Alaska Department of Fish and Game
Division of Wildlife Conservation
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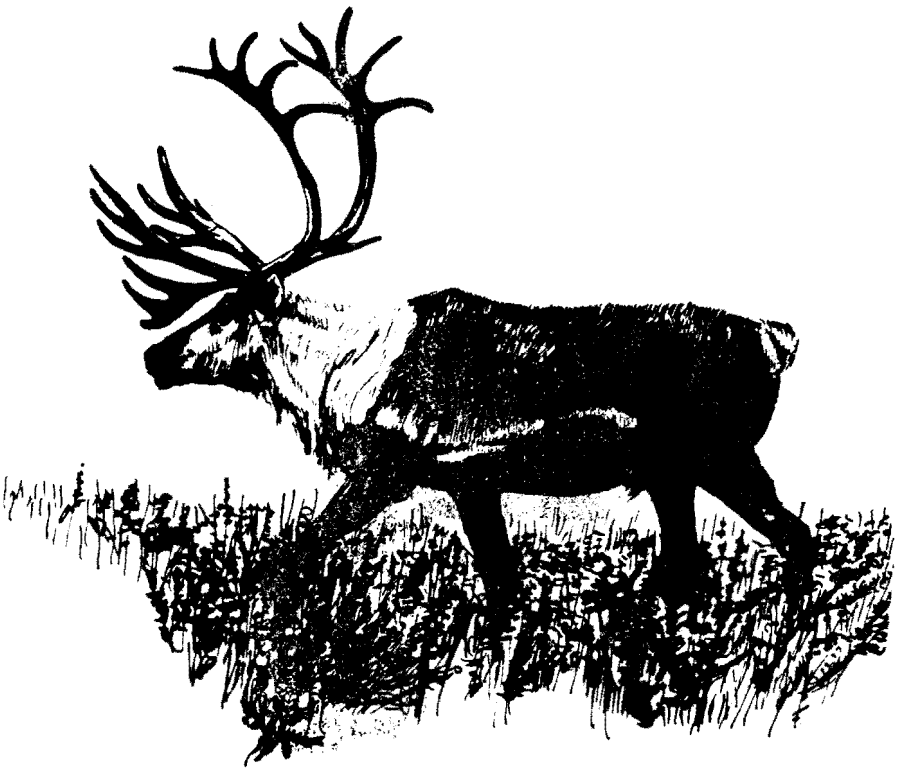
Annual Report of Survey-Inventory Activities
1 July 1988-30 June 1989

CARIBOU



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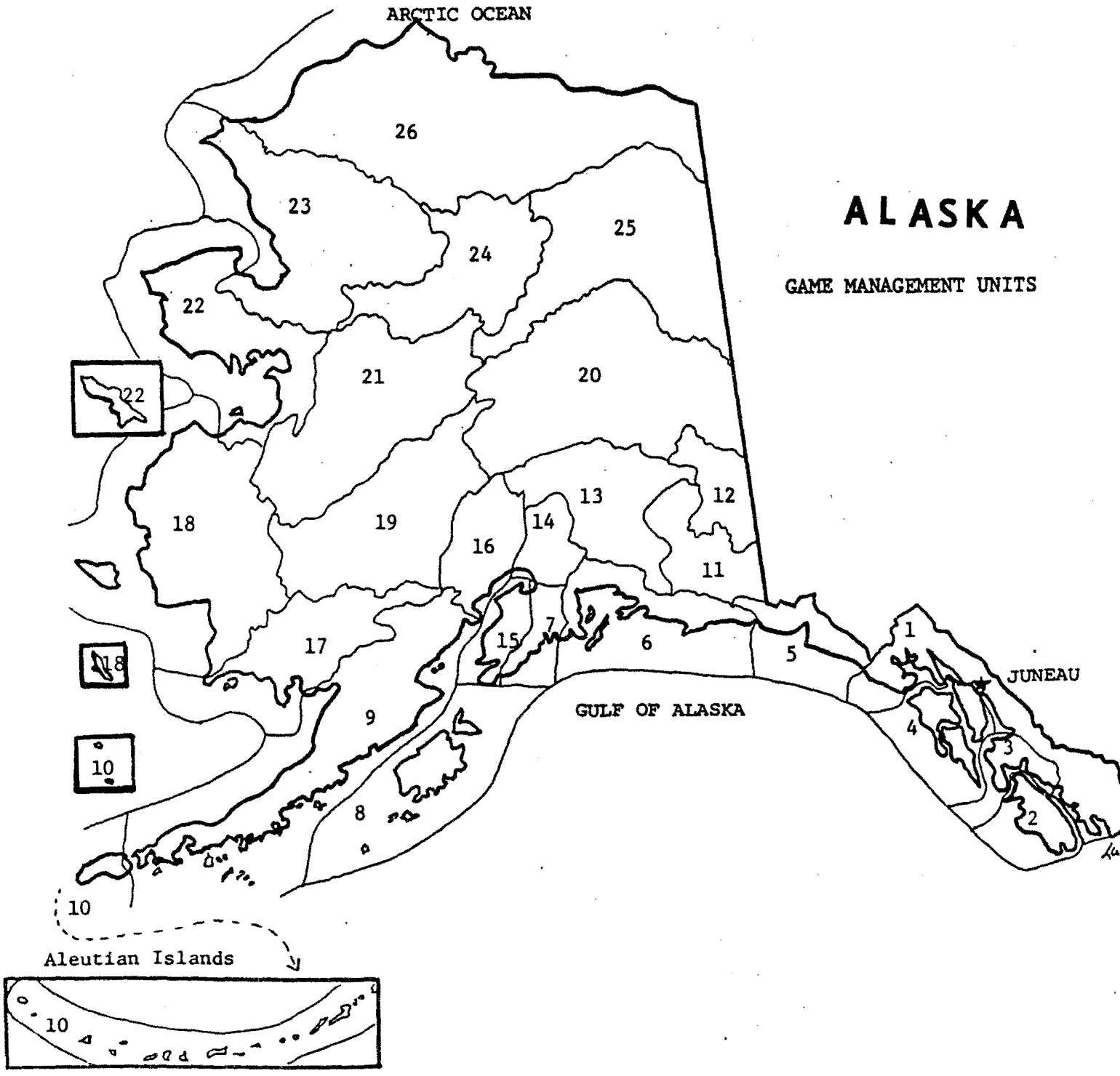
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STATEWIDE HARVEST AND POPULATION STATUS

Twenty-nine groups of caribou are identified in Alaska as "herds," but the size of these groups varies from a few hundred to over 300,000. The total number of caribou in the state is approximately 720,000, and almost three-fourths (71%) of these are found in two herds: the Western Arctic and the Porcupine. Status of the smaller herds (e.g., less than 1,500) is difficult to ascertain, and we really don't know whether these populations are stable, increasing, or declining. Statewide caribou populations are relatively high and increasing, a decidedly more optimistic outlook than the one existing a decade ago.

The harvest of caribou (both reported and estimated) during the 1988-89 reporting period was 23,579. The reported harvest, which is derived largely from hunter report cards, is far below the actual harvest. Compliance with reporting requirements is still a significant problem, particularly in rural areas. Herd status and estimated harvest in 1988-89 are summarized on the following page.

Steven R. Peterson
Senior Staff Biologist

Herd Name	Game Management Unit	Population estimate	Population trend	Total Harvest (Reported & estimated)
Kenai Mountains	7	305	Declining	25
Mulchatna	9A & B, 17B & C, 19B	70,000	Increasing	3,000
N. AK Peninsula	9C & 9E	20,000	Stable	2,300
S. AK Peninsula	9D & 10 (Unimak Island)	4,000	Decreasing	125
Adak	10 (Adak Island)	500	Stable	147
Mentasta	11	2,484	Decreasing	49
Chisana	12	1,660	Increasing	64[a]
Nelchina	13, 14B	40,000	Increasing	1,656
Kenai Lowlands	15A	125	Stable	3
Denali	13E, 20C	2,700	Increasing	0
Kilbuck Mountains	18	950	Increasing	30
Andreafsky	18	--	--	--
Beaver Mountains	19, 21	1,600	--	17
Kuskokwim Mtns.	19, 21	300	--	--
Sunshine Mtns.	19	550	--	2
Big River	19	750	--	43
Rainy Pass	19	1,500	--	85
Tonzona	19	1,000	--	45
Delta and Yanert	20A	10,690	Increasing	555
White Mountains	20B, 20F, & 25C	875	Increasing	12
Macomb Plateau	12 & 20D	800	Increasing	36
Fortymile	20E	22,000	Increasing	791
Galena Mountain	20F, 21C, 21D & 24	500	--	6
Wolf Mountain	20F, 21C, 21D, & 24	300	--	0
Ray Mountains	20F, 21C, 21D, & 24	700	--	2
Western Arctic	21D, 22A, 22B, 23 24, 26A	343,167	Increasing	10,000
Porcupine	25A, 25B, 25D, 26C	165,000	Increasing	3,500[a]
Central Arctic	26B & 26C	16,000	Increasing	336
Teshekpuk	26A & 26B	11,000	--	750
Statewide Totals		719,456		23,579

[a] Includes Canadian harvest.

STUDY AREA

GAME MANAGEMENT UNIT: 7 (4,423 mi^2)

HERD: Kenai Lowland, Kenai Mountain, Tustumena Bench, Fox River

GEOGRAPHICAL DESCRIPTION: Kenai Mountains

BACKGROUND

As a result of reintroductions of caribou in 1965-66 and 1985-86 (Spraker 1989) there are now 4 small herds on the Kenai Peninsula. 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 Tustumena Bench Caribou Herd (TBCH) is found in the upper drainages of Funny and Killey Rivers in Subunit 15B; and the Fox River Herd (FRCH) occupies the area between upper Fox River and Truuli Glacier in Subunit 15C. The population sizes of the KLCH, KMCH, TBCH, and FRCH are 115, 300, 90, and 30 caribou, respectively.

Recently transplanted caribou in the TBCH and FRCH, where hunting is prohibited, have shown a steady growth. Annual status reports for the Tustemena Bench and Fox River groups have not yet been initiated. The KMCH has been hunted annually since 1972. As hunters became aware of the KMCH, the number of issued permits and harvest sharply increased. In 1974 a harvest quota of 50 caribou was recommended to stabilize the herd at approximately 250 animals, because little was known concerning the carrying capacity of their range. An unlimited number of permits and extended seasons were allowed, and the season was closed by Emergency Order when necessary. In 1977 a limited permit system was begun, resulting in an annual success rate ranging from 17% to 33% for all permit holders. The KMCH began declining after 1985 for unknown reasons; harvest have been reduced there since 1987.

POPULATION OBJECTIVES

To maintain the posthunting herd at 400 animals until a carrying capacity is determined for the winter range.

METHODS

Aerial surveys using a Piper Super Cub were conducted to determine general distribution. On 21 October 1988 a Bell-206B helicopter was used for a sex and age survey. Since 1977 harvest

data were collected through the mandatory reporting requirements of the drawing permit process.

RESULTS AND DISCUSSION

Population Status and Trend

The KMCH has had 2 population peaks in its 25-year history. The original introduction of 15 caribou in 1965-66 grew to a minimum of 339 in 1975. The population was reduced to 194 by 1977, reaching the 2nd peak of 434 in 1985. For the last 3 years KMCH has shown a declining trend to a minimum of 305 caribou in the fall of 1988. Production appears to have also declined in recent years. The 1979-83 mean was 22.8% calves, with a peak of 29% recorded in 1982; the 1986-88 mean was 14.8% calves.

Population Size:

In October 1988 a total of 280 caribou were counted in the KMCH. Hunters killed an additional 25. The total fall 1988 minimum population estimate was 305 caribou. Fall estimates were 434 and 347 in 1985 and 1987, respectively.

Population Composition:

There were 23 calves:100 cows and 32 bulls:100 cows; calves composed 15% of the herd. Sex ratios declined from 1979 to 1982, but they showed no discernable trend between 1983 and 1988 (Table 1). Calf production in the early 1980's was higher than those for the last 3 years.

Mortality

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 will be issued.

Human-induced Mortality:

Hunters reported killing 25 caribou during the 1988 drawing-permit hunt, representing the lowest reported harvest since 1981 and indicating reduced permit availability and a declining harvest trend over the last 3 years (Table 2). The 1988 harvest was 43% lower than the reported harvest of 44 in 1987. Since permits numbers were limited beginning in 1977, harvests have ranged from 21 to 52 caribou. The largest harvest occurred in 1975, when 87 hunters each reported killing 1 caribou.

Hunter Residency and Success. Primarily Alaska residents hunted the Kenai Mountains herd. A total of 80 individuals reported hunting, and there was a 17% success rate.

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 100 and 250 permits have been issued each year since. One hundred fifty permits were issued during the reporting period, a decrease from 250 issued in 1986 and in 1987. A record number of 949 people applied for the 150 available permits, and 80 (53%) of the permit holders reported hunting. The reduced number of permits in 1988-89 reflects management concerns about decreasing population size and productivity.

Harvest Chronology. Twelve (48%) of the 25 reported caribou were killed during the first 2 weeks of the season.

Transport Methods. Nineteen (76%) of the successful hunters walked into the area they hunted, two (8%) used horses, and two (8%) used aircraft. Unsuccessful hunters followed a similar pattern of reliance on foot travel.

Game Board Actions and Emergency Orders

In the spring of 1988 a Department proposal was adopted by the Board of Game to reduce the number of permits from 250 to 150 for the fall 1988 season. No further Board action was taken during the 1988-89 reporting period.

CONCLUSIONS AND RECOMMENDATIONS

Data from 1988 suggests the KMCH is currently about 120 below the Department's population size objective of 400 caribou. Limited habitat, harsh environmental conditions, predation, and human harvests are all possible explanations for the recent lack of growth of this herd. An approved recommendation to the Board of Game to reduce the number of permits issued resulted in a harvest of 25 animals, compared with 44 reported in 1987. This harvest level will allow the herd to increase gradually, if controlling factors other than human harvest do not change significantly. If neonate mortality continues to be high, as witnessed in 1987, and fall recruitment low during the 1989 fall surveys, I suggest we readjust the population size objective downward to 300 caribou, until factors influencing calf recruitment are identified. Capture and examination of caribou on late winter range is also recommended.

LITERATURE CITED

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Table 1. Kenai Mountains herd composition, harvest, and estimated population size 1979-88.

Year	Total caribou counted	Calves (%)	Calves: 100 females	Males: 100 females	Harvest	Estimated population size
1979	201	15	24	44	33	234
1980	227	20	35	36	21	248
1981	256	27	47	30	21	277
1982	266	29	51	27	28	294
1983	276	23	40	39	20	305
1984[a]	343	--	--	--	52	395
1985	401	15	25	44	33	434
1986[b]	---	--	--	--	50	---
1987	303	12	20	44	44	347
1988	280	15	23	37	25	305

[a] No composition information.

[b] No survey.

Table 2. Kenai Mountains herd annual harvest by permit (drawing) hunt, 1984-85 to 1988-89.

Year	Season dates	Participation			Harvest				Percent success
		Applicants	Permits	Hunters	Male	Female	Unknown	Total	
1984-85	8/10-10/31	648	200	114	34	17	1	52	26
1985-86	9/10-11/15	236	200	134	21	12	0	33	17
1986-87	9/06-10/31	826	250	134	36	14	0	50	20
1987-88	8/10-9/30	[a]	250	157	21	23	0	44	18
1988-89	8/10-9/30	949	150	180	15	10	0	25	17

[a] Missing data.

STUDY AREA

GAME MANAGEMENT UNIT: 9A, 9B, 17B, 17C, nd 19B (40,000 mi^2)

HERD: Mulchatna

GEOGRAPHICAL DESCRIPTION: Northern Bristol Bay and the Nushagak Hills

BACKGROUND

There is little information available on the Mulchatna Caribou Herd (MCH) before 1973. According to Skoog (1968), the area presently occupied by the MCH was probably used seasonally during the 1800's by segments of 2 large migratory herds as well as by a resident herd. Caribou apparently migrated between the Alaska Peninsula and the Mulchatna range. Additionally, a large herd occupying the Bering Sea coast from Norton Sound to Bristol Bay probably utilized the current Mulchatna range. Presently, the range of this former herd is nearly devoid of caribou, except for the tiny Kilbuck Mountains and Andreafsky herds, and it is probably the largest area of unoccupied caribou habitat in the state.

The MCH was first surveyed in 1949, when the population was estimated at 1,000 caribou (ADF&G files). Skoog (1968) estimated the MCH at 5,000 animals in 1964. An estimated 6,030 caribou were observed on a survey in June 1973, but it was not until June 1974 that a major effort was made to accurately census this herd. A total of 13,079 caribou were counted at that time, providing a basis for an October estimate of 14,231 caribou.

Photocensusing surveys during the 1970's indicated a declining trend in population size (Table 1). Both seasons and bag limits were reduced continuously during this period; however, poor counting conditions and inconsistent survey efforts may have contributed to this apparent decline.

In 1981, 20 radio transmitters were attached to caribou, greatly assisting our ability in locating postcalving aggregations. The 1981 photocensus was conducted 30 June; 18,599 caribou were counted. Photocensus estimates since then have documented an annual rate of increase of approximately 17%.

POPULATION OBJECTIVES

To maintain a minimum population of 25,000 adults with a minimum bull:cow ratio of 35 bulls:100 cows.

METHODS

A photocensus estimate of the herd was conducted during the postcalving aggregation by ADF&G and Lake Clark National Park staff. A fall sex-age composition survey was conducted in October; 8 additional radio collars were placed on caribou. Most of the 20 radio collars placed in 1981 had ceased to operate by 1988-89. Monthly radio-tracking flights were conducted by the National Park Service to continue the demographics study that began in 1981. A spring productivity survey was conducted on the calving grounds in the Snipe and Twin Lakes area. Harvest monitoring by ADF&G staff was maintained along the Mulchatna and upper Nushagak Rivers during the first half of September when hunting pressure was most intense. Harvest data were collected from statewide harvest reports. Data was of limited value, because no reminder letters were sent to hunters failing to report.

RESULTS AND DISCUSSION

Population Status and Trend

The increasing size of the Mulchatna herd since 1981 (17% per year) has been attributed to a succession of mild winters since the late 1970's, low predation rates, and an annual harvest rate of less than 5% since 1976. Radiotelemetry data indicated that summer and fall range use has expanded northwest to the Taylor Mountains and the Aniak River drainage and north throughout the Stony River drainage. Winter range use has expanded southeast across the Kvichak River to the Naknek River drainage and northeast as far as Kokhanok. Significant numbers of caribou (300+) have been wintering on the west side of the Nushagak River between Kemuk Mountain and the Muklung Hills since 1986.

Several peripheral groups appeared to be autonomous from the Mulchatna herd. A group of 100 to 300 caribou were located near Etolin Point. Rainy Pass had an estimated 200 to 400 that may have remained in that vicinity throughout the year. A group of approximately 600 to 800 caribou inhabited the Kilbuck Mountains to the west of the Mulchatna range.

A radiotelemetry study to determine population size and demographics of this group was initiated in 1986 by the Department and the Yukon Delta National Wildlife Refuge. This group had never been observed to intermix with the Mulchatna herd until fall the of 1988, when approximately 1,100 Mulchatna caribou moved into the area, remaining throughout the winter. The largest peripheral group to the main herd occupies the upper Koktuli and Stuyahok River drainages. This group of approximately 2,000 to 3,000 caribou spent the spring, fall, and summer in this area, joining the main herd on the wintering grounds in late November or early December.

Population Size:

A photocensus of the Mulchatna herd was conducted on 30 June 1988; 60,328 caribou were observed, representing a 32% increase over the 45,742 observed in 1987 (i.e., extrapolated population estimate of 52,527). The increased effort to photograph all groups of males during the 1988 survey may have partially accounted for an increase of this magnitude. During the photocensus conducted on 28 June 1989, the population of the Mulchatna herd was estimated at 70,000 caribou. Again, we attempted to photograph all male groups, because no sex-age composition count was planned for the fall of 1989.

Population Composition:

Sex-age composition surveys were conducted on 6 October 1988 and 29 June 1989 (Table 2). Ratios of both males:100 females and calves:100 females during fall composition counts have remained consistently high during the 1980's. The percentage of males in postcalving aggregations has steadily declined as this herd has increased in number. The increase noted in the fall ratio of males:100 females indicated that the current level of hunting pressure had a negligible effect on the male segment of the population.

Distribution and Movements:

The cooperative effort between ADF&G and the Lake Clark National Park continued during this reporting period. The additional 8 radio transmitters placed on caribou in October were monitored monthly by NPS personnel. Range use patterns were similar to those in 1987-88, except that deep snows in late October and November forced caribou from their traditional winter range west of Iliamna Lake between the Koktuli Hills and the Nushagak River to cross the Kvichak River and winter between Kokhanok and the Naknek Rivers. A major portion of the northern Alaska Peninsula herd moved north across the Naknek River and intermingled throughout the winter with the Mulchatna herd. Radiotelemetry data throughout the winter and spring indicated the herds separated during the spring migration and all radio-collared animals returned to their traditional calving grounds in May.

Mortality

Season and Bag Limit:

There is no open season in Subunit 17A and that portion of Subunit 17C west of the Nushagak River. The open season for all hunters in Subunits 9A, 9B, and the remainder of Subunits 17 and 19B 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 not more than one may be taken from 1 September to 30 November; for

resident hunters not more than one may be taken from 10 August to 30 November. The bag limit for nonresident hunters is 1 caribou.

Human-induced Mortality:

The reported harvest from the Mulchatna herd during the 1988-89 regulatory year was 1,471, which is the highest recorded for this herd; of these, 1,153 were males, 280 were females, and 38 were unknown. Most females were taken during the winter season. Weather conditions were ideal for hunting in March, and nearly all of the harvest from December to March occurred then. As in previous years, the majority of harvest by local residents was not reported. Most of the unreported harvest is attributed to the Nushagak River villages in Unit 17, although efforts to distribute harvest tickets and establish license vendors in those villages have met with some success. The total estimated unreported harvest during this regulatory year was 1,500 caribou, bringing the total estimated harvest to slightly less than 3,000 caribou.

General field observations indicated that the density of hunters in these units has increased steadily since the early 1980's during the fall season. Harvest levels remaining at less than 5% of the total population do not appear to be limiting herd growth.

Natural Mortality:

A ground survey of the calving grounds in the Snipe and Twin Lakes area conducted 3 to 6 June 1989 indicated that the major cause of calf mortality on the calving grounds was predation by brown bears. Remains of 11 calves were found; one died shortly after birth from an unknown illness, and one appeared to have been killed by wolves. The others had been killed by brown bears.

Snow depths were abnormally high in the Wood-Tikchik Mountains and in all drainages of the Nushagak and Mulchatna Rivers. Atypical of most years, snow accumulated to depths approaching 1 meter by mid-November over most of the traditional wintering area west of Iliamna Lake between the Kvichak River and the Stuyahok and Koktuli Hills. Most of the herd was forced to winter east of the Kvichak River in areas not traditionally used between Kokhanok and King Salmon; however, reports from hunters in March indicated that the harvested females all had some fat reserves left and nearly all were carrying calves.

Habitat Assessment

No effort to assess the condition of winter range utilized by the MCH was made during this reporting period. For the past 3 years this herd has expanded its winter range annually to the east across the Kvichak River. Additionally, it has continued to expand its summer range to the north and west. Visual observations of the habitat in the Twin and Snipe Lakes area

indicated a general deterioration of range quality on the calving grounds since 1980.

CONCLUSIONS AND RECOMMENDATIONS

The MCH has experienced exceptionally rapid growth since 1980. The postcalving population estimates have increased from 20,618 in 1981 to 70,000+ in 1989. While hunting pressure has grown in recent years, annual harvests have remained at less than 5% of the population.

Concurrent with this population growth, the MCH has expanded into new range to the north and west in the summer and fall and to the south and east during the winter months. While the area west of the Nushagak River in Subunit 17C has been closed to caribou hunting for the past 3 years, this herd continues to have difficulty establishing significant use of this habitat because of illegal harvests by some area residents.

Radiotelemetry has been a valuable tool for managing this herd. Comparatively few dollars have been spent annually on MCH management, and population estimates would be impossible without the use of radio transmitters to locate the postcalving aggregations. The 20 radio collars placed on caribou in this herd in 1981 and most of the 10 placed in 1982 are no longer functional. Ten, 10, and 8 transmitters were placed on caribou in 1986, 1987, and 1988, respectively. A minimum of 30 radio transmitters are required to maintain a high probability of finding all of the major postcalving aggregations during the annual photocensus estimate in a herd of this size. Because cooperative efforts with the Clark National Park Service to conduct annual photocensus estimates and monitor herd movements have been highly successful and cost effective for both agencies; they should be continued. While it is impossible to predict how long this herd may continue to increase, it is very likely that rate of increase may occur during the next few years. A potential advantage of continued herd growth is the possible colonization of vacant historical caribou habitat along the Bering Sea coast to the northwest. This would be a substantial benefit to local residents because ungulate density is extremely low in the area.

LITERATURE CITED

Skoog, R.O. 1968. Ecology of the Caribou (*Rangifer tarandus granti*) in Alaska. Ph.D Thesis. Univ. of California, Berkley. 699 pp.

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Table 1. Mulchatna caribou photocensus estimates, 1949 to present.

1949 First survey of Mulchatna Herd. Est. 1,000 caribou.
1965 Skoog estimated 5,000 caribou (Skoog, 1968).
1973 Estimate 6,030 (ADF&G Files).

Date	Preliminary Estimate	Actual Count	Extrap. Estimate
1949	--	--	1,000[a]
1965	--	--	5,000[b]
1973	--	--	6,030[c]
1974	--	13,079	14,231
1975[d]	--	--	--
1976		9,097	--
1977[d]	--	--	--
1978		6,340	7,503
1979[d]	--	--	--
1980	10,000+ caribou observed.	--	--
1981		18,599	20,618
1982[d]	--	--	Increase noted
1983	--	25,416	--
1984	24,221	33,214	--
1985	36,706	42,945	--
1986	Photocensus work discontinued due to bad weather.	--	--
1987	37,262	45,742	52,527
1988	45,456	60,328	--
1989	51,868	70,000	--

[a] First survey of Mulchatna herd.
[b] Estimate, Skoog, 1968.
[c] Estimage, ADF&G files.
[d] No photocensus or extrapolation estimates were made.

Table 2. Sex and age composition counts of the Mulchatna caribou herd conducted in the summer and fall, 1974-1989.

Date	Males:100 females	Calves:100 females	Calf %[a] in herd	Female %[a] in herd	Male %[a] in herd	Sample size
SUMMER COUNTS						
6/19 & 20/74	36.0	38.3	22.0	57.3	20.7	3,130
6/18/78	32.1	49.5	27.2	55.1	17.1	1,006
6/5 & 6/79	--	45.9	31.5	--	--	531
7/1/81	26.4	51.9	29.1	56.1	14.8	3,324
6/16/82	14.7	59.3	34.1	57.5	8.4	5,097
6/16 & 17/83	52.2	51.4	25.2	49.1	25.6	1,926
6/16 & 17/83	44.5	49.7	26.0	51.2	22.9	1,926
6/26/84	39.2	57.8	29.3	50.8	19.3	2,731
FALL COUNTS						
10/16 & 17/74	55.0	34.9	18.4	52.7	29.0	1,846
10/27/78	50.3	64.5	27.6	42.7	21.5	758
10/29/80	31.3	57.1	30.0	52.4	17.6	2,250
9/30/81	52.5	45.1	22.8	50.6	26.6	1,235
10/19/86	55.9	36.9	19.2	51.9	29.0	2,171
10/13/87	68.2	60.1	26.3	42.8	29.9	1,358
10/6/88	66.0	53.7	24.4	45.5	30.0	536

[a] Weighted percentages based on proportion of population represented by each sample.

STUDY AREA

GAME MANAGEMENT UNIT: 9C and 9E (24,000 mi^2)

HERD: Northern Alaska Peninsula

GEOGRAPHICAL DESCRIPTION: Alaska Peninsula

BACKGROUND

The Northern Alaska Peninsula Caribou Herd (NAPCH) ranges from Port Moller to the Naknek River drainage. Historically, the size of this population has fluctuated widely, peaking at the turn of the century and again in the early 1940's (i.e., 20,000 caribou). The last population low occurred during the late 1940's (i.e., 2,000 caribou); since that time the herd has experienced steady growth until 1984, stabilizing at approximately 20,000.

POPULATION OBJECTIVES

To maintain the midsummer population between 15,000 and 20,000 and an October sex ratio of 40 bulls:100 cows.

METHODS

Radiotelemetry-aided aerial photocensus were conducted in late June on postcalving concentrations. Fall sex and age composition surveys were conducted in October during the rut, and reconnaissance flights (i.e., using radiotelemetry) were conducted throughout the year to monitor herd movement. The harvest was monitored by harvest tickets and supplemented by hunter checks.

RESULTS AND DISCUSSION

Population Status and Trend

The NAPCH has grown since the early 1950's. Photocensuses in 1984 and 1985 showed the population numbered at least 19,000. In 1986 census results were unreliable, because several radio-collared caribou could not be located and only slightly more than 15,000 caribou were counted. In 1987 less than 16,000 caribou were counted. The 1988 and 1989 surveys indicated the herd had stablized at the population objective (Table 1).

Population Size:

Survey conditions in June 1989 were good, although clouds and winds near mountains prevented total coverage. Most of the radio-collared caribou were located, and the herd was in large

postcalving concentrations. Although the June 1989 photocensus accounted for 19,180 caribou, it represented the minimum number because the sex-age composition classification and extrapolation for estimating the portion of the herd (mostly bulls) not associated with the postcalving aggregations were not done.

Population Composition:

A sample of 1,156 caribou was classified in October 1988 as follows: 25% calves, calf:cow ratio of 49:100, bull:cow ratio of 49:100, and 13% medium-to-large bulls (Table 1). A sample of 1,939 caribou classified from the June 1989 photocensus showed 33% calves in the herd. Since 1983 the percentage calves present during the postcalving censuses of the NAPCH has ranged from 25% to 33%, while the Southern Alaska Peninsula herd has had only 12% to 18%.

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 2 years a majority of the herd has been north of the Egegik River by the first of August. Traditionally, this herd winters between the Egegik and Naknek Rivers; however, in 1986 and 1987 many caribou wintered north of the Naknek River to the Alagnak River, nearly overlapping with a portion of the Mulchatna herd. By late November 1988 an estimated 3,000-4,000 caribou, including nine with radio collars, had crossed the Naknek River. During the next several months these caribou intermingled with the Mulchatna herd between the Naknek River and Lake Iliamna. Radio-collared caribou from both herds associated in the same groups; 2 NAPCH and 6 Mulchatna radio-collared caribou were part of a large group that moved up the east side of Lake Iliamna to Kokhanok. The presence of 40,000 to 50,000 caribou from both herds in this area represented a major shift in winter distribution. Prior to the reporting period, as many as 7,000 Mulchatna caribou had moved into the Alagnak River drainage and 2,000+ NAPCH caribou had used the Pauls and King Salmon Creek area. In 1988 extremely deep snow in the Mulchatna-Nushagak River drainage forced much of the Mulchatna herd to move southeastward across the Kvichak River. It is believed that record-setting-cold northwesterly winds and deteriorating range conditions south of the Naknek River prompted more NAPCH caribou to move into the northern portion of Subunit 9C.

By late March at least half of the NAPCH caribou had moved back across the Naknek River; the remainder straggled south throughout the rest of the spring. During June all except 1 of the 9 radio-collared caribou that had been north of the Naknek River were located on the traditional calving area. The one missing caribou was not with the Mulchatna herd; it either died or remained in the area southeast of Lake Iliamna. Historically, caribou have not spent the summer in the Alagnak River-Big Mountain area;

however, in recent years several small groups (predominantly bulls) have been seen. For the first time in 1989, calving was documented occurring in the hills between King Salmon Creek and the Alagnak River. It is not know if these caribou were originally from the NAPCH or Mulchatna herd.

Mortality

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

Human-induced Mortality:

The 1988-89 reported harvest from the NAPCH was 939 (Table 2), including 841 males (85%) and 147 females (15%). Most local and some nonlocal hunters did not report killing caribou. In an effort to estimate the percentage of the nonsubsistence harvest that was not reported during the fall of 1987, a total of 106 successful hunters were checked as they departed King Salmon. Harvest ticket numbers, hunter residency, and harvest were discretely recorded so that later reporting would not be seriously biased. These hunters had taken a total of 116 caribou. After harvest reports had been returned, a comparison was made between the field interviews and reported harvest. Of the 106 hunters previously interviewed, 65 submitted the required harvest report, indicating a harvest of 70 caribou; thus just over 60% of the known harvest was reported. McNay (1988) used a similar procedure in Unit 20, estimating the reporting rate at 56%. Although this is a crude procedure for estimating the unreported harvest, the results suggest that the nonsubsistence harvest may be as much as 40% higher than that reported. Applying a 40% correction factor to the 989 caribou reported, the total nonsubsistence harvest is estimated at 1,400 caribou.

Based on surveys of all villages in Subunits 9C and 9E (J. M. Morris, pers. commun.), the unreported subsistence harvest is estimated at 900-1,000 caribou. Combining the two estimates results in a total human harvest for Subunits 9C and 9E of 2,300-2,400 caribou, or about the same as that for 1988. Because of the proximity of many Mulchatna caribou to the Naknek-King Salmon area, an unknown portion of this harvest was from the Mulchatna herd. Although there is no way to segregate the harvest, 100 to 200 caribou were from the Mulchatna herd.

Harvest Chronology. The majority of the reported harvest for the NAPCH occured between 10 August to 31 October, 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 (Table 3). The reported caribou harvest on the Alaska Peninsula increased during odd-numbered years having concurrent October brown bear seasons (Table 3). During the past 3 winters (1986-87 to 1988-89), caribou have crossed the Naknek River in unprecedented numbers, allowing easier access by hunters in vehicles. This easy access combined with low air fares from Anchorage and a liberal bag limit (i.e., 4 caribou) attracted a heavier winter hunting effort than usual. The subsistence harvest is primarily opportunistic, and some of the villages in Subunit 9E traditionally hunt caribou in March as they migrate south.

Natural Mortality:

Although specific data on natural mortality is lacking, it is believed to be much lower than that for the Southern Alaska Peninsula herd. A comparison of the percentage of calves observed during the postcalving census (30%) with the percentage classified in October (25%) suggested good calf survivals. The 1988-89 winter was extremely cold; however, snow cover south of Lake Iliamna was light, and no evidence of an abnormally high winter mortality was noted.

Habitat

No quantitative data is available to assess range conditions; however, preliminary analysis of data (i.e., body weights, blood parameters, body size) from the caribou transplanted in 1988 and consistently high calf production indicate that the caribou are in relatively good condition. Nevertheless, the expansion of the winter range north of the Naknek River may be an indication that this herd's winter range is being heavily used.

Game Board Actions and Emergency Orders

Because the 1987 photocensus suggested a decline in the herd and a record harvest was taken during 1987-88, reductions in bag limits and alignment of regulations with those for the Mulchatna herd were recommended and adopted for the 1988-89 season. Thus for Subunits 9A, 9B, 9C, 9E, 17B, and a portion of 17C, nonresidents may take only 1 caribou; only subsistence hunters may take 2 caribou during August; and the bag limit does not increase to 4 caribou until 1 December, one month later than in the past.

CONCLUSIONS AND RECOMMENDATIONS

The NAPCH has remained at the upper end of the population objective, despite increasing harvests. To maintain this herd at or slightly below the 20,000 objective, it may be necessary to increase the harvest. With the Mulchatna herd still growing, I recommend the regulations for both herds be the same. More

specific recommendations for changes in regulations will be made to the Board before it deliberates on caribou seasons. The NAPCH showed no signs of stress; i.e., low reproductive success or poor body condition. Although we have recommended range analysis or a comprehensive analysis of animal condition to determine if the population objectives are appropriate for several years, funding and personnel limitations have prevented ADF&G or Becharof National Wildlife Refuge staff from undertaking this project. It still remains a high priority.

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Table 1. Summary of caribou population statistics for the Northern Alaska Peninsula Herd.

Year	Population count	Population estimate	Summer %calves	Fall %calves	Ratio bulls:100 cows	Ratio calves:100 cows
1981	16,600	18,000	28	23	34	39
1982	16,800	18,000	27	26	52	52
1983	18,000	19,000	29	16	39	27
1984	19,000	20,000	25	22	39	39
1985	18,978	20,000	27	--	--	--
1986	15,274	15,300+	28	18	51	34
1987	15,629	17,000	30	25	54	52
1988	19,000	20,000	30	25	49	49
1989	19,180	20,000	33	--	--	--

Table 2. Northern Alaska Peninsula Caribou Herd annual reported harvest and estimated harvest 1983-89.

Year	Reported			Unreported estimate		Grand total
	Male	Female	Total[a]	Sport[b]	Subsistence	
1983-84	493	128	639	256	900	1,795
1984-85	569	166	743	297	900	1,940
1985-86	612	133	751	300	900	1,951
1986-87	602	118	720	288	900	1,908
1987-88	841	158	1,003	400	900	2,303
1988-89	841	147	989	400	900	2,300

[a] Includes unknown sex.
[b] Computed using the number 0.40, which represents the percentage of 106 sampled sport hunters who didn't return their harvest tickets during the 1987-88 hunting season and assumes the same for other years.

Table 3. Harvest chronology for Northern Alaska Peninsula Caribou Herd 1984-85 to 1988-89.

Month	1984-85		1985-86		1986-87		1987-88		1988-89	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
August	116	51	82	11	145	41	106	25	88	17
September	271	25	256	29	245	12	293	15	339	26
October	95	16	150	13	81	15	223	8	173	10
November	65	34	71	26	58	16	129	63	48	16
December	7	6	7	1	25	12	43	14	54	18
January	2	0	4	9	9	1	6	2	21	7
February	7	18	11	15	11	8	4	1	36	16
March	11	15	31	29	29	13	37	30	76	36
Totals	574	167	612	113	605	118	841	158	841	147

STUDY AREA

GAME MANAGEMENT UNIT: 9D and 10 (10,000 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. Unimak Island has often been included, but caribou on the island probably should be considered a distinct herd (Skoog 1968). Historically, the size of the SAPCH has varied widely, ranging from 500 to over 10,000 (Table 1); Skoog (1968) speculated that the Alaska Peninsula was marginal habitat for sustaining large caribou populations, because of periodically severe icing conditions and ash from frequent volcanic activity affecting food supply and availability. Recent herd history includes a growing phase from 1975 to 1983 and a declining phase from 1983 to the present (Pitcher et al. 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 in the mid-1980's, averaging about 1,000; however, with more restrictive regulations and reduced herd size, the harvest has declined to <200 caribou. Undernutrition may be playing a role in the decline of the SAPCH. Predation by wolves and brown bears as well as human harvest are also contributing to the decrease in numbers (Pitcher et al. 1990).

POPULATION OBJECTIVES

To maintain a minimum population of 5,000 to 6,000 caribou in midsummer with an October sex ratio of 40 bulls:100 cows.

METHODS

An aerial postcalving aggregation radiotelemetry survey in late June or early July has been conducted in most years since 1984. Fall sex and age composition surveys are periodically conducted with a helicopter in October or early November. Occasional radio-tracking flights are conducted to monitor herd distribution. A late-fall aerial census conducted along standardized systematic transects on the Izembek National Wildlife Refuge (INWR) occurs annually. Hunter harvests are monitored by harvest tickets and supplemented by field checks by INWR staff around Cold Bay. During 1989 studies were conducted

on causes of low calf recruitment in the SAPCH (Pitcher et al. 1990).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

A total of 3,386 caribou were counted during the July 1989 SAPCH census. Survey conditions were fair, although low clouds over the Caribou River flat and high winds near mountains prevented total coverage. All of the radio-collared caribou were located, generally in large postcalving concentrations. Total herd size was arbitrarily estimated at 4,000, based on perceived thoroughness of the census. This count was the lowest obtained during the 1980's (Table 1) and continues a declining trend that began in about 1984 (Pitcher et al. 1990). The decline has been characterized by consistently low calf recruitment throughout the 1980's (Table 1, Pitcher et al. 1990).

Population Composition:

In a composition sample of 886 caribou 12% were calves, and calf:cow and bull:cow ratios were 19:100 and 41:100, respectively (Table 1). On 13 June 1989 during an aerial survey, calves composed 17% of the sample (n = 2,321) (Pitcher et al. 1990).

Distribution and Movement:

Data from radio-tracking surveys conducted by staff from both INWR and the Department suggest that the SAPCH two main subgroups calve and winter in separate areas (Pitcher et al. 1990). Approximately 25% of the herd appears to calve and winter on the Caribou River flat. The remainder of the herd calves in the Black Hill-Trader Mountain area and winters around Cold Bay. An additional few caribou are thought to calve in the mountains east of the Caribou River flat. Caribou on Unimak Island are thought to be resident and probably should be considered a separate herd.

Mortality

Season and Bag Limits:

The open season in Subunit 9D and Unit 10 for subsistence hunters only is 1 September to 31 March; the bag limit is 2 caribou. For all resident and nonresident hunters the season is 1 September to 31 October; the bag limit is 1 caribou.

Human-induced Mortality:

The 1988-89 reported harvest of the SAPCH was 48 caribou, including 35 males and 13 females (Table 2); however, when

unreported sport and subsistence harvests are considered, the total harvest may approach 150. The accuracy of our harvest estimate is questionable. The INWR staff monitored local harvests in the Cold Bay area and estimated total harvests from surrounding villages. Their estimate for total harvest was higher and probably more accurate that ours.

The reported harvest occured mostly in November and December, coinciding with herd migration to the wintering area near Cold Bay. The SAPCH caribou then became available along the local road system.

Natural Mortality:

Annual survivorship of radio-collared adult females from the SAPCH was estimated at 0.61, which is extremely low, compared with other Alaskan caribou herds (Pitcher et al. 1990). Causes of death were not determined, although predation by wolves and brown bears is likely a factor. Both predators are relatively abundant on the SAPCH range.

Calf survival in the SAPCH has been low throughout the 1980's; during the reporting period the percentage of calves in the herd averaged 13% in early July, only 1 month after calving. Undernutrition is thought to be a factor in the low survival, although predation by wolves and brown bears is also probably involved (Pitcher et al. 1990).

Habitat Assessment

No formal assessments of habitat were made on the SAPCH range. Habitat on the Caribou River flat is substantially different than that 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, while the Black Hill-Trader Mountain and Cold Bay areas are generally midelevation ericaceous shrub tundra. Plant phenology is earlier on the Caribou River flat.

Game Board Actions and Emergency Orders

Game regulations for the SAPCH in Subunit 9D and Unit 10 were relatively stable until 1986, when an Emergency Order in November reduced the bag limit to 1 caribou. In 1987 the bag limit was 2 caribou for subsistence hunters and one for resident and nonresident hunters; however, on 31 August 1987 the season was closed by Emergency Order. Following the INWR October census, the subsistence season in Subunit 9D was reopened by Emergency Order from 17 November to 17 January and a bag limit of 2 caribou established. The reason for the emergency closure and reopening of Subunit 9D season was concern over the possible overharvesting of a declining population. The herd was censused in November 1986 and June 1987, resulting in respective counts of 4,543 and 4,067. These counts indicated the herd was below the minimum

objective of 5,000 animals and declining. Shortly thereafter (November 1987) the staff of INWR counted 6,400 caribou. The count indicated that the herd was above the minimum population objective, so the 1987 season was reopened for subsistence hunting.

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. Because of a lack of precise answers to these questions, we feel that hunting mortality should be reduced to the greatest extent possible, particularly for females. We realize that we are 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 have concerns 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. In this case it may be difficult to manage the herd at a level between nutritional and predator limitation.

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Table 1. Caribou composition counts, total counts, and population estimates in Subunit 9D, 1983-89.

Date	Males:100 females	Med. & Large male %	Calf: 100 females	Calf %	Sample size	Total count	Estimated population size
1/83	--	--	--	--	--	5,641[a]	5,641+
5/83	--	--	--	18	Unknown	5,264[a]	5,264+
10/83	--	5	--	15	1,596	--	--
11/83	--	--	--	--	--	10,203[a]	10,203+
7/84	--	4	--	17	2,389	7,500[b]	7,500+
10/84	--	7	--	15	1,566	--	--
7/85	--	--	--	6	2,333	4,044[b]	4,044+
10/85	--	12	--	9	1,460	--	--
1/86	--	--	--	--	--	3,333[c]	--
7/86	--	4	--	17	2,594	--	--
11/86	32	9	20	12	2,307	4,543[c]	4,543+
6/87	--	--	--	12	723	4.067[e]	4,784
7/87	--	--	--	12	1,689	--	--
10/87	36	--	26	16	1,769	6,401[d]	6,401+
6/88	--	--	--	16	1,162	3,407[e]	4,000
10/88	41	10	19	12	886	--	--
6/89	--	--	--	17	2,321	--	--
7/89	--	--	--	--	--	3,386[e]	4,000

[a] Aerial photo-direct count census with systematic search.
[b] Aerial photo-direct count census with systematic transects.
[c] Direct count census with systematic transects.
[d] Aerial photo-direct count census with systematic transects and radio telemetry cross check.
[e] Aerial photo-direct count census with radio telemetry search.

Table 2. Annual reported harvest and estimated harvest in Subunit 9D, 1983-89.

Year	Male	Reported female	Total[a]	Unreported estimate subsistence and sport	Grand total
1983-84	168	81	254	500-700	800-1000
1984-85	279	109	388	500-700	900-1100
1985-86	180	162	345	500-700	850-1050
1986-87	36	18	56	300-500	400-600
1987-88	41	40	81	50-100	130-180
1988-89	35	13	48	50-100	100-150

[a] Includes unknown sex.

STUDY AREA

GAME MANAGEMENT UNIT: 10 (300 mi^2)

HERD: Adak

GEOGRAPHICAL DESCRIPTION: Adak Island

BACKGROUND

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

In less than 10 years the herd grew to 189 caribou. Because of the high productivity of the herd and the lack of predators, human harvest was the only feasible method of maintaining an optimum herd size. The first hunting season was authorized in 1964, and 4 caribou were harvested. Seasons were progressively liberalized as the herd continued to grow, and by 1972 the harvest approached 100. Since then, the estimated post-hunting population size has ranged from 200-300 in the last few years. Harvest has varied from 69-149 per year.

Adak has proven to be a difficult area to manage caribou. Weather and physical distance from human population centers often make both data collection and hunting prohibitively expensive. Management has only been possible because of the cooperative efforts of the ADF&G, U.S. Fish and Wildlife Service (FWS), and the U.S. Navy. The Department's intent for this herd has been to provide for an optimum harvest of caribou. By maintaining the herd size below the carrying capacity through hunting, the range quality was expected to remain high so that caribou could maintain high reproductive success. A more recent concern has been our ability to limit population growth through hunting. The current harvest of about 150 caribou is close to the maximum hunters on the island are capable of taking. The rapid expansion of caribou numbers on this island is undesirable.

POPULATION OBJECTIVE

To maintain the precalving population at 150 animals for use by all user groups.

METHODS

Aerial surveys of caribou range on the island are conducted by personnel from the Alaska Maritime National Wildlife Refuge and the Adak Naval Air Station whenever aircraft are available during

suitable flying conditions. Harvest information is collected from hunters by the FWS at Adak.

RESULTS AND DISCUSSION

Population Status and Trend

The estimated posthunting caribou population on Adak island has ranged from 177 to 300 from 1978 to 1988. The prehunting population size is aproaching 500 caribou. Because of the lack of comparable survey data, no objective determination about recent trends can be made; FWS biologists on Adak Island believe the herd size has been stable to slightly increasing during the past few years.

Population Size:

An aerial survey of the Adak Island caribou herd was conducted in a U.S. Coast Guard "Dolphin" helicopter on 28 and 30 August 1988 (Table 1); FWS biologists counted 335 caribou in 28 seperate groups. No estimates of sex and age composition or total population size were made.

Distribution and Movements:

Caribou are distributed throughout Adak Island, but most of them reside on the south end, away from the Navy base. Specific calving areas are believed to be in the upper Hidden and Boot Bay areas.

Mortality

Season and Bag Limit:

The open season for subsistence, resident, and nonresident hunters in Unit 10 (Adak Island only) is 1 September to 31 March. The bag limit is 2 caribou by registration permit only (Hunt No. 550).

Human-induced Mortality:

Hunters reported harvesting 147 caribou, including 85 males (58%) and 62 females (42%) from Adak Island during this reporting period. It was one of the highest harvests ever reported, second only to the 1985-86 season when 149 caribou were killed. The percentage of males in the 1988-89 harvest was higher than those reported for the previous 4 seasons (Table 2). Age data were not analyzed for caribou harvested in 1988-89 (Table 3).

Hunter Residency and Success. Personnel from the Alaska Maritime NWR at Adak issued 352 registration permits (Hunt No. 550) to 231 Alaska residents (65%) and 121 nonresident military personnel (34%). Most of the permittees lived on Adak Island.

Of the permittees who reported hunting (n = 249), 105 (42%) were successful and 147 (58%) were unsuccessful. Sixty percent (n = 63) of the successful hunters killed 1 caribou and 41% (n = 42) killed two. The mean number of days spent hunting by successful hunters was 7.2 days; unsuccessful hunters spent an average of 4.6 days.

Permit Hunts. All caribou hunting on Adak is by registration permit (Hunt No. 550).

Harvest Chronology. Seventy-five percent of the harvest occurred during the first 3 months of the season. October and November were the most productive months, accounting for 66% of the harvest. Less than 1% of the reported harvest was taken during December and January, when the U.S. Navy tug was not available for transporting hunters.

Transport Methods. Data on modes of transportation used by caribou hunters on Adak were not collected during this reporting period. In past years, most hunters have accessed caribou on the northern part of the island by highway vehicle and foot. The southern part of the island was usually reached by a private charter boat or a U.S. Navy harbor tug. The 5 public-use cabins maintained by the FWS on the southern half of the island are popular base camps for hunters.

Natural Mortality:

No information on natural mortality was obtained during this reporting period. Natural mortality is usually low in this herd, because there are no natural predators, winters are relatively mild, and the herd has been reported to be essentially disease-free.

Habitat Assessment

Range condition was analyzed in the late 1960's and early 1970's. Department biologists were especially concerned that if the Adak caribou population were not maintained at or below the carrying capacity of their range, the herd would experience rapid growth and subsequent decline similar to that seen on Saint Matthew Island in the mid-1960's (Klein 1968). The carrying capacity of the range has never been determined, but for management purposes the posthunting season population goal was originally set at 250 caribou. In 1980 the population objective was revised to a more conservative level of 150 caribou.

Game Board Actions and Emergency Orders

An Emergency Order closing the Adak caribou hunt was issued in December 1982, when it appeared that harvest would reduce the herd to a level below the management objective. For the same reason, an Emergency Order closed the entire 1983-84 hunting

season. Subsequent information suggested that a large portion of the herd had not been surveyed in 1982 and 1983, and the population level was not as low as was believed.

Prompted by concerns of local residents, the Department recommended that the Board of Game reduce the bag limit on Adak from 4 caribou to 2 caribou and that the hunt be administered as a registration hunt. The Board adopted these changes for the 1983-84 season. No Emergency Orders or Board actions have affected the Adak caribou hunt for the past 5 seasons.

CONCLUSIONS AND RECOMMENDATIONS

When caribou were transplanted onto Adak Island the potential for overpopulation and resulting range deterioration were well understood. Since then there have been diligent efforts to census the herd, encourage hunting, and periodically assess range condition. Efforts to obtain adequate population data are often hampered by poor weather and limited availability of aircraft. Hunting efforts are also limited by weather, but it is mostly limited by the remote location of the island and by security considerations on the Navy base. Policies of acting base commanders regarding hunting and the use of a Navy harbor tug for access to hunting areas also affect harvests.

Based on data from the 1988 census and the opinions of FWS biologists stationed on Adak Island (Byrd 1989), it appears that the herd is above the objective level. If these trends are actually occurring, the herd may reach a level that is unmanageable by hunting alone.

It is important that the Department, the FWS, and the U.S. Navy work together to develop a method of routinely surveying the herd. These surveys should receive high priority by all of the agencies involved, and funding for commercial aircraft charters should be secured if military aircraft are not available. A meeting between FWS, the Department, and the Navy is planned on Adak Island for fall of 1990. No changes in the season or bag limit are recommended at this time.

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Table 1. Population size of the Adak Island caribou herd, Unit 10, 1984-1988.

Survey date	Caribou observed	Estimated herd size
09 Jul 1984	360	--
22 Aug 1985	313	420-500
1986	NO SURVEY	--
1987	NO SURVEY	--
28 & 30 Aug 1988	335	--

Table 2. Annual harvest of Adak Island caribou, Unit 10, 1984-1989[a].

Regulatory year	Caribou harvested		
	Male	Female	Total
1984-85	82 (57)	62 (43)	144
1985-86	74 (50)	75 (50)	149
1986-87	58 (43)	76 (57)	134
1987-88	65 (54)	56(46)	121
1987-88	85 (58)	62 (42)	147

[a]percentage in parentheses

STUDY AREA

GAME MANAGEMENT UNIT: 11 (13,257 mi^2)

HERD: Mentasta

GEOGRAPHICAL DESCRIPTION: Wrangell Mountains

BACKGROUND

Regular surveys of the Mentasta Caribou Herd (MCH) began in the early 1970's. Prior to this time little information was available concerning this population, but there was some speculation that the herd was a remnant group from large-scale movements of the Forty-Mile Caribou Herd into the Copper River Basin during the 1920's. Skoog (1968) indicated there was no evidence to support this contention, and there are records of caribou in the Wrangell Mountains prior to 1920. From 1973 to 1987 the estimated herd size varied from approximately 2,200 to 3,160 and averaged 2,660. Count data indicated a trend of increasing herd size from 1973 to 1985 or 1986 followed by a decline through 1988.

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

POPULATION OBJECTIVES

To maintain a minimum overwinter population of 2,500 adults and a minimum posthunting bull:cow ratio of 35 bulls:100 cows.

METHODS

An aerial postcalving aggregation and associated fall sex and age composition surveys have been conducted in most years since 1973. These censuses involved direct counts of all caribou observed in postcalving aggregations immediately followed by sex and age composition surveys. The proportions of calves and bulls in the population were estimated from fall sex and age composition surveys. The proportions of calves and bulls in the fall were used with the postcalving cow base to extrapolate total fall population estimates. Fall aerial sex and age composition counts were also used to estimate herd composition and to evaluate calf production and survival.

Radio-collared caribou were located seasonally to delineate herd distribution for sex and age composition surveys and censuses. In addition, identified range-use patterns were evaluated in relation to land-use decisions. Expiring radio collars were replaced on caribou. All hunts were monitored by issuing permit reports and by checking hunters in the field. Beginning in 1986 a 3-year population dynamics study was initiated in cooperation with the National Park Service (NPS) to evaluate calf production, survival of cows and calves, and use of seasonal ranges by cows and calves (Lieb et al. 1989).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

The MCH was estimated to number 2,484 in 1988, based on the post-calving aggregation count and fall sex and age composition survey conducted in June and October, respectively. This estimate is 21% (675 caribou) lower than the 1987 herd estimate of 3,159. I considered the 1987 population estimate to be high, reflecting the high percentage of cows and low percentage of bulls in the 1987 postcalving composition survey (Table 1). This bull:cow ratio was probably biased, as a result of focusing composition counts in the areas where most radio-collared cows were found. In prior years postcalving composition surveys tended to be more widespread and more representative of the caribou counted in postcalving aggregations. The 1987 postcalving aggregation count, which was conducted in the same areas as in other years, was probably more indicative of the population trend than the extrapolated herd estimate.

Population estimates obtained from the MCH from 1973 to 1985 showed an increasing trend; the average annual rate of increase was 5%. The most recent postcalving aggregation counts, extrapolated estimates, and proportion of calves in the herd (Table 1) suggested the MCH has been decreasing since 1985. This decline was attributable to poor calf survival, as indicated in

the low calf:cow ratios observed during composition surveys (Table 1). Based on an estimated range size of 3,700 mi^2, the density was 0.7 caribou/mi^2. Current herd size is below the minimum management objective of 2,500 adults.

Population Composition:

From 1984-85 to 1988-89 composition data collected during post-calving and fall sex and age composition surveys are presented in Table 1. Ratios of calves:100 cows during both postcalving and fall counts indicated reduced productivity and/or survival in 1987 and 1988, compared with prior years.

In 1988, 43 bulls:100 cows were observed in the fall, approximately the same as the long-term (1973-74 to 1987-88) average of 41 bulls:100 cows and higher than the minimum objective of 35 bulls:100 cows.

Distribution and Movement:

Approximately 35 female caribou have been radio-collared as part of the MCH study. These animals were monitored on a monthly basis during the reporting period. Distribution and movements observed in 1988-89 were similar to those observed over the past 5+ years.

In mid-July radio-collared cows were distributed on their post-calving grounds from the Nadina River north and east to the Upper Copper River at elevations of 2,600 to 7,000 feet. In late August these cows were found over much of the same range utilized during the early summer at elevations of 2,200 to 5,800 feet. By the third week of September (i.e., snow line at about 4,500 ft) caribou had shifted downhill and to the northeast, with about 60% of those radio-collared on the Drop Creek/Upper Copper River Flats. Some caribou were found on the flats from Moose Point to the Sanford River and south to the Nadina River; the elevational distribution extended from 2,500 to 4,100 feet.

By mid-October there was complete snow cover over the Mentasta range. Caribou were spread widely from the Sanford River northeast across the Upper Copper River flats to the upper portion of the Nabesna River in Unit 12. There was a general eastward movement of caribou at this time, ranging from elevations of 2,800 to 3,400 feet. From early December to late February most of the radio-collared caribou were on the east side of the Mentasta Mountains at elevations ranging between 2,000 and 3,600 feet. By the first week in April, approximately 90% of the radio-collared cows were located on the west side of the Mentasta Mountains; most of these were distributed from Drop Creek to the Little Tok River divide.

In early October 1988 Nelchina caribou were shifting into wintering areas. Much of the herd was spread out on the Lake Louise Flat, but about one-third of it was spread out in Subunit

13C and adjacent portions of Unit 11, where they intermixed with Mentasta caribou. By January 1989 approximately 40% of the Nelchina herd was either east of the Mentasta Mountains or immediately adjacent in Unit 11 with the Mentasta herd. In early April most of these Nelchina caribou shifted back into Unit 11 with the Mentasta herd and continued with their spring migration back to their calving grounds in Unit 13.

Mortality

Season and Bag Limit:

The open season for subsistence and resident hunters in Unit 11 is 10 August to 30 September. The bag limit for subsistence hunters is 1 caribou by registration permit only. The bag limit for resident hunters is 1 caribou by drawing permit only. There is no open season for nonresident hunters.

Human-induced Mortality:

The reported harvest in 1988 was 49 caribou for the combined drawing-permit sport hunt and the registration permit subsistence hunt (Table 2). This low harvest, representing about one-half of the prior 4-year mean (i.e., 97 caribou) is attributed to a substantial reduction in the number of drawing permits issued (i.e., 100) and the change in bag limit for the sport hunt to one bull. Since 1977 when permit hunts were established, the highest harvest was 149 (1978). The 1988 harvest was composed of 45 (92%) males and 4 (8%) females, compared with an average of 78% males from 1984-85 to 1987-88.

Some illegal and unreported harvests of Mentasta caribou have been documented, but we have insufficient information to estimate total numbers. Few road mortalities occurred because the MCH is seldom found near roads. Additional hunter harvest of Mentasta caribou occurs in the western portions of Unit 12. Most are taken by hunters operating off the Nabesna Road or Nabesna and Jacksina Rivers. In 1988, 21 caribou (all bulls) were from these areas; morever, a total of 51 hunters reported hunting caribou in this area in Unit 12.

Hunter Residency and Success. By law, only Alaskan residents can hunt Mentasta caribou. In 1988 local hunters took 29 animals, while nonlocals took 20 (Table 3). For local hunters this represented a slight increase from the 1984-85 to 1987-88 average annual harvest of 25 caribou. For nonlocals the 1988-89 harvest of 20 caribou was substantially below the previous year's 95. Total hunter success in 1988-89 was 47%, slightly below the mean of 52% for 1984-85 to 1987-88.

Successful subsistence and sport hunters spent 3.7 and 3.6 days afield, respectively; while unsuccessful subsistence and sport hunters spent a respective 3.9 and 3.5 days afield.

Permit Hunts. From 1984-85 to 1988-89 the number of drawing permits issued has ranged from 350 (1984-85) to 100 (1988-89) (Table 2). In 1985 all caribou drawing-permit hunts were limited to qualified subsistence hunters, and with many applicants choosing to apply for the Nelchina hunt, only 170 applications were received for the Mentasta hunt. The number of sport-hunting drawing permits available was reduced from 300 in 1987 to 100 in 1988, because the herd was declining.

The subsistence registration permit hunt was initiated in 1986. The number of hunters participating has remained small, because many local hunters prefer to hunt Nelchina caribou. The NCH is larger, it is more accessible from the road system, and a winter season is offered. In 1986, 154 Mentasta permits were issued to qualified local residents, whereas in 1987 and 1988, 64 and 68 permits were issued, respectively. The marked difference between the number of permits issued in 1986 and those in 1987 and 1988 was caused by a delayed Nelchina caribou hunt opening in 1986 when local hunters obtained Mentasta permits during the interim.

Harvest Chronology. The chronology of the Mentasta caribou harvest for the past 5 years is listed in Table 4. Changes in chronology over this period are related to changes in season dates for the sport and subsistence hunts. In general, harvests tended to be fairly evenly distributed over the hunting season; sport hunters focused more effort during the portion of the season coinciding with the moose season. Subsistence hunters, on the other hand, seemed to focus more effort before and after the moose season, possibly because of the advantage of living close to the Mentasta caribou range.

Transport Methods. Methods of transportation used by successful hunters are listed in Table 5. From 1986-87 to 1988-89, 44% and 73% of subsistence and sport hunters, respectively, used aircraft, compared with a respective 48% and 25% use of ORV's and highway vehicles. Except for increased use of 3 or 4 wheelers, strong trends in transportation methods used by sport and subsistence hunters are not apparent. Reduced use of ORV's by sport hunters after 1983 may be related to restrictions instituted by the National Park Service (NPS).

Natural Mortality:

Predation by wolves and grizzly bears represents a significant mortality factor for the MCH. Although they are numerous over much of the MCH range, their harvest by sport hunters and trappers have been relatively low. Land-and-shoot trapping was discontinued in WRST preserve in 1986, and sealing records suggest that this has resulted in a reduced wolf harvest throughout much of the Mentasta range. Good calf production but poor calf survival were observed in 1987 and 1988 (ADF&G files), suggesting that increased numbers of predators may be affecting calf survival. According to Lieb et al. (1989), the natural mortality of adult females from the MCH (178/year), which was

higher than that for the NCH (108/year), may also be attributable to high predator populations.

Habitat Assessment

In 1982 a Mentasta caribou range exclosure study was initiated by the NPS (with ADF&G cooperation) to monitor condition and trend of caribou forage species. Casual observations at these and a number of other sites over the past few years suggested that lichen production may be low throughout a large portion of the Mentasta range. No additional information concerning range condition of this herd is available. In recent years a substantial portion of the Mentasta winter range has been used on a regular basis by Nelchina caribou, but the effects of this use have not been studied.

Game Board Actions and Emergency Orders

From 1977 to 1984 sport and subsistence hunters competed for Mentasta caribou permits under a single annual drawing-permit hunt. In 1985 as a result of court actions and measures adopted by the Board of Game, hunting of the MCH was permitted only under a Tier II subsistence drawing permit, for which all Alaska residents could apply. Permit applications were graded according to a formula that favored rural residents who were dependent on game as the major portion of their diet and had few available alternative resources. Permits were issued to those with the highest scores. All 170 applicants received permits.

In 1986 separate sport and subsistence hunts were instituted, and 154 subsistence registration permits were issued. To accommodate the anticipated subsistence harvest and maintain the harvest at 5% of herd size, the number of sport drawing permits was reduced from 350 to 275. In 1987 the Board increased the number of drawing permits to 300. In 1988, concerned with the apparent reduction in herd size and poor survival of calves, the Board reduced the number of drawing permits to 100 and changed the bag limit for sport hunters to 1 bull.

In 1983 the Board established a special winter hunt in Unit 12 for Nelchina caribou for residents of the Tetlin-Northway area. This Board action resulted from a request by local residents for a winter hunt after roughly 7,000 Nelchina caribou and 1,500 Mentasta caribou migrated into the Tetlin Flats area. A total of 85 permits for Nelchina caribou were issued. In 1984 a second special winter hunt was held in the same area, when about 1,000 caribou arrived in the Tetlin area. Ten permits were issued, but because only a few Nelchina caribou migrated east that winter, most animals taken were probably Mentasta caribou. No special hunts were authorized in 1985 and 1986. In 1987 a hunt was again requested by local residents, and the Board authorized 85 registration permits on the condition that the hunt would occur only if Mentasta caribou were not present in the hunt area. This condition was imposed because the hunt had the potential to

adversely impact the Mentasta herd whenever significant numbers of Mentasta animals were available to hunters. At its spring 1988 meeting the Board modified the regulation to establish a harvest quota of 80 Nelchina caribou.

CONCLUSIONS AND RECOMMENDATIONS

Based on a comparison of postcalving herd counts obtained in 1986 and 1987, composition data, and information obtained in the Mentasta caribou study, the Mentasta herd declined approximately 12% from 1986 to 1987, largely because of the poor survival of the 1986 calf cohort. This followed an approximate 12-year period during which the herd appeared to be increasing at a slow rate (3%). A postcalving count in 1988 suggested little additional decline in overall numbers of caribou in the MCH from those of the previous year. The extrapolated total herd estimate in 1984 was 2,484, including 2,206 adults. This is approximately 300 caribou below the stated herd objective of 2,500 overwintering adults.

Concerns and problems associated with the management of the Mentasta herd include accurately estimating population size and trend, determining the extent and effects of common range use and interaction between Nelchina and Mentasta caribou, managing predator populations at levels appropriate to the caribou management objectives, providing for hunting demands in the face of declining caribou numbers, coordinating Mentasta caribou management with the NPS, and minimizing illegal harvests.

I recommend that the Department initiate a cooperative (i.e., NPS) or independent study to determine the causes of neonatal calf mortality in this herd. This information is needed to develop management plans for predators. I also recommend that we evaluate the extent and ramifications of common range use by Nelchina and Mentasta caribou and document any interchange between these two herds. No changes in season dates or bag limits are recommended at this time, because the current harvest of predominantly bulls accounts for only 2% of the herd and has little impact on herd trends.

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Table 1. Mentasta Caribou Herd composition counts and population estimates, 1984-85 to 1988-89.

Year	Calves:100 cows-summer	Calves:100 cows-fall	Calf % fall	Bulls:100 cows-summer	Bulls:100 cows-fall	Postcalving aggregation count	Extrapolated aggregation estimate
1984-85	44	29	18	20	36	3,032	2,722
1985-86	51	46	25	17	41	3,108	3,140
1986-87	--	--	--	--	--	3,032[a]	-----
1987-88	18	12	8	6	41	2,583	3,159[b]
1988-89	34	18	11	14	43	2,520	2,484

[a] No postcalving or fall composition surveys were flown in 1986. Thus no population estimate was made; 3,032 represents a total herd count made in late June 1986.

[b] High estimate.

Table 2. Mentasta Caribou Herd harvest by permit hunt, 1984-85 to 1988-89.

Hunt no.	Year	Permits issued	Did not hunt	Unsuccessful hunters	Successful hunters	Bulls	Cows	Total
510	1984-85	350	142	87	119	84	34	118
	1985[a]-86	170	53	50	67	51	16	67
	1986-87	275	127	78	63	54	9	63
	1987-88	300	122	76	95	77	18	95
	1988-89	100	35	34	23	23	0	23
511	1986-87	154	44	56	29	23	6	29
	1987-88	64	20	24	17	14	2	16
	1988-89	68	20	21	26	22	4	26
Total all hunts:	1986-87	429	171	134	92	77	15	92
	1987-88	364	142	100	112	91	20	111
	1988-89	168	55	55	49	45	4	49

[a] In 1985 Hunt 510 was a Tier II Subsistence Hunt for all Alaska residents.

Table 3. Mentasta Caribou Herd hunter residency and success, 1983-84 to 1988-89.

Year	Successful				Unsuccessful			
	Local res.	Nonlocal res.	Non-res.[a]	Total[b]	Local res.	Nonlocal res.	Non-res.[a]	Total[b]
1983-84	28	49	10	90	24	59	6	89
1984-85	26	89	3	119	15	68	3	87
1985[b]-86	23	44	--	67	16	34	--	50
1986-87	29	63	--	92	56	78	--	134
1987-88	17	95	--	112	24	76	--	100
1988-89	29	20	--	49	21	34	--	55

[a] Beginning in 1985 nonresidents were no longer permitted to hunt the Mentasta herd in Unit 11.

[b] Includes unknown residency.

Table 4. Mentasta Caribou Herd harvest chronology percent by time period, 1984-85 to 1988-89.

Hunt no.	Year	Week Ending 8/19	8/27	9/03	9/10	9/17	9/24	10/01
510	1984	--	22.9	5.9	21.2	17.8	13.6	18.6
510	1985[a]	--	--	--	--	32.8	28.4	38.8
510	1986[b]	--	--	--	14.5	21.0	25.8	38.7
510	1987	7.4	8.4	10.5	22.1	23.2	20.0	8.4
511	1986	--	28.6	14.3	7.1	7.1	21.4	21.4
511	1987	23.5	17.6	17.6	17.6	17.6	--	5.9
510 & 511	1986	--	8.9	4.4	12.2	16.7	24.4	33.3
510 & 511	1987	9.8	9.8	11.6	21.4	22.3	17.0	8.0
510 & 511	1988	14.6	16.7	25.0	12.5	10.4	16.7	4.1

[a] In 1985 season opened on 10 September.

[b] In 1986 season opened on 6 September.

STUDY AREA

GAME MANAGEMENT UNIT: 12 (10,000 mi^2)

HERD: Chisana (includes some information on Fortymile Macomb, Mentasta, and Nelchina Herds)

GEOGRAPHICAL DESCRIPTION: Upper Tanana and White River drainages

BACKGROUND

Unit 12 is seasonally inhabited by caribou from the Fortymile, Mentasta, Macomb, and Nelchina herds. Chisana caribou are present in Unit 12 year round and some Mentasta caribou may also be year-round residents. Caribou were more abundant in Unit 12 in the 1960's than they are at the present time, particularly those associated with the Nelchina herd that frequented the eastern Alaska Range. Skoog (1968) estimated the Chisana herd at about 3,000 caribou in the early 1960's.

The small Chisana herd ranges in extreme southeastern Unit 12 in the Nutzotin and north Wrangell Mountains from the Nabesna River east into the Yukon Territory, Canada. Scattered bands of Mentasta caribou, primarily bulls, summer in the Mentasta Mountains; since the early 1980's, large numbers of Mentasta caribou have moved northeast into the Mentasta Mountains and the Northway-Tetlin Flats to winter. A very few caribou from the Nelchina herd summer near Gillette Pass in the eastern Alaska Range, and in recent years hundreds to thousands of Nelchina caribou have migrated northeast into the Mentasta Mountains along with Mentasta caribou in November, returning to Units 11 and 13 in December. These movements were documented from radio-collared animals in both the Mentasta and Nelchina herds. Macomb caribou have always been present during summer in the Robertson River drainage dividing Unit 12 and Subunit 20D. During the past 4 years, however, Macomb caribou have moved eastward as far as Moon Lake in the fall and early winter; as many as 400 caribou were observed in Unit 12 during September 1987. Occasionally, caribou from the Fortymile herd inhabit the extreme northern portions of Unit 12 in late fall and winter.

A cooperative study of the Chisana herd with the National Park Service (NPS) (Wrangell-Saint Elias National Park/Preserve) was initiated in October 1987. Fifteen female caribou were radio-collared to determine seasonal movements, calf production and survival, and adult mortality and to facilitate spring and fall composition counts. A similar Department effort was also initiated on the Macomb herd by the Delta ADF&G staff in the spring of 1988. Glennallen ADF&G staff have long been involved with monitoring collared Nelchina caribou and are cooperating with NPS in a baseline study of the Mentasta herd. This report deals primarily with the Chisana herd.

POPULATION OBJECTIVES

To maintain a population of approximately 1,500-2,000 caribou.

To maintain a posthunting bull:cow ratio of no less than 40:100.

METHODS

The Chisana Caribou Herd has never been censused with either conventional or photocensusing techniques; however, several near total counts have been made during aerial composition surveys of the herd in the summer or fall. During the fall 1988 and summer 1989 composition counts, we tried to find and enumerate all caribou in the herd.

We conducted a sex-age composition survey by helicopter in late September 1988 to determine bull, small (yearling) bull, and calf:100 cow ratios as well as the percentage of each sex-age class in the population. Caribou were classified as large mature bulls, medium bulls, small bulls (those with cow-like antlers), cows, and calves. The National Park Service funded both the summer and fall composition counts.

I also conducted a June 1989 sex-age composition survey from a fixed-wing aircraft (PA-18 Super Cub) to document the percentage of calves in the herd. Caribou were classified simply as adults or calves. I estimated the harvest by examining caribou harvest reports and interviewing a Yukon Territory hunting guide operating within the Chisana herd's range.

RESULTS AND DISCUSSION

Population Status and Trend

I classified 1,540 caribou and observed about 120 more in the Flat Creek and Solo Creek Flats area in large postcalving aggregations. Although it represented the greatest number of Chisana caribou counted in recent years, the estimate is probably conservative. Therefore, the Chisana Caribou Herd has reached the lower boundary of the population objective of 1,500-2,000. Local residents of Chisana and a big game hunting guide in the adjacent Yukon Territory (i.e., David Dickson) stated that caribou numbers have increased noticeably for the last 5 years and the herd has been expanding its summer and fall range eastward into Canada. I suspect this trend will continue, despite the minimal growth in 1989, because of the relatively severe winter of 1988-89.

Population Composition:

For the second consecutive year the bull:cow ratio was again slightly below the population objective of 40 bulls:100 cows (Table 1). Counts in both years are probably reliable, because they were done during the rut and a very high portion of the populations was sampled. There does not appear to be any problem with reproduction, and professional big game guides in the area were satisfied with the availability of mature bulls during the hunting season.

The 21-22 June 1989 aerial survey indicated the lowest calf production/survival recorded since 1978 (Table 2). The sample was large, and I believe it reflects the effects of the severe weather conditions of the previous winter. Snow depths were far above normal early in the winter, temperatures were low in late winter, and the area experienced a late snowfall in May that coincided with calving. The effects of the winter on survival of the 1988 cohort of calves will not be measured until the fall of 1989.

Distribution and Movement:

During most of the past 11 years the Chisana Herd has been nonmigratory, making only short seasonal movements within its normal range. In the winter of 1988-89, however, many caribou moved northeast to the vicinity of the town of Beaver Creek on the Alaska Highway, 20 miles into the Yukon Territory. For the past 3 years, the number of Chisana caribou have increased in the Yukon Territory between the Braye Lakes in Alaska and the White River in the Yukon. Such range extensions are expected for an increasing population.

Mortality

Season and Bag Limit:

The open season for subsistence, resident, and nonresident hunters is 1 to 20 September; the bag limit is 1 bull.

Human-induced Mortality:

Forty-nine bull caribou were reported taken from the range of the Chisana herd in the fall of 1988, the same as in 1987 (Table 3). This is only slightly greater than the 5-year-mean reported harvest of 44 bulls/year. In addition, I learned that about 15 bulls are taken legally in the Yukon Territory each year. If the herd numbers approximately 1,800 adults, there was a 4% rate of legal harvest in 1988, limited to bulls only. I believe harvest reporting to be high for the Chisana herd, because so many of the hunters are guided nonresidents.

In addition to those caribou taken from the Chisana herd in 1988, hunters reported taking 21 bulls from the Mentasta herd in the

Nabesna Road area, four from the Macomb herd in the Cathedral and Sheep Creek area, and one from the Nelchina herd in Gillette Pass; the total reported harvest was 75 bull caribou for Unit 12 (Table 4). No caribou were reported taken from the Fortymile herd in Unit 12 in 1988, because the herd ranged well north of the Unit 12 boundary, except during the winter season. While reporting by caribou hunters seeking Chisana caribou is fairly high because many are nonresidents hunting with guides, the same cannot be said for hunters seeking caribou elsewhere in Unit 12. Observations indicated a harvest of approximately 7 or 8 caribou from the Macomb herd in Unit 12, yet only 4 successful hunters reported taking one (Table 4). The fall of 1988 was the 2nd year that these caribou had been observed south of the Alaska Highway.

Nearly all 21 Mentasta Herd caribou harvested were taken in the vicinity of the Nabesna Road, compared with reported harvests of 15 in 1987 and 12 in 1986. I believe that nonreporting is at least as bad as in other areas (about 40%), so at least 15 additional caribou were probably killed. I expect interest in caribou hunting in the Nabesna Road area to increase during the 1989 season, when caribou hunting along the Taylor Highway in Subunit 20E will be limited by a drawing-permit system.

During the winter of 1988-89 there appeared to be a high incidence of caribou poaching in the Northway-Tetlin Flats, where Mentasta caribou wintered. Because caribou from the Mentasta and possibly the Nelchina herds are present and widely distributed nearly all winter in the Northway-Tetlin Flats, enforcement of the closed season is extremely difficult. Lack of adequate air support for the local Fish and Wildlife Enforcement Officer makes detection of poaching in remote areas nearly impossible

Hunter Residency and Success. No data were available concerning the residency status of Unit 12 caribou hunters, because harvest reports were hand-tallied; however, past analyses indicated that a high proportion of successful hunters in the Chisana area were guided nonresidents. Because the Nabesna Road area does not appear to be popular with nonresidents, I assumed that most caribou taken from the Mentasta herd in the Nabesna Road area were taken by residents.

One hundred thirty-four hunters reported hunting caribou in Unit 12 during the 1988 season, harvesting 75 caribou for a hunter success of 56%. Reported hunter success was 84% for the Chisana herd, 50% for the Macomb herd, and 41% for the Mentasta herd. One successful and 5 unsuccessful hunters reported hunting the portion of Unit 12 (southwest) ranged by the Nelchina herd. These hunter success rates are most likely biased on the high side, because a lower proportion of unsuccessful hunters return harvest reports than do successful hunters.

Transport Methods. Most successful hunters of Chisana caribou used horses for access in 1988 (51%), followed by aircraft (27%), three- or four-wheelers (14%), boats (2%), and unknown

transportation (6%). The Chisana herd inhabits a fairly remote area, and virtually all hunters initially reach the area by aircraft. Nonresidents generally reached caribou using aircraft and horses provided by their guides, while resident hunters used aircraft or three- and four-wheelers. Because of easy road access, most successful hunters of Mentasta caribou used highway vehicles, off-road vehicles, or three- and four-wheelers.

Natural Mortality:

Predation is the greatest source of natural mortality affecting caribou in Unit 12, based upon incidental observations of caribou carcasses. Isolated instances of winter predation by coyotes, lynx, and wolverines have also been noted over the years. Of the 15 Chisana caribou cows collared in October 1987, only one (7%) died from natural but unknown causes during the winter of 1987-88, but three (21%) of 14 died during the winter of 1988-89; 1 collared cow could not be located during the June 1989 survey.

In my field notes (May 1988 survey) during the peak of calving in the Chisana area, I recorded seeing 9 golden eagles (two of which were actively trying to kill a newborn calf), 1 wolf, 1 coyote, 1 grizzly bear, and wolf tracks. During the 21-22 June 1989 survey of the herd, we saw 2 wolves actively hunting a postcalving aggregation of about 500 caribou.

Predation losses in Unit 12 have contributed to the recent decline of the Mentasta Caribou Herd. Wolf densities in wintering areas in the Mentasta Mountains and the Northway-Tetlin Flats were moderately high. It is likely that the combination of winter predation by wolves and illegal harvests by humans resulted in a relatively high combined loss of Mentasta caribou wintering in Unit 12 during 1987-88 and again in 1988-89. On the other hand, snow depths in Unit 12 during 1988-89 were less than those in adjacent portions of Units 11 and 13 to the south.

Habitat Assessment and Enhancement

While no quantified assessment of caribou range has been conducted, P. Valkenburg (pers. commun.) suggested that the Chisana caribou range has a greater proportion of grass-sedge habitat and a lower proportion of lichen habitat than ranges of other caribou herds in Interior Alaska. However, forested areas near Beaver Creek, Canada, where the herd wintered in 1988-89, had more lichens than the herd's normal winter range. In contrast, there is a much greater proportion of lichen-producing habitat in the Mentasta Mountains and Northway-Tetlin Flats wintering areas used by Mentasta and Nelchina caribou. These herds have only wintered in Unit 12 in noticeable numbers since the early 1980's, so winter range conditions were probably good.

No plans exist for enhancement of caribou ranges. It can take over 15 years for burned areas to begin producing lichens. Therefore, habitat management for Unit 12 caribou will depend on

the occurrence of wildfires under terms of the Alaska Interagency Fire Management Plan.

Prescribed burning could improve production and quality of grasses and sedges in the Chisana area, but the entire area is managed by the National Park Service, which is generally opposed to habitat manipulation, even though previous federal policies resulted in several decades of attempted exclusion of wildfires from the area.

CONCLUSIONS AND RECOMMENDATIONS

The Chisana Caribou Herd appears to be growing slowly. While the maximum allowable harvest of this herd has occurred over the reporting period, the herd has met the suggested population objectives. There may be some room for herd growth if the herd should expand its range into Canada. I recommend no changes in season or bag limit for the Chisana Herd.

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Table 1. Summary of fall sex-age composition surveys of the Chisana Caribou Herd, Unit 12, 1977-88.

Date	Bulls: 100 cows	Sm bulls: 100 cows	Calves: 100 cows	% Yrlgs (n)	% Calves (n)	% Cows (n)	% Bulls (n)	Bulls % Sm (n)	Bulls % Med (n)	Bulls % Lg (n)	Total caribou
09/29/77	41		44	6 (15)	22 (61)	51 (139)	21 (58)				273
10/20/78	34		18	6 (6)	11 (11)	62 (62)	21 (21)				100
09/31/80-10/02/80	18		21	4 (23)	15 (84)[a]	69 (401)			12 (71)		579
10/13/82	36	12	21	16 (64)[b]	13 (54)	64 (261)	23 (94)	8 (32)	19 (42)	5 (20)	409
10/14/86	43	8	33	9 (48)[b]	19 (94)	57 (288)	23 (125)	5 (24)	13 (64)	7 (37)	507
10/09/87	39	21	28	25(188)[b]	17 (126)	60 (456)	23 (178)	12 (94)	6 (47)	5 (37)	760
09/27/88	36	10	31	12(118)[b]	19 (184)	60 (586)	21 (209)	6 (59)	10 (96)	6 (54)	979
Mean	38	13	29	12	16	59	22	8	12	7	

[a] Includes cows and small and medium bulls.

[b] Calculated by doubling number of small bulls; not additive in total numbers.

Table 2. Summary of June sex-age composition surveys of the Chisana Caribou Herd, Unit 12, 1976-88.

Date	% Yrlgs (n)	% Calves (n)	% Cows older than calves (n)	Unidentified	Total caribou
6/16/76	--	20 (41)	80 (167)	--	208
6/19/78	--	9 (30)	91 (286)	--	316
6/19/80	--	12 (16)	88 (121)	--	137
6/21/81	--	15 (66)	85 (360)	--	426
6/21/83	--	16 (26)	74 (136)	100	263
6/25/84	--	15 (49)	85 (268)	--	317
6/20/87	--	17 (88)	83 (436)	--	524
5/24/88	27 (84)	15 (46)	85 (267)	--	313
6/21-22/89	--	10 (160)	90 (1,380)	120	1,660
Mean		14	86		

[a] Calving not yet completed (105 of 157 cows older than yearlings had distended udders).

Table 3. Reported caribou harvests from the Chisana Caribou Herd, 1983-1988.

Year	Reported harvest of bulls	Total hunters	% Success
1983	28	28	100
1984	31	43	72
1985	65	90	72
1986	41	54	91
1987	49	58	84
1988	49 (+15 in Canada)	58	84
Mean	44	55	84

Table 4. Caribou harvests from all herds in Unit 12, 1988.

Herd	Reported harvest	Total hunters	% Success	Estimated harvest		
				Unreported	Illegal	Total
Chisana	49	58	84	5-10	5	59-64
Mentasta	21	51	41	5-20	10-30	36-71
Macomb	4	8	50	3-4	2-3	9-11
Nelchina	1	6	17	0	0	2
Fortymile	0	0	0	0	0	0
Unknown	0	11				
Total	75	134	56	13-34	17-38	106-148

STUDY AREA

GAME MANAGEMENT UNIT: 12 and 20D (1,900 mi^2)

HERD: Macomb

GEOGRAPHICAL DESCRIPTION: Eastern Alaska Range between Delta River and Yerrick Creek south of the Alaska Highway

BACKGROUND

The Macomb Caribou Herd (MCH) was relatively unknown, receiving little sport harvest pressure prior to 1972 (Jennings 1974); herd size was estimated to be 350-400 caribou at that time. Hunting pressure increased on the MCH in 1972, when restrictions were placed on hunting the Fortymile, Nelchina, and Mentasta herds along the road system.

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

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

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

In addition to concerns about excessive hunting of Macomb caribou, there was also concern that the herd was limited by predation. Wolf control in the eastern Alaska Range during the winter of 1980-81 removed most of the wolves believed to prey on Macomb caribou. With wolf control, fall calf survival increased from 13 calves:100 cows in 1980 to 33 calves:100 cows in 1981. The MPMA was renamed the Macomb Plateau Controlled Use Area (MPCUA) in 1981 to more accurately reflect the access restrictions that were in effect there. The boundaries and access restrictions remained the same.

Previous population 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 the movements and identity of the MCH. Information gathered from local residents suggested that there were many more caribou between the Robertson and Delta Rivers historically than there are today. Therefore, I revised the population size objective to 1,000-1,500 caribou.

On 29 June 1988, 713 caribou were counted within the range of the MCH. Assuming that at least 800 caribou were present, the herd grew at about 6% annually from October 1985 to June 1988.

POPULATION OBJECTIVES

To increase the size of the MCH to 1,000-1,500 caribou by 1993 by maintaining a minimum growth rate of about 5% annually, unless food becomes limiting.

To manage the MCH to maintain 40 bulls:100 cows after the hunting season.

To monitor body condition to determine if food becomes a limiting factor at higher population levels.

To determine calf survival and factors affecting calf survival.

To monitor herd movements to determine if a significant portion of the herd moves out of Subunit 20D during the hunting season.

METHODS

Sex-age composition counts were conducted on the MCH on 16 October 1988 and 11 June 1989. A Bellanca Scout aircraft was used to locate aggregations of caribou by both radio-tracking and visual searching. A Hughes-500 helicopter with a pilot-observer team located caribou by visual searching only. Caribou were classified by the observer in the helicopter as either bulls, cows, or calves. During the October count, bulls were further classified by size (i.e., large, medium, small) and we attempted

to enumerate all caribou in the herd by relocating all radio-collared caribou and tracking groups in snow. Caribou movements were monitored during the 1988 hunting season on 17 and 29 August and 11 September to determine if they had moved east of the MPCUA and into Unit 12, as they had done in 1987.

RESULTS AND DISCUSSION

Population Status and Trend

On 16 October 1988, 772 caribou were counted during the composition surveys. This total count corroborates the 713 counted during the photocensus of 29 June 1988. The MCH therefore contains about 800 caribou. It is increasing in size (i.e., 6% annually from October 1985 to October 1988).

Population Composition:

Sex and age composition data collected during October 1988 and June 1989 indicated that the herd experienced fair calf survival and continued to have a moderately high bull:cow ratio (Table 1).

Distribution and Movements:

All radio-collared caribou remained within the permit hunt area in Subunit 20D during this reporting period. On 17 August 1988, 12 of 14 radio-collared caribou were located within the MPCUA. Two caribou were located west of the MPCUA along the Johnson River. We also searched for caribou in Unit 12 as far east as Yerrick Creek and found none.

On 29 August 1988, 11 of 14 radio-collared caribou were located within the MPCUA. Two caribou were located along the Johnson River, and one was located in the Granite Mountains.

On 11 September 1988, 11 of 14 radio-collared caribou were located within the MPCUA. Two caribou were located in the Granite Mountains, and one was located along the Johnson River.

Mortality

Season and Bag Limit:

The subsistence season in Subunit 20D (i.e., south of the Alaska Highway) is from 10 August to 30 September; the bag limit is 1 bull. The open season for resident and nonresident hunters is from 10 August to 30 September; the bag limit is 1 bull by drawing-permit only (Table 2). One hundred fifty permits are issued.

Human-induced Mortality:

The total reported harvest from the MCH during 1988 was 38 caribou (Table 3). Hunters with Macomb permits reported killing 36 caribou. Subsistence hunters took at least 2 bulls. Based on reported harvest, approximately 5% of the Macomb herd was harvested during the 1988 hunting season.

The 1988 harvest is significantly less than the 57 caribou harvested in 1987. The harvest declined in 1988 because no large groups of Macomb caribou moved out of the permit hunt area in Subunit 20D and into Unit 12, where they could be hunted without a permit, as they did in 1987. However, the 1988 harvest is significantly larger than the average of 22 caribou per year for the previous 5 years.

Hunter Residency and Success. Ninety-seven percent of Macomb permittees were Alaskan residents, and 30% of permittees were local nonsubsistence- and subsistence-qualified residents. Nonresidents received 3% of the permits. There was a substantial increase in hunting by nonlocals during 1988; 67% of the hunters were nonlocals, compared with only 17% in 1987. Although local and nonlocal hunters killed almost the same number of caribou (Table 4), local hunters had a 79% success rate and nonlocal hunters had a 43% success rate.

Hunter Effort. Macomb permit hunters had an overall success rate of 55% during 1988, which is the highest success rate since the permit hunt was established in 1978 (Table 3). This is the 2nd consecutive year that hunters had a very high success rate hunting the MCH. During 1987, 47% of Macomb permittees killed caribou.

Successful and unsuccessful permittees hunted means of 3.8 and 3.4 days, respectively (Table 5). Although there was no clear trend in mean days hunted, hunter effort has been relatively high during the last 2 years. Hunter effort should be decreasing instead of increasing as herd size increases; however, weather and herd movements have a significant influence on hunter effort. There are relatively few good access points onto the Macomb Plateau, and most hunters do not walk very far from them. Therefore, if caribou are not readily available near the main access points, hunter effort increases, because hunters spend more time waiting for caribou.

Permit Hunts. There was a substantial increase in the number of applications for hunt No. 530 during 1988; the ADF&G received 511 applications for 150 Macomb permits (Table 6). This resulted in 3.4 applications for each permit, representing the largest number of applications received since 1979. Only 45% of the permittees actually hunted during 1988. Two reminder letters were sent to permittees during 1988, resulting in 145 of 150 hunt reports being returned.

Harvest Chronology. Caribou were killed throughout the entire season; 3 to 8 caribou were killed each week (Table 7). Generally, most permittees hunted during August because weather is usually poor on the Macomb Plateau in early September; however, a significant portion of the harvest occurred during September 1988.

Transport Means. Highway vehicles were the most commonly used mode of transportation for Macomb caribou hunters (48%) with permits (Table 8). Airplane access increased from 6% in 1987 to 15% during 1988, and use of horses decreased from 36% in 1987 to 26% in 1988.

Caribou Harvest Locations. Most hunters with Macomb permits (80%) hunted on the Macomb Plateau, and 89% of the caribou killed by Macomb permittees were killed there. There were no significant changes in harvest locations over previous years.

Natural Mortality:

Rates of natural mortality for the MCH are unknown. Wolves, grizzly bears, black bears, and golden eagles all occur in the area and prey on caribou.

CONCLUSIONS AND RECOMMENDATIONS

The Macomb Herd appears to be slowly increasing in size; however, the accuracy of past population estimates is unknown. Another census-composition count should be conducted in October 1989.

There was a significant increase in the number of applications for Macomb permits for the 1988 hunting season. Department staff and members of the public have suggested eliminating the permit requirement for the MCH. However, in view of the recent upsurge in permit applications and harvests and the goal of providing uncrowded hunting conditions, I recommend continuing the permit system. I also recommend we closely monitor subsistence hunting to determine whether it represents an insignificant portion of the total harvest.

Herd movements should be monitored during the 1990 hunting season to determine if Macomb caribou move into Unit 12. If they regularly move into Unit 12 during the hunting season, it may be necessary to close hunting by Emergency Order along the north face of the Alaska Range west of Yerrick Creek or enlarge the Macomb permit hunt area to include the north face of the Alaska Range in Unit 12.

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Table 1. Historical sex and age composition of the Macomb Caribou Herd, 1974-89.

Date	Bulls: 100 cows	Yrlgs: 100 cows	Calves: 100 cows	Yrlg % in herd	No. yrlg	Calf % in herd	No. calves	Cow % in herd	No. cows	Small bull % of bulls	Small bulls	Med. bull % of bulls	Med. bulls	Large bull % of bulls	Large bulls	Total bulls % in herd	Total bulls	Sample size
10/25/74	43	8	15	5	21	9	40	60	269	--	--	--	--	--	--	26	115	445
10/16/76	41	13	20	8	21	12	32	57	159	--	--	--	--	--	--	23	65	277
10/21/77	42	18	32	9	30	17	54	52	167	--	--	--	--	--	--	22	70	321
10/26/78[a]	--	--	--	--	--	12	28	--	--	--	--	--	--	--	--	--	--	234
10/80	43	10	13	6	18	8	24	60	184	--	--	--	--	--	--	26	80	306
11/13/81	53	20	33	10	43	16	72	48	215	--	--	--	--	--	--	26	115	445
		Small bulls: 100 cows																
10/82	20	13	26	--	--	18	39	68	148	63	19	30	9	10	3	14	30	217
5/31/83	--	--	16	--	--	14	19	86	116	--	--	--	--	--	--	--	--	135
10/83	33	16	24	--	--	15	36	64	152	48	24	--	--	--	--	21	50	238
5/20/84	6	--	85	--	--	44	28	52	33	--	--	--	--	--	--	3	2	63
12/01/84	28	12	40	--	--	24	83	60	210	45	26	34	20	21	12	17	58	351
6/11/85	--	--	38	--	--	28	142	72	374	--	--	--	--	--	--	--	--	516
10/30/85	45	19	31	--	--	17	90	57	295	43	57	38	50	20	26	26	133	518
6/18/86[a]	1	--	32	--	--	24	112	76	354	--	--	--	--	--	--	--	2	468
6/11/87	1	--	48	1	2	32	50	66	105	--	--	--	--	--	--	1	1	158
10/16/88	46	19	32	--	--	18	122	56	377	41	70	31	54	28	48	26	172	671
6/11/89	25	--	37	--	--	23	116	62	313	--	--	--	--	--	--	15	78	507

[a] Survey done with fixed-wing aircraft.

Table 2. Seasons, bag limits, and harvest for the Macomb Caribou Herd from 1972 to 1988.

Year	Season	Bag limit	Reported harvest M	F	Total[a]	Comments
1972	10 Aug-31 Mar	3 caribou				
1973	10 Aug-31 Mar	1 caribou	0	0	28	Season closed 30 Sep by emergency order
1974	10 Aug-20 Sep	1 caribou	24	15	39	Macomb Plateau Management Area established
1975	10 Aug-20 Sep	1 caribou	0	0	38	
1976	10 Aug-20 Sep	1 caribou	41	24	65	
1977	1-15 Sep	1 caribou	17	23	93	Season closed 8 Sep by emergency order
1978	10 Aug-30 Sep	1 bull	16	0	16	70 drawing permits
1979	10 Aug-30 Sep	1 bull	20	0	20	70 drawing permits
1980	10 Aug-30 Sep	1 bull	12	0	12	70 drawing permits
1981	10 Aug-30 Sep	1 bull	19	0	19	70 drawing permits
1982	10 Aug-30 Sep	1 bull	40	0	40	140 drawing permits
1983	10 Aug-30 Sep	1 bull	11	0	11	140 drawing permits
1984	10 Aug-30 Sep	1 bull	20	0	20	140 drawing permits
1985	21-30 Sep	1 bull	12	0	12	140 Tier II drawing permits
1986	10 Aug-30 Sep	1 bull	10	0	10	Subsistence registration permit, 100 drawing permits
1987	10 Aug-30 Sep	1 bull	57	0	57	Subsistence season, 150 drawing permits
1988	10 Aug-30 Sep	1 bull	36	0	36	Subsistence season, 150 drawing permits

[a] Includes those of unknown sex.

Table 3. Annual harvest, number of hunters with Macomb permits, success of permittees, and number of Macomb permits issued from 1978 when drawing permits were first required to 1988.

Year	Hunter harvest	Number hunters	% Hunter success	Number permits
1978	16	49	33	70
1979	20	39	51	70
1980	12	42	29	70
1981	19	39	49	70
1982	40	83	48	140
1983	11	63	17	140
1984	20	51	39	140
1985	12	55	22	140
1986	10	38	26	100 + Subsistence
1987	57[a]	70	47	150 + Subsistence
1988	36	65	55	150 + Subsistence

[a] This harvest includes 33 caribou killed during the Macomb permit hunt, an estimated 20 killed in Unit 12 outside the permit hunt area, and 4 killed by subsistence hunters from Dot Lake.

Table 4. Hunter residency and success for Macomb caribou permit hunters from 1982 to 1988.

	Successful hunters				Unsuccessful hunters			
Year	Local resident	Nonlocal resident	Non-resident	Total	Local resident	Nonlocal resident	Non-resident	Total
1982	12			40[a]	30			43[a]
1983	5			11[a]	15			52[a]
1984	10			20[a]	8			31[a]
1985	11	1	0	12	28	15	0	43
1986	9	0	1	10	19	8	1	28
1987	29	4	0	33	28	8	1	37
1988	15	18	1	36[b]	4	24	1	65

[a] Total in these years includes nonlocal resident and nonresident hunters.
[b] Includes 2 hunters of unknown residency.

Table 5. Mean days hunted for successful and unsuccessful Macomb caribou permit hunters from 1982 to 1988.

Year	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

Table 6. Number of applications, permits issued, and applications per permit for Macomb caribou from 1979 to 1988.

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

Table 7. Harvest chronology for caribou killed during the Macomb permit hunt, 1988.

Year	Week of the hunting season								
	1	2	3	4	5	6	7	8	Unk
1987	8[a]	6	10	3	4	1	0	0	1
1988	2[b]	4	6	4	5	3	3	8	1

[a] Week 1 had 5 days open to hunting.
[b] Week 8 had 2 days open to hunting.

Table 8. Transportation methods used by hunters for the Macomb caribou permit hunt from 1982 to 1988.

Year	Number of hunters (%)				
	Airplane	Horse	3- or 4-wheeler	ORV	Highway vehicle
1982	7 (8)	13 (15)	2 (2)	5 (6)	57 (68)
1983	3 (5)	19 (31)	1 (2)	4 (7)	34 (56)
1984	5 (9)	17 (32)	0 (0)	6 (11)	25 (47)
1985	1 (2)	19 (38)	2 (4)	1 (2)	27 (54)
1986	5 (21)	5 (21)	1 (4)	0 (0)	13 (54)
1987	4 (6)	25 (36)	4 (6)	2 (3)	33 (47)
1988	10 (15)	17 (26)	4 (6)	3 (5)	31 (48)

STUDY AREA

GAME MANAGEMENT UNIT: 13 and 14B (25,000 mi^2)

HERD: Nelchina

GEOGRAPHICAL DESCRIPTION: Nelchina Basin

BACKGROUND

In the late 1940's the Nelchina Caribou Herd (NCH) was estimated at 5,000-15,000 caribou. Aided by intensive predator control, the herd began increasing in size in the early 1950's, continued to expand throughout the late 1950's and early 1960's, and peaked at about 70,000 caribou by the mid-1960's. A dramatic decline in numbers occurred in the late 1960's and early 1970's, reaching a low point in 1972-73 (7,000 to 10,000 caribou). Beginning in about 1973-74 the NCH again began to increase in numbers. This increase has continued through the late 1980's.

The NCH has historically been important to hunters because of its accessibility and proximity to the population centers of Anchorage and Fairbanks. Between 1954 and 1988 about 110,000 Nelchina caribou were killed by hunters. With the increases in NCH size that began in mid-1950's, increased bag limits and extended seasons were instituted. From 1955 until 1971 the bag limit varied from 2 to 4 caribou and the season varied from a split 2-month season in September and November to a 7-month season from August to March. Estimated annual harvests from 1955 through 1971 ranged from 2,500 to more than 10,000 caribou. With the recognition in 1972 that the herd had drastically declined in numbers, seasons and bag limits were curtailed. From 1972 through 1976, the bag limit was 1 caribou and season length ranged from 15 to 40 days in the fall. Even with such restrictions the harvests ranged from 560 to 1,200 caribou, excessive in terms of desired herd growth. In 1976 the season was closed by Emergency Order after 800 caribou were taken in 5 days. It became apparent that even a short open season was no longer feasible, if harvests were to be properly controlled. Since 1977 Nelchina caribou have been hunted by permit only.

POPULATION OBJECTIVES

To increase the herd to 30,000 overwintering adults and maintain annual harvests of caribou at 7% of the adult population until then.

METHODS

Biennial censuses and associated sex and age composition counts have been conducted during the past 4 years. The censuses, which

involved direct aerial counts of all caribou observed in postcalving aggregations, were immediately followed by sex and age composition surveys. The cow base, as well as the proportions of calves and bulls, in the population was estimated. The total fall population estimates were extrapolated from the survey data.

Aerial sex and age composition counts were conducted annually during the fall to estimate herd composition and to evaluate calf recruitment. Radio-collared caribou were located seasonally to delineate herd distribution for sex and age composition surveys and censuses and to determine seasonal range use. Radio collars on caribou were replaced on an as-needed basis. All hunts were monitored by use of permit reports, periodic check stations, and hunter field checks. Forage condition and use have been monitored at approximately 5-year intervals at established range stations.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

The NCH was estimated at 30,276 in the fall of 1987, based on the postcalving aggregation and fall sex and age composition surveys conducted in June and October, respectively. The most recent population data were obtained during a postcalving count of the main NCH conducted on 27 June 1989, when 39,754 caribou were observed. In addition, 2,107 caribou were counted in the Upper Susitna River subherd located in Subunit 13E. These figures only represent the total number of animals observed. The 1989 extrapolated population estimate for the NCH will not be available until the late-fall composition survey has been completed; however, based on 1988 composition data, it should be approximately 40,000.

Population estimates obtained since 1985 (Table 1) and the 1989 postcalving count showed the NCH to be steadily increasing. If the 1989 fall population estimate is 40,000 caribou, the NCH will have exhibited an average annual growth rate of 8% since 1983. The observed rate of growth has varied from year to year in response to a number of factors, including errors in population estimation. Based on an estimated herd range size of 20,000 mi^2 (Lieb et al. 1988) and a population estimate of 40,000 caribou, the density was 2.0 caribou/mi^2.

Population Composition:

Composition data collected during recent postcalving and fall sex and age composition surveys are presented in Table 1. Fifty one calves:100 cows were observed during the 1989 postcalving survey, down substantially from the 1987 ratio of 61 calves:100 cows, but

similar to the prior 3-year average (1983-1985) of 49 calves:100 cows. Neonatal calf survival has varied from year to year, partially reflecting weather conditions during the calving period. In the fall of 1988, 48 calves:100 cows were observed, similar to the 1987 ratio of 51:100. A drop of approximately 10 calves:100 cows from summer to fall typically has been observed in recent years.

In the fall 1988 survey 56 bulls:100 cows were observed, up from both the previous year and the prior 4-year average of 50:100. Recent fall bull:cow ratios have been lower than those observed in the early 1980's (1980-83), when they averaged 60:100. This reduction is most likely the result of a harvest regime in which approximately 85% of the caribou killed each hunting season have been bulls. Simulations of herd composition changes over the period 1980-87 support this hypothesis.

Distribution and Movements:

A limited number of radio-tracking flights to monitor the NCH were made at key periods of the year during 1988-89. During the postcalving/early summer period in 1988 caribou were found throughout the eastern Talkeetna Mountains. from Fog Lakes southeast to the Little Nelchina River. Caribou were also in the Nelchina and Matanuska drainages south of Eureka. By the end of September caribou were spread widely over lower-elevation hills in the eastern Talkeetna Mountians, the Lake Louise Flat, and the Alphabet Hills. Some caribou moved east into the Gakona and Chistochina River drainages during August and September.

During the first week of October a substantial portion of the herd moved through the Gakona and Chistochina River drainages and into Unit 11. Approximately one-third of the Nelchina herd apparently intermixed with Mentasta caribou in the Upper Copper River area of Unit 11 by the end of October. These Nelchina caribou moved further east over the next month, across the Mentasta Mountains, and into the western drainages of the Nabesna and Tok Rivers, as did most of the Mentasta herd. By January approximately 40% of the Nelchina herd was east of the Mentasta Mountains in Units 11 or 12. The remaining 60% of the herd was spread out from Fog Lakes east across the Lake Louise Flat. A large portion of the caribou wintering in western Unit 13 were in the Nelchina, Little Nelchina, and Tazlina River drainages. In early April most of the Nelchina caribou wintering in Unit 12 shifted back into Unit 11 with the Mentasta herd. Spring migration occurred from mid-April through mid-May, with eastern Nelchina caribou moving west across the Richardson Highway between Sourdough and Meiers Lake and across the Lake Louise Flat.

Much of the distribution and movements observed in 1988-89 were similar to those observed over the past 5 years, including heavy use by Nelchina caribou of the upper Copper River portion of the Mentasta herd range in late winter. From observations made over

the past few years, the level and frequency of contact between these two herds were substantially greater than had been documented. The effects of such common range use and contact, especially on the smaller Mentasta herd, are unknown. In the western portion of the range there was greater use in 1988 of the Nelchina and eastern Matanuska River drainages by Nelchina caribou during both winter and summer than had been observed during prior years.

Mortality

Season and Bag Limit:

The open seasons for subsistence hunters are 10 August to 20 September and 1 January to 28 February. The bag limit is 1 caribou by registration permit only. The season will be closed when 450 caribou have been taken; up to 50% of this quota may be taken in the fall season. During the winter season, hunting may occur in Unit 13, except for Subunit 13B and that portion of Subunit 13A within 1/2 mile of the Alaska Pipeline. The open season for resident hunters is 10 August to 20 September; the bag limit is 1 caribou by drawing permit only. Up to 1,775 permits will be issued, and the season will be closed when 1,250 caribou have been harvested.

Human-induced Mortality:

The reported harvest in 1988 was 1,656 caribou for the combined drawing-permit sport hunt and the registration permit subsistence hunt (Tables 2 and 3). The 1988 harvest was 91 caribou, less than the 1987 harvest of 1,747 but a 66% increase over the prior 4-year-mean (1983-86) annual harvest of 995 caribou. Since initiation of the drawing-permit hunt in 1977, the largest harvest prior to 1987 was 1,063 in 1984. The 1988 harvest was composed of 1,293 (78%) males, 349 (21%) females, and 14 (1%) unknowns. This represents a slight shift in harvest to females. In 1986, 19% of the harvest were females, and from 1983 to 1986 females averaged 17%. This shift was related to the regulatory changes in 1987 that allowed caribou of either sex to be harvested in the winter subsistence hunt. Prior to 1987 only antlerless (i.e., mostly bulls) caribou could be taken in the winter. Some illegal and unreported harvests of Nelchina caribou have been documented, but we have insufficient information to estimate total numbers. Road kills occur primarily during the winter; they increased substantially in 1988-89 because of deep snows; i.e., 150 caribou, or 8% of the reported mortality, compared with only 3% in 1987-88 (Table 2).

Hunter Residency and Success. Only Alaskan residents can hunt Nelchina caribou. In 1988 local hunters took 551 animals, and nonlocals took 1,105 (Table 4). Although both of these harvest totals are similar to the previous year's figures, they represent a great increase over the 1983-86 average annual harvests of 267 by locals and 728 by nonlocals. These increases have resulted

from an increase in the number of permits issued; increases in the hunter success rate also contributed to the overall increases.

Total hunter success in 1988 was 72%, down slightly from the 74% success rate observed in 1987 but up from a mean of 63% for 1983-86. This increase was primarily a product of increased numbers and availability of caribou during both the fall and winter hunts.

Permit Hunts. From 1984 to 1988 the number of drawing permits issued (primarily to nonlocal hunters) increased from 1,400 to 1,775, while the number of local subsistence permits issued increased from 500 to 1,161 (Table 3). The number of sport hunting permits available for drawing has increased gradually as the NCH has grown. There have been few problems associated with administering this hunt; however, as the number of hunters has increased in recent years, problems of congestion at access points and popular hunting locations have begun to develop.

The subsistence hunt has changed character over the past 5 years. Originally a small drawing-permit hunt (i.e., 150 permits), the number of available permits gradually increased (i.e., 450 permits in 1983, 500 permits in 1984). In 1986 the hunt was changed to an unlimited registration permit hunt with a harvest quota of 275 caribou; 1,132 permits were issued to qualified local residents. By the end of the fall season the quota had been reached and no winter hunt was held. In 1987, 1,183 registration permits were issued and a quota of 325 caribou was established, of which only 50% could be taken in the fall. With a 40-day season in effect, the fall quota (165) was reached in less than 20 days and the fall hunt was stopped by Emergency Order (EO). The winter hunt was closed by EO after only 4 days; the winter quota had been exceeded by more than 175 caribou. The 1988 quota was increased to 450, and 225 were allocated for each season. With 1,161 permits issued the fall quota was exceeded by the 4th week of the season (330 caribou taken) and the hunt was closed by EO. In an attempt to keep the subsistence harvest within the total allocation established by the Board of Game, the winter season was limited to only 1 day, (1 January) by EO. The harvest for this single day (i.e., 205 caribou) was especially high because hunting pressure was heavy and a large number of caribou were wintering along the Glenn Highway and readily accessible. It is apparent that with a 3-day reporting requirement, it is very difficult to keep from exceeding harvest quotas if closure of the hunt are based strictly on permit reports.

Harvest Chronology. The chronology of the Nelchina caribou harvest for the past 5 years is listed in Tables 5 and 6. Differences in the chronology of the sport hunts related to changes in season dates. The harvest for the last 2 years was fairly evenly distributed over the hunting season. The chronology of subsistence harvests, since the subsistence hunt

became a registration permit hunt with a harvest quota, reflected season dates and the effects of anticipated closures under the quota.

Transport Methods. Methods of transportation used by successful hunters are listed in Tables 7 and 8; for subsistence hunters there have been few changes over the past 5 years, except in those years when a winter hunt was held and snowmachines became an important transportation means. Highway vehicles remained the predominant form of transport (55%) in 1988-89. For sport hunters there were no apparent trends for the same period. Highway vehicles (31%), 3 or 4-wheelers (23%), and ORV's (19%) were used by most successful hunters. Field observations suggested that the use of 4-wheelers was growing; such transportation greatly increased the mobility of hunters, opening up much of the back country.

Natural Mortality:

Predation by wolves and grizzly bears is potentially a significant mortality factor for the NCH. Wolf and grizzly bear harvests by sport hunters and trappers have been relatively high on the core Nelchina caribou range over the past few years. The resulting low populations of predators may have aided the growth of the NCH. Few wolves have been observed on the caribou calving grounds over the past decade, and this factor may have been responsible for the high calf survivals observed throughout the calving period. With the elimination of the land-and-shoot trapping method (1987-88), wolf numbers and associated caribou mortality will increase on the Nelchina range.

Mortalities attributable to severe weather have been low during the 1984-88 reporting periods. Winter snow accumulations have been average or below average, except during the winter of 1988-89 when snowfall was generally above average. However, other than increased road kills, caribou mortality during the winter of 1988-89 was not appreciably higher than those observed in prior years. Spring came fairly early and snowpack did not prevent caribou from migrating to the calving grounds. The only recent adverse weather during calving occurred in 1983, and the postcalving and fall calf:cow ratios were low that year.

Habitat Assessment

Between 1955 and 1962, 39 range stations, including exclosures, were established at various sites throughout much of the Nelchina caribou range. These stations were examined at approximately 5-year intervals from 1957 through 1983. Evaluations of the range stations indicated that the lichen standing crop increased over much of the range from the early 1970's to 1983. However, as the herd doubled in size over the decade 1974-1983, increases in lichen biomass in areas of substantial caribou use came to a halt. In areas of light caribou use, lichen development continued. The calving and summering grounds in the western

Talkeetna Mountains, with a history of nearly continuous heavy caribou use for over 30 years, supports a poor lichen standing crop. As stated in Lieb et al. (1987), "While the productivity, survival, and general condition of NCH animals has been good in recent years, it is clear that population levels in the 20-30,000 range have had a substantial negative effect on the lichen flora - even on moderately-utilized seasonal ranges. Lichen standing crops are expected to continue decreasing with either increased or stable herd size. It is of concern to managers that even current numbers of caribou have dramatically impacted their seasonally preferred food and that only limited areas of lichens in good condition remain within the traditional range of the NCH. A larger herd and the resultant range deterioration could reduce body condition, increase the incidence of disease, reduce productivity and survival, increase the use of unsuitable habitats, and trigger emigration."

Preliminary examination of data collected during range station evaluations summer 1989 indicated that areas receiving heavy use by caribou showed further range deterioration. A complete report of the 1989 range evaluation will be available at a later date.

The potential for loss of habitat because of land disposal and mining is also of concern. Interest in mining and increased mining activity in and adjacent to the Nelchina calving grounds and interest in land disposals, including recent disposals on the Lake Louise Flat, have the potential of causing habitat losses. A third development of concern is the planned gas pipeline adjacent to the existing oil pipeline and Richardson Highway. This utility corridor transects the NCH winter range. Should the gas pipeline, in tandem with the oil pipeline, form a barrier to caribou movement, it would cut the herd off from up to 50% of its winter range. These types of developments should be designed and controlled to minimize loss of caribou habitat and adverse disturbance to caribou.

Game Board Actions and Emergency Orders

In 1983 the management objective of a herd size of 20,000 adult caribou was reached. With composition data indicating continued good reproduction and survival and with range evaluation work indicating at least some of the caribou range to be in fair-to-good condition, the Board increased the population objective to 30,000 adult caribou.

In 1985 in response to changes in the subsistence law, hunting of the Nelchina herd was permitted only under a Tier II classification; i.e., there was only 1 drawing permit hunt for which all Alaskan residents could apply. Permit applications were rated according to a formula favoring rural residents dependent on game as a major portion of their diet. There were 1,800 permits issued for the fall and winter season.

In 1986 as a result of additional changes to subsistence law, the Board reinstituted separate sport and subsistence hunts. The allocation for sport hunting permits was reduced to 1,300, in order to accommodate subsistence demands. The subsistence hunt was changed to a registration hunt, and a harvest quota was provided. Approximately 1,100 registration permits were issued a quota of 275 caribou was established for the fall and winter seasons combined. The quota was reached as the 3-week fall season closed. As a result, an EO closure was announced and no winter hunt was held.

In 1987 the number of sport drawing permits were increased to 1,700, when the Board agreed to begin slowing the rate of herd growth by allowing up to a 7% harvest. In addition the fall season for both sport and subsistence hunting was extended 10 days, opening on 10 August. The subsistence harvest quota was increased to 325 caribou; up to 50% of this quota could be taken in the fall. Approximately 1,200 registration permits were issued. The bag limit for the winter season was changed from antlerless to any caribou to reduce the harvest of bulls. Composition data suggested the bull:cow ratio was declining, and management no longer focused exclusively on maximizing herd growth. In 1988 the Board increased the number of sport permits to 1,775 and allocated 450 caribou for the subsistence hunt. Prior season dates, eligibility requirements, and hunt conditions remained in effect.

CONCLUSIONS AND RECOMMENDATIONS

Based on recent population estimates and composition data, the NCH is continuing to increase in size and appears healthy. Projecting the herd's size by using results from the 1989 postcalving counts and composition surveys and fall 1988 composition data produces a fall 1989 estimate of 40,000 caribou. This estimate slightly exceeds the management objective of 30,000 adult caribou. The 1990 harvest should be increased to maintain the herd at its current size, unless the Board increases the population size objective. The 1990 harvest will need to approach 5,000 caribou to maintain the current herd size.

Concerns and problems associated with the management program for the Nelchina herd include (1) accurately estimating population size and trend; (2) monitoring animal condition; (3) translating range condition information into a reasonable estimate of what the optimum caribou population level should be; (4) managing predator populations at levels that do not substantially conflict with caribou management goals; (5) maintaining a harvest program that meets the population objectives while maintaining desirable hunting conditions (in the face of increasing numbers of hunters); (6) and monitoring and minimizing adverse effects of land use activities on the Nelchina range.

I recommend annual censuses and composition counts. Changes in the number of caribou counted from one survey to the next can reflect variable counting conditions, differences in counters and pilots, and changes in distribution of the herd as well as real population changes. Thus it becomes very important to obtain population estimates over a number of years. Without annual censuses and composition counts, actual population status and trend is much more difficult to determine in a timely manner. Changes may go unrecognized for several years. Even with a yearly census, there is no guarantee of an accurate determination of herd status. With the recent increases in herd size, a counting error of ± 10% is probable. Given this situation and the potential for overharvesting, there may be an inclination to harvest conservatively, potentially allowing the herd to exceed the population objective set by the Board of Game.

We need to explore ways of improving the accuracy of our herd counts. Improved photographic techniques should be employed for counting large groupings of caribou. I also recommend conducting surveys (possibly one every 4 years) of peripheral calving/post-calving sites throughout the Nelchina range in order to estimate the numbers of caribou in Nelchina subherds.

We should continue the periodic examination of the 39 existing Nelchina range stations, along with new sites established during 1989 in key calving, summering, and wintering areas. Information on the relative use of forage species is needed, and it could be obtained through analyses of fecal-pellet samples. A program should be initiated to monitor the body condition of Nelchina caribou. Growth and size (e.g., lower jaw measurements) and other condition factors such as fat deposition, parasite load, and blood parameters should be examined. In 1989 lower jaw measurements were taken from caribou harvested on the winter subsistence hunt. Jaw measurements will be compiled yearly in an attempt to detect changes in length over time as an indicator of herd condition.

I recommend developing a program to monitor the wolf population on the Nelchina range and associated predation on caribou. In particular, I recommend radio-collaring a number of wolf packs on this range. Over recent years wolf numbers over most of the Nelchina range have been maintained at relatively low-to-moderate levels. The associated predation level on Nelchina caribou, while not accurately known, has allowed herd growth. If wolf numbers increase on the Nelchina range and harvests are increased to stabilize herd growth, it will become increasingly important to have good information on wolf numbers and predation levels, especially on the critical calving grounds. With higher wolf numbers the 10-11% annual herd increment potentially available for hunting over the past few years could be substantially reduced.

Fall and winter subsistence hunts have been closed by Emergency Order after the reported harvests equaled the quotas. Because

additional harvest reports were received after the closures, quotas have been substantially exceeded in these hunts. With subsistence demand exceeding current quotas, I foresee continued problems with harvests exceeding quotas and seasonal closures by EO. Without further bag limit restrictions (e.g., 2 caribou per household), we will need to develop a harvest chronology model to close the hunt in a more timely manner to minimize exceeding quotas.

Since the fall subsistence season may never extend for more than a 2- to 4-week period if the quota is not increased, I recommend changing the opening date from 10 August to 25 August. This will provide hunting opportunity to subsistence hunters who wish to hunt in September and provide for subsistence hunting for moose and caribou at the same time. This, in turn, will probably reduce the take of caribou, because those hunters taking moose will probably not take as many caribou.

LITERATURE CITED

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Table 1. Nelchina Caribou Herd composition counts and population estimates, 1985-89.

Year	Calves:100 cows (summer)	Calves:100 cows (fall)	Calf % (fall)	Bulls:100 cows (fall)	Population estimate
1984-85	55	46	23	54	27,528
1985-86	--	42	23	44	---
1986-87	61	51	25	50	30,276
1987-88	--	48	24	56	---
1988-89	51	N/A	N/A	N/A	N/A

Table 2. Nelchina Caribou Herd annual harvest and accidental deaths, 1984-85 to 1988-89.

Year	Reported			Estimated	Accidental	Grand
	M	F	Total[a]	(Illegal)	(Road kills)	total
1984-85	891	166	1063	---	---	1063
1985-86	809	184	989	---	---	989
1986-87	766	184	958	18	43	1019
1987-88	1380	364	1747	---	27	1771
1988-89	1293	349	1656	---	150	1806

[a] Includes unknown sex.

Table 3. Nelchina Caribou Herd harvest data by permit hunt, 1984-85 to 1988-89.

Hunt no.	Year	Permits issued	Did not hunt	Unsuccessful hunters	Successful hunters	Bulls	Cows	Total
Sport								
515[a]	1984-85	1400	290	318	777	632	141	777
	1985-86[b]	1800	225	526	995	815	174	995
	1986-87	1300	236	366	680	553	124	680
	1987-88	1700	207	241	1228	1064	159	1228
	1988-89	1775	223	394	1121	944	167	1121
Subsistence								
516W[c]	1984-85	500	76	123	286	259	25	286
562W[d]	1986-87	1132	434	354	278	213	60	278
562W	1987-88	1183	328	274	519	306	205	519
	1988-89	1161	345	249	535	349	182	535
Totals	1988-89	2936	567	643	1656	1293	349	1656

[a] Drawing permit sport hunt except for 1985-86

[b] Tier II drawing permit subsistence hunt.

[c] Subsistence drawing permit hunt.

[d] Subsistence registration permit hunt.

Table 4. Nelchina Caribou Herd hunter residency and success, all hunts combined, 1984-85 to 1988-89.

Year	Successful				Unsuccessful			
	Local res.	Nonlocal res.	Nonres.	Total	Local res.	Nonlocal res.	Nonres.	Total
1984-85	286	777	---	1,063	123	318	---	441
1985-86	297	692	---	989	207	305	---	512
1986-87	278	680	---	958	354	366	---	720
1987-88	519	1,228	---	1,747	274	241	---	515
1988-89	551	1,105	---	1,656	256	387	---	643

Table 5. Nelchina Caribou Herd harvest chronology percentages by time period, Hunt No. 515, 1984-85 to 1988-89.

Year	Week Ending									
	8/13	8/20	8/27	9/03	9/10	9/17	9/24	10/01	Jan.	Feb.
1984-85	--	--	35.0	16.9	19.7	15.6	12.8	--	--	--
1985-86[a]	--	--	--	--	--	30.1	19.1	--	20.2	30.6
1986-87	--	--	--	16.2	35.9	22.8	14.4	10.7	--	--
1987-88	23.4	16.1	10.8	13.8	16.0	20.0	--	--	--	--
1988-89	9.1	19.4	16.2	15.6	13.0	13.2	13.5	--	--	--

[a] In 1985-86, Hunt No. 515 was a Tier II subsistence hunt for all Alaskan residents.

Table 6. Nelchina Caribou Herd harvest chronology percentages by time period, Hunt Nos. 516W and 562W, 1984-85 to 1988-89.

Year	Week Ending 8/13	8/20	8/27	9/03	9/10	9/17	9/24	10/01	Jan.	Feb.	Mar.
1984-85	--	--	5.6	10.5	8.4	3.5	6.0	--	16.8	11.9	37.2
1985-86[a]	--	--	--	--	--	--	--	--	--	--	--
1986-87	--	--	--	10.4	30.1	33.1	17.1	9.3	--	--	--
1987-88	13.9	9.6	14.7	--	--	--	--	--	61.8	--	--
1988-89	7.9	15.7	18.6	17.8	--	--	--	--	39.8	--	--

Table 7. Nelchina Caribou Herd successful hunter percentages by transport methods, Hunt No. 515, 1984-85 to 1988-89.

Year	Airplane	Horse	Boat	3 or 4-wheeler	Snowmachine	ORV	Highway vehicle	n
1984-85	21.1	1.7	14.8	20.4	--	19.8	22.2	771
1985-86[a]	11.1	0.6	9.3	9.2	17.0	11.3	41.5	986
1986-87	13.8	0.9	15.7	17.6	--	21.6	30.5	676
1987-88	13.3	0.9	12.7	26.8	--	19.3	26.9	1,217
1988-89	12.0	1.0	13.0	23.0	--	19.0	31.0	1,121

[a] In 1985-86 Hunt No. 515 was a Tier II subsistence hunt for all Alaskan residents.

Table 8. Nelchina Caribou Herd successful hunter percentages by transport methods, Hunt Nos. 516W and 562W, 1984-85 to 1988-89.

Year	Airplane	Horse	Boat	3-or 4-wheeler	Snowmachine	ORV	Highway vehicle	n
1984-85	7	1	2	2	16	8	65	276
1985-86[a]	--	--	--	--	--	--	--	--
1986-87	14	2	7	12	--	13	52	270
1987-88	4	1	4	9	26	10	47	498
1988-89	4	1	4	9	19	8	55	512

[a] In 1985-86 the only Nelchina caribou hunt was a Tier II subsistence Hunt (No. 515) for all Alaskan residents.

STUDY AREA

GAME MANAGEMENT UNITS: 13E and 20C (2,036 mi^2)

HERD: Denali

GEOGRAPHICAL DESCRIPTION: Central Alaska Range, primarily in Denali National Park and Preserve (DNPP)

BACKGROUND

The Denali Caribou Herd has experienced at least 2 major population declines during this century. The herd included approximately 20,000-30,000 caribou from the early 1900's until the late 1940's (Murie 1944). The population declined to approximately 7,000-9,000 caribou in the late 1940's (Murie 1961), stabilized, and then declined again steadily from 1,500 to 8,000 caribou between 1968 and 1972 (Haber 1977). Biologists do not agree on causes for these declines; explanations include heavy snowfall, emigration, low reproduction, and overgrazed range conditions. After the second major decline, the herd reportedly stabilized at 1,200-1,500 caribou between 1972 and 1980 (Grosnick 1979, Troyer 1980). Since Boertje's (1981, 1984) research, the herd has grown to its present size of approximately 2,700-3,000 caribou (L. Adams, pers. commun.).

Human consumptive use of the Denali herd since at least the mid-1960's has been relatively low. Mean annual reported harvest from 1967 through 1975 was 50 caribou (Buskirk 1976). Hunting of the herd has been prohibited since the fall of 1977, when the season was closed because of the small herd size; however, there has been increasing pressure from some local residents to re-open the Denali herd to a limited caribou hunt.

Since the hunting closure, the primary human use of the Denali herd 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. Research on the Denali herd has provided insight into the population dynamics of an unhunted, unmanaged caribou herd as well as the adjacent Delta herd. Caribou in the Tonzona drainage, in the western portion of DNPP, are considered a different herd and are reported on separately.

POPULATION OBJECTIVES

To provide for an annual harvest of < 1% of the herd size after it reaches 4,000.

To compare data between the Denali and Delta herds.

To provide information to the public on opportunities to view and photograph caribou within DNPP.

METHODS

The Alaska Department of Fish and Game does not routinely participate in survey and inventory activities associated with the Denali herd. National Park Service (NPS) biologists obtained a minimum population estimate in 1987, using aerial photocensus techniques described by Davis et al. (1979) and Davis and Valkenburg (1985). In addition, 2 population estimates were derived using the census results, in conjunction with data from a 1987 fall composition survey of the herd (L. Adams, pers. commun.). In 1988 and 1989, a photocensus was attempted but not completed because of weather and aircraft-scheduling problems (L. Adams, pers. commun.).

Radiotelemetry has been used to study various aspects of the Denali herd and its predators. Caribou calves have been radio-collared annually since 1984 for a study of neonatal mortality (Adams 1986). The demography and distribution of wolves in DNPP has been studied since 1985, with the aid of radiotelemetry (Mech et al. 1988). In 1986 NPS biologists began radio-collaring adult cow caribou to investigate reproductive and mortality rates and to improve composition counts and population estimates (Adams 1986). Historical data were compiled for this report to summarize population trends and composition of the Denali Herd.

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 (Shults 1988). Extrapolations to account for caribou not seen during the photocensus resulted in an estimate of approximately 2,700 caribou. A photocensus was not conducted in 1988 or 1989; however, a 1989 minimum population estimate was calculated by adding the number of cows and calves observed during the 30 May 1989 composition survey (1,263 cows $\geq$1 year old, 500 calves) to the number of bulls estimated to be in the herd (720), based on the previous 5-year (1984-88) mean bull:cow ratio of 57:100. Although this resulted in an estimate of 2,483 caribou, the extrapolated estimate is 2,700-3,000 caribou because 15-28% of the radio-collared cows have been outside the search area during composition counts in the previous 2 years (L. Adams, pers. commun.).

Population Composition:

Fall composition surveys of the herd have been completed annually since 1984 (Table 1). Calf:cow ratios (28-38:100) are similar to those of other caribou herds in Alaska that are growing slowly. Calves composed 15-20% of the composition samples. Bull:cow ratios ranged from 47:100 to 67:100, except in 1984 when only 26:100 were observed. It is not unusual for unhunted caribou populations to only have 60 bulls:100 cows, because bulls do not live long after their prime. Predation and other mortality on postrutting bulls can be high because of the bull's lowered resistance and energy levels.

Preliminary results on the reproductive success of radio-collared cows during the 1989 calving season indicated high productivity but relatively low postnatal survival of calves (L. Adams, pers. commun.). Ninety-five percent of 40 cows $\geq$3 years old were pregnant (presence of antlers); however, only 42% of these pregnant cows had calves with them on 6 June. Thirty-eight percent (5 of 13) of the 2-year-old cows were pregnant, but only one of these still had a calf on 6 June. During a composition count on 30 May 1989, 40 calves:100 cows were counted. Composition surveys also indicated that between May and September calf:cow ratios declined from 43:100 to 37:100 in 1987 and from 43:100 to 33:100 in 1988.

Compared with the Denali herd, the Delta herd has generally had a higher proportion of calves (17-21%), lower fall bull:cow ratios (32-49:100), and similar overwinter survival of calves (Table 2). As expected, the Delta herd had a lower proportion of large bulls than the Denali herd. Bulls were categorized according to size during some fall composition counts. In 1987, 53%, 23%, and 24% of the Delta herd bulls were small, medium, and large, respectively, compared with 28%, 39%, and 33% in the Denali herd during the same year.

Distribution and Movements:

The range of the Denali herd is centered within DNPP and was described by Boertje (1981). In more recent years, the general movements and distribution of the herd have changed somewhat. For instance, the migration pattern between the calving and summering areas has shifted; the summering area is now farther east, the eastern wintering area is not used much, and the Cantwell calving area has only been used by a small portion of the herd. 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.). Valkenburg (1987) reported that in 1985 a calf caribou radio-collared by the NPS left the Denali herd and wintered with a separate calving group of caribou in the Tonzona drainage, remaining there through the calving season. Valkenburg speculated that the Tonzona and Denali herds may have a relationship similar to the Delta and

Yanert herds, in which some interchange takes place. The Tonzona herd currently numbers at least 400 caribou.

Mortality

Season and Bag Limit:

Hunting of Denali herd caribou has been prohibited since the fall of 1977.

Natural Mortality:

Predation appears to be the primary factor limiting growth of the Denali herd. Mortality of neonatal caribou calves has been studied by NPS biologists since 1984. During the first 4 years of the study, 50% of 224 calves collared as newborns died before October (Adams 1986; L. Adams, pers. commun.). Similarly, the mean mortality rate (1979-87) for Delta caribou from birth to 5 months was 50% (±14 SD) (Davis et al. 1988). In the Denali herd, most mortality (39%) occurred prior to 1 June, and predation was responsible for all but 1 death during this early period. Mortality from predation was caused primarily by grizzly bears (49%) and wolves (28%).

Grizzly bear densities within the DNPP have been estimated to be approximately 1/12 mi^2 (Dean 1986), which is one of the highest densities measured in Interior Alaska. Wolf densities within DNPP were estimated in 1988 at 1 wolf/45 mi^2, with about 6,668 mi^2 of suitable habitat for wolves (Mech et al. 1988). A minimum of 17 wolf packs have had home ranges at least partially within DNPP boundaries. Estimates of wolf numbers increased from approximately 110 to 150 wolves between 1987 and 1988 (Mech et al. 1988). This large increase was thought to represent a real change in the wolf population, because the average number of pups produced per pack was more than twice as high in 1988 as in 1987 and several new pairs produced pups (Mech et al. 1988). The McLeod Lake wolf pack occupies a substantial portion of the herd's calving area (Mech et al. 1988). The pack's use of caribou was evidenced in May 1988, when 9 freshly killed caribou calves were found scattered over a quarter-mile long area and 9 cows without calves were seen nearby. In a separate incident, 5 dead calves were found, apparently all killed at the same time (Mech et al. 1988). In 1989 the emphasis of wolf research in the DNPP will shift from estimating distribution, population size, and pack size, to studying interactions between wolves and the Denali herd. In addition, the natural mortality rates of a adult cows should be available from research on the radio-collared caribou in the future.

Habitat

Habitat use by the Denali herd was summarized by Boertje (1981, 1984), 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 calving grounds of the Denali herd.

Game Board Actions and Emergency Orders

In spring 1988, the Clear-Healy Advisory Committee proposed re-opening a limited caribou hunt on the Denali herd; however, the Board of Game did not pass this proposal. The Board has not made a determination on subsistence use of the Denali herd.

CONCLUSIONS AND RECOMMENDATIONS

The Denali herd is growing, but it is still probably far below carrying capacity. Caribou are at relatively low densities, the percentage of caribou breeding as 2-year-olds is much higher than in the Delta herd, and winter mortality rates are relatively low.

We are currently meeting our objectives. The herd has provided extensive viewing and photographic opportunities for visitors to DNPP and has provided valuable comparisons with the adjacent hunted and intensively managed Delta herd. The herd is currently unhunted, but as herd size continues to increase we can expect increasing pressure from local residents to re-open the herd to some limited consumptive-use opportunities. In response to these requests, we plan to assess the desirability of establishing a limited caribou hunt during the next reporting period.

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Table 1. Summary of sex and age composition of the Denali Caribou Herd, 1978-89.

Survey date (mo/day/yr)	Calves: Per 100 cows	Calves: % in herd	Calves: No.	Bulls: Per 100 cows	Bulls: % in herd	Bulls: No.	Cows: % in herd	Cows: No.	Sample size	Source
4/25-26/84[a]	46	28	170	20	12	74	62	370	600	Adams 1986, BGDIF C-2
4/22-23/85[b]	34	18	272	58	30	456	52	792	1,520	ADF&G files
4/29/86[c]	25	18	91	16	11	56	71	359	506	Adams 1986, Valkenburg 1987
4/14/87[d]	46	30	176	10	6	37	64	382	595	NPS data
4/18/88[e]	32	20	95	28	17	82	61	292	476	NPS data
3/25-26/89	42	25	353	26	15	216	60	847	1,416	NPS data
5/24/81[f]	50	27	20	--	--	--	55	41	75	
5/24/82	30	23	67	--	--	--	77	221	288	ADF&G files
6/1-3/84	52	--	398	--	--	--	--	766	1,164	Adams 1986
6/1-3/85	34	--	75	--	--	--	--	220	295	Adams 1986
5/28/86	49	--	184	--	--	--	--	341	525	Adams 1986
5/29-30/87	43	29	487	5	3	58	67	1,124	1,670	NPS data
5/27-29/88	43	28	435	10	7	105	65	1,002	1,542	NPS data
5/30/89	40	27	500	5	3	61	69	1,263	1,824	NPS data
6/20/76	16	--	107	--	--	--	--	666	773	Troyer 1980
7/16-22/77[g]	18	--	86	--	--	--	--	471	557	Troyer 1980
6/25-26/78	38	--	235	--	--	--	--	618	853	Troyer 1980
6/27/79	22	--	168	--	--	--	--	751	919	Troyer 1980
6/21-22/80[g]	20	--	95	--	--	--	--	469	564	Troyer 1980
6/24/81	24	24	145	--	5	4	80	593	738	
6/24-25/82	21	17	124	--	--	--	83	600	724	ADF&G files
6/14/83	19	14	74	17	12	66	74	395	535	ADF&G files
6/19/83[h]	38	22	279	22	13	162	59	741	1,252	

Table 1. Continued.

Survey date (mo/day/yr)	Calves: Per 100 cows	Calves: % in herd	Calves: No.	Bulls: Per 100 cows	Bulls: % in herd	Bulls: No.	Cows: % in herd	Cows: No.	Sample size	Source
6/1-3/84	52	--	--	--	--	--	--	--	1,164	
6/1-3/85	34	--	--	--	--	--	--	--	295	
9/27/84	36	20	316	47	26	411	55	881	1,608	ADF&G files
9/25/85	28	15	183	56	30	368	54	654	1,205	Valkenburg 1987
9/27/86	38	20	210	56	29	305	51	547	1,062	Adams 1986
9/27/87[i]	35	19	224	56	29	356	52	631	1,211	NPS data
9/27-28/88	33	16	221	67	33	451	50	678	1,350	NPS data

[a] 88 male calves:100 female calves (n = 49).
93% cows had antlers (= pregnant) (240 of 256).
84% (32 of 38) bulls were young bulls, suggesting that if mature bulls were sampled, the herd's bull:cow ratio would double or more (40-50:100).

[b] Includes 131 caribou of unknown sex.

[c] Low bull:cow ratio indicates many missing bulls. Possible underestimate of calves because there was considerable segregation of bulls and cows and some calves could have been with bulls.

[d] 99 of 176 (56%) calves were female.

[e] 98 male calves:100 female calves.

[f] Yearlings - 25:100 cows, 13% in herd, n = 10.

[g] Incomplete count; many failed to congregate on postcalving grounds.

[h] Yearlings - 9:100 cows, 6% in herd, n = 70.

[i] Bulls - 118 (33%) large, 138 (39%) medium, 100 (28%) small. 73 male calves:100 female calves.

NOTE: Distended utter count data available from many surveys (May 1984-88). Some composition data prior to 1976 was summarized by Buskirk (1976).

Table 2. Comparison of composition counts on Denali and Delta Caribou Herds, 1984-89.

Year	April Calves:100 cows		Late May Calves:100 cows		Fall Calves:100 cows		Fall Bulls:100 cows	
	Denali	Delta	Denali	Delta	Denali	Delta	Denali	Delta
1984	46	49	--	82	36	26	42	36
1985	34	34[a]	--	--	28	56	49	36
1986	25	29	40	82	38	56	41	29
1987	46	--	43	60	37	56	32	31
1988	32	29	43	--	33	67	33	35
1989	42	--	40	--	--	--	--	--
Mean(SD)	37.5(8.5)	35.3(9.5)	41.5(1.7)	74.7(12.7)	34.4(4.0)	33.4(3.2)	52.2(15.4)	39.4(7.0)

[a] Conducted 3 May 1989.

STUDY AREA

GAME MANAGEMENT UNIT: 15A (1,538 mi^2)

HERD: Kenai Lowland

GEOGRAPHICAL DESCRIPTION: Kenai 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 1960's 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 to be a limiting factor at the current population size, growth since the mid-1970's has been slow. Predation, including free-ranging domestic dogs and wild predators, is controlling growth. Although hunting was allowed in 1981 and 1988, it has not influenced this small caribou herd. A report relating to a joint ADF&G-USFWS program to capture caribou and transplant them into Subunit 15A (1985-86) will be published separately by the Department of Fish and Game.

POPULATION OBJECTIVES

To increase the herd to a minimum of 150 animals by 1990.

METHODS

On 19 June 1989 a PA-18 aircraft was used to classify adults, large bulls, and calves. Limited hunting was administered by drawing permit.

RESULTS AND DISCUSSION

Population Status and Trend

One hundred seventeen caribou, including 11 (9%) calves, were located during the 1989 spring survey (Table 1). The population was estimated to be between 117 and 130. Large antlered bulls made up a minimum of 23% of the observed adults ($\underline{N}$ = 24 of 106). The spring calf production and survival was the lowest recorded.

A similar survey conducted on 16 June 1988, when 115 caribou (11.3% calves) were observed, suggested the KLCH remained stable during 1989; however, the low proportion of calves observed in 1989 (9%) suggested it will probably remain stable or slightly decline during the winter of 1989-90.

Mortality

Season and Bag Limits:

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

Natural Mortality:

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

Habitat Assessment and Enhancement

Since this herd occupies a large summer and winter range relative to the herd size, habitat is not suspected to be limiting at this time. Additionally, numerous observations of the herd by staff biologists suggest that they appear healthy, and calves in the KCLH appear to grow faster than those observed in the Kenai Mountain herd.

Game Board Actions and Emergency Orders

The Board of Game reestablished the hunting season in 1988 to allow for a limited amount of hunting opportunity. Local support for hunting was high. No Game Board action was proposed during 1989.

CONCLUSIONS AND RECOMMENDATIONS

Reaching the published objective of 150 caribou by 1990 appears unlikely. 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 FY 91.

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. However, if this population indicates a declining trend, hunting will be curtailed.

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Table 1. Spring composition data for Kenai Lowlands Caribou Herd, 1976-77 - 1988-89.

Date	Count	% Calves	Permits issued	Harvest	
				Male	Female
1976-77	32	23	-	-	-
1977-78		No Data	-	-	-
1978-79	59	25	-	-	-
1979-80	54	17	-	-	-
1980-81	60	13	-	-	-
1981-82[a]	66	30	5	4	0
1982-83	71	25	-	-	-
1983-84	61	28	-	-	-
1984-85	75	21	-	-	-
1985-86	No	Data	-	-	-
1986-87	98	27	-	-	-
1987-88	115	11	-	-	-
1988-89[b]	117	9	3	2	1

[a] First hunting season

[b] Second hunting season

STUDY AREA

GAME MANAGEMENT UNIT: 18 (42,000 mi^2)

HERD: Kilbuck and Andreafsky Mountains

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

BACKGROUND

Historically, caribou ranged over much of the Yukon-Kuskokwim (Y-K) Delta, including Nunivak Island, and the population peaked during the 1860's; however, by the early 1900's, 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 Kilbuck Mountains herd, 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 900-1,000 caribou, an increase of 100-200 from that for 1988. Radiotelemetry data indicate that Kilbuck caribou calve on high ridges in the western portion of the Kuskokwim Mountains, summer in alpine meadows, and winter in valleys and wind-blown slopes and ridge tops. Their range includes the eastern portion of Unit 18, encompassing the edge of the lowlands of the Y-K Delta and the montane western border of Subunits 19B and 17B.

Limited information is available for the Andreafsky Mountains herd, estimated to number less than 100 caribou. This herd apparently calves and winters near Needle Mountain in the headwaters of the Andreafsky River drainage near the border of Units 18 and 22A.

POPULATION OBJECTIVES

To increase caribou numbers.

To ascertain the status and size of the Kilbuck and Andreafsky Mountains herds.

METHODS

The caribou population in the Kilbuck Mountains has been surveyed periodically by Department staff since May 1984. Regularly scheduled monthly flights were initiated by the U.S. Fish and Wildlife Service (USFWS) in February 1986 as part of a cooperative management study (Hinkes 1989). Systematic biweekly aerial surveys of the Kilbuck and southern Kuskokwim Mountains began in 1987 and continued through the 1988-89 reporting period.

Eighteen caribou (8 males and 10 females) radio-collared in 1987-88 were monitored by Department and USFWS staff during the reporting period. Mortality and losses of dropped collars from bulls reduced this number to 12 caribou (3 males and 9 females) by the spring of 1989. Radio-collared caribou were relocated using fixed-wing aircraft. Caribou locations were determined using LORAN C and subsequently mapped. Detailed methodology for the Kilbuck radiotelemetry study is available in Hinkes (1989).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

The current population estimate for the Kilbuck herd is 900-1,000 caribou. Approximately 800-900 caribou were estimated to occur in the area during the 1987-88 reporting period. Radiotelemetry studies indicated that Kilbuck caribou compose a distinct, resident herd that calves during mid-May on mountain ridges in the upper Kisaralik River drainage.

A minimum of 1,587 caribou were observed during a November 1988 aerial survey conducted in the Kilbuck Mountains. During October 1987, only 685 caribou were observed during surveys conducted in the Kilbuck Mountains. It is unlikely that all the additional caribou observed during the 1988 survey resulted from reproduction in the Kilbuck herd. Most of the increase was attributed to immigration from the rapidly expanding Mulchatna herd, which demonstrated marked movements to the north and west of its usual range in Units 17 and 19.

Population Composition:

Sex and age composition information was collected during a November 1988 aerial survey (Hinkes 1989), and 845 caribou were classified (30% bulls, 47% cows, 12% calves, and 11% unclassified). Composition ratios were 63 bulls:100 cows, 24 yearlings:100 cows and 26 calves:100 cows. Calving in the Kilbuck Caribou Herd was monitored during 10-25 May 1989 (Hinkes 1989). A ratio of 67 calves:100 cows was observed, essentially the same ratio as the one observed during 1988 (66 calves:100 cows). Percentage of short yearlings observed during the May 1989 aerial survey was 10%, and the observed ratio was 17 yearlings:100 cows.

Distribution and Movements:

During the reporting period, movements and distribution of Kilbuck caribou followed a similar pattern to that described in the previous progress report (Patten 1989). All radio-collared caribou remained in the western and central Kuskokwim and

southern Kilbuck Mountains. A single radio-collared caribou moved south of the study area during the spring of 1988 but returned by August 1988.

Sufficient evidence is available suggesting that range overlapping between Mulchatna and Kilbuck caribou occasionally occurs in the vicinity of the southern Kuskokwim and Kilbuck Mountains. A radio-collared female from the Mulchatna herd was located within the range of the Kilbuck herd from February through April 1989. A group of approximately 2,000 caribou from the Mulchatna herd moved from the southeast onto the lowlands between the Aniak River and Whitefish Lake near the border of Subunit 19A and Unit 18 during November 1988. Several small groups of these caribou were reported to have crossed the lower Kuskokwim River in several locations into Unit 18 during that time. These caribou apparently returned to Unit 17 during February through April 1989.

Mortality

Season and Bag Limits:

There is no open season south of the Yukon River in Unit 18. The open season for subsistence, resident and nonresident hunters for the remainder of Unit 18 is 1 February to 31 March. The bag limit is 1 caribou.

Human-induced Mortality:

The season south of the Yukon River was closed by the Board of Game in 1985. Some poaching was observed in 1986, but none was documented during 1987-88. A major poaching incident was discovered by USFWS biologists on an aerial patrol in March 1989. Up to 30 Kilbuck caribou may have been illegally taken. State and federal enforcement officers responded immediately, and an investigation was initiated.

We have no information on harvest for the Andreafsky herd, other than anecdotal and unsubstantiated reports, because harvest reporting rates are extremely poor. We believe that human-induced mortality may be excessive.

Natural Mortality:

Little information is available on natural mortality. A female caribou was killed by wolves in the southern Kilbuck Mountains during February 1988, and another one was killed during November 1988. A wolf pack of 8-12 animals has ranged over the study area during the last 3 years, and caribou may be an important component of the wolves diet.

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 May 1988, and

nine were observed there in 1989 (Hinkes 1989); 1 kill site may have been observed. The selection of calving sites on high, rugged ridges suggests predator avoidance.

Habitat Assessment

As previously reported, the lichen range in the Kilbuck and southern Kuskokwim Mountains is among the best in Alaska. Neither the Andreafsky Mountains nor the Kilbuck Mountains has been substantially grazed by caribou or reindeer for over 50 years. We believe that both areas could support much higher densities of caribou.

Game Board 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 we believed harvest was exceeding sustained-yield limits. The rapid growth and recovery of the Kilbuck herd since that time confirmed our belief that human harvest was probably a major factor limiting herd growth.

CONCLUSIONS AND RECOMMENDATIONS

The Kilbuck Caribou Herd has been studied on a cooperative basis by the USFWS and Department since 1986. Kilbuck caribou, estimated at 900-1,000 animals, composes a distinct resident herd in the Kilbuck and southern Kuskokwim Mountains. Some animals from this herd have calved for 4 consecutive years on high ridges in the vicinity of Kisaralik Lake. This herd continues to expand in numbers and range. Aerial surveys of the Kilbuck herd should be continued to determine if a harvestable surplus exists; however, the management goal for the Kilbuck herd is for continued population growth.

The range overlapping between the Kilbuck herd and the expanding Mulchatna herd needs to be further investigated. In order to better establish the overall range of the 2 herds, additional caribou from the Kilbuck herd and those believed to be transients need to be captured and collared.

The status of the Andreafsky herd is of significant concern. Although documentation is lacking, anecdotal reports of excessive hunting mortality continue. Additional survey flights are recommended, and a proposal to close the hunting season is under consideration.

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STUDY AREA

GAME MANAGEMENT UNITS: 19, 21A, and 21E (60,523 mi^2)

HERD: Beaver Mountains, Big River, Kuskokwim Mountains, Mulchatna, Rainy Pass, Sunshine Mountains, and Tonzona Herds

GEOGRAPHICAL DESCRIPTION: Unit 19 consists of all drainages of the Kuskokwim River upstream of the village of Lower Kalskag. Subunits 21A and 21E contain that area in the Yukon River drainage from Paimiut upstream to but not including the Blackburn Creek drainage and the entire Innoko and Nowitna River drainage upstream from the confluence of the Little Mud and Nowitna Rivers.

BACKGROUND

Discussions with village elders indicated that caribou once existed in far greater numbers over a larger range. As testament to that previous abundance, a large mountain in the area is called Horn Mountain, a reference to where caribou antlers had been traditionally gathered. 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 the better range to the south. As that herd increases (1989 spring estimate of 70,000 animals), it appears to be expanding its range northward, reinvading portions of Unit 19 to the north.

In the Kuskokwim Mountains, which largely divide Unit 19 from Unit 21, small caribou bands have apparently existed since the turn of the century. Reindeer herders from the Yukon villages of Holy Cross and Shageluk have traditionally herded their animals to summer range in these mountains. Apparently, herders commonly lost reindeer in the area, and theoretically these reindeer freely banded and interbred with existing caribou. The Beaver Mountains Caribou Herd calves much earlier than most caribou herds (early to mid-May), suggesting either a strong influence of reindeer genes in the population or exceptionally good nutrition (Skogland 1985).

POPULATION OBJECTIVES

To determine population size and trend of the Big River and Rainy Pass herds by the fall of 1991.

To determine the seasonal ranges and discreetness of the Kuskokwim herds by 1993, especially for the Big River Rainy Pass herd and Kuskokwim Mountains herds.

To monitor harvests annually to ensure that they do not significantly restrain population growth or contribute to population declines.

To establish minimum population size objectives for the various herds and propose seasons and bag limits to help attain those objectives by the fall of 1995.

METHODS

Harvest reports were analyzed, and incidental observations of caribou numbers and calving areas were made. No formal surveys have been conducted since 1985 (Pegau 1986).

RESULTS AND DISCUSSION

Population Status and Trend

Because no formal surveys of the various caribou herds in Unit 19 and Subunits 21A and 21E have been conducted since June 1985, the status and population trends are largely unknown. Based on casual observations and reports, most herds have remained relatively stable or declined slightly since Pegau's (1986) estimates were made.

Distribution and Movements:

Harvest analyses and incidental observations have provided a few insights into caribou movements. A spring photocensus of the Mulchatna Caribou Herd was conducted during 1989. That herd generally calves south of Unit 19 in Unit 17, but recent expansion in numbers (1989 estimate of about 70,000 caribou) has led to a northward expansion of range into Unit 19. With this northward movement, harvest in Unit 19 has increased throughout Subunit 19B and into portions of Subunit 19A. As this herd continues to expand, additional harvest will occur throughout Subunits 19A, 19B, and portions of 19C. At least 1,000 Mulchatna caribou migrated from traditional range in the upper Hoholitna region in a northwest direction to near Kalskag during the winter of 1988-89. Apparently most returned to more traditional areas during the spring of 1989.

Mortality

Season and Bag Limit:

The open season for subsistence, resident, and nonresident hunters in Subunits 19A north of the Kuskokwim River is 10 August

to 30 September; the bag limit is 1 caribou. An additional open season during the winter (1 November to 28 February) excludes nonresident hunters. The open season for subsistence hunters residing in Lime village is 10 August to 31 March; the bag limit is 5 caribou. The open season for other subsistence hunters and residents in Subunit 19A south of the Kuskokwim River, and Subunit 19B is 10 August to 31 March. The bag limit for subsistence hunters is 4 caribou; however not more than 2 caribou may be taken from 10 to 31 August and no more than 1 caribou may be taken from 1 September to 30 November.

Human-induced Mortality:

About two-thirds of the reported harvest of caribou in Units 19 and Subunits 21A and 21E are from the Mulchatna herd (Table 1). Discounting those harvested from the Mulchatna herd, the 1988-89 reported harvest (i.e., 124) was comparable to the previous year's harvest, but nearly a 3-fold increase over the reported harvest for 1986-87. The numbers of hunters participating have followed a similar pattern. The unreported harvest was still high, representing from 25% to 50% of the documented harvest.

Hunter Residency and Success. Although the residency of hunters is not documented, I suspect that hunters are about equally distributed in the resident and nonresident classes. Hunters (both successful and unsuccessful) reported hunting an average of 5.8 days, with hunts lasting from 1 to 21 days. 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%.

Harvest Chronology. Sixty-two percent of the reported caribou harvest occurred in September, 27% in August, and the remainder from October to March. The harvest chronology has not changed significantly over the past 5 years.

Transport Methods. Four hundred eighty-four of 590 reporting (82%) caribou hunters used airplanes. Sixty-one (10%) reported using boats. The remainder was distributed among horses, three- and four-wheelers, snowmachines, and off-road vehicles.

Natural Mortality:

Although no specific data have been collected concerning natural mortality rates during this reporting period, wolf predation was relatively high among most of the caribou herds in Units 19 and 21. The winter of 1988-89 was relatively severe; deep snows and extremely cold temperatures resulted in increased mortality.

Game Board Actions and Emergency Orders

In response to a lawsuit filed by residents of Lime Village, the Board of Game adopted less-restrictive subsistence regulations for its residents. Beginning in July 1989, residents of Lime

Village will not have individual bag limits for caribou; instead, they will have a village quota of 100. There will be no closed season; however, the taking of cows and calves from 1 April to 9 August will be prohibited. Additional rulings are forthcoming that will result in similar subsistence regulations for other villages.

CONCLUSIONS AND RECOMMENDATIONS

To meet the objectives stated previously in this report, reconnaissance flights must be conducted during spring and early summer 1990 to identify calving and bull aggregation areas. To adequately manage the various herds, additional funds and staff time must be devoted to assessing herd sizes and trends. Increased enforcement of the reporting requirements should occur to adequately document the actual harvest.

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Table 1. Caribou harvest ticket returns for Unit 19 and Subunits 21A and 21E, 1988-89.

Herd	No. harvested				Total returns
	Bull	Cow	Unspec.	Total	
Beaver/Sunshine Mountains	3	0	0	3	10
Big River	47	2	1	50	78
Kilbuck Mountains	3	0	0	3	5
Rainy Pass	44	12	0	56	77
Tonzona	5	2	0	7	18
Mulchatna	303	28	2	333	415
Unspecified herd	5	0	0	5	8
Totals	410	44	3	457	611

STUDY AREA

GAME MANAGEMENT UNIT: 20A (6,500 mi^2)

HERDS: Delta and Yanert

GEOGRAPHICAL DESCRIPTION: Central Alaska Range and Tanana Flats

BACKGROUND

During the past 20 years the Delta and Yanert Caribou Herds have experienced large fluctuations in population size. The lowest population level was estimated to be 2,000 caribou in 1975. In 1989 the population was estimated to be 10,690, the highest on record. A more thorough review of Delta and Yanert caribou population fluctuations was given by Davis (et al. 1988a).

Prior to 1974 the Delta and Yanert herds were managed by liberal either-sex general hunting seasons. Since 1974 regulations have become increasingly complex. Both registration and drawing permits have been used to regulate caribou harvests as well as access in defined controlled-use areas. Beginning in 1987 harvests during the general season were restricted to bulls only. Historical trends in harvests (McNay 1990) and a detailed description of changes in hunting regulations since 1968 (Davis et al. 1989a) have been presented in previous reports.

Population objectives for the Delta and Yanert Caribou Herds have evolved slowly since the mid-1970's (McNay 1990). In 1987 the Board of Game determined that there had been no significant subsistence use of Delta and Yanert caribou. Therefore, subsistence use has not been a major consideration in management planning.

POPULATION OBJECTIVES

To determine optimum herd size by allowing the combined Delta and Yanert Caribou Herds to increase at an average annual rate of approximately 3% until population responses to increased density become apparent and/or limiting.

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

To provide an annual combined Delta and Yanert harvest of at least 500 caribou and a hunter success rate of at least 30%.

To establish population size goals for grizzly bears and wolves by the fall of 1991 and maintain regular sport hunting of bears and hunting and trapping of wolves to maintain populations at desired levels.

METHODS

On 14 October 1988, 3,003 caribou of the combined Delta and Yanert herds were classified from a helicopter. Observers Robin Beasley, Jim Davis, and Mark McNay classified 20%, 45%, and 35% of the sample, respectively. Survey efforts were distributed around the locations of 40 of 49 functioning radio collars. Jim Davis located radio-collared caribou from a fixed-wing aircraft on 13 October. On 14 October we used a helicopter to survey areas where the radio-collared caribou had been located. Weather prevented the helicopter survey of 1 large group in southwestern Subunit 20A. All groups encountered during the helicopter search were classified. The data from the classification were compiled in 2 ways: first by combining all observations and calculating sex:age ratios from the unweighted sums and second by weighting group classifications according to the distribution of radio collars among the 3 main geographical areas that had been sampled. Classifications were based on the following criteria: (1) cow--external genitalia ("vulva") visible; antlers small, free of velvet, and poorly developed; (2) calf--small body size, short face, antlers small, often only a spike or branched once and black and velvet covered, and behavioral cues; (3) small bull--"cow-sized" animal or larger with antlers nearly indistinguishable from an adult cow, uniformly white rump below anus, tail often has a "cottontail appearance", penis sheath occasionally visible from the side; (4) medium bull--antlers clearly larger than on cows or small bulls, uniformly white rump below anus, as in small bulls, tail may appear fuller than in cows, including bulls of several cohorts; and (5) 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.

On 30 June 1989 the combined Delta and Yanert Herds were censused from 3 fixed-wing aircraft. Fifty-five radio-collared caribou (i.e., all known active radios) led observers to most large postcalving aggregations. The census centered around the upper Wood River drainage, but additional groups that were not associated with radio-collared caribou were found during systematic searches of the Yanert River, Dry Creek, the West Fork of the Little Delta River, and the Tatlanika River drainage. While locating all 55 known functional radio collars, photographs were taken of the largest groups using hand-held 35-mm cameras from a Super Cub and a Bellanca Scout aircraft. A large-format floor-mounted camera was used to photograph some groups from a DeHavilland Beaver. The total population estimate was derived by counting individual caribou on the photographs and adding those caribou in small groups that were enumerated visually from the search aircraft. No correction factor was used to account for caribou that were undoubtedly missed during the search. However, because of the level of search effort and good survey conditions, the number of missed caribou was considered to be inconsequential.

Growth rates for the combined Delta and Yanert Caribou Herds were calculated from 1985 and 1989 census results. The finite growth rate (λ) was expressed as a percentage and calculated as $(\lambda-1)$ $100\% = {}_{(e}r)100\%$ where e is a constant (2.171828), and r is the observed exponential rate of change. The exponential rate of change (r) was calculated as: $(\log_e T_2 - \log_e T_1)/t$ where T_1 and T_2 were the population estimates and t was the time interval between estimates (Gasaway et al. 1986).

ADF&G personnel interviewed hunters during the 1st 2 weeks of September 1988 to determine the frequency of harvested caribou not reported through the harvest ticket system. Hunters were not told the purpose of these interviews because it would bias reporting. 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 estimate actual number of hunters and 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). The marked sample consisted of interviewed hunters; the harvest reports were considered the recapture sample. Therefore, an estimate for total hunters was derived using a minimum bias mark-recapture formula:

$$N = \left[\frac{(n_1 + 1)\ (n_2 + 1)}{m_2 + 1}\right] - 1$$

where n_{1t} = interviewed hunters (i.e., marked sample), n_{2t} = total harvest reports returned, and m_{2t} = interviewed hunters who also returned harvest reports (i.e., recaptured markers).

Similarly, the number of successful hunters (i.e., harvest) was calculated using n_{1s} = interviewed successful hunters, n_{2s} = total successful harvest reports returned, and m_{2s} = successful interviewed hunters who also returned a harvest report.

The reporting rates for successful hunters and total hunters were calculated simply as m_{2s}/n_{1s} and m_{2t}/n_{1t}, respectively. Confidence limits around those proportions were then taken from the binomial confidence limit program.

It is not possible to calculate the reporting rate of interviewed, nonsuccessful hunters from interview report data because a hunter who was unsuccessful when interviewed could have later taken a caribou and failed to return the harvest report. Therefore, using the estimates of successful hunters and total hunters derived from hunter interviews, a nonsuccessful hunter reporting rate was calculated as

$$\frac{\text{Total rept. hunters - Rept. successful hunters}}{\text{Total est. hunters - Total est. successful hunters}} \times 100 = \frac{215}{488} \times 100\% = 44\%$$

To improve hunter reporting rates, 120 radio and 51 television advertising spots were purchased and aired between 5 October and 14 October 1988 by Fairbanks broadcasters. Additional advertising was purchased in the hunting supplement of the newspaper in early September, and a newspaper article requesting hunters to return harvest reports was published in late September.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

Results of the 30 June 1989 photocensus indicated that the combined Delta and Yanert Caribou Herds had continued increasing in size (Table 1). The 1989 estimate was more accurate than the 1988 estimate of 8,338 caribou that had been based on incomplete survey coverage of areas known to contain caribou. The 1985 census estimate of 8,083 caribou was also a good estimate of population size. Comparing the 1985 and 1989 population estimates yielded an estimated finite annual growth rate of 7.2%; however, based on fall composition values collected 2-3 months after each census, the 1989 population may have contained more calves (i.e., 22% calves 1989, 20% calves 1985, Table 2). The estimated finite growth rate of the adult population ($\geq$1 year) was 6.5%.

The Yanert herd has not been adequately censused since 1983, because the Delta and Yanert herds have overlapped when photo-censusing occurred. The count of 570 caribou in the Yanert River drainage during composition surveys in October 1986 is the best recent estimate of minimum population size for the Yanert herd. At the time of that survey, all but 1 radio-collared Yanert caribou were present and no radio-collared caribou from the Delta herd were present.

Population Composition:

A composition survey of the combined Delta and Yanert Caribou Herds was conducted on 14 October 1988. Final composition estimates calculated by weighting the raw data according to the distribution of radio-collared caribou within 3 sample areas provided results almost identical (within 1%) to unweighted values (Table 2).

The bull:cow ratio has declined in recent years because hunting pressure has focused on bulls. 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. During the the period 1985 to 1987, small bulls (probably mostly yearlings)

averaged 53% of the total bull sample in October composition counts; large bulls averaged 21% of all bulls (Table 3).

The population objective calls for a minimum of 6 large bulls:100 cows. The 1989 value of 2 large bulls:100 cows was well below the population objective. Changes in hunting regulations will be necessary to reduce the harvest of bulls, particularly large bulls.

Distribution and Movement:

Prior to 1979 the Delta Herd appeared to show strong fidelity to traditional calving areas along upper Delta Creek in southeastern Subunit 20A; however, since 1979 the Delta herd has increased in population size and expanded its range. It now calves over a much larger area along the eastern foothills of Subunit 20A between Dry Creek and the Delta River (Valkenburg et al. 1988). The Yanert Caribou Herd calves between the upper Yanert River and upper Wood River.

Radio locations have demonstrated increasing overlapping between the 2 herds during the calving (Valkenburg et al. 1988), postcalving, rutting, and winter periods since the mid-1980's. During the rut in 1988 and 1989, overlapping between the 2 herds was complete, and in the winter of 1988-89 the entire Yanert herd wintered on the Delta herd's winter range. By fall 1989 only 1 radio-collared Yanert caribou had a functioning radio collar.

During at least the last 3 years, the Delta Caribou Herd has 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; (2) postcalving aggregations in the upper Wood River drainages and along the Wood and 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; and (7) eastward movement across the Wood River to the eastern foothills and southeastern Tanana Flats during March and April.

Snow depth and timing influence caribou in both their selection of specific calving sites and in initiation of major seasonal movements. Caribou were dispersed throughout the eastern foothills during late August and early September 1987. On 11 September 1987 a storm dropped up to 10 inches of snow in the foothills of the Alaska Range, and within 2 days most of the caribou had moved west across the Wood River toward rutting and wintering areas. During 1988 in the absence of significant snow,

caribou remained distributed throughout the eastern and western foothills until late September.

As the Delta herd continues to grow, it is expanding its range northward onto the Tanana Flats. Increasing movement across the Parks Highway into Denali Park may also occur as well as increasing overlapping between the Delta and Yanert herds in the Yanert drainage.

Mortality

Season and Bag Limit:

The open seasons for resident and nonresident hunters in Subunit 20A north of the Yanert Controlled Use Area, west of the Wood River Controlled Use Area, and south of the Rex Trail is 10 to 25 August and 21 September to 31 December. The bag limit is 1 caribou by drawing permit only; 200 permits will be issued (Hunt No. 570). The open seasons for resident and nonresident hunters in Subunit 20A within the Yanert Controlled Use Area are 1 to 15 September and 1 January to 28 February. The bag limit is 1 bull. The open season for the remainder of Unit 20A is 1 to 15 September. The bag limit is 1 bull. There is no subsistence season.

Human-induced Mortality:

The caribou harvest from both the general season and permit hunts in Subunit 20A during 1988 was reported at 441 caribou taken by 698 hunters (Table 4). However, reporting rates have been low in recent years for both successful and nonsuccessful hunters (McNay 1990). The total estimated harvest, including hunt Nos. 570 and 571, was 555 caribou by an estimated 1,085 hunters during 1988 (Table 5). Based on my experiences during hunter interviews, I believe caribou that are crippled and not recovered by hunters contributed an additional 10-20% to the caribou mortality induced by hunters during September.

The estimated caribou harvest was derived from harvest reports and 186 caribou hunters who were interviewed in the field between 1 and 15 September 1988 (Table 6). Seventy-six of the 103 successful hunters interviewed (74%) returned harvest reports. During 1986 and 1987 when there was no effort to encourage hunter reporting through advertising, the estimated reporting rates by successful hunters were 56% and 57%, respectively.

During 1989 field interviews will again be conducted, but there will be no advertising campaign to encourage reporting by hunters. If estimated hunter reporting in 1989 is substantially below the 74% estimated for 1988, it will be considered further evidence that the 1988 advertising contributed to increased hunter reporting.

Permit Hunts. Since 1985, 200 either-sex permits have been issued annually for hunt No. 570 in southwestern Subunit 20A. During 1988, 139 of the 200 permit holders hunted and killed 114 caribou (Table 7).

Beginning in the regulatory year 1988-89, the winter hunt in the Yanert Controlled Use Area was managed as drawing-permit hunt No. 571. Twenty-five permits were issued for the 1 January-28 February season. Fourteen of the 25 permittees hunted and reported taking only 2 caribou: 1 bull and 1 cow (Table 8). Interest by permittees and their success rate were very low, because virtually all Yanert caribou wintered with the Delta herd during 1988-89 and few were present in the legal hunting area.

Natural Mortality:

Davis et al. (1988b) estimated a 56% mean rate of natural mortality among zero to 5-month-old Delta Herd calves from 1981 through 1988. Natural mortality rates for radio-collared adults were higher among males (19%) than among females (7%), but there was no apparent difference between mortality rates of 5- and 24-month-old caribou.

Wolf predation is the major source of natural mortality of Delta and Yanert caribou, and it has increased in recent years, based on mortality of radio-collared caribou (Davis et al. 1987). During daily monitoring of 4 wolf packs over a 30-day period in March and early April 1989, wolves killed 16 moose, 18 caribou, 2 sheep, and 1 wolf; i.e., a kill rate of 1 caribou/6.9 days/pack in that multiprey system.

Game Board Actions and Emergency Orders

The winter Yanert caribou season was closed by Emergency Order in January 1988. Emergency Orders closing the winter season in the Yanert Controlled Use Area were also issued in 1987 and 1985. To prevent the recurring potential for overharvesting, the Department recommended and the Board implemented drawing permit hunt No. 571 for the Yanert Controlled Use Area beginning 1 January 1989. Hunt No. 571 allows up to 25 drawing permits to be issued for the 1 January-28 February portion of the season and a bag limit of 1 caribou.

CONCLUSIONS AND RECOMMENDATIONS

The combined Delta and Yanert Caribou herds grew at an annual finite growth rate of 7.2% between 1985 and 1989. Excluding calves, the apparent annual finite growth rate was 6.5%. However, I believe much of the observed growth between 1985 and 1989 occurred after the bulls-only bag limit was implemented in the general hunting season beginning in 1987.

Concurrent with bulls-only hunting, the bull:cow ratio and the proportion of large bulls declined. In October 1989 the bull:cow ratio was 27:100 and there were only 2 large bulls:100 cows. The population objectives called for a minimum of 30 bulls:100 cows with at least 6 large bulls:100 cows and a population growth rate of approximately 3% annually. Therefore, to stop the decline in the bull:cow ratio, increase the proportion of large bulls, and reduce the growth rate of the population, I recommend a change in hunting seasons and bag limits that increases the harvest of cows and reduces the harvest of bulls. In addition, to more effectively meet the management goal of providing maximum hunting opportunities, I recommend implementing a late-winter hunt. Regulation proposals to meet the recommendations will be drafted during the next reporting period and submitted to the Board of Game at their March 1990 meeting.

Reporting rates for successful caribou hunters during 1986 and 1987 were estimated to be 56% and 57%, respectively. During 1988 following a media campaign designed to encourage hunters to mail in harvest reports, reporting rates by successful hunters were estimated to be 74%. If successful hunter reporting rates are substantially lower in 1989 with no media reminders, it will be taken as further evidence of the effectiveness of radio and television advertising in prompting voluntary reporting by hunters.

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Table 1. Postcalving census results of Delta and Yanert Caribou Herds combined, 1973 and 1979-89.[a]

Census date	Estimated population size of Delta/Yanert Caribou Herds combined (includes calves)
1973	2,804
1979	4,191
1980	4,478
1981	4,962
1982	7,335
1983	6,969
1984	6,260
1985	8,083
1986	7,804
1987	8,380
1988	8,338
1989	10,690

[a] All censuses conducted in June or July. Methods to arrive at population estimate varied among years. See Davis and Valkenburg (1985) for explanation of methods prior to 1985, and Davis et al. (1987) for methods used from 1985 to 1989.

Table 2. October sex and age composition of the Delta Caribou Herd, 1983-89.

Year	Bulls: 100 cows	Calves 100 cows	Calf % of herd	Cow % of herd	Bull % of herd	n
1983	54	41	23	50	27	1,333
1984	42	36	20	56	24	1,093
1985	49	36	20	54	26	1,164
1986	41	29	17	59	24	1,934
1987	32	31	19	61	20	1,682
1988	33	35	21	60	20	3,003
1989	27	36	22	62	16	1,965

Table 3. Size class distribution of bulls classified on fall composition counts, Delta Caribou Herd, 1983-89.

Year	Total bulls:100 cows	Small bulls (%)	Medium bulls (%)	Large bulls (%)	Total bulls (n)	% of bulls in herd
1984	42	28	32	40	258	24
1985	49	57	24	19	306	26
1986	41	49	30	21	468	24
1987	32	53	23	24	329	20
1988	33	49	38	13	593	20
1989	27	64	28	7	324	16

Table 4. Summary of reported Delta and Yanert Caribou Herd harvest, Subunit 20A, 1983-88.

	Delta Herd									Yanert Herd			Total 20A (Delta & Yanert)		
	General season			Permit hunt [a]			Total Delta Herd			General season					
Year	Bulls	Cows	Total[a]	Bulls	Cows	Total[b]	Bulls	Cows	Total[b]	Bulls	Cows	Total[b]	Bulls	Cows	Total[c]
1983	576	98	694	--	--	--	576	98	694[d]	40	12	54	616	110	748
1984	--	--	--	258	153	413	258	153	413[d]	77	22	99[d]	335	175	510
1985	165	48	215	86	15	102	251	63	317	53	11	64	317	75	396
1986	260	77	341	90	17	107	350	94	448	54	16	72[d]	404	110	520
1987[e]	237	3	240	88	33	122	325	36	362	66	2	68[d]	391	38	430
1988	255	4	261	95	17	114	350	21	375	64	0	64[f]	415	22	437

[a] During 1984 all hunting of the Delta Herd was by registration permit. Beginning in 1985 a drawing permit (Hunt 570) was used in the western portion of the Delta Herd's range; the remainder of 20A was open to general hunting.

[b] Totals include animals of unspecified sex.

[c] Total also includes animals for which specific location was not given.

[d] Years in which season was closed by emergency order.

[e] Beginning in 1987 the general season was bulls only; drawing permit hunt 570 remained either sex.

[f] Beginning in 1988 the winter season was open by drawing permit only and only 1 bull and 1 cow were taken during the 1988-89 permit hunt.

Table 5. Summary of combined Delta and Yanert Caribou Herd harvest and hunters, 1986-88.[a]

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

[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 6. Summary of results of field interviews and hunter reports for Subunit 20A, 1986-88.

Interviews and harvest reports	1986	1987	1988
Total interviews	178	103	186
Interviews of successful caribou hunters	48	40	103
Harvest reports returned by interviewed hunters	62	45	108
Harvest reports returned by hunters who were successful when interviewed	27	23	76
Total harvest reports returned	592	528	540
Successful harvest reports returned (i.e., reported harvest)	413	305	325

Table 7. Summary of results of Delta Caribou Herd permit hunt 570, 1985-88.

Year	Harvest			Hunted but unsuccessful	Did not hunt	Did not report	Total permits
	Male	Female	Unk				
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

Table 8. Summary of results of Yanert Caribou Herd permit hunt 571, 1988.

Year	Harvest			Hunted but unsuccessful	Did not hunt	Did not report	Total permits
	Male	Female	Unk				
1988	1	1	0	12	10	1	25

STUDY AREA

GAME MANAGEMENT UNIT: 20E (11,000 mi^2)

HERD: Fortymile

GEOGRAPHICAL DESCRIPTION: Charley, Fortymile, and Ladue River drainages

BACKGROUND

Murie (1935) estimated the FCH at 528,000 in the 1920's; 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 1940's (Skoog 1956). Coinciding with a federal wolf control program, the FCH began to increase. By 1960 the herd had grown to about 60,000 (Skoog 1968). Subsequently, wolves and harvests of caribou by humans increased; both sources of mortality contributed to another population decline. The population reached its recent historic low in the mid-1970's; i.e., 6,500 caribou.

The FCH increased from 5,740 to 8,610 caribou in the summer of 1975 to about 10,000 in the summer of 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 all helped to reduce caribou mortality and led to herd growth. During the period 1975-84 the herd grew from about 6,500 to 12,000 (finite rate of annual growth of about 1.10). Between 1984 and 1988, the herd increased from 12,000 to 20,000.

POPULATION OBJECTIVES

To increase the herd size to 50,000 adults by the year 2000.

To maintain average annual harvests of $\leq$ 3% of the estimated herd size until the population objective is achieved.

To maintain a posthunting bull:cow ratio of at least 35:100.

To minimize the impact of development on caribou habitat and maintain a near-natural wildfire regime.

METHODS

In 1988 Division of Wildlife Conservation (DWC) staff in Tok monitored caribou harvest and hunting pressure through hand-tallied harvest reports and contacts with hunters in the field (i.e., Taylor Highway and associated trails). Area and regional DWC staff sampled the sex composition of the herd and recruitment

of calves to 4 months on 2-3 October 1988. We used the Division's Bellanca Scout to locate radio-collared caribou and then classified caribou associated with collared animals from a Hughes-500D helicopter.

Division staff helped the Upper Tanana-Fortymile Advisory Committee draft a proposal restricting caribou hunting in the Taylor Highway area that was submitted to the Board of Game; drawing permits would be required of nonlocal hunters, while subsistence hunters could hunt with registration permits.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

Based upon the summer 1988 census, the FCH contained at least 20,000 caribou. The extrapolated 1989 estimate is about 22,000. The herd has grown steadily since the mid-1970's, and future growth is anticipated.

Population Composition:

While there does not appear to be any apparent trend in calf survivals from 1984 through 1988 (Tables 1 and 2), there appears to be a declining trend in the proportion of bulls in the population as a result of several years of bulls-only harvests (Table 1). The sex ratio was 61 bulls:100 cows in 1983; it has declined steadily to only 38 bulls:100 cows in the fall of 1988. Although the bull:cow ratio is approaching the minimum objective of 35 bulls:100 cows, computer models predict that the ratio will stabilize as the total population grows.

Distribution and Movement:

The FCH generally summers in the northern and western portions of Subunit 20E after aggregating in late June or July in the Glacier Mountain, Granite Creek, or Mount Harper areas. During late September caribou generally begin moving eastward, crossing the Taylor Highway in October. In the past few years many caribou have moved north and then back to the west by late November.

In the fall of 1988, the FCH moved northwest toward the Birch Creek drainage during September. The herd was surveyed near the Yukon Fork in October. There was no major movement eastward across the Taylor Highway.

Slate Creek and the lower Middle Fork areas are important wintering areas, although a scattering of wintering caribou may be found from the Charley River southeast to the Ladue River (Valkenburg and Davis 1988). Calving and postcalving areas of the FCH are not as consistent and predictable as other herds, and

calving has occurred on or near winter range in recent years. The total range of the FCH is far smaller than it was in the 1920's or 1960's when the herd was much larger. The herd's range has not increased noticeably since 1976, even though the herd has tripled in size (Valkenburg and Davis 1988). Range expansion is expected as the herd continues to grow.

Mortality

Season and Bag Limit:

The open season for resident and nonresident hunters in Subunit 20E is 10 August to 20 September. The open seasons for subsistence hunters are 10 August to 30 September and 1 December to 28 February. The bag limit for all hunters is 1 bull.

Human-induced Mortality:

The reported harvest during the 1988-89 seasons was 403 bulls and 2 cows (Table 3), representing a substantial increase of 156% from the reported harvest of 156 bulls during the 1987-88 season. The harvest was also 55% above the 5-year mean of 257 bulls. Road patrols and other hunter contacts in the fall of 1984 revealed that only 63% of successful caribou hunters had reported their harvest. Therefore, the actual legal harvest in 1988-89 was probably closer to 635 bulls, plus an estimated 150 cows taken illegally. The total probable harvest was 785 caribou. About 40 caribou were also taken in the Yukon Territory, so the FCH total harvest was approximately 820, or about 4% of the herd during the 1988-89 season. Although this rate of harvest is greater than the annual objective of 3%, harvests in previous years have been lower than 3%. Although the effect on herd growth is not significant, it will be important to prevent continued escalation of the harvest.

More hunters (965) reported hunting FCH caribou in 1988-89 than in any year since herd recovery began in the mid-1970's. The lack of caribou hunting opportunities in other accessible areas may be responsible for the "rediscovery" of the FCH by hunters and rapid increase in hunting pressure on the FCH, particularly in the Taylor Highway area.

Hunter Residency and Success. Because harvest reports were hand-tallied, no assessment of hunter residency is possible. Because much effort was expended by local hunters early in the fall season, local resident hunters took a high proportion of the total harvest. Relatively few nonresident hunters hunt FCH caribou.

Hunter success (42%) was much higher than it was in 1987-88 (Table 3). Caribou distribution and movements during the fall open season were largely responsible for the greater success rate in the fall of 1988.

Harvest Chronology. The number of caribou harvested during each 10-day period during the general fall hunting season (10 Aug-20 Sep) ranged from 48 to 153. The period with the highest harvest coincided with the 1-10 September moose season. One hundred and eighty-nine bulls, or 47% of the fall harvest, occurred during the period 10 to 31 August (i.e., before the moose season opened).

Transport Methods. Use of highway vehicles (27%), three- or four-wheelers (36%), and aircraft (29%) was high in the 1988 fall season (Table 4). Of the successful hunters who reported using aircraft for access, 47% flew into the Molly Creek airstrip and 53% flew into various other smaller, undeveloped airstrips. All of the 108 successful hunters reported using highway vehicles on the Steese Highway (n = 3) or the Taylor Highway and the short Boundary Cutoff (n = 105). Most of the 146 successful hunters reporting the use of three- or four-wheelers hunted on the Taylor Mountain trail, the Chicken Ridge trail west of Chicken, or the ridge system near mile 103 on the Taylor Highway.

Over one-half (71%) of all hunters using aircraft were successful, because they were able to reach the herd in the remote central portion of its range during the fall. Forty-six percent of hunters using three- and four-wheelers were successful, largely because a few thousand caribou moved north through the Taylor Mountain, Chicken Ridge, and Boundary Cutoff areas in late August and September. People hunting from highway vehicles on the Taylor Highway were outside the range of the FCH early in the fall and most of the winter. Hunters using highway vehicles experienced greater success during September, when caribou crossed the Taylor Highway near Jack Wade Creek and the Boundary Cutoff.

Disparate success rates for hunters using different means of access have caused controversy between local hunters who hunt near the Taylor Highway and nonlocal hunters who use aircraft to hunt caribou. Local hunters are disgruntled because few caribou are available to them near highway and trail systems, and their harvest is low. Local hunters mistakenly believe that their low rate of success is caused by competition from nonlocal hunters using aircraft. In reality, this is not the case.

Given the present hunting seasons, caribou are simply not abundant in the eastern portion of the herd's range that is accessible by land vehicles during the fall season. The fall harvest by hunters using aircraft has not been great enough to reach harvest quotas, nor are the activities of these hunters likely to affect caribou movements toward the Taylor Highway. Restrictions on the use of aircraft for hunting the FCH would not increase harvests by hunters near the highway. Harvests by local hunters can only be increased by scheduling a hunting season in October and November, when the herd is likely to cross the Taylor Highway during its fall migration, and by allowing the harvest of caribou of either sex. As the herd continues to grow, more

caribou may become available near the Taylor and Steese Highways, if the FCH expands its summer and early fall range.

Natural Mortality:

Calf mortality is the single greatest factor restraining herd growth. Valkenburg and Davis (1988) reported that calf:cow ratios declined 54% from late May to late September 1987. A decline of 17% was noted between late June and early October 1988 (Tables 1 and 2). Annual composition counts in late June provided some indication of the chronology of calf mortality (Table 2). These data suggested that calf mortalities were highest from late May to late June before decreasing. The low calf:cow ratio observed in June 1988 either reflected particularly poor early calf survivals or an artifact of sampling (Table 2).

Valkenburg and Davis (1988) reported that the adult mortality rate of the FCH (i.e., 13-16%) was caused by wolf predation from 1983 to 1987. Intensive aerial surveys indicated a population of approximately 265 wolves inhabited the FCH range in the fall of 1986 (i.e., 241 wolves in 38 packs and 24 singles). Valkenburg and Davis (1988) estimated that wolves consumed 2,250 caribou (16% of the FCH >3 months old) from 1 September 1986 to 1 September 1987. With a potential maximum rate of growth of 24.3% minus the 16% adult mortality rate, the observed rate of population growth should have been 8.3%, which corresponds with an observed 10% rate of annual growth from 1984 to 1986.

Habitat Assessment and Enhancement

Davis et al. (1978) believed that habitat conditions in the range of the FCH used during the 1960's were adequate for at least 50,000 caribou. I have no reason to believe differently now, especially because lichens on winter ranges have had at least 25 years to grow since the last period when caribou were abundant in this area. The FCH is expected to expand into historical range as it continues to grow and utilize ungrazed range.

There is some evidence (Viereck and Schandelmeier 1980) that the long-term quality of caribou range is dependent upon the maintenance of a near-natural wildfire regime. The relationship between caribou and their food resources is poorly understood, but enhancement of range on a large scale can only be achieved through manipulation of wildfire. Production of lichens begins about 15 years after a fire and continues for at least 125 years, when mosses choke out lichens in the understory of spruce forests. Only another fire can set back plant succession to start the cycle again. Cottongrass, another preferred forage species for caribou, also benefits from fire, which removes insulating dead leaves and increases flower production in spring.

Implementation of the Alaska Interagency Fire Management Plan and adherence to its provisions should assure a near-natural fire

regime in the range of the FCH. About 60% of the FCH's range in Alaska is in the Limited Suppression category that provides for simple monitoring of wildfires.

Game Board Actions and Emergency Orders

The Alaska Board of Game voted to end the practice of land-and-shoot taking of wolves at their November 1987 meeting. As predicted, the harvest of wolves declined substantially in Subunit 20E during the winter of 1988-89. Any long-term reduction in annual wolf harvests within the herd's range is expected to increase predation on the FCH and delay progress toward attaining population management objectives.

In March 1989 the Board approved a petition by the Upper Tanana-Fortymile Advisory Committee to implement a permit system to regulate hunting pressure and harvests of the FCH. The petition was submitted in response to the dramatic increase in hunting pressure on the herd during the fall of 1988, a significant inadvertent harvests of cows, and difficulties experienced by local subsistence hunters in successfully hunting caribou. Effective during the 1989-90 seasons, nonresident hunters will be prohibited from hunting caribou in the Taylor Highway area, nonlocal residents will have to receive one of 750 drawing (lottery) permits to be able to hunt, and local subsistence hunters must obtain a registration permit. Nonlocal hunters will have a bag limit of 1 bull, but subsistence hunters will be able to take 1 caribou of either sex. The petition included a provision for local subsistence hunters to hunt during October and November, but it was not approved.

CONCLUSIONS AND RECOMMENDATIONS

The primary management goal has been met since the mid-1970's. The secondary goal of providing for subsistence use has not been met through this reporting period. The bag limit of 1 bull (fall season) and 1 antlerless bull (winter season) and a season closure during the fall migration have served to limit the subsistence harvest far below local demand for caribou. The tertiary goal of providing maximum opportunity to hunt caribou has definitely not been met in recent years. The relatively small size of the FCH has necessitated restrictive seasons and bag limits, especially for nonlocal hunters.

Nonlocal hunters have only a bag limit of 1 bull and 10 days less to hunt in the fall season than subsistence hunters; also they have been excluded from the winter hunt entirely. A substantially larger herd would provide greater opportunities for all user groups and help meet all 3 stated goals.

In the 1920's the FCH was believed to be the largest herd in North America. Poor management in the 1960's and early 1970's caused the herd to reach a record-low level by the mid-1970's.

Management since that time has allowed the herd to increase to about 22,000 caribou, or about 4% of its former size. Human use during the past 15 years has been low, commensurate with the herd's small size.

A rare opportunity exists to greatly increase the size of the FCH, because the herd is so far below carrying capacity and its range virtually undeveloped. When its size was larger, the FCH was a generally accessible herd that predictably crossed 2 major highways. The FCH could provide great benefits to Alaskans, if managed to attain former levels of abundance. Increased abundance would also benefit the management of other species of big game and furbearers occurring within the herd's range.

Historical observations and recent research findings indicate that performance of the FCH for the past 40 years has been sensitive to changes in wolf abundance (Davis et al. 1978, Valkenburg and Davis 1988). Continued herd growth cannot be taken for granted, and it could be slowed or stopped by a significant increase in wolf numbers.

The management of caribou and their predators cannot be separated from the management of the low-density moose population within the range of the FCH. I recommend an integrated approach to management of all large ungulates and their predators in Subunit 20E, northern Unit 12, and northern Subunit 20D. Increased harvest of wolves and grizzly bears by the public should be encouraged; the harvest of moose and caribou should be kept low and restricted to mostly males to allow populations to expand. To this end, I recommend that the Board of Game continue to authorize the liberal hunting seasons and bag limits on grizzly bears, reauthorize land-and-shoot hunting of wolves, and authorize other effective programs to control predation on ungulates in this area until population objectives for all species have been achieved.

The Board of Game should also consider additional regulatory changes to better address human subsistence needs for FCH caribou. The herd is not accessible to local hunters during the fall or winter season, when caribou are usually located far west of the Taylor Highway or are in scattered small bands. Extension of the hunting season during October and November, when caribou cross the Taylor Highway, would help immensely. As long as harvests do not exceed 3% of the estimated population and are largely composed of males, the impact on population growth will be insignificant. The new permit hunts for the 1989-90 seasons are expected to reduce the harvest experienced during the 1988-89 season, provide greater control of hunting pressure, improve harvest reporting, and reduce competition between local subsistence hunters and nonlocal hunters. Satiation of subsistence demands with FCH caribou has great potential to reduce excessive use of depleted moose populations in Unit 12 and Subunit 20E. Experience gained next year should serve to further refine the regulations, if necessary.

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Table 1. Summary of fall sex and age composition data for the Fortymile Caribou Herd, Subunit 20E, 1983-88.

Year	Bulls: 100 cows	Yrlgs: 100 cows	Calves: 100 cows	Yrlg % (n)	Calf % (n)	Cow % (n)	Bull % (n)	Total sample
1985	50	--	36	--	19 (208)	54 (574)	27 (285)	1,067
1986	36	29[a]	30	18 (212)[a]	17 (235)	61 (842)	22 (304)	1,381
1987	40	--	37		21 (475)	57(1,274)	22 (504)	2,253
1988	38	25[a]	30	13 (172)[a]	18 (229)	59 (770)	23 (296)	1,295

[a] Calculated by doubling number of small bulls; not additive.

Table 2. Summary of April and late June sex and age composition data for the Fortymile Caribou Herd, Subunit 20E, 1984-89.

Year	Bulls: 100 cows	Yrlgs: 100 cows	Calves: 100 cows	Calf % (n)	Cow % (n)	Bull % (n)	Total sample
1984	42	27[a]	45	24 (954)	53 (2,098)	23 (888)	3,940
1985	18	32[b]	48	29 (1,103)	60 (2,285)	11 (415)	3,803
1986[c]	14	40[b]	40	26 (153)	65 (380)	9 (53)	586
1987	46	--	47	25 (883)	52 (1,860)	24 (853)	3,596
1988	54	--	36	19 (339)	53 (946)	29 (514)	1,799
1989	No Survey						

[a] March survey of short yearlings.

[b] April survey of short yearlings.

[c] April data only.

Table 3. Summary of reported and calculated harvests of the Fortymile Caribou Herd, Subunit 20E, 1983-84 through 1988-89.

Year	No. males	Total harvest	No. hunters	Percent success	Estimated unreported harvest[a]	Total harvest
1983-84	200	200	378	42[b]	117	317
1984-85	245	245	176	80[b]	144	389
1985-86	251	251	692	38[c]	147	398
1986-87	232	232	532	44	88	370
1987-88	156	156	618	25	92	248
1988-89	403	405	976	42	386	791
$\bar{x}$	247	248	562	45	162	419

[a] Estimated number of caribou taken but not reported assuming a 63% reporting rate for successful hunters determined in 1984.

[b] Some hunters took the legal 2-bull bag limit. Winter season not held due to Emergency Order.

[c] Bag limit 1 bull beginning in 1985.

[d] Up to 150 cow caribou were believed taken in 1988-89 in addition to an estimated 236 bulls legally taken but not reported.

[e] Includes 2 cows.

Table 4. Transportation methods and success by method for hunters using the harvest reporting system in Subunit 20E, 1988-89.

Method	No. of hunters using method (%)	Number unsuccessful %	Number successful (%)	% of harvest
Aircraft	162 (17)	46 (29)	116 (71)	29
Horse	5 (1)	2 (40)	3 (60)	1
Boat	51 (5)	41 (80)	10 (20)	2
3- or 4-wheeler	318 (33)	171 (54)	147 (46)	36
Snow machine	2 (--)	1 (50)	1 (50)	--
Off-road vehicle	54 (5)	36 (66)	18 (34)	4
Highway vehicle	376 (38)	266 (71)	110 (29)	27
Unknown	8 (1)	--	--	
Total	976	563	405	--

STUDY AREA

GAME MANAGEMENT UNITS: 20F, 21C, 21D, and 24 (48,000 mi^2)

HERDS: Galena Mountain, Ray Mountain, Wolf Mountain

GEOGRAPHICAL DESCRIPTION: Galena Mountain, Kokrines Hills, and Ray Mountains

BACKGROUND

Caribou are distributed in small numbers throughout the Kokrines Hills and Ray Mountains north of the Yukon River from the Dalton Highway to the lowlands northwest of Galena Mountain. The history of caribou in the Ray Mountains and Kokrines Hills was reviewed in a previous report (Osborne 1989).

POPULATION OBJECTIVES

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

To allow expansion of the caribou population in the Ray and Kokrines Mountains until they are large enough to make them available to hunters.

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

METHODS

Caribou in the Galena Mountain and Wolf Mountain Herds were monitored through a cooperative radiotelemetry study involving USFWS, BLM, and ADF&G that tracked movements and mortality (Robinson 1988). Annual census counts were conducted from fixed-wing aircraft on the Galena Mountain segment of the herd during October, and fall and spring counts are made on the Ray Mountains segment. Scott Robinson (BLM) has conducted most of the Ray Mountains surveys from fixed-wing aircraft. Hunting mortality was monitored through harvest reports and subsistence hunter interviews.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

There is some evidence that the caribou in the 3 mountain areas are distinct herds. The population status and trend of each were described previously (Osborne 1989).

Population Composition:

The information that exists on population composition in these herds is of limited usefulness, because all counts have been done with fixed-wing aircraft and the caribou have not been segregated by sex (Tables 1-3). Fall calf percentages in the Ray and Galena Mountain herds have been consistently low. Percentages in the Wolf Mountain herd were slightly better, but none of the herds are likely to be increasing much in size. The only additional data collected during this reporting period came from a fixed-wing survey of the Galena Mountain herd in October 1988 (Table 1).

Distribution and Movements:

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

Mortality

Season and Bag Limit:

The open seasons for subsustence and resident hunters in the Tozitna River drainage of Subunit 20F are 10 August to 30 September and 1 to 15 March. Only 1 bull caribou may be taken during the late-summer or 1 caribou of either sex may be taken during the 1 to 15 March season. The open season for nonresident hunters in Subunit 20F is 10 August to 30 September; the bag limit is 1 bull. The open season for all hunters in Unit 21, except Subunit 21D west of the Yukon and Koyukuk Rivers, is 10 August to 30 September; the bag limit is 1 caribou. The open season for all hunters in Unit 24, the Kanuti River drainages upstream from Kanuti, Chalatna Creek, and the Fish Creek drainage is 10 August to 30 September; the bag limit is 1 bull.

Human-induced Mortality:

During the 1988-89 hunting season 8 caribou were reported harvested: two from the Ray mountains and six from the Melozitna River (Table 4).

Game Board Actions and Emergency Orders

The Board of Game issued an Emergency Regulation effective 25 November 1988 that moved the eastern boundary of the WAH hunting area east to allow harvest of the WAH caribou that had migrated to the Koyukuk lowlands in Unit 21. Although the season was

open, snow conditions precluded anyone from taking these caribou. In January when the herds had become mixed and snow access improved, an Emergency Order closure was issued (i.e., 11 January 1989) to prevent overharvesting of the resident Galena Mountain herd.

CONCLUSIONS AND RECOMMENDATIONS

Until funding levels allow the gathering of data on population size, trend, and distribution of caribou in the Ray Mountains and Kokrine Hills, only general objectives relating to protection of the herd will be proposed. Hunting seasons and bag limits should remain conservative.

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Table 1. Aerial counts of caribou from the Galena Mountain Herd, 1978-88.

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

Table 2. Aerial counts of caribou from the Wolf Mountain Herd, 1978-87.

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

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

Table 3. Aerial counts of caribou from the Ray Mountains Herd, 1977-88.

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

[a] Incomplete survey.

Table 4. Reported harvest of resident caribou in Subunits 20F, 21C, 21D, and Subunit 24, 1981-88.

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

STUDY AREA

GAME MANAGEMENT UNIT: 21D, 22A, 22B, 23, 24 and 26A (140,000 mi^2)

HERD: Western Arctic

GEOGRAPHICAL DESCRIPTION: Northwest Alaska

BACKGROUND

The WAH currently ranges over approximately 140,000 mi^2 of mountain, forest, and tundra habitats during their annual migration. Primary winter range of the WAH has historically included the Selawik, Huslia, Buckland, Ungalik, and Shaktoolik River drainages in Units 22 and 23. Calving occurs predominantly during the first week of June near the Colville and Utukok Rivers on the North Slope in Subunit 26A.

Historically, the size of the WAH has fluctuated greatly. During the early 1970's, the herd size was estimated at 240,000 caribou (Hemming 1971). By 1976 the herd had declined to about 75,000 (Davis and Valkenburg 1978). Biennial postcalving photocensuses indicated that the WAH has steadily increased in size since 1976. Estimated growth rate, based on census data, has varied from 7% to 22% annually; the actual annual growth rate is thought to have averaged around 14%. Herd size as of July 1988 was estimated at 343,167 caribou. Harvest levels during 1988-89 are believed to have remained well below the sustained-yield capacity of the herd.

MANAGEMENT OBJECTIVES

To maintain a postcalving population of at least 200,000 caribou.

To minimize conflicts with the reindeer industry.

To monitor the size and composition of the population and use this information to predict population trends.

To develop an information and education program to improve harvest reporting and public understanding of management of the WAH.

To encourage public involvement in the regulatory process and in the formulation of management guidelines.

To advocate measures to minimize the impact of industrial development on caribou habitat and movement patterns.

METHODS

Radiotelemetry has continued to provide the basis for obtaining population information on the WAH. During August and September 1988, 17 female caribou were radio-collared at Onion Portage on the Kobuk River. The technique used to collar caribou on the Kobuk River has been described by Larsen and Machida (1989).

Two of the caribou collared in 1988 were outfitted with Argos Data Collection and Location System (DCLS) satellite transmitters manufactured according to specifications outlined in Fancy et al. (1988). The life expectancy of the satellite collars is approximately 18-24 months. Collars deployed since 1987 were programmed to transmit location and activity data. Information concerning data retrieval and processing has been provided in Larsen and Machida (1989).

Aerial spring composition surveys were conducted during April and May 1989 to determine short-yearling recruitment. As in past spring composition surveys, radiotelemetry was used to locate caribou. The use of radiotelemetry allowed us to objectively distribute our sampling effort. When collared animals were located, the composition of up to 200 caribou per radio collar in the immediate vicinity of each collared animal was determined. Caribou were classified as either adults or short-yearlings. A Piper PA-12 aircraft flying parallel to bands of caribou was used to conduct the surveys. During 1986, 35-mm photography was used to collect composition data (James and Larsen 1988); however, all previous and subsequent composition data were collected using direct visual counts.

Calving-ground surveys were conducted during 10-12 June 1989 to determine parturition rates. Cow caribou were located using radiotelemetry. Once visually observed, we determined whether each cow had antlers or was accompanied by a calf. We also recorded an estimate of group size to the nearest 10,000 or 1,000 and plotted the location of collared cows on Federal Aviation Administration 1:500,000 navigational charts. A Cessna-185 aircraft was used to conduct the surveys.

During August and September 1988, we collected mandibles and blood samples from hunter-killed bull caribou on the Kobuk River, as a means of indirectly assessing nutritional status of the herd. Mandible total length, length of tooth rows, and diastema and mandible heights were later measured and catalogued. Because of problems with serum separation, the blood samples collected during 1988 were not usable.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

The WAH has continued to increase in number since 1976, when the population size was estimated at 75,000. Our 1988 photocensus of the WAH resulted in a minimum count of 343,167 caribou (Table 1). Until 1986 this increase appeared to be coupled with a decrease in the annual rate of change (Table 1). Following the low 1982-1986 growth rate of 8%, between 1986 and 1988 it jumped to a recorded high of just over 22%.

Although there may be several explanations for this apparent increase in the herd's growth rate, we believe the most plausible explanation concerns the variability in the quality of our photocensus data. Our 1986 photocensus data were compromised by blurred photos and the common occurrence of caribou tightly packed onto snow patches. Such tightly packed groups were very difficult to count. The 1988 photos, on the other hand, were much clearer and contained far fewer aggregations of caribou on snow patches. Additionally, the majority of the photos were taken from a height of 800 feet, rather than from the 1,000 feet in 1986; and a greater number of calves were discerned and counted. For these reasons, we believe the 1986 estimate of 229,433 was substantially lower than the actual population size.

The average annual rate of change between 1976 and 1988 was 14%. The actual annual rate of increase probably has remained at or near this value for the past 12 years, rather than fluctuating radically as our data suggest. It is also possible that the 1976 estimate of 75,000 was substantially lower than the actual population size. This would account for the 19% rate of increase observed between 1976 and 1978.

As a result of the increase in the size of the WAH, the density of the herd has also increased. Using 140,000 mi^2 as a rough approximation of the overall range of the WACH, density has increased from 0.5 caribou/mi^2 in 1976 to 2.4 caribou/mi^2 in 1988 (Table 1). In northern Quebec, Messier et al. (1988) reported a density of 2.8 caribou/mi^2 for the George River Caribou Herd. They concluded that annual growth rates should be limited to less than 5% to prevent caribou populations from radically overshooting their carrying capacities and resulting in drastic die-offs. Like the WAH, the George River herd has been increasing at a rate of over 10% annually.

In northwest Alaska, we currently do not have the information needed to predict an upper size limit for the WAH; however, even with this information, we could not implement management actions that would limit herd growth. Our management options are presently limited only to manipulating hunter harvest. Continued

monitoring of the herd will be to first understand and later predict patterns in population growth and composition.

Population Composition:

Spring composition surveys were conducted during April and May 1989 (Table 2). We classified as short-yearlings 24% of 7,048 caribou. The percentage of short-yearlings observed since 1977 has ranged from 15% to 26% (Table 3).

Fifty-eight radio-collared caribou were located during surveys conducted on the North Slope calving grounds during 10-12 June 1989. One of these caribou was a bull, 34 were cows accompanied by newborn calves, 16 were cows without calves, five were cows that had not been sighted, and two were mortalities. Of the 50 cows observed, 68% were accompanied by calves, compared with 49% in 1988 (Table 4). This apparent difference was probably related to the timing of the counts. During 1988 calf counts were conducted during 3-5 June, and in 1989 they were conducted during 10-12 June. The 1988 counts were probably conducted before parturition had been completed. We recommend conducting calf counts during the 6-12 June period.

Caribou biologists have speculated that cows that produce calves will retain their antlers longer than cows that do not produce them. To test this theory, we subjected our cow, calf, and antler data to a chi-square goodness of fit analysis. As with our 1988 data, we found no significant relationship between the presence of antlers and the presence of calves ($X^2 = 0.06$, $N = 50$, $0.9 > p > 0.7$).

Distribution and Movement:

The July 1988 postcalving migration was different from what had been observed during the past 10 years or more. Following calving, the herd moved west towards the Lisburne Peninsula; however, the herd subsequently split into 2 discrete groups. One of the groups, numbering about 100,000, turned southeast and moved down into what is recognized as their usual route through the upper Kivalina, Wulik, Kelly, and Kugururok River drainages; while the other group, numbering about 200,000, moved northeast along the coast to the Kukpowruk River drainage. From the Kukpowruk River, the group turned and retraced their route southwest along the coast past Cape Sabine. At the Pitmagea River and Thetis Creek, the group headed inland towards Windy Lake. From there the group appeared to follow the usual route east through the Brooks Range. The fall migration pattern were typical; large numbers of caribou crossed the Kobuk River at Onion Portage and in the vicinity of Kiana during August and September 1988.

One hundred forty-eight radio relocations were obtained during 5 radio-tracking flights conducted in October and November 1988 (Table 5). Seventy percent of the fall and early winter

relocations were south of the Selawik Hills, 11% were between the Noatak River and the Waring Mountains, 7% were between the Warings and the Selawik Hills, and 6% were transmitting on mortality mode. Three percent and 2% were in the Kiwalik River and Mulgrave Hills, respectively. Because these data only represented caribou distribution in areas surveyed, we cannot quantify the overall distribution of the WAH during this time period; however, we suspect these data roughly approximated the herd's usual fall and early winter distribution.

An additional 228 relocations were obtained during 10 flights conducted in February and March 1989 (Table 6). As observed in the fall of 1988, 69% of the spring relocations were south of the Selawik Hills. Large concentrations of overwintering caribou were observed in the vicinity of the Nulato Hills and in the Ungalik and Inglutalik River drainages. Eighteen percent of the relocations were between the Waring Mountains and the Selawik Hills, 5% were between the Noatak River and the Warings, and 6% were transmitting on mortality mode (Table 6). Because no radio-tracking flights were conducted in the western Brooks Range between October and November, the overwinter distribution of WAH caribou on the North Slope is unknown.

Forty-five radio-collared caribou were relocated during short-yearling composition surveys conducted in April and May 1989 (Table 2). Of these, 41 were on the Selawik River flats, three were along the middle-to-upper Noatak River, and one was in the vicinity of Kiana. One relocation on the Selawik flats was of a cow that had been killed by wolves. The collar and one other from the Selawik Hills were retrieved for future use (i.e., refurbished).

During June calving ground surveys, 85% of our radio relocations were made on the traditional calving grounds on the North Slope; however, 3 radio-collared cows were relocated along the south side of the Kobuk River between Ambler and Kiana. One of these cows was accompanied by a calf, and several other uncollared cows in the area were also observed with calves. Because no efforts have been made to quantify the number of parturient cows south of the traditional calving grounds, we are uncertain whether this represents a normal situation or a noteworthy change in calving distribution. Future calf surveys should include additional flights in the Noatak and Kobuk River drainages.

Three cows were collared with DCLS satellite transmitters during September 1987. All 3 caribou were on the Lisburne Peninsula during early July 1988 at the time of the postcalving aggregation, subsequently moving eastward through the Brooks Range during August (Fig. 1-3). Two of the 3 caribou crossed the Kobuk River during late August and early September close to where they had been collared the previous year. The third caribou (No. 7870), however, crossed the Kobuk River downstream of the village of Kiana near the mouth. In contrast to the previous winter, all 3 caribou wintered farther south and west during the

1988-89 winter. During the 1987-88 winter, the 3 cows wintered in the Tagagawik, Selawik, and Huslia River drainages in Units 23 and 24. During the 1988-89 winter, they wintered in the upper Shaktoolik and Ungalik River drainages in Subunit 22A.

Satellite transmitters were placed on 2 additional cows during September 1988. The caribou outfitted with transmitter No. 10907 died on approximately 3 December 1988 near the village of Nulato, and only 3 months of movement data were obtained (Fig. 4). Cow No. 10906 wintered in Subunit 22A near the Koyuk River drainage east of Granite Mountain and in the southern portion of Unit 23 in the Buckland River drainage (Fig. 5). Because analyses of the satellite telemetry data are still preliminary, results will be reported more completely in future progress reports.

Prior to September 1989, approximately 85 WAH caribou possessed functional collars. Given the current population estimate of 343,167 caribou, about 3 caribou per 10,000 were collared. Although quantitative data are lacking, opportunistic observations indicate that the total number of collars is insufficient to provide an accurate, overall picture of WAH distribution, particularly during the winter and spring. Because collars were only deployed at Onion Portage, only those animals crossing the Kobuk River enroute to southerly winter ranges were collared. Animals wintering north and east of the Kobuk were not available for collaring.

Mortality

Seasons and Bag Limits:

The open season for resident and subsistence hunters in Units 23, and 24 and Subunits 21D, 22A, 22B, and 26A is 1 July to 30 June. The bag limit is 5 caribou per day; however, not more than 5 caribou may be transported south of the Yukon river per regulatory year. Cow caribou may not be taken during 14 May-30 June. The open season for nonresident hunters is 1 July to 30 June. The bag limit is 5 caribou; cow caribou may not be taken from 16 May to 30 June.

Human-induced Mortality:

The 1988-89 reported harvest is 2,215 caribou, 19% less than the 2,740 caribou reported for 1987-88 and 42% less than the 3,808 caribou reported for 1986-87 (Table 7). Harvest levels in Units 21D, 22, 24 and 26A during 1988-89 were very similar to those reported the previous year; however, harvests in Unit 23 declined markedly from 2,009 in 1987-88 to 1,353 in 1988-89 (32%). Reasons for the decline in the harvest are not clear. The number of caribou harvested annually is normally related more to distribution of caribou than to population size. Because the WAH has tended to winter further south and east than previously reported, caribou may not have been available to hunters at opportune times, particularly those residing in Unit 23.

Apparently, few caribou wintered near the villages of Ambler, Kobuk, and Shungnak. In addition, the availability of employment opportunities at the Red Dog Mine may have resulted in less interest in hunting caribou among Unit 23 residents.

As indicated in previous progress reports, the magnitude of the actual harvest is substantially higher than the reported harvest. Anderson and James (1986) estimated that the reported harvest may account for as little as 25% of the actual harvest. Estimates of the actual harvest provided by Department staff in the recent past have ranged as high as 12,000 caribou. The problem is not due to poor reporting rates but to the reluctance of many hunters to purchase a license and register to hunt. The total number of "overlays" (i.e., registration permits) issued in 1987-88 (932) is very similar to that for 1988-89 (970). Reporting rates among these hunters who obtain licenses and harvest reports have ranged from 71% to 80% since the reporting system was instituted in 1984-85.

Hunter Residency and Success. The reported harvest is taken predominantly by local hunters (82%) residing in the range of the WAH (Tables 7 and 9). Quantitative data for evaluating hunter success are not available for the WAH; however, success rates are believed to be very high. During the 1988-89 season, 78% of the hunters who reported taking caribou harvested more than one, and 12% reported taking more than ten.

Harvest Chronology. Because the WAH harvest report form does not request harvest dates, we do not have detailed information concerning the chronology of the harvest. However, we believe the patterns documented in previous progress reports have not changed significantly (Table 8). Caribou taken during the fall are harvested predominantly during late August through October. Although caribou are harvested throughout the winter, most are taken during January through April.

Natural Mortality:

During the June calving surveys, we observed 6 dead caribou lying in the forest on the south side of the Kobuk River between Ambler and Kiana. Because there were several cows with calves in the area, we suspect that the deaths may have resulted from birthing complications. In addition, 15-20 carcasses were observed by staff in the Noatak area during the spring of 1988. Other undetected deaths probably occurred as a result of the harsh 1988-89 winter in northwest Alaska.

Habitat Assessment

In the last progress report (Larsen and Machida 1989), we discussed the possibility of establishing study plots to quantify vegetation changes within the range of the WAH. This was not accomplished during the reporting period; however, we are continuing to collect and measure mandibles from hunter-killed

caribou as a means of indirectly monitoring the herd's nutritional status. Results of this work will be reported on more completely in future progress reports.

Recent findings by Messier et al. (1988) suggest that nutritional status can also be assessed by examining pregnancy rates. Caribou herds having $\geq$ 25% of the 2-year-old females conceiving represent growing populations, while herds with < 10% of the 2-year-olds conceiving represent declining populations. To determine the status of the WAH using these criteria, we need to collect female caribou during the spring. During the coming year, we will evaluate the possibility of doing this.

During the spring of 1989, we observed several hundred sets of caribou tracks in the vicinity of the Red Dog Mine. It appeared that the caribou had been moving northwest until they encountered the port site road. At that point, it appeared that they turned north and paralleled the road for about 40 miles. When they encountered a spur road positioned perpendicular to their route of travel, they chose to cross the main road and continue northwest across the Wulik River drainage. J. Hemming (pers. commun.) reported observing several thousand caribou traveling in the vicinity of the Red Dog Mine, despite the fact that over 200 aircraft landings and take-offs occurred at the mine during the past year.

CONCLUSIONS AND RECOMMENDATIONS

The WAH has continued to grow since 1976 at a rate of 7-22% annually. In July 1988 we estimated the herd's size at 343,167, the highest recorded to date. We plan to census the herd again in July 1990.

Poor harvest reporting remains a problem that needs to be addressed. We should continue to encourage the public to get involved in the regulatory process and in the formulation of management guidelines for the WAH. As the herd grows, conflicts with reindeer herding on the Seward Peninsula may become more frequent. Staff should continue to work with herders to minimize caribou-reindeer conflicts. Involving interested members of the public in radio-tracking flights and other field work should remain a priority.

The Department, together with the National Park Service and the NANA Regional Corporation, should continue to monitor caribou distribution and movements and human activities in the vicinity of the Red Dog Mine, road, and port site. To better evaluate the distribution of caribou north of the Kobuk River, additional caribou should be collared in the Noatak area. No regulatory changes are proposed at this time.

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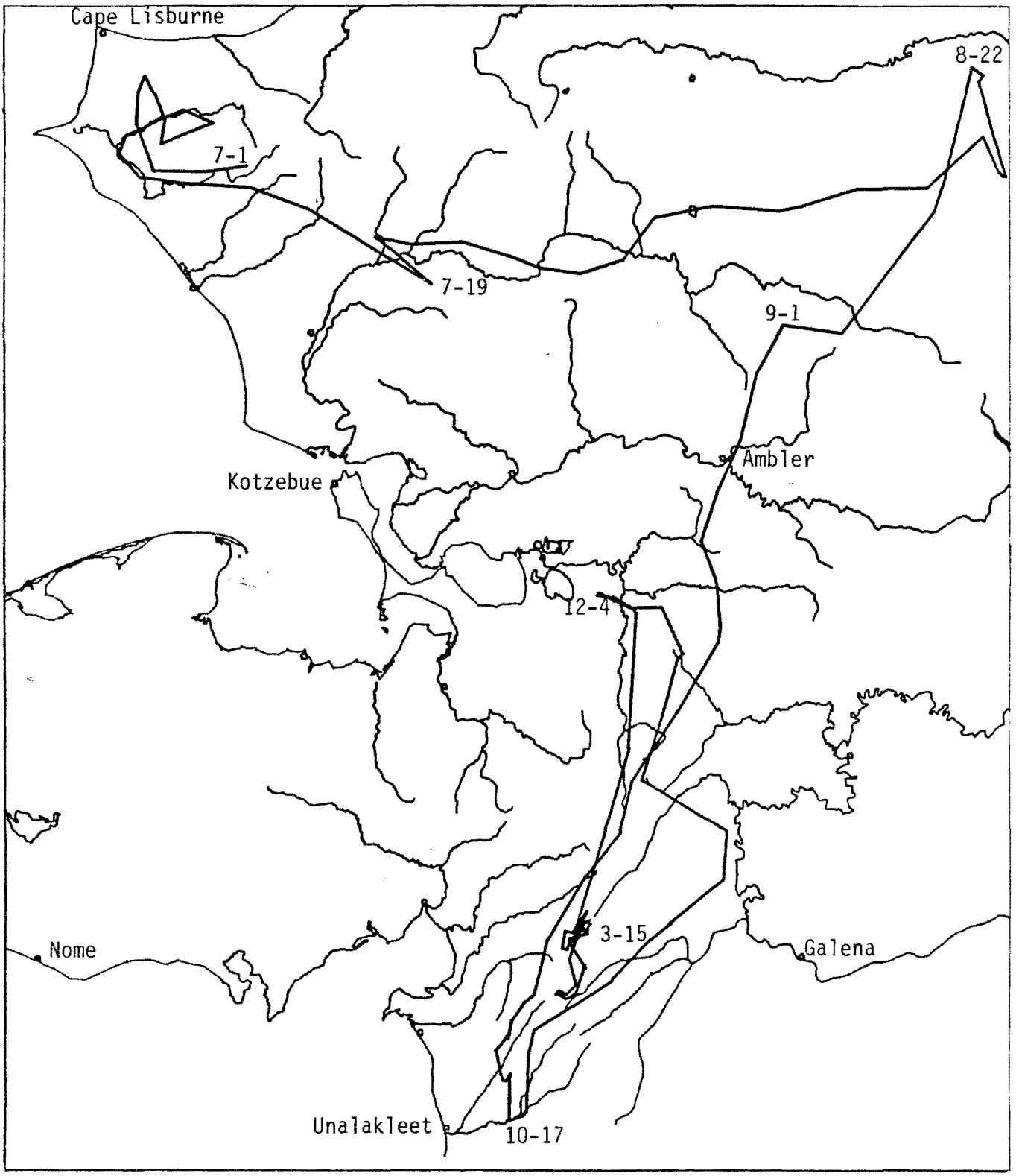

Figure 1. Movement of satellite-collared cow caribou (No. 7871) from July 1, 1988 to March 15, 1989.

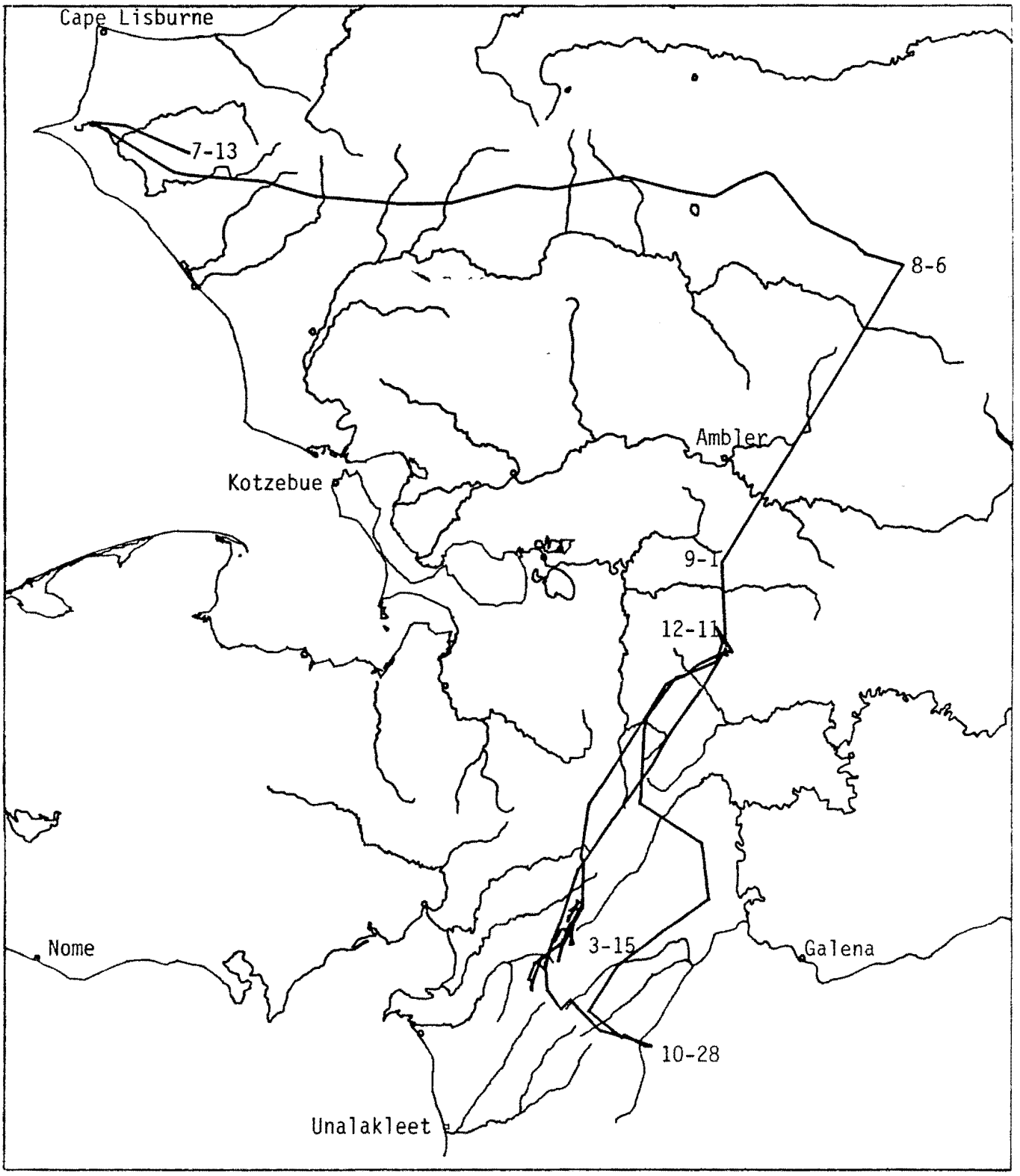

Figure 2. Movement of satellite-collared cow caribou (No. 7908) from July 13, 1988 to March 15, 1989.

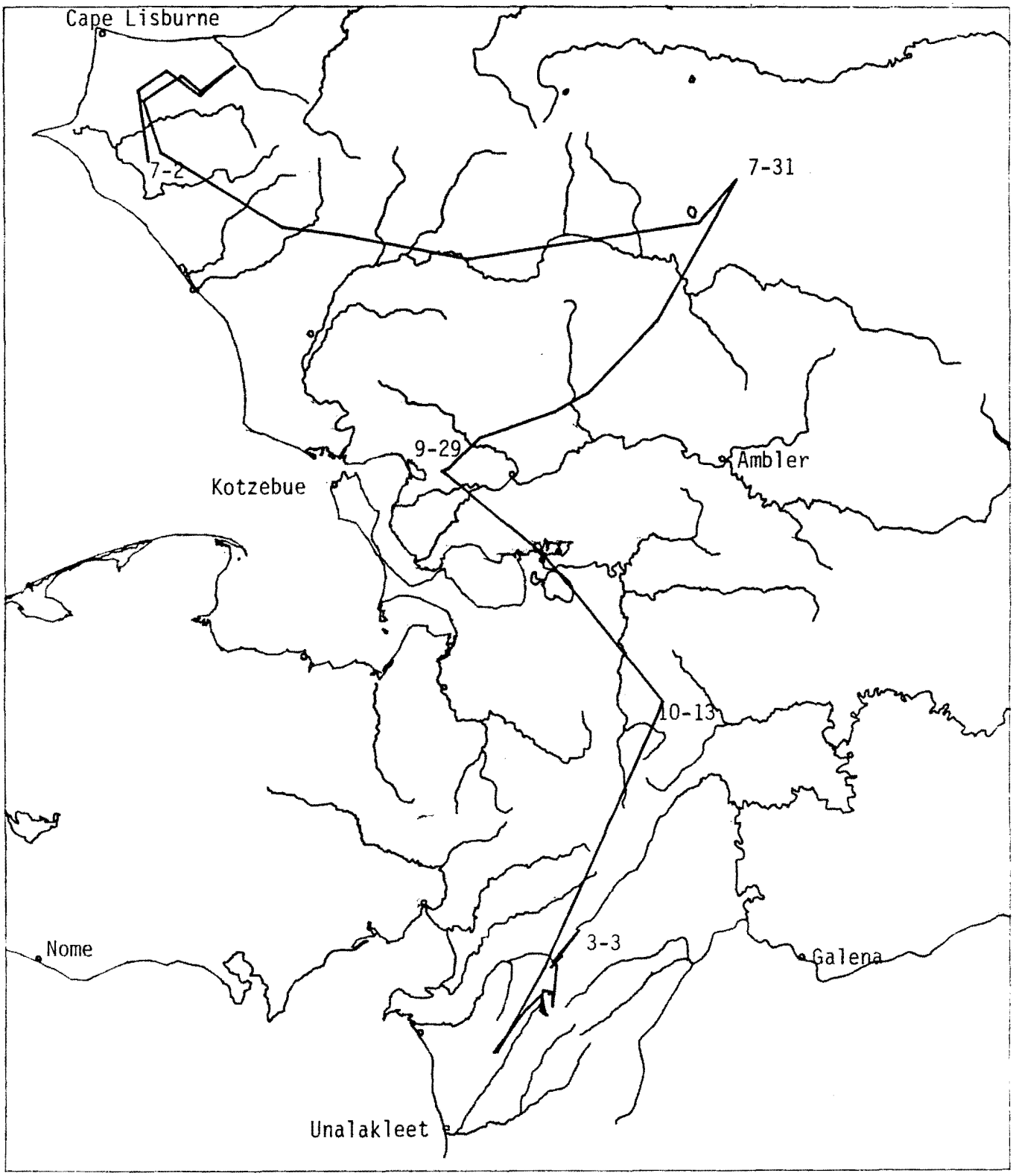

Figure 3. Movement of satellite-collared cow caribou (No. 7870) from July 2, 1988 to March 3, 1989.

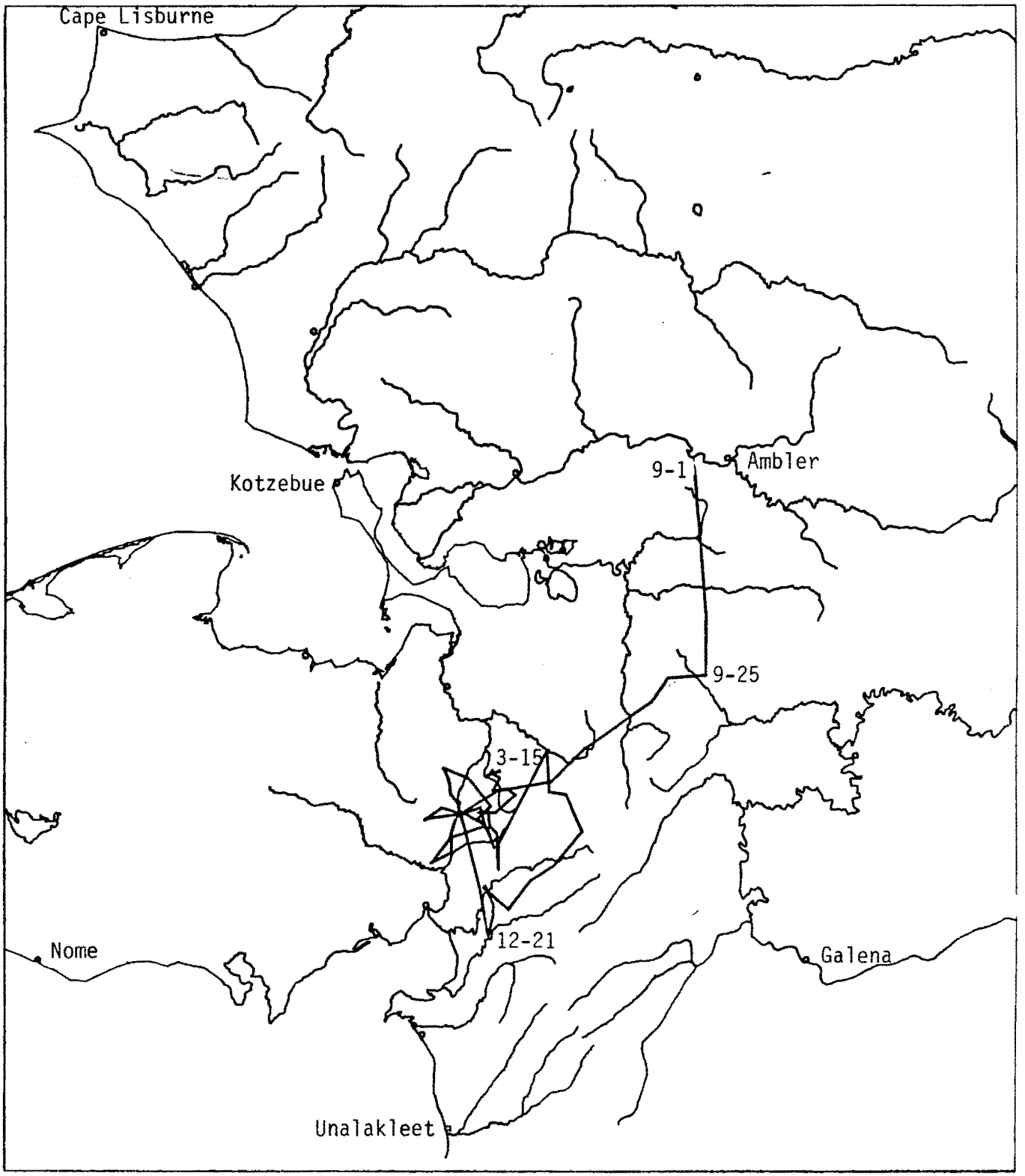

Figure 4. Movement of satellite-collared cow caribou (No. 10906) from September 1, 1988 to March 15, 1989.

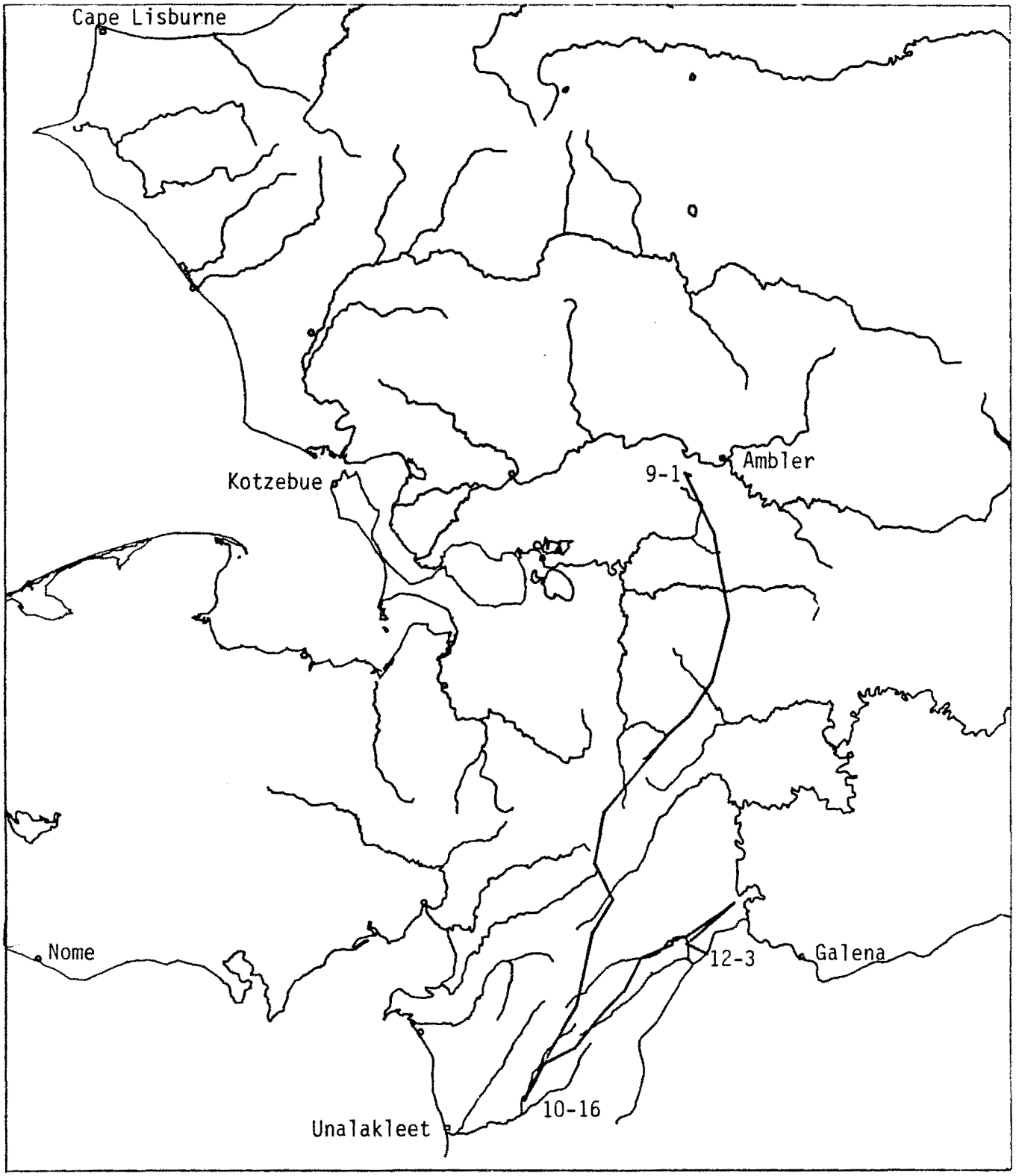

Figure 5. Movement of satellite-collared cow caribou (No. 10907) from September 1, 1988 to December 3, 1988.

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

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

[a] $\frac{\ln [Nt + t_1] - \ln [Nt]}{t} = r$ $\quad e^r$ = 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 Western Arctic Caribou Herd, 1989.

Date	Location[a]	Adults[b]	Short-yearlings	Total caribou	% short-yearlings
28 April	Middle Noatak R.	484	148	632	23
28 April	Kallarichuk Hills	41	9	50	18
3 May	Selawik Flats	644	233	877	27
3 May	Hockley Hills	75	26	101	26
9 May	Selawik Flats	3,153	1,126	4,279	26
11 May	Selawik Flats	933	176	1,109	16
Total		5,330	1,718	7,048	24

[a] All locations were within Unit 23.

[b] All caribou older than short-yearlings.

Table 3. Summary of spring composition surveys of the Western Arctic Herd, March-May 1977-1989.

Year	GMU	Adults	Short-yearlings	% short-yearlings
1977	---	9,313	3,204	26
1978	---	7,814	1,567	17
1979	---	2,992	1,035	26
1980	---	7,823	2,559	25
1981	---	1,404	414	23
1982	23,26A	5,536	1,253	18
1983	23,24,26A	6,727	1,648	20
1984	23,26A	4,047	936	19
1985	23,26A	7,207	1,275	15
1986	23	5,372	1,227	19
1987	23	7,981	2,150	21
1988	23	6,047	1,312	18
1989	23	5,330	1,718	24

Table 4. Numbers of Western Arctic cow caribou observed during calf surveys, Unit 23 and 26A, 1988-89.

Date	Cows with calves			Cows without calves			% of cows
	w/antlers	w/o antlers	Total	w/antlers	w/o antlers	Total	w/calves
3-5 June 1988	21	5	26	18	9	27	49
10-12 June 1988	16	18	34	7	9	16	68
Total	37	23	60	25	18	43	58

Table 5. Relocations of radio-collared WAH caribou, October-November 1988.

Date	North of Noatak R.	Mulgrave Hills	Noatak R. to N. side of Waring Mtns.	S. side of Waring Mtns.- Selawik Hills	South of Selawik Hills	West of & incl. Kiwalik R.	Mortality mode	Total
10/11/88	--	3	8	3	16	3	1	34
10/20/88	--	--	9	--	6	--	2	17
10/25/88	--	--	--	2	43	--	2	47
11/21/88	--	--	--	--	16	1	4	21
11/22/88	--	--	--	6	23	--	--	29
Total	--	3	17	11	104	4	9	148

Table 6. Relocations of radio-collared WAH caribou, February - March 1989.

Date	North of Noatak R.	Mulgrave Hills	Noatak R. to N. side of Waring Mtns.	S. side of Waring Mtns.- Selawik Hills	South of Selawik Hills	West of & incl. Kiwalik R.	Mortality mode	Total
2/22/89	--	--	--	5	33	--	3	41
3/03/89	--	--	5	2	1	--	--	8
3/14/89	--	--	--	--	31	--	2	33
3/22/89	--	--	--	--	1	--	--	1
3/23/89	--	--	--	6	61	--	3	70
3/26/89	--	--	--	--	--	--	1	1
3/27/89	--	--	--	--	1	--	--	1
3/29/89	--	2	5	16	28	--	5	56
3/30/89	--	--	--	4	1	2	--	7
3/31/89	--	--	1	8	-	--	1	10
Total	--	2	11	41	157	2	15	228

Table 7. Reported harvest of WAH caribou from 3 non-overlapping reporting systems, 1987-88 and 1988-89.

Unit	WAH harvest report 1987	WAH harvest report 1988	Eastern Arctic harvest report 1987	Eastern Arctic harvest report 1988	Statewide harvest report 1987	Statewide harvest report 1988	Total 1987	%	Total 1988	%
21D	39	73	0	0	0	0	39	(1)	73	(3)
22	214	326	0	0	1	0	215	(8)	326	(15)
23	1797	1176	114	84	112	93	2023	(74)	1353	(61)
24	1	29	12	5	0	0	13	(0.5)	34	(2)
26A	376	309	63	89	11	31	450	(16)	429	(19)
Total	2427	1913	189	178	124	124	2740		2215	

Table 8. Number of WAH caribou taken during fall and spring, 1987-88 and 1988-89 (WAH harvest reporting system).

Unit	Fall Harvest 1987-88	Fall Harvest 1988-89	Spring Harvest 1987-88	Spring Harvest 1988-89
21D	19	34	20	39
22	58	133	156	193
23	1163	742	634	434
24	0	0	1	29
26A	234	195	142	114

Table 9. Residency of hunters reporting on the WAH harvest reporting system, 1988-89.

Residency	Reports issued	Reports returned (percent)	Harvest
Alaska Resident (non-local)	90	72 (80)	77
Local resident[a]	833	574 (69)	1817
Nonresident	47	38 (81)	19
Total	970	684 (71)	1913

[a] Resident of Units 21D, 22A, 22B, 23, 24 and 26A.

Table 10. Summary of number of overlays issued and number returned, WAH harvest reporting system, 1986-87 to 1988-89.

Unit	Overlays issued			Reports returned (percent)		
	1986	1987	1988	1986	1987	1988
21D	38	59	87	31(82)	48(81)	75(86)
22	404	206	264	358(89)	172(83)	204(77)
23	600	556	531	465(78)	413(74)	333(63)
24	2	1	20	1	1	10
26A	110	109	92	79(72)	86(79)	62(67)

STUDY AREA

GAME MANAGEMENT UNIT: 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) is an international herd that migrates regularly between Alaska and the Yukon and Northwest Territories, Canada. The herd ranges across approximately 96,500 mi^2, most of which is roadless wilderness bisected by the Porcupine River (Garner and Reynolds 1986).

The northeast coastal plain of Alaska, within the Arctic National Wildlife Refuge (ANWR), contains the major portion of the PCH's calving range. It also contains potential oil reserves that both industry and government wish to explore. The possible consequences of oil development are being studied by various state, federal, and private agencies. The Porcupine Caribou Management Board was recently established as an international body to coordinate management of the herd among the various governmental agencies and user groups in Alaska and Canada. Results of the studies, Board recommendations, and the actions of Congress regarding the opening of ANWR to further exploration and development will determine how the herd may be managed to provide for subsistence and other uses.

The PCH was probably relatively stable at about 100,000 animals during the 1960's and 1970's (Table 1). The population began increasing in 1979 and reached over 135,000 caribou in 1983. The rate of increase estimated from recruitment and mortality data was about 10% per year between 1983 and 1986 (Whitten 1987), but the July 1987 census (165,000) indicated that growth since 1983 may have been closer to 5%.

POPULATION OBJECTIVES

To manage the herd to maintain a minimum population size of 100,000 animals and otherwise allow natural regulatory mechanisms to operate.

To determine subsistence harvest levels and demand by 1991.

METHODS

Composition counts were conducted by observers on the ground in July 1988. Movements, natality, mortality, recruitment, and population characteristics were determined from radio-collared cows and calves. Composition counts and telemetry data were used to estimate productivity and growth of the PCH.

Reports submitted by nonsubsistence hunters provided most of the data on the harvest. Subsistence harvest data were gathered through Subsistence Division and opportunistically by field interviews.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

In the July 1987 photocensus, 172,362 caribou were counted; however, some of them counted in the Canning River area belonged to the Central Arctic herd, so the actual count of the PCH was revised to approximately 165,000. This figure is 22% higher than the count in 1983, representing a mean rate of increase of about 5.5% per year. No census was conducted during this reporting period; however, another one has been scheduled for July 1989.

Population Composition:

There were no obvious trends in either calf:cow or yearling:cow ratios (Table 2). No fall composition counts have been conducted since 1980, and the adult sex ratio of the herd is unknown.

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. (in press), and Golden (1989). The following summary of PCH movements during 1988-89 was provided by K. R. Whitten (pers. commun.). Most of the caribou remained in large aggregations on the ANWR coastal plain in July 1988, while a few moved across the Canning River and mixed with the Central Arctic Caribou Herd (CAH) or moved almost to Prudhoe Bay. Most of the herd moved southeast into Canada in late July and August, but a few animals stayed behind with the CAH. During September the PCH moved in a roughly clockwise direction from the British Mountains, south across the Porcupine River, west toward Alaska, north across the Porcupine River, and finally back north to the British Mountains and the North Slope in the Yukon Territory. Most of the herd wintered in the northern Richardson Mountains, the west side of the MacKenzie Valley in Northwest Territories, or in the Ogilvie Mountains. Caribou from the latter area were delayed in their March migration to the northwest by deep snow.

Snow cover also inhibited movement to calving grounds in ANWR and forced caribou to travel along the virtually snow-free foothills of the northern Brooks Range. Caribou moved rapidly to the coastal plain to calve when warm June temperatures melted the snow. Very high-density calving occurred between the Jago and Hulahula Rivers, which is within the core calving area of the ANWR coastal plain. Most of the PCH calved within the area being considered for oil development (1002 area) in June 1989.

Mortality

Season and Bag Limit:

The hunting season for all hunters is from 1 July to 30 April. The bag limit for nonresidents is 5 caribou; the bag limit for resident and subsistence hunters is 10 caribou, provided that no more than five are transported south of the Yukon River.

Human-induced Mortality:

There is no apparent trend in the magnitude or distribution of the sport harvest of the PCH over the last 5 years (Table 3). Sport harvests have averaged less than 5% of the estimated total harvest and less than 0.1% of herd size. Few cows are killed by sport hunters.

Subsistence harvests continued to be largely unreported and largely unmonitored, except at Kaktovik. PCH harvest by subsistence hunters from Kaktovik for 1988 was estimated at 162 $\pm$ 20 caribou, 65% bulls, and 35% cows (S. Pedersen, pers. commun.). Other subsistence harvests of the PCH in Alaska are unknown, but because most of the herd wintered in Canada, it was less than 500 caribou. The Canadian harvest is unknown as well, but it may have been between 2,000 and 4,000, based on estimates from other years when the bulk of the PCH had been in Canada (Whitten 1986). Maximum harvest of the PCH in 1988 was probably about 3% of the total population.

To improve estimates of the subsistence harvest, ADF&G has established a system of registering caribou hunters. Addresses of potential hunters will be obtained so that hunters can be contacted by a mailed questionnaire or interviewed after the season.

Hunter Success. Reported hunter success in PCH is highly dependent on herd distribution. Hunter success was poor in all subunits except 26C in 1988, primarily because few caribou wintered in Alaska (Table 4). Generally, few subsistence hunters obtained harvest tickets; consequently, their level of success has been difficult to estimate. Only 2 hunters reported using a bow and arrow to take a caribou. All other successful hunters reported used firearms.

Harvest Chronology. Ninety-seven percent of the nonsubsistence harvest occurred in August and September 1988. Subsistence hunters from Kaktovik took twice as many caribou during the summer as in the winter; CAH caribou were harvested more heavily than usual in 1988-89, because the PCH was unavailable all winter and much of the summer (S. Pedersen, pers. commun.).

Transport Methods. In 1988, 84% of the successful hunters who reported used aircraft to transport caribou, while 12% used boats and the rest used snowmachines, ORV's, highway vehicles, or horses (Table 5). Only aircraft and boat use was reported in Subunit 26C.

Natural Mortality:

During June 1988, 90 radio-collared cows gave birth to 74 calves, a parturition rate of 82%. Twenty-two calves died within the month, resulting in a mortality rate of 30%. Mortality of calves <48 hours old appears to have declined in the years since 1983-85, while the mortality rate of older calves increased (K. Whitten, pers. commun.). Total mortality, as a percentage of the herd, has been fairly constant since 1983. Late snow cover has apparently contributed to higher levels of predation in some years (K. Whitten, pers. commun.). Calving occurred along the southern edge of the coastal plain in 1987, because northern areas were still covered in snow. Whitten believed the greater density of wolves and grizzly bears in the foothills to the south and east of the coastal plain resulted in higher predation.

Habitat Assessment

The carrying capacity of the PCH range is not known. The population density is approximately 1.7 caribou/mi^2, based on its overall range size of 96,500 mi^2 (Garner and Reynolds 1986). Golden (1989) briefly reviewed results of ongoing research on caribou-habitat relationships in the PCH. Current research on PCH habitat relationships center on (1) extensive range mapping in Yukon Territory and (2) estimation of forage composition and biomass in "core" and peripheral calving areas inside and outside the 1002 study area within ANWR (K. Whitten, pers. commun.). This research will be useful in defining PCH carrying capacity and in estimating the effects on caribou of the potential disturbance or loss of habitat from further oil exploration and development.

Game Board Actions and Emergency Orders

The seasons have remained the same over the last 5 years. The bag limit was raised in 1984 from five to 10, and hunters were allowed to transport 5 caribou instead of three out of the area. These changes had essentially no effect on the PCH because of the population's large size, annual growth rates, and relatively light harvest.

CONCLUSIONS AND RECOMMENDATIONS

I believe the management objectives for the PCH are being met. The population has been increasing for 10 or 11 years, and it is capable of sustaining a greater harvest. The improved system for recording subsistence harvest that will be adopted next year, plus greater cooperation with the Subsistence Division, should result in better harvest data. However, I believe resident and nonresident caribou harvests should be documented centrally (e.g., in the same manner ADF&G does with moose and sheep) to increase the area biologist's ability to track all aspects of harvest.

Current research programs conducted by ADF&G, USFWS, and Canadian biologists on population dynamics, movements, and habitat use of the PCH are filling in the biological data gaps, especially those related to the important core calving portion of the 1002 area of the coastal plain. I recommend these programs be given high priority, because of the increasing pressure to open that area to industrial development and the international importance of the PCH.

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Table 1. Population estimates of the Porcupine Caribou Herd, 1961-87.[a]

Year	Population estimate[b]	Type of estimate
1961	115,000	Calving ground census
1964	140,000	Calving ground census
1972	102,000	APDCE[c]
1977	105,000	APDCE
1979	110,000	Modified APDCE
1982	138,000	Modified APDCE
1983	135,284	Modified APDCE
1984	150,000	Extrapolation from 1983
1985	165,000	Extrapolation from 1983
1986	180,000	Extrapolation from 1983
1987	165,000	Modified APDCE

[a] No census was conducted in 1988.

[b] Data from 1961 through 1986 were from Garner and Reynolds (1986), and 1987 data were from ADF&G files.

[c] Aerial photo-direct count-extrapolation (APDCE) (Davis et al. 1979).

Table 2. Historical sex and age composition of the Porcupine Caribou Herd, 1971-88.

Month/ year	Bulls: 100 cows	Yrlgs: 100 cows	Calves: 100 cows	Yrlg % in herd	No. yrlg	Calf % in herd	No. calves	Cow % in herd	No. cows	Small bull % of bulls	Small bulls	Med. bull % of bulls	Med. bulls	Large bull % of bulls	Large bulls	Total bull % in herd	Total bulls	Sample size
4/71	28	--	54	--	--	30	8,474	55	15,780	--	--	--	--	--	--	15	4,383	28,637
7/71	24	18	38	10	2,920	21	6,164	56	16,220	--	--	--	--	--	--	13	3,893	29,197
7/72	23	17	49	9	1,055	26	3,047	53	6,212	--	--	--	--	--	--	12	1,407	11,721
10/72	55	18	31	9	270	15	450	49	1,469	--	--	--	--	--	--	27	809	2,998
7/73	16	10	47	6	1,146	27	5,157	58	11,079	--	--	--	--	--	--	9	1,719	19,101
10/73	51	12	33	6	12	17	34	51	102	--	--	--	--	--	--	26	52	200
7/74	9	5	67	3	424	37	5,227	55	7,770	--	--	--	--	--	--	5	706	14,127
7/75	23	17	52	9	1,693	27	5,080	52	9,783	--	--	--	--	--	--	12	2,258	18,814
7/76	5	18	58	10	1,376	32	4,404	55	7,569	--	--	--	--	--	--	3	413	13,762
7/77	7	18	39	11	2,807	24	6,125	61	15,567	--	--	--	--	--	--	4	1,021	25,520
10/77	77	31	49	12	1,073	19	1,699	39	3,487	--	--	--	--	--	--	30	2,682	8,941
6/78	--	12	85	6	25	43	181	51	214	--	--	--	--	--	--	0	0	420
7/78	30	15	68	7	1,307	32	5,974	47	8,774	--	--	--	--	--	--	14	2,614	18,669
10/78	31	12	61	6	59	30	294	49	480	--	--	--	--	--	--	15	147	980
7/79	15	13	55	7	1,341	30	5,746	55	10,535	--	--	--	--	--	--	8	1,532	19,154
7/80	59	29	66	11	1,027	26	2,349	39	3,572	--	--	--	--	--	--	23	2,098	9,046
10/80	60	19	54	8	1,113	23	3,218	43	5,946	--	--	--	--	47	1,683	26	3,594	13,871
6/82	--	13	79	7	108	41	670	52	851	--	--	--	--	--	--	0	0	1,629
7/82	95	42	43	15	2,953	15	3,005	36	7,040	--	--	--	--	46	3,122	34	6,720	19,718
6/83	--	24	74	12	212	37	664	51	895	--	--	--	--	--	--	0	0	1,771
7/83	9	10	73	5	139	38	978	52	1,343	--	--	61	75	39	48	5	123	2,583
7/86	57	29	52	12	2,340	22	4,290	42	8,190	--	--	--	--	--	--	24	4,680	19,500
7/87	72	26	62	10	3,275	24	7,882	38	12,719	49	4,494	--	--	51	4,674	28	9,168	33,044
7/88	28	19	54	10	614	27	1,712	50	3,186	57	518	--	--	43	390	14	908	6,420

Table 3. Porcupine Caribou Herd harvest, 1984-89, and subunit harvest, 1988.

	Reported harvest				Estimated unreported harvest			
Year	M	F	Unk	Total	Alaska	Canada	Total	Total harvest
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
Subunit								
25A	28	1	0	29				
25B	8	0	0	8				
25D	0	0	0	0				
26C	46	6	0	52				

Table 4. Hunter success in the Porcupine Caribou Herd, 1987 and 1988.

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
% successful	41	31	0	35	76	51

Table 5. Transport methods of successful hunters reporting from the range of the Porcupine Caribou Herd, 1987 and 1988.

Year	Air-plane	Horse	Boat	Snow-machine	Off-road vehicle	Unk
1987	85	3	12	1	1	1
1988	49	1	7	1	0	0

STUDY AREA

GAME MANAGEMENT UNIT: 25C, 20B, and 20F (4,000 mi^2)

HERD: White Mountains

GEOGRAPHICAL DESCRIPTION: White Mountains area

BACKGROUND

During the late 1970's, reports from the public and incidental observations by biologists confirmed the year-round presence of caribou in the White Mountains, implying that a small resident had existed for many years (Valkenburg 1988). Prior to this, the area was believed to be used only seasonally by a portion of the adjacent Fortymile Caribou Herd. As recently as 1960, 30,000 Fortymile caribou moved northwest across the Steese Highway to calve in the White Mountains (Jones 1961). Historical changes in the size and distribution of the Fortymile herd were thoroughly reviewed by Davis et al. (1978) and Valkenburg and Davis (1986). The first survey and inventory progress report on the White Mountains Caribou Herd was by Valkenburg (1988).

The White Mountains herd has not received much attention by ADF&G because of its small size (i.e., 750-1,000 caribou), low annual harvest (i.e., 1-12 caribou), and relative inaccessibility during the hunting season; however, the Bureau of Land Management (BLM) considers management of caribou in the Steese-White Mountains area as a high priority. One of the goals in the Steese National Conservation Area (SNCA) Habitat Management Plan is to manage present and historical caribou habitat as a primary land use. Although the SNCA is used mostly by the Fortymile herd, it borders the eastern edge of the White Mountains herd, which is primarily within the White Mountains National Recreation Area (WMNRA).

A cooperative study by BLM and ADF&G was initiated in 1982 to determine the identity and distribution of caribou in the White Mountains; between 1982 and 1988, 31 caribou were radio-collared. Data were obtained from 15 of these caribou (14 cows, 1 bull) that had been collared in Willow Creek (29 June 1982), Victoria Creek (29 September 1982), and Victoria Creek/Tolovana River (20 April 1984) areas. Relocations were obtained 1 or more times per month during the winter (1 Nov-31 Mar) and 1 or more times every 2 weeks during the remainder of the year.

MANAGEMENT OBJECTIVES

To establish herd size and trend by 1990.

To determine the feasibility of establishing a winter caribou hunt by 1990.

To establish population objectives by 1992.

To continue to delineate seasonal ranges that are used by caribou in the White Mountains.

METHODS

Harvest data was obtained from hunter report cards. Caribou killed north of or on an unknown side of the Steese Highway were assumed to be White Mountains caribou, while those killed south of the highway were assumed to be Fortymile caribou. Data from hunters hunting south of the highway are included in the Fortymile Caribou Herd report.

RESULTS AND DISCUSSION

Population Status and Trend

Little is known about the historical status of resident caribou in the White Mountains. The White Mountains herd has increased considerably since 1980, and it is continuing to increase (Valkenburg 1988).

Population Size:

Based on general observations, the White Mountains herd range from 750 to 1,000 caribou (T. Hobgood, pers. commun.).

Population Composition:

During the last 6 years, 3 caribou composition surveys were completed in the White Mountains (Table 1). Calf:cow ratios (30-33:100) were similar to those of other caribou herds in Interior Alaska that are growing slowly. Calves composed from 18% to 23% of the composition samples, and bull:cow ratios (i.e., ranging from 35:100 to 44:100) were inconsistent with the low reported harvest rate (i.e., only 12 bulls in 1988). At least 4 explanations could account for this apparent inconsistency: (1) lack of reporting by successful hunters; (2) incorrect classification of bull caribou during composition surveys; (3) high natural mortality; (4) inadequate sampling among bulls.

Distribution and Movement:

From June 1982 to June 1989 912 relocations of radio-collared caribou (Fig. 1) were documented (Durtsche and Hobgood 1988); 180 relocations were made in FY 89. Calving has occurred from 6 to 28 May in the upper ridges of 3 areas: (1) between Lime Peak and Mount Prindle, including the ridge northeast of Mount Prindle;

(2) Cache Mountain; and (3) the headwaters of Victoria Creek along the VABM Beaver ridge. In 1989 all radio-collared cows calved in the Lime Peak area, but calving was also observed in Victoria Creek. By September caribou had moved west and north across Beaver Creek to the Victoria Creek drainage, although some caribou remained east of Beaver Creek until late September-early October. Rutting behavior was observed in the Victoria Creek headwaters and vicinity of VABM Beaver. Caribou wintered in the headwaters of Bear Creek, Tolovana River, Hess Creek, and Victoria Creek. Spring movements eastward to the calving grounds occurred from early April through late May.

The White Mountains herd has not mingled with other caribou herds for more than 6 years, and it maintains discrete calving areas; however, a radio-collared bull from the Fortymile herd wintered west of Birch Creek in 1985-86 and 1986-87 and was in the Mastodon Dome area in the summer of 1987, indicating increased use of the Birch Creek drainage by the Fortymile herd. This trend should continue as the population increases and may lead to the eventual mixing of the 2 herds (Valkenburg 1988). The 2 herds will most likely overlap in the southeastern portion of the range of the White Mountains, particularly in the Mount Prindle, Quartz Creek, and Preacher Creek areas.

Mortality

Seasons and Bag Limit:

The open season for resident and nonresident hunters in Subunits 20B and 25C is 10 August to 20 December. The open season in Subunit 20F is 10 August to 30 September. The bag limit is 1 bull.

Human-induced Mortality:

Reported harvests of this herd have been consistently low, ranging from 1 to 12 since 1983 (Table 2). In 1988, 12 bull caribou were reported harvested between 16 August and 19 September. Successful hunters used off-road vehicles (ORV's) and airplanes to get to their hunting areas (Table 3). A low harvest from this herd is expected, because most of the herd is relatively inaccessible during the hunting season. Some caribou harvested north of the Steese Highway may be from the Fortymile herd, which has been increasing in size and ranging into the Upper Birch Creek drainage in recent years.

Sixty-three hunters (84% of those reporting) were unsuccessful in 1988. Highway vehicles (n = 33) were the most common type of transportation; ORV's (n = 19), boats (n = 3), horses (n = 1), and walking (n = 1) were used less frequently.

The BLM has been promoting public use of the White Mountains National Recreation Area. They have built trails and shelters to

facilitate this use. Their proposed 18-mile Nome Creek Road would link the Steese Highway with 2 new campgrounds and several trail heads. The road is intended to increase recreational opportunities. To determine current public use of that area and provide information to people about new ORV restrictions, BLM personnel were stationed at the U.S. Creek Road in the fall of 1988. From 2 to 13 September they counted 115 vehicles, 51 ORV's, and 205 visitors passing their station (R. Goodwin, pers. commun.). Most visitors were moose or caribou hunters, suggesting the degree of unreported hunting in this area may be substantial. McNay (1988) estimated that the overall reporting rate for caribou hunters (both successful and unsuccessful) in Subunit 20A during 1986 was only 35%. To increase reporting rates in 1988, hunters were reminded by newspapers, radio, and TV to return their harvest reports.

Natural Mortality:

Although eight of the 31 radio-collared caribou have died (all in the last 2 years), most were very old females that had been collared in 1982. One of 10 female calves collared in September 1988 was killed by wolves the evening after being collared, and one died from probable wolf predation in January 1989.

Habitat

During the summer of 1988, a 518,000-acre wildfire in the headwaters of Victoria Creek, Hess Creek, and the Yukon Flats burned approximately half of the White Mountains herd winter range (Fig. 2). BLM began studying the effects of this fire on caribou movements, distribution, and habitat use in fall 1988. During the winter following the fire, the herd shifted their range westward to the Wolf Creek vicinity (T. Hobgood, pers. commun.). Two proposed developments that could affect the White Mountains Herd are mineral development in the Lime Peak area and a recreational access road from the Steese Highway to Nome Creek.

CONCLUSIONS AND RECOMMENDATIONS

The cooperative study between BLM and ADF&G indicated that caribou in the White Mountains have not mingled with other caribou herds for at least 7 years and maintain a discrete calving area in the higher mountains east of Beaver Creek. The White Mountains herd is now considered a separate herd; i.e., it uses a distinct calving area.

Areas used by the White Mountains herd for calving, rutting, and wintering have been identified. Activities that could be detrimental to caribou use of these areas should be monitored and discouraged, if necessary. BLM's progress report on their caribou research will be completed in 1989.

Interest in hunting caribou in the White Mountains and along the Steese Highway has increased because of development of trails and facilities by BLM, and most other road-accessible caribou hunts are by permit only. Opportunities to hunt the White Mountains herd could be increased with a winter hunt, but before such a hunt is authorized more information on population size and trend should be collected.

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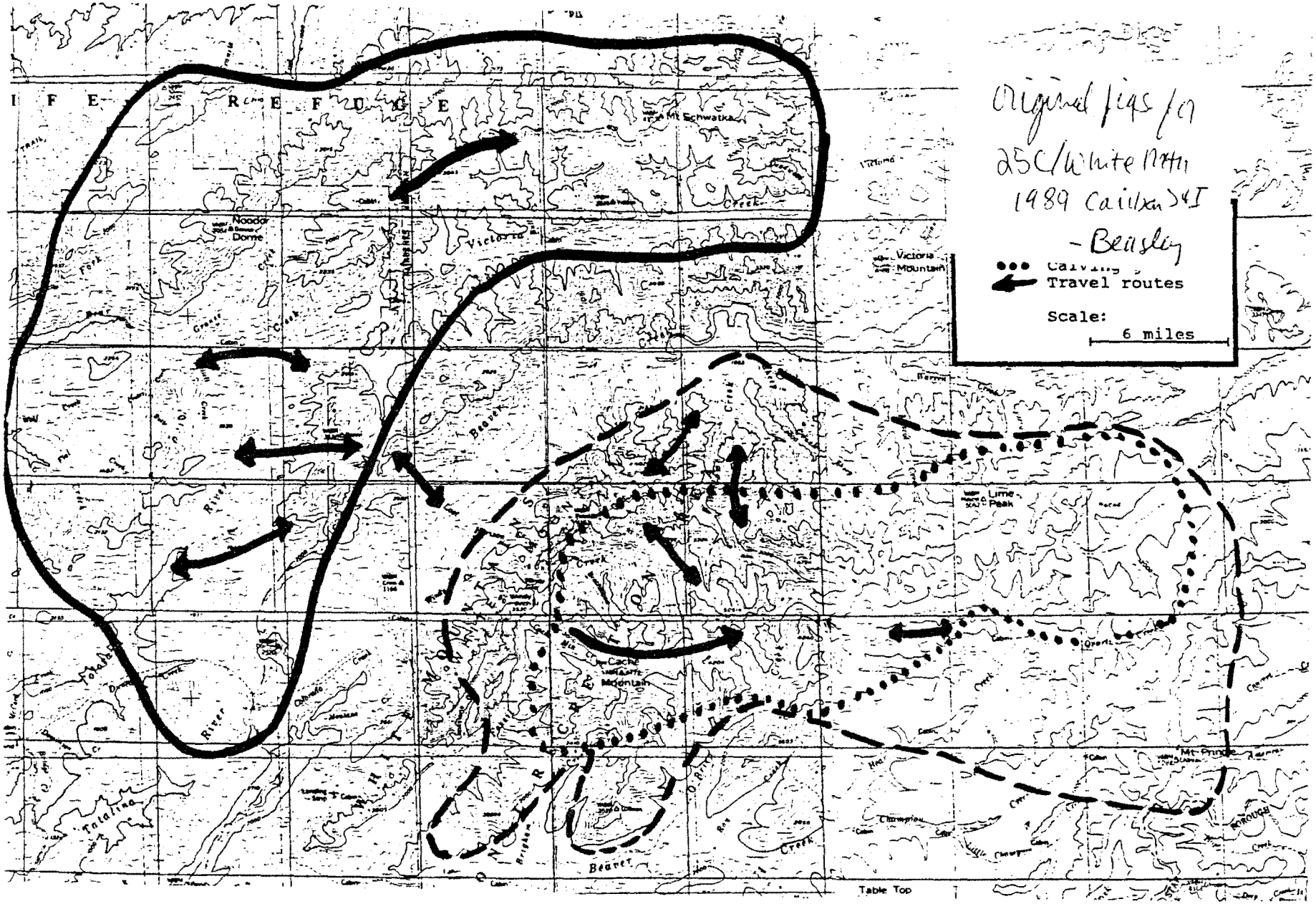

Figure 1. Approximate range of the White Mountains Caribou Herd (based on Durtsche and Hobgood 1988, and Hobgood, pers. commun.).

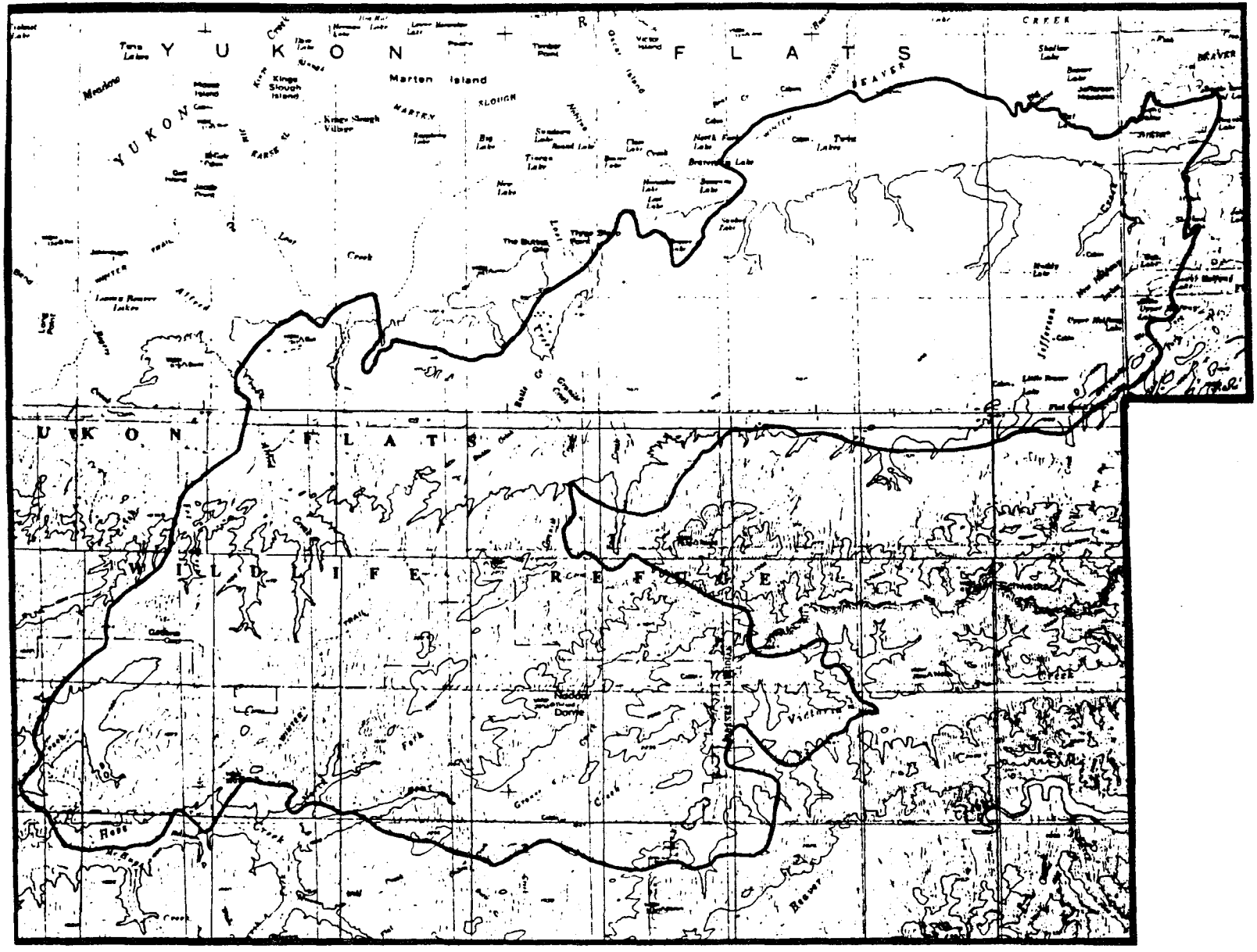

Figure 2. Boundary of 518,000-acre wildfire (A043) in 1988 (map courtesy of T. Hobgood, BLM).

Table 1. Caribou composition from counts in the White Mountains area, 1984 to 1988.[a]

Date	Bulls: 100 cows	Calves: 100 cows	Calves		Cows		No. bulls				Total caribou
			%	No.	%	No.	Sm.	Med.	Lg.	Total (%)	
29 Sep 1983	44	31	18	24	57	77	9	10	15	25 (34)	135
late Jun 1985	31	39	23	24	59	62	--	--	--	18 (19)	105
early Oct 1985	35	30	18	12	60	39	10	2	2	22 (14)	65
9 Jun 1988	--	53	--	103	--	193[b]	--	--	--	-- (--)	296[c]
29 Sep 1988	42	33	19	40	57	120	26	8	17	51 (24)	211

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

[b] A few bulls included.

Table 2. Caribou harvest and hunting pressure in the White Mountains area, 1983-84 to 1988-89.[a]

Regulatory year	Bulls	Cows	Total harvest	No. hunters	Percent success
1983-84	5	1	6	8	75
1984-85	1	0	1	25[b]	4
1985-86	12	0	12	60[b]	20
1986-87	2	0	2	6[b]	25
1987-88	6	0	6	49[c]	12
1988-89	12	0	12	75[c]	16

[a] Data prior to 1987-88 were from ADF&G 86 files.

[b] Includes hunters along the Steese Highway.

[c] Includes hunters north of Steese Highway, on unknown side of Steese, or in unknown portion of Subunit 25C.

Table 3. Date, location of kill, means of transportation, and hunt length for successful hunters in the White Mountain area, 1988.

Date of kill	Location of kill	Transportation	Hunt length (days)
10 Aug	Preacher Creek	3-/4-wheeler	1
16 Aug	Unknown portion of Subunit 25C	Airplane	2
21 Aug	N of Twelvemile Summit, Preacher Creek	Off-road vehicle	5
29 Aug	N of Twelvemile Summit, Preacher Creek	Off-road vehicle	5
29 Aug	Preacher/Bachelor Creek	3-/4-wheeler	4
30 Aug	Preacher Creek	3-/4-wheeler	5
2 Sep	1 mi S upper Nome Creek	Highway vehicle	1
2 Sep	Champion Creek	3-/4-wheeler	6
10 Sep	White Mountains	Airplane	4
10 Sep	White Mountains	Airplane	4
18 Sep	1.5 miles W of Lime Peak	Airplane	1
19 Sep	103 mile Steese Highway	Highway vehicle	2

STUDY AREA

GAME MANAGEMENT UNIT: 26B and 26C (26,000 mi^2)

HERD: Central Arctic

GEOGRAPHICAL DESCRIPTION: Central Arctic Slope and Brooks Range

BACKGROUND

The Central Arctic Caribou Herd (CAH) was first recognized by biologists as a discrete herd in the early 1970's. Much of the CAH's range, especially its calving area, lies within or near the industrial area around Prudhoe Bay. Most caribou winter to the south and southeast of the oilfield along the foothills of the Brooks Range, but some wintering occurs in and adjacent to the developed area.

The exploration and development of oil on the North Slope that began in the 1960's provided the impetus for extensive research by the ADF&G on the CAH's distribution, movements, and population dynamics. The University of Alaska, ADF&G, and the oil industry have also studied the effects of industrial activity on the herd, indicating that it has affected local distribution of the CAH but apparently not its productivity (Whitten 1987).

The herd grew rapidly throughout the 1970's and early 1980's. According to Whitten (1987) the CAH grew from 5,000 in 1975 to 13,000 in 1983 (i.e., 13%/year). Since 1983 the annual growth rate has been lower, the most recent estimate placing the population at roughly 16,000 in the summer of 1986 (Lawhead and Cameron 1988). Whitten (1987) believed population growth may have slowed since 1983 because of increased hunter harvest, lower yearling recruitment in 1987, or poor weather conditions. Hunting pressure was initially very light, but it grew steadily as the herd became better known, its size increased, and seasons and bag limits were liberalized. Hunting pressure reached a peak in 1985, largely because of access from the Dalton Highway and poorly enforced restrictions against private vehicles and snowmachines along the road. Changes in the 1986-87 and 1987-88 game regulations reversed the trend of rapidly increasing harvests.

POPULATION OBJECTIVES

To maintain a minimum population size of 10,000 and allow natural regulatory mechanisms to operate.

To determine subsistence harvest levels and demand by 1991.

To enhance viewing opportunities along the Dalton Highway by 1991.

METHODS

Composition, distribution, and movements of the CAH were monitored during June 1988 between the Colville and Canning Rivers. Caribou were classified on the basis of genitalia, body size, and antler development. A helicopter was used between 10 and 15 June to sample 2-mile-wide strip transects, spaced at 2- to 6-mile intervals across the calving grounds. A road survey was conducted by light truck along 43 miles of the road system in the Kuparuk Oilfield. Thirty-five cows with conventional radio collars were monitored on the calving grounds during June and July, and 5 cows with satellite radio collars were relocated several times a day throughout the year to determine seasonal movement patterns and habitat use.

Harvest reports submitted by nonsubsistence hunters provided most of the data on take of caribou. Subsistence harvest data were gathered by Subsistence Division staff through field interviews with hunters.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

There has been no census since 1982; attempts in 1988 were unfruitful, mostly because CAH and Porcupine caribou became mixed shortly after calving and remained at least partially mixed through the fall and winter.

Population Composition:

There appears to have been a downward trend in the June calf:cow ratio in the CAH since 1981, indicating either lowered natality or calf survival or both (Table 1). Cameron et al. (1988) suggested that poor nutritional condition of cows during the fall and winter of 1985-86 and 1988-89 resulted in low natality in June 1986 and June 1989. Poor recruitment of yearlings in 1987 followed the possibly poor 1986 natality (Table 1). The ratio of 32 yearlings:100 cows in 1988 was equivalent to levels prior to 1987.

Distribution and Movements

The CAH is relatively nonmigratory compared with the Porcupine Caribou Herd. Its movements, especially those in relation to the oilfield, have been the subject of several studies and reviews (Garner and Reynolds 1986, Lawhead and Cameron 1988, Murphy 1988, Fancy et al. 1989, Smith and Cameron 1989).

The distribution of the CAH in 1987 and 1988 was similar (Smith and Cameron 1989). During the summer of 1988, caribou were most

common near the Kuparuk River and Oliktok Point. They appeared to prefer to cross the Spine and Oliktok Roads at those places, avoiding most of the oilfield (Smith and Cameron 1989). Radio-collared cows without calves tended to be closer to the Kuparuk road system than cows with calves. Road survey and satellite-telemetry data indicated caribou avoided the oilfield complex when not harassed by insects (Smith and Cameron 1989).

Mortality

Seasons and Bag Limit:

In Subunits 26B and 26C the open season for all hunters was from 1 July through 30 April. The bag limit for nonresident hunters was 5 caribou in Subunit 26C, but only one in Subunit 26B. In Subunit 26B the bag limit for subisistence hunters was 5 caribou; however, cows could not be harvested 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 five could be transported from the subunit.

Human-induced Mortality:

Reported harvest by nonsubsistence hunters appears to have stabilized, and few cows were taken (Table 2). The reporting rate for successful hunters was estimated at 62-73% in the Delta and Fortymile herds (ADF&G files). Sixty-four percent of the reported 1988 harvest occurred within or near the Dalton Highway Corridor Management Area.

The subsistence harvest from Kaktovik was estimated at 142 for 1988; about 64% were bulls, 33% were cows, and 3% were unknown (S. Pedersen, pers. commun.). Subsistence harvest by residents of Anaktuvuk Pass and Nuiqsut was largely unreported. Overall harvest of the CAH in 1988-89 was estimated to be about 2%, based on an estimated population size of 16,000 animals. This level of harvest was well below herd production. To improve estimates of subsistence harvest, the ADF&G has established a system of registering caribou hunters. Addresses of potential hunters will be obtained and used to contact them by questionnaire or interview after the season.

Hunter Success. Reported hunter success has remained high for the last 3 years (Table 2), 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 2). 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. Eighty-four percent of the nonsubsistence harvest occurred in August and September 1988. Subsistence hunters from Kaktovik took twice as many caribou in the summer as in the winter (S. Pedersen, pers. commun.). CAH caribou were harvested more heavily than usual in 1988-89 because the Porcupine Caribou Herd was unavailable all winter and much of the summer (S. Pedersen, pers. commun.).

Transport Methods. Successful hunters have predominantly used aircraft and highway vehicles for transportation (Table 3). 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.

Natural Mortality:

Predation is an important source of mortality for caribou across North America, but its influence on CAH caribou is not clear (Garner and Reynolds 1986). Cameron et al. (1988) believed predation was negligible on the CAH calving grounds. They infrequently observed predators on the calving grounds, and of the few dead calves they encountered, none showed signs of predation.

Habitat Assessment

Recent results of aerial surveys, radiotelemetry data (Lawhead and Cameron 1988), and road surveys (Dau and Cameron 1986) have indicated that use of calving areas by the CAH continues to be restricted by development and associated activities. Females calving within the Prudhoe Bay Oilfield have remained at consistently low numbers for 10 years (Dau and Cameron 1986). Parturient caribou are apparently sensitive to disturbance and avoid areas with greatest development activity. Because CAH caribou do not show a similar response before and after calving, they may be much more tolerant of disturbance at those times (Dau and Cameron 1986).

The density of the CAH is estimated to be 0.13 caribou/mi^2 (Garner and Reynolds 1986), but the carrying capacity of the herd's range is unknown. The winter range is in the foothills and valleys to the south, which are outside most of the oilfields. However, the calving and insect-relief areas of the summer range on the coastal plain are within the oilfields, and caribou access to those areas may be essential to the herd's productivity. Continued study of caribou response to the growing oilfields will provide valuable information about the adaptability of caribou to displacement from apparently critical habitats.

CONCLUSIONS AND RECOMMENDATIONS

The CAH is probably still growing, but recruitment has declined considerably. A census is badly needed to confirm the current estimates of the herd size and trend. The harvest is probably having little influence on the herd, except perhaps in depressing the adult sex ratio. A fall composition count has not been conducted since 1981, and the adult sex ratio of the herd is unknown.

The current season for harvesting cows (i.e., 1 October to 30 April) only applies to subsistence hunters. All other hunters may take 1 caribou from 1 July to 30 April. I recommend the 1 October-30 April restriction for the harvesting of cows be applied to all other hunters as well. I believe this would serve to protect cows with young calves, particularly along the Dalton Highway.

Motorized transport of game along the road corridor is now restricted to aircraft, licensed highway vehicles, and boats (Whitten 1987). These latest regulatory changes have apparently been successful in curbing the rapidly increasing CAH harvest. Better enforcement of these regulations and the travel restrictions would also improve viewing and photography opportunities along the Dalton Highway. To accomplish this, I recommend ADF&G cooperate and coordinate activities with enforcement and land management agencies.

Oil development within the range of the CAH is continuing to expand. The impact of existing development on caribou is not fully known; however, it does seem to have restricted caribou use of calving grounds and limited the movements of parturient cows. Human-made structures and vehicular traffic, which alter movement patterns, increase the energetic demands on caribou already affected by calving and insect harassment (Murphy 1988). I recommend that the ADF&G continue to monitor oil development and related activities in the Prudhoe Bay and Kuparuk areas for their effects on caribou so that potentially detrimental impacts to the CAH population can be prevented.

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Table 1. Population composition of the Central Arctic Caribou Herd, June 1981 through 1988.

Year	Sample size	Percent of population				Number:100 cows		
		Bulls	Cows	Calves	Yrlgs	Bulls	Calves	Yrlgs
1981	3,337	4	46	40	10	9	85	22
1984	2,692	4	45	40	11	9	89	25
1985	2,357	7	42	37	15	16	88	35
1986	891	4	51	28	17	7	56	33
1987	7,887	2	51	38	10	4	75	19
1988	4,892	3	49	32	16	7	66	32

[a] Data sources: 1984-85, Smith and Cameron (1986); 1986, R. D. Cameron (pers. commun.); 1987, Lawhead and Cameron (1988); 1988, Smith and Cameron (1989).

Table 2. Harvest of caribou and hunter success in Subunit 26B, 1984-88.

Year	Reported harvest						Estimated unreported harvest[a]	Total harvest
	Male	Female	Unk	Total	No. of hunters	% success		
1984	313	55		368	--	--	100-200	468-568
1985	482	177	3	662	--	--	100-200	762-862
1986	311	34		345	287	76	100-200	445-545
1987	176	2	3	181	225	77	100-200	281-381
1988	179	7		186	255	73	100-200	286-386

[a] Estimate by area biologist based on distribution of caribou.

Table 3. Transport methods of successful caribou hunters reporting from Subunit 26B, 1984-88.

Year	Air-plane	Horse	Boat	Snow-machine	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