provide information to people about the winter distribution of White Mountains caribou.

METHODS

BLM biologists located radio-collared caribou at least twice per month from 1982 to 1989, when the BLM project ended. After July 1989 the radio-collared caribou were located 3 times by ADF&G personnel. They were located once on 6 October 1989 for a fall census and composition count, once on 17 May 1990 to determine calving areas and age at first reproduction, and once on 14 February 1991 before the 1990-91 winter hunting season began.

ADF&G and BLM biologists completed a composition count on 6 October 1989. Two pilots in 2 PA-18-150 Super Cub aircraft visually searched for caribou while another located radio—collared caribou from a Bellanca Scout. Pilots directed a Bell 206

helicopter to all caribou. Antler configuration and genitalia were used as criteria to classify each caribou into 1 of 5 categories: cow, calf, small bull, medium bull, or large bull (see McNay 1990 for criteria for each category). M. McNay (ADF&G) classified all caribou encountered, except when an unclassified group of caribou mixed with a previously classified caribou group. BLM biologists recorded data from the back seat of the helicopter.

On 17 May 1990, P. Valkenburg located radio-collared cows and recorded their reproductive status (presence of antlers, udder development, and/or presence of a calf). His search area included Mt. Prindle, Lime Peak, Cache Mountain, headwaters of Victoria Creek, Mt. Schwatka, Victoria Mountain, and Preacher Creek.

We used harvest report cards to document harvest and hunting pressure. Most hunters in Subunit 25C reported hunting along the Steese Highway, which has been considered the dividing line between White Mountains and Fortymile caribou ranges. Data from hunters reporting along or north of the Steese Highway were included in this report because no Fortymile Herd caribou were immediately adjacent to the Steese Highway. Data from hunters reporting south of the Steese were included in the Fortymile herd report.

We evaluated the feasibility of opening a winter hunting season consistent with herd management objectives by examining data on population size and recruitment and discussing options with BLM biologists and local advisory committees. Herd accessibility during the proposed winter hunt was predicted from winter radio-telemetry locations and an early March reconnaissance flight in 1990. We informed the public about the winter herd distribution through local newspaper articles, discussions at advisory committee meetings, and through conversations with interested individuals who visited the office.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The size of the White Mountains herd has probably increased considerably since 1980 (Valkenburg 1988) and presently numbers 900-1,000 caribou. This estimate is based on the 1989 composition count where a minimum population size of 930 caribou was derived by adding the number of caribou classified (744) to the number observed but not classified because of group mixing (25% x 744 = 186). Observers were confident that few caribou were missed during the survey; 13 of 14 radio-collared caribou were located and areas peripheral to located caribou were searched by fixed-wing aircraft. The missing radio collar was considered inactive and was never heard on subsequent relocation flights.

Population Composition: On the 6 October 1989 composition survey, 744 caribou were classified. The sample came from 33 groups and included 13 of 14 radio-collared cows. The bull:cow ratio was higher (50:100) than in previous surveys (Table 1), but consistent with expected ratios for a lightly hunted herd. Lower bull:cow ratios in previous surveys probably reflected incorrect classification and/or inadequate sampling (P. Valkenburg, pers. commun.). The 1989 calf:cow ratio (36:100) was slightly higher than during previous surveys (31-33:100). Calves consistently composed 18-19% of all samples from this herd. As in previous surveys, most bulls were classified as small (46%). However, the proportion of bulls within the medium and large categories varied among surveys. This variability probably reflects a difference in criteria used by observers to place a bull in the medium or large category, rather than a change in the size distribution among bulls.

On 17 May 1990, radio-collared caribou cows were located to estimate pregnancy rates. Four of 6 locatable 24-month-old radio-collared cows were pregnant, as evidenced by hard antlers, presence of a developed udder, or presence of a calf (Table 2). One 24-month-old female was in dense spruce and its status was not determined. Based on these observations of adult cows, the calving peak was estimated as 15-16 May 1990. This date is considered somewhat early and indicates abundant range resources (P. Valkenburg, pers. commun.).

Distribution and Movements: The White Mountains herd showed a consistent pattern of seasonal range use and movement from 1982 through 1990 (Durtsche and Hobgood 1990). Cows calved in upper Bear Creek/Quartz Creek, Cache Mountain, and in the Victoria Creek/VABM Beaver vicinities, generally from 6 to 27 May. In summer, caribou moved to the high ridges of the White Mountains and the Bear Creek/Preacher Creek headwaters. During late September/early October, the herd traveled west and north from the White Mountains across Beaver Creek to VABM Beaver and the headwaters of Victoria Creek. Caribou wintered in the headwaters of the Tolovana River, Hess Creek, and Victoria Creek. Heaviest winter caribou concentrations occurred in Grouse, Butte, Crater, and Belt Creeks. From early April through mid- to late May, caribou moved from these wintering areas to the calving grounds via VABM Beaver, across Beaver Creek, through Windy Gap, to Cache Mountain and beyond. Some caribou also moved via the west- and north-facing slopes of VABM Fossil, across Willow Creek, up Mascot Creek, to the Rocky Mountain (Lime Peak) and Bear Creek/Preacher Creek ridge complexes. An early movement occurred in August 1989, when most of the herd crossed Beaver Creek near Windy Gap 1 month earlier than normal.

On 14 February 1991, radio-collared caribou were found in the headwaters of the Tolovana River and Victoria Creek, and in Bear Creek. Groups containing about one-half of the radio-collared caribou were located on the west-facing slopes of VABM Beaver (P. Valkenburg, pers. commun.). BLM biologists will summarize their observations in their Fall 1991 Field Report.

Mortality

Harvest:

Season and Bag Limit. In 1989-90, the fall hunting season was 10 August-20 September throughout most of the herd's range (Subunit 25C and 20B) and 10 August-30 September in the portion of Subunit 20F ("Subunit 20F, except Tozitna drainage") that includes the westernmost portion of the herd's range. In 1990-91, the fall hunting season for the herd's entire range (Subunit 20B; 25C; and 20F, south of the Yukon River) was 10 August-20 September. The bag limit for both fall hunts was 1 bull.

In February 1991, 2 newly established drawing permit winter hunts opened for hunting caribou 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 permit hunts was 1 caribou.

Board of Game Actions and Emergency Orders. The Board of Game changed 2 regulations pertaining to White Mountains caribou during their spring 1990 meeting. The Board adopted the ADF&G proposal to shorten the fall hunting season in "that portion of Subunit 20F south of the Yukon River" from 10 August to 30 September to 10 August to 20 September to create consistent seasons throughout the herd's range. The Board also adopted ADF&G's proposal to increase hunting opportunities on this lightly hunted herd by opening 2 winter drawing permit hunts (see Season and Bag Limit section).

Hunter Harvest. Reported harvests are consistently low, ranging from 2 to 14 bulls per year during the last 5 years (Table 3). The 1989 harvest represents less than 3% of the herd. Most hunters were from the Fairbanks area (Table 4). Success rates during the last 5 years ranged from 12 to 33%. Successful hunters reported taking caribou throughout the season from 10 August to 17 September. Successful hunters reported using off-road vehicles ($n = 4$), three- or four-wheelers ($n = 4$), and highway vehicles ($n = 4$) for access. In addition, 2 local Steese Highway residents walked from their homes to their hunting area.

Hunter success in the 2 new winter drawing permit hunts (577 and 578) was very low, but reports were still coming in when this report was written. Results of these hunts will be discussed in the next report.

Other Mortality. The only data on nonhunting mortality available were from radio-collared caribou. Of 10 calves and 6 cows radio-collared on 28 and 29 September 1988, 1 calf was killed by wolves the night after radio-collaring and 1 cow died of capture-related causes on 11 October 1988. Biologists found another dead calf (18 Jan 1989), a dead yearling cow (6 Oct 1989), and a dead adult cow (fall 1990); however, the

cause of death was unknown in all cases. Mortality data will be analyzed in the BLM Fall 1991 Field Report.

Habitat

Assessment: In 1988, a 518,000-acre wildfire in the headwaters of Victoria Creek, Hess Creek, and the Yukon Flats burned approximately half the winter range of the White Mountains herd. That fall, BLM began studying this fire's effects on caribou movements, distribution, and habitat use. Since this fire, the herd has shifted its winter range west into the Wolf Creek area (W. Hobgood, pers. commun.). Still, the postfire breeding success in 24-month-old caribou and early peak calving dates in 1989 and 1990 indicate that the White Mountains caribou have relatively abundant food resources. There is no reason to suspect this fire will negatively affect herd performance. No fires were reported in the herd's range during 1989 and 1990.

Three other issues may affect habitat in the herd's range (W. Hobgood, pers. commun.). First, a private landowner expressed interest in subdividing his 63-acre parcel adjacent to an airstrip on Beaver Creek, including possibly building a road access to this subdivision. Although this parcel is not in core caribou range, indirect impacts to wildlife in the area may result from increased access. Second, BLM plans mining reclamation activities in Nome Creek in summer 1991. The reclamation will include leveling tailings, sealing bypasses, and diverting the creek to the low point in the drainage. Noise associated with this reclamation may temporarily displace caribou and other wildlife. Lastly, several members of the public have expressed interest in having BLM provide increased airplane access into the WMNRA.

CONCLUSIONS AND RECOMMENDATIONS

The White Mountains Caribou Herd will probably continue to provide a relatively low harvest (but significant hunting opportunity) because of its relative inaccessibility in fall and winter hunting seasons. However, the trail system established by BLM is popular in February, March, and April among snowmachiners and mushers, and the presence of caribou and their tracks contribute to user enjoyment. As BLM continues to promote and develop the WMNRA, caribou habitat use should be monitored to assure that human use does not adversely affect caribou.

To ensure that mining and recreational activities do not adversely affect caribou, seasonally important caribou range such as the core calving/summering areas of Lime Peak, movement corridors through Windy Gap and the ridges along Willow Creek, and wintering areas in the upper Tolovana, Hess Creek, and Victoria Creek should be considered during land use planning.

Nearly half the White Mountains herd winter range burned in 1988. The fire has not affected the few caribou now present but could have temporarily reduced the amount of winter range available. In general, fire is beneficial to caribou and other species because it renews lichen growth. The White Mountains now provide an opportunity to study caribou/fire relationships.

No changes in caribou hunting regulations are recommended at this time. We are meeting our consumptive use goal of providing an increased opportunity to hunt caribou by opening winter permit hunts for 100 permittees and retaining a 40-day fall hunting season. Likewise, opportunities to view caribou in winter are increasing. Future attainment of the basic herd-protection goal will depend on good communication and careful planning with the BLM and the public.

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Table 1. White Mountains Caribou Herd fall composition counts and estimated population size, 1983-89[a].

Survey date	Total 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	Estimate of herd size
9/22/83	44	31	18	57	26	29	44	25	135	--
10/85	36	31	18	60	71	14	14	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	930
No data collected in 1990										

[a] All surveys done in a Bell 206 helicopter.

Table 2. Reproductive status of 8 radio-collared caribou cows in the White Mountains Herd, 17 May 1990.

Collar no./ frequency	Hard antlers?	Distended udder?	Calf present?	Age of cow (years)
NV/1.400	Y	Y	Y	15
NV/1.760	Y	Y	N	2
NV/1.640	Y	Y	N	2
NV/1.420	N	N	N	2
NV/1.235	Y	Y	Y	2
NV/1.740	Y?	Y	N	2
NV/1.430	1 velvet	N	N	2
NV/1.390	Y	Y	Y	10-15

Table 3. White Mountains Caribou Herd mortality, 1985-90.

Regulatory year	Reported harvest[a]				"Nonhunting" mortality	Total
	M (%)	F (%)	Unk	Total		
1985-86	12	0	0	12	--	--
1986-87	2	0	0	2	--	--
1987-88	6	0	0	6	5[b]	11
1988-89	12	0	0	12	3[c]	15
1989-90	14	0	0	14	2[d]	16

[a] There was no known unreported harvest, but in other herds only about 60% of successful hunters report.

[b] These 5 were radio-collared cows found dead between 1 July and 7 December 1987 (Durtsche and Hobgood 1990).

[c] Radio-collared caribou: 1 calf killed by wolves (9/30/88), 1 adult cow died shortly after collaring (10/11/88), 1 calf was found dead of unknown causes (1/18/89).

[d] Radio-collared caribou: 10/6/89, yearling female found, scavenged by grizzly but cause of death unknown; fall 90, antlerless cow found, cause of death unknown.

Table 4. White Mountains Caribou Herd hunter residency and success, 1985-90.

Regulatory year	Successful			Unsuccessful[a]	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

[a] Residency of unsuccessful hunters were not analyzed, but most are Fairbanks, Central, and Circle residents who drive and hunt from the Steese Highway.

LOCATION

Game Management Unit: 26A (56,000 mi^2)

Herd: Teshepuk 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 1940's and local residents have reported observing caribou in the area throughout the year since the 1930s. The Teshekpuk Lake Caribou Herd (TLCH) was documented in the mid-1970s as a separate herd from the Central Arctic Caribou Herd (CACH) and the Western Arctic Caribou Herd (WACH) by Davis and Valkenburg (1978). The TLCH is considered an important subsistence resource to hunters from Barrow and Nuiqsut and, to a lesser degree, other North Slope villages. Because of overlap between the 2 herds, collection of TLCH harvest data has been incorporated into the WACH harvest reporting system.

ADF&G and U. S. Bureau of Land Management (BLM) staff conducted visual counts from 1978 to 1982 and estimated that 3,000 to 4,000 caribou inhabited the area around Teshekpuk Lake (Davis and Valkenburg 1979, Reynolds 1981, and Silva 1985). Radio collars were attached to 12 cows and 8 bulls in 1980 and monitored jointly by the ADF&G and BLM. In July 1984, the ADF&G and BLM conducted the first census using a modified aerial photo-direct count-extrapolation (APDCE) technique and counted 11,822 animals (Davis et al. 1979). In 1986, as part of a joint project with the ADF&G the North Slope Borough Department of Wildlife Management (NSB), and BLM, radio-collared 17 cow caribou with VHF radio collars.

MANAGEMENT DIRECTION

The overall objective is to maintain the existing size of the TLCH and provide for hunting on a sustained yield basis.

Operational objectives defined in a draft cooperative management agreement between ADF&G 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 calving grounds each year; 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 without the use of helicopters and/or 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; and 8) determine sources of significant, non-hunter mortality.

METHODS

A census of the TLCH was conducted during July 1989 in cooperation with the NSB and BLM using a modified photocensus technique (Davis et al. 1979). Photographs were taken on 23 July and counted the following winter.

Because unusually large numbers of dead and lethargic caribou were reported in the area south of Teshekpuk Lake, aerial surveys were flown, hunters and pilots interviewed, and dead caribou necropsied to determine the extent and cause of the problem. By means of interviews with Nuiqsut hunters and a reconnaissance flight, the approximate size of the affected area was determined. We flew transects in a portion of the area to estimate how many dead caribou were present. Radio-tracking flights were flown to determine if radio-collared animals from either the WACH or CACH were present. In a cooperative project between ADF&G, NSB, and the University of Alaska, Fairbanks (UAF), 10 caribou were collected and necropsied. Four of these caribou were found dead and 6 were shot.

Aerial spring composition surveys were flown in April 1990 to estimate short yearling recruitment. Transects were flown in a Cessna 185 aircraft over the area south of Teshekpuk Lake and random groups were chosen for classification. Caribou were classified as either adults or short yearlings.

Reports received from pilots flying in the Teshekpuk Lake area and 1 survey flown in early June were used to delineate the calving grounds and determine the time of peak calving.

VHF radiotelemetry was used to obtain TLCH population, movement, and distribution information. Radio-tracking flights were conducted in April and mid-June to determine distribution. In addition, Platform Transmitter Terminals (satellite radio collar transmitters or "PTTs") manufactured by Telonics, Inc. (Mesa, AZ) were attached to 6 caribou on 30 June 1990. These caribou were all females with calves and were radio-collared between Teshekpuk Lake and the Beaufort Sea coast to minimize the chances that WACH or CACH caribou would be radio-collared.

Satellite location data were received from the Argos Data Collection and Location System computer in Landover, Maryland in 2 different ways. Location information could be retrieved at any time for the preceding 4 days using a computer modem, and microcomputer diskettes were sent monthly with location information from the preceding month.

We chose a 6-hour per 48-hour transmission cycle for 11 months of the year to prolong battery life, and a 6-hour per 24-hour cycle was chosen for the month of July to monitor movements more closely when caribou are aggregated after calving. In addition, receiving daily locations during July will help determine the optimum time to conduct a photocensus in July 1991. A more detailed discussion of satellite telemetry as applied to arctic caribou was provided by Fancy et al. (1988).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: During the July 1989 photocensus, 16,649 caribou were counted. The count was 41% higher than the census completed in 1984, and would indicate a mean annual rate of increase of 7.1% occurred during the 5-year period (Table 1).

Population Composition: Spring composition surveys were conducted during April 1990, and 74 of the 352 caribou (21%) observed were classified as short yearlings. The first survey was conducted in conjunction with a radio-tracking flight and limited time was available for completing the composition work. The second survey ended prematurely because of weather. During a radio-tracking flight conducted in June 1990, 5 radio-collared cows were located, and all had calves.

Distribution and Movements: The TLCH was previously considered a fairly sedentary herd that remained in the vicinity of Teshekpuk Lake throughout the year. However, recent location information received from the 6 PTTs deployed in 1990 changed this perception. Preliminary location results from the PTTs indicate that TLCH animals exhibited a much wider distribution in 1990 than was previously believed. Most of the results were received after the 1989-90 report period and will be analyzed more completely in subsequent reports. To summarize, all 6 females with PTT's wintered considerable distances from the Teshekpuk Lake area. One animal wintered near the southern Seward Peninsula in GMU 22A; 2 animals wintered on the south side of the Brooks Range between Anaktuvuk Pass and Wiseman in GMU 24; and 3 wintered between Barrow and Wainwright.

From 1980 through 1990, TLCH caribou collared with VHF transmitters were generally relocated in an area from Nuiqsut to the east, Barrow to the west, the Beaufort Sea coast to the north, and latitude 70^0 to the south. Apparently, little overlap has occurred with WACH and CACH animals (ADF&G files).

There have been some exceptions to this pattern, however. One radio-collared male wintered in the Noatak drainage with WACH caribou, but returned to the Teshekpuk Lake vicinity the next summer. In winter 1982-83, 3 radio-collared TLCH females wintered with WACH and, possibly, CACH caribou in the northern foothills of the Brooks

Mountain Range. One of these females returned to the Teshekpuk Lake area to calve and another crossed the pipeline and died on the Sagavanirktok River Delta in May (ADFG files).

Radio collars and direct observations were used in the last decade to develop a description of general movement patterns of the TLCH. Females were generally found north and east of Teshekpuk Lake from the mid-May to late June. During most of the summer (late June through July), caribou were commonly found seeking relief from insects 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 dispersed in all directions and no movement pattern was readily apparent. The TLCH does not seem to have clearly defined migration routes, but this perception may simply reflect a paucity of information (Silva 1985).

Subsistence hunters reported that calving occurred southeast of Teshekpuk Lake during the 1930's and 1940's (Silva 1985). Davis and Valkenburg (1979) have since identified the main calving area as southeast of Teshekpuk Lake during 1976 and 1977 and northeast of the lake in 1978. Surveys conducted since 1978 indicated that calving has occurred northeast of Teshekpuk Lake (Silva 1985, ADFG Files)

During spring 1990, we observed the main calving aggregation northeast of Teshekpuk Lake between the east end of the lake, Atigaru Point, and Cape Halkett. Most caribou calved north of the Kogru River, but some were seen south of the river. Peak calving occurred during 3-8 June.

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: Because the TLCH is remote and relatively inaccessible to most non-local resident and nonresident hunters, most of the harvest is attributable to local subsistence hunting. Because of the location of the TLCH, most hunting pressure comes from residents of Barrow, Nuiqsut, and Atqasuk.

At this time, it is impossible to determine exactly how many TLCH caribou are harvested because: 1) most hunters that harvest TLCH caribou also harvest caribou from other herds and there is no easy way to distinguish among animals from different herds; 2) the TLCH harvest is reported as part of the WACH reporting system and it is impossible to determine whether the reported harvest is from the TLCH or WACH, and 3) only a small proportion of North Slope hunters actually report their harvest.

It is possible to estimate (roughly) the harvest from the TLCH by using data from subsistence use studies and personal interviews about size and locations of caribou harvests. In a study conducted for the NSB and U.S. Minerals Management Service (MMS), Braund (1989) estimated that the total caribou harvest for Barrow during 1987-1988 was 1,643 caribou and for 1988-1989 was 1,403. The estimate for 1989-90 is 1,656 caribou harvested (S. Braund, Pers. Com.).

To estimate what percentage of the caribou harvested in Barrow during 1989-90 were from the TLCH, past radio-tracking information was examined. Radio-tracking information indicated that during fall and winter when most of the harvest occurred, caribou between Nuiqsut and Dease Inlet were largely TLCH caribou (ADFG files). From personal interviews and a cursory examination of the Braund data, it appears that roughly a third of the caribou harvested by Barrow hunters came from this area. Some radio-collared animals found between Dease Inlet and the Barrow area were also TLCH caribou. Approximately 1/3 to 1/2 of the caribou (552-828 animals) harvested by Barrow hunters were TLCH caribou. A more in-depth examination of Braund's data collected should provide a better harvest estimate.

Pedersen (1991) estimated that 513 caribou were harvested by Nuiqsut residents in 1986. Local residents believed at least half the caribou harvested in 1989-90 were from west of town, which is the area normally used by TLCH caribou. If the number harvested was similar in 1989-90, and if at least half the caribou harvested are from the TLCH, then approximately 206 TLCH caribou were taken by Nuiqsut residents. Information concerning hunting locations gathered from personal interviews indicate that at least 50 TLCH caribou were harvested by Atqasuk residents. When the harvest estimates from these 3 communities are combined, a rough estimate of the TLCH caribou harvest for 1989-90 is 808-1,084 animals.

Satellite radio collar information in 1990 indicated TLCH caribou were much more wide-ranging than previously thought. TLCH caribou were probably exposed to hunting pressure from the villages of Wainwright, Point Lay, and Anaktuvuk Pass in addition to

the communities mentioned above. Harvest levels of TLCH caribou may be greater in the future if the movement pattern detected in 1990 continues.

Hunter Residency and Success: Most hunters are local residents of GMU 26A and only a few TLCH caribou were taken by non-local resident and nonresident hunters, primarily from the Colville River drainage. No quantitative data are available on hunter success, but success rate is believed to be high.

Harvest Chronology: Most of the harvest occurs from July through October. Few caribou are taken during early winter, but numbers increase in February and March. Braund and Associates (1988) have summarized harvest chronology for Barrow residents (Table 2). The harvest pattern for other villages is believed similar. However, more spring hunting occurs in Nuiqsut and Atqasuk because hunters are not occupied with spring whaling as they are in Barrow.

Transportation Methods: Most people use boats for to hunt TLCH caribou in July, August, and September. Snowmobiles are used the remainder of the year. Some use of aircraft and ATVs occurs throughout the year. Hunters sometimes use highway vehicles when caribou are near the limited road systems associated with the villages, particularly the gas well road near Barrow.

Other Mortality: In late winter and spring 1990, unusually large numbers of dead and lethargic caribou were reported by hunters and pilots south of Teshekpuk Lake. Interviews with knowledgeable individuals, and a reconnaissance flight conducted later, indicated that dead and lethargic caribou were common in the area west to the Ikpikpuk River, south and east to the Colville River, and 70^0 latitude to the north, an area of about 5,500 mi^2. Hunters reported that some caribou were so weak that snowmobiles could be driven close to the animals and the caribou would not run away. Many individuals interviewed commented that they could not remember seeing so many dead caribou over such a large area in the recent past. We flew transects covering 180 mi^2 in the affected area and found 42 dead animals (1 caribou per 4.3 mi^2). If dead caribou occurred at that density throughout the area, approximately 1,292 dead caribou were in the area at that time.

UAF, NSB, and ADF&G personnel necropsied 10 caribou collected from the area and determined that all were in an emaciated, malnourished condition. The cause of death of the 4 animals were found dead was directly related to their emaciated condition, and the 6 animals that were shot were in such poor body condition that they were not likely to survive the winter. The rumen contents of all 10 animals contained small quantities of poor quality forage. All 10 animals had warble infections of varying degrees (4 had very heavy infestations), 2 had Besnoitiosis, 4 had gross evidence of lungworm, and 1 had hydatid cysts. All the animals were frozen before examination so complete histological examination was not possible, although gross examination revealed no sign of infectious disease (memo from Dr. John Blake, Institute of Arctic Biology, UAF).

When radio-tracking flights were conducted in the affected area, radio collars from the TLCH, WACH, and CACH were found. Of the 3 CACH radio collars found, 1 was on mortality mode frequency. Of 7 WACH radio collars found, 3 were on mortality frequency. Two TLCH radio collars were found, and neither was on mortality mode. It is impossible to say what percentage of the animals in the area were TLCH caribou, or how many died during winter and spring 1989-90.

The cause(s) of the die-off which occurred in the southern portion of the TLCH range are unclear, but it appears that the number of caribou wintering in that area may have exceeded the carrying capacity of the range. In winter 1989-90, 50,000 to 60,000 WACH caribou remained north of the Brooks Mountain Range, which is many more than had been reported in recent years. In addition, the distribution of radio collars indicated that a large number of CACH and TLCH caribou were in the area as well.

Additional reports indicated that caribou on the North Slope may have had poor feeding success in summer 1989, and many may have gone into the winter with inadequate fat reserves. Some hunters reported that caribou harvested in fall 1989 had an unusually thin fat layer. Summer 1989 was the warmest in the last decade and insects were more abundant than usual. Insect harassment may have prevented caribou from accumulating adequate fat reserves. The combination of low overall fat reserves and the large number of caribou found on winter range may have resulted in a larger than usual number of winter-killed caribou.

Habitat Assessment

No efforts were made to assess TLCH range quality directly. The fact that many caribou appeared to starve in the southern portion of the TLCH range would suggest that area may have been overgrazed. Caribou harvested farther north during late winter near Teshekpuk Lake were in better apparent condition than those farther south, indicating that winter range there was not overgrazed.

Oil development is the main threat to TLCH habitat. Extensive development has already occurred a short distance to the east, and it is quite possible that part of the TLCH range will eventually be developed for drilling or transporting oil. Much of the TLCH calving area is in a BLM Special Management Zone that will be given a greater level of protection than the surrounding area. However, more survey and telemetry work needs to be done to delineate other critical habitat areas that will need protection.

CONCLUSIONS AND RECOMMENDATIONS

The TLCH population increased from an estimated 11,822 caribou in 1984 to 16,649 caribou in 1988, an annual increase rate of 7.1%. Continued census and composition work will be necessary to monitor the population adequately.

The amount of exchange occurring among the TLCH, CACH, and WACH is presently unknown. If considerable exchange is occurring among the herds, then changes in population size may reflect immigration or emigration rather than reproductive success. Long-term studies, particularly telemetry studies, of all 3 herds are needed to understand better the relationship among them and for making important management decisions in the future.

As mentioned earlier, it is difficult to estimate TLCH harvest levels accurately. Unfortunately, it will be even more difficult in the future because the North Slope Subsistence Study ended with the 1989-90 season. A new method to determine harvest needs to be developed. At present, ADF&G and the NSB are developing a program which would use village monitors to interview hunters and collect subsistence use information.

In 1990 satellite radio collar information indicated that TLCH caribou were much more wide-ranging than previously believed. We do not know whether the caribou ranged more widely in 1990 than in previous years or if this new tool has given us a means of documenting previously undetected movements. We need to determine whether the TLCH will continue to range as widely and be exposed to hunting pressure from all villages in Subunit 26A. In order to continue this effort, we should continue the satellite telemetry work for at least 3 more years.

Because the TLCH population appears to be increasing in number, we do not recommend any regulatory changes. However, the TLCH is relatively small compared to other arctic caribou herds and it receives substantial hunting pressure. If hunting pressure increases, or oil development occurs within the range of the TLCH, or if another large natural die-off occurs, regulatory restrictions may be necessary in the future. Because the TLCH mixes with caribou from the WACH and CACH, it would be impossible to create regulations that would just impact the TLCH. If a separate bag limit and/or season was established and enforced for the core area of the TLCH between Dease Inlet and the Colville River, the TLCH harvest could be significantly reduced.

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Table 1. Population estimates and average annual rate of change of Teshepuk Lake herd caribou.

Year	Population estimate	Average annual rate of change
1978-1982	3,000-4,000[a]	N/A
1984	11,822[b]	N/A
1989	16,649[b]	7.18

[a] Derived from visual estimate.
[b] Derived using aerial photocensus.

Table 2. Annual caribou harvest and chronology, and percent by time period for Barrow hunters during 1987-1990[a].

Regulatory year	Harvest periods						Annual harvest
	Jul-Aug	Sep-Oct	Nov-Dec	Jan-Feb	Mar-Apr	May-Jun	
1987-88	41%	43%	1%	0%	5%	6%	1,643
1988-89	39%	41%	4%	3%	4%	7%	1,403
1989-90	Data not yet available						1,656[b]

[a] Braund, 1989.
[b] Braund, Pers. Comm.

LOCATION

Game Management Unit: 26B and 26C (26,000 mi^2)

Herd: Central Arctic

Geographical Location: Central Arctic Slope and Brooks Range

BACKGROUND

The Central Arctic Caribou Herd (CACH) was first recognized by biologists as a discrete herd in the mid-1970s (Cameron and Whitten 1979). Much of the herd's summer range lies within, or adjacent to, the industrial area near Prudhoe Bay. CACH caribou winter to the south and southeast of the oilfield in the northern foothills of the Brooks Range. Variable mixing with the Porcupine Caribou Herd to the east and with the Western Arctic and Teshekpuk herds to the west has occurred.

The CACH has grown from an estimated 5,000 caribou in 1975 to approximately 13,000 in 1983 (Cameron and Whitten 1979; Whitten 1988; Whitten and Cameron 1983a, unpubl. observations). The present population size is unknown. Over the past decade there have been several years of relatively low calf production (Cameron et al. 1988, Smith and Cameron 1990), and the herd has probably now stabilized and may be declining.

Oil exploration and development on the North Slope, which began in the late 1960s, provided the impetus for long-term ADF&G studies of the population dynamics, distribution, movements, and effects of development on the CACH. In recent years, calving activity has been consistently rare in the Prudhoe Bay oilfield (Whitten and Cameron 1985) where some was known to occur before development. Additionally, cows and newborn calves are underrepresented along the Trans-Alaska Pipeline corridor and around oil production facilities (Cameron et al. 1979, Dau and Cameron 1986a,b). Major movements of CACH caribou through the Prudhoe oilfield no longer occur in summer (Whitten and Cameron 1983b), and caribou distribution and movements within the Kuparuk oilfield have been altered substantially (Smith and Cameron 1983, 1985a,b; Curatolo and Murphy 1986).

MANAGEMENT DIRECTION

Based on the hypothesis that displacement, if of sufficient magnitude, would be harmful to the CACH (Cameron 1983), ADF&G proceeded with 2 management approaches. We worked with the oil industry to minimize disturbance to caribou movement from barriers created by oil development. Acting on the assumption that stress is cumulative, ADF&G

has also curtailed hunting in areas adjacent to the oilfield and the pipeline haul road. The current management objectives reflect these concerns.

Management Goals and Objectives

1. Minimize the adverse effects of development on caribou.

   A. Work with industry to prevent the construction of barriers to the free passage of caribou.

   B. Work with industry and other agencies to minimize disturbance to caribou in proximity to developments, except where caribou constitute a hazard.

   C. Maintain necessary restrictions on caribou hunting.

2. Provide for continued caribou hunting at a level which does not significantly affect population dynamics of the CACH, especially in areas away from developments.

   A. Determine the influence of current harvest levels on the CACH.

   B. Minimize harvest of cows from the CACH.

   C. Maintain a bull:cow ratio of at least 40:100.

3. Maintain opportunities for people to see caribou along the Dalton Highway and in the oilfields.

   A. Work with industry and other agencies to minimize disturbances to caribou in proximity to developments, except where caribou constitute a hazard.

   B. Regulate hunting along the Dalton Highway so that conflicts between hunters and nonconsumptive users are minimized, and so that caribou are not displaced from the vicinity of the road by hunting.

METHODS

Distribution and movements of the CACH were monitored during June and July 1990 in conjunction with an ongoing research project. Only population composition data specifically relevant to the research project objectives were obtained for mid-June. During mid-June, systematically chosen north-south transect lines were flown by helicopter, and all caribou observed within 1 mile of the transect lines were counted and classified. In July 1990, 35mm photographs were taken of aggregations west of Prudhoe

Bay, but the images on the photographs were too small to count. East of the Sagavanirktok River CACH caribou again mixed with Porcupine herd caribou in early July, and a census was not possible.

Harvest of CACH caribou by nonlocal hunters in 1989-90 was estimated from returns of harvest ticket report cards. Because local residents (primarily Alaska Natives residing north of the Yukon River) are not required to file regular harvest reports and did not use the required harvest ticket report cards, the Division of Subsistence has estimated caribou harvest at Kaktovik and Nuiqsut. These estimates are the best information available for harvest from the CACH by local residents. All caribou reported on harvest ticket report cards from Subunit 26B were assumed to be CACH caribou, although in fall 1989 many Porcupine herd caribou were present in the southeast corner of the unit. In winter 1989-90 both Western Arctic and Porcupine herd caribou wintered in the vicinity of the pipeline. The area used by Porcupine herd caribou in fall was not accessible to hunters, and less than a dozen caribou were probably taken there. However, unknown numbers of Western Arctic and Porcupine herd caribou could have been harvested in Subunit 26B during the winter and spring.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: There has been no census since 1983 (Table 1) despite attempts in 1987-90. The only recruitment index available after 1985, when April surveys ceased (Table 2), is the yearling:cow ratio from calving ground surveys (Table 1) which may not accurately reflect yearling numbers in the herd. Hence, it has been impossible to predict population size with confidence. Without the results of the 1990 35mm photographs, any herd size estimates west of the pipeline would involve too much guesswork to be worthwhile, and east of the pipeline, summer interactions with the Porcupine herd have made July postcalving aggregation censuses impractical.

Population Composition: Fall information on the age and sex composition of the herd has not been collected since 1981 (Table 3), and summer information has not been collected since 1983 (Table 4). In the early 1980s, the bull:cow ratio of the CACH was the highest of any herd in Alaska (Table 3). The current bull:cow ratio is undoubtedly lower than it was in the early 1980s because selective hunting of bulls has increased and recruitment has probably declined.

Distribution and Movements: Movements and distribution of the CACH in 1989 and 1990 were similar to those previously documented (Garner and Reynolds 1986, Lawhead and Cameron 1988, Murphy 1988, Fancy et al. 1989, Smith and Cameron 1989). Annual mixing of CACH, Western Arctic, and occasionally Teshekpuk herd caribou has occurred in winter for many years. More recently, some Porcupine herd caribou have also

wintered within the CACH range. Despite this mixing, there have been few (less than 1% of radio-collared caribou) documented cases of radio-collared caribou changing calving grounds.

Mortality

Harvest:

Seasons and Bag Limit. In Subunits 26B and 26C the 1989-90 open season for all hunters was 1 July through 30 April. The bag limit for nonresident hunters was 5 caribou in Subunit 26C, but only 1 in Subunit 26B. In Subunit 26B the bag limit for subsistence hunters was 5 caribou; however, cows could not be taken prior to 1 October. The bag limit for other resident hunters was 1 caribou. In Subunit 26C, the bag limit for resident and subsistence hunters was 10 caribou, but no more than 5 could be transported from the subunit.

Board of Game Actions and Emergency Orders. Because of the *McDowell vs. Alaska* ruling in December 1989 all residents of the state are now recognized as subsistence hunters. Therefore, the Alaska Board of Game changed the hunting season and bag limit in August 1990, so that subsistence hunters could take 1 bull between 1 July and 30 September and 1 or 2 (depending if a bull was taken previously or not) caribou between 1 October and 30 April. Nonresidents could take only 1 caribou between 1 July and 30 April.

Hunter Harvest. Reported harvest by nonlocal hunters declined to 140, and few cows were taken in 1989-90 (Table 5). Sixty-four percent of the reported 1988 harvest occurred within or near the Dalton Highway Corridor Management Area.
The reporting rate for successful hunters was estimated at 62-73% from the Delta and Fortymile Herds (Davis et al. 1991). I suspect it to be similar from the CACH. The actual harvest of CACH caribou is probably much greater than the reported harvest.

The subsistence harvest by Kaktovik villagers was estimated at 142 for 1988; about 64% were bulls, 33% were cows, and 3% were unknown. The Kaktovik harvest in 1989 was similar to 1988 (S. Pedersen, pers. commun.). Subsistence harvest by residents of Anaktuvuk Pass and Nuiqsut was largely unreported. The proportion of CACH caribou taken by each of the villages is unknown.

Overall harvest of the CACH in 1989-90 was probably only about 2% of the herd and was composed mostly of bulls. Although the CACH may be declining, harvest is not a major factor in this decline.

Hunter Success. Reported hunter success has remained about 70% for the last 3 years (Table 5), but the reported rate is probably inflated because fewer unsuccessful hunters report. The success rates were not calculated for 1984-85 and 1985-86, but there were

180 and 283 successful hunters in those years, respectively. The number of hunters for the last 3 years ranged from 225 to 287, of which 73-77% were successful (Table 5). Firearms were the primary harvest method in 1988-89, but 40% of the hunters used bows and arrows, reflecting the regulation restricting hunters to that method within 5 miles of the Dalton Highway.

Harvest Chronology. Data for 1989-90 are not available, but 84% of the nonlocal harvest occurred in August and September 1988. Subsistence hunters from Kaktovik took twice as many caribou in summer as in winter (S. Pedersen, pers. commun.).

Transport Methods. Successful hunters have predominantly used aircraft and highway vehicles for transportation (Table 6). Transport by highway vehicle declined significantly after 1986, probably because of better enforcement of Dalton Highway restrictions and the smaller bag limit that decreased the attractiveness of driving to the North Slope to hunt caribou.

Natural Mortality. Predation is an important source of mortality for caribou across North America, but its influence on CACH caribou is not clear (Garner and Reynolds 1986). Cameron et al. (1988) believed predation was negligible on the CACH calving grounds. They infrequently observed predators on the calving grounds, and of the few dead calves they encountered, none showed signs of predation. During a muskoxen survey in April 1989, P. Valkenburg found tracks of only 2 packs of wolves (both had recently been eliminated by hunters with snowmobiles) and 2 single wolves within the range of the CACH north of the Brooks Range.

Habitat

Assessment: Few caribou use areas of intensive oil development for calving (Whitten and Cameron 1985; Dau and Cameron 1986a,b; Lawhead and Cameron 1988; Smith and Cameron 1990). Parturient caribou are sensitive to disturbance and tend to avoid areas with greatest development activity.

Before the extensive development of roads and gravel pads west of Prudhoe Bay, caribou commonly sought relief from insects along the coast. In recent years, caribou west of the pipeline used gravel pads and coastal areas for insect relief. The coastal areas which are more difficult to access now because of the extensive pipeline network associated with the oilfields. This may be contributing to a lower nutritional intake during summer which may be a factor in the smaller mean body size of animals in the CACH during recent years (Cameron et al. 1990).

CONCLUSIONS AND RECOMMENDATIONS

The CACH growth rate appears to have decreased in recent years, and the herd may now be declining in size. More information on herd size and recruitment is needed if we are to understand herd dynamics.

Caribou harvest in Subunit 26B has been a minor influence on CACH dynamics because harvest of cows is low and because other herds may periodically use the CACH winter range. The Prudhoe Bay closed area and oil industry policies largely preclude harvest of caribou within the oilfield. Caribou harvest by bowhunters near the Dalton Highway is increasing, and caribou may be temporarily displaced from the road by bowhunters when tourists expect to see them. If displacement occurs or conflicts between hunters and tourists develop, we should consider closing a narrow corridor (perhaps 1/4 or 1/2 mile) on both sides of the road to hunting.

The CACH grew rapidly as development progressed west from Prudhoe Bay. After 1985, population growth slowed and the CACH probably began to decline, at least in the area west of the pipeline. This decreased growth may be oil—development related as it does not appear to be occurring in that part of the CACH which calves east of Prudhoe Bay where there is no extensive development.

Although it may not be absolutely necessary to know the CACH population size to manage for the low level of harvest now occurring, the CACH is a high profile herd politically, and population data are highly sought by many people. Collecting basic population data (population size and fall composition) should be a high priority.

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Table 1. Central Arctic herd caribou calving composition counts and estimated population size, regulatory years 1978-90.

Survey date	Yearlings: 100 cows	Bulls: 100 cows	Calves: 100 cows	Percent calves	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	47	3	1,865	--
6/80	48	4	69	31	45	2	787	--
6/81	22	9	87	40	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	45	4	2,692	--
6/13-14/85	35	16	88	37	42	7	2,357	--
6/12-13/86	33	7	56	29	51	4	891	--
6/13/87	19	4	74	37	51	2	4,839	--
6/10-15/88	32	7	66	32	49	3	4,892	--
6/11-15/89	16	6	48	28	59	4	2,520	--
6/11-15/90	11	31	75	35	46	14	6,543	--

Table 2. Central Arctic Herd caribou late winter composition counts, regulatory years 1977-85.

Survey date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent bulls	Composition sample size
5/3-5/77	75	32	16	48	36	889
5/78	37	40	23	56	21	351
5/79	88	60	24	40	35	499
4/80	127	51	18	36	46	1,309
4/81	135	34	13	37	50	998
4/82	124	60	21	35	44	2,124
3/83	99	54	21	40	39	2,090
3/24/84	226	69	17	25	57	1,286
4/85	53	48	24	50	26	683

Table 3. Central Arctic Herd caribou fall composition counts, regulatory years, 1976-81.

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

Table 4. Central Arctic herd caribou postcalving composition counts, regulatory years 1976-83.

Survey date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent bulls	Composition sample size
7/76	87	40	18	44	38	1,389
7/77	68	52	24	46	31	3,734
7/78	54	50	25	49	26	4,043
8/80	77	86	33	38	29	480
7/81	73	61	25	41	30	8,334
7/83	72	45	21	46	33	7,310

Table 5. Harvest of caribou and hunter success in Subunit 26B, 1984-89.

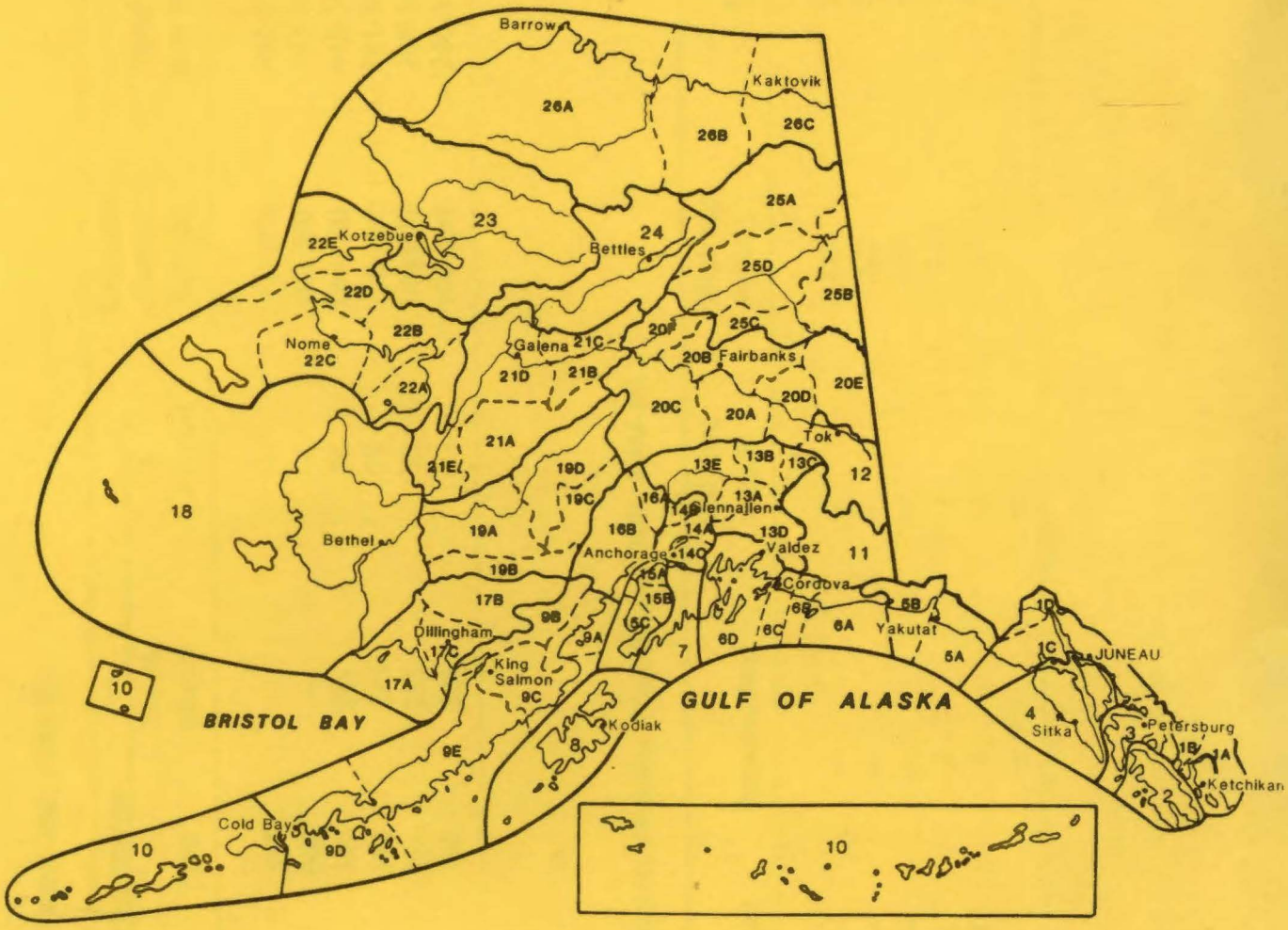
Regulatory year	Reported harvest						Estimated unreported harvest[a]	Total harvest
	Male	Female	Unk	Total	No. of hunters	% success		
1984	313	55	0	368	--	--	100-200	468-568
1985	482	177	3	662	--	--	100-200	762-862
1986	311	34	0	345	287	76	100-200	445-545
1987	176	2	3	181	225	77	100-200	281-381
1988	179	7	0	186	255	73	100-200	286-386
1989	132	8	0	140	221	63	100-200	240-340

[a] Estimate by area biologist based on distribution of caribou.

Table 6. Transport methods of successful caribou hunters reporting from Subunit 26B, 1984-89.

Regulatory year	Airplane	Horse	Boat	Snowmachine	Off-road vehicle	Highway vehicle	Total
1984	40	--	--	--	--	140	180
1985	61	--	--	--	--	222	283
1986	85	--	--	--	--	133	218
1987	83	1	11	2	1	71	169
1988	69	1	17	0	1	88	176
1989	--	--	--	--	--	--	--

Alaska Game Management Units



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