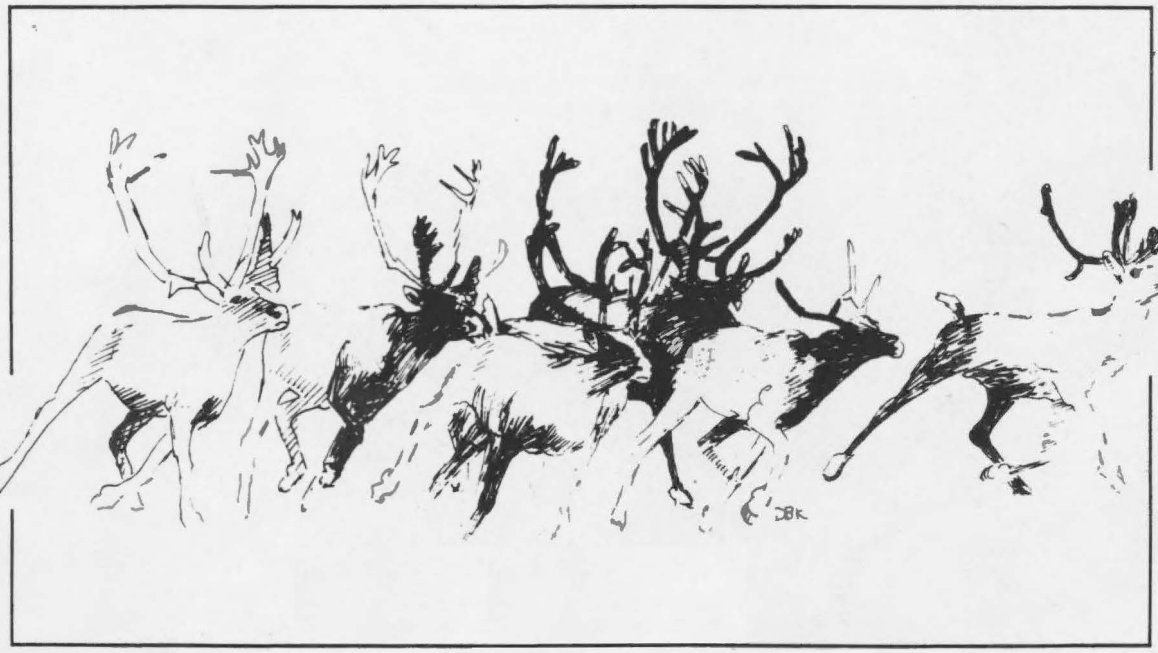
Alaska Department of Fish and Game
Division of Wildlife Conservation
Federal Aid in Wildlife Restoration
Annual Report of Survey—Inventory Activities
1 July 1987—30 June 1988

CARIBOU



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DEPARTMENT OF FISH AND GAME
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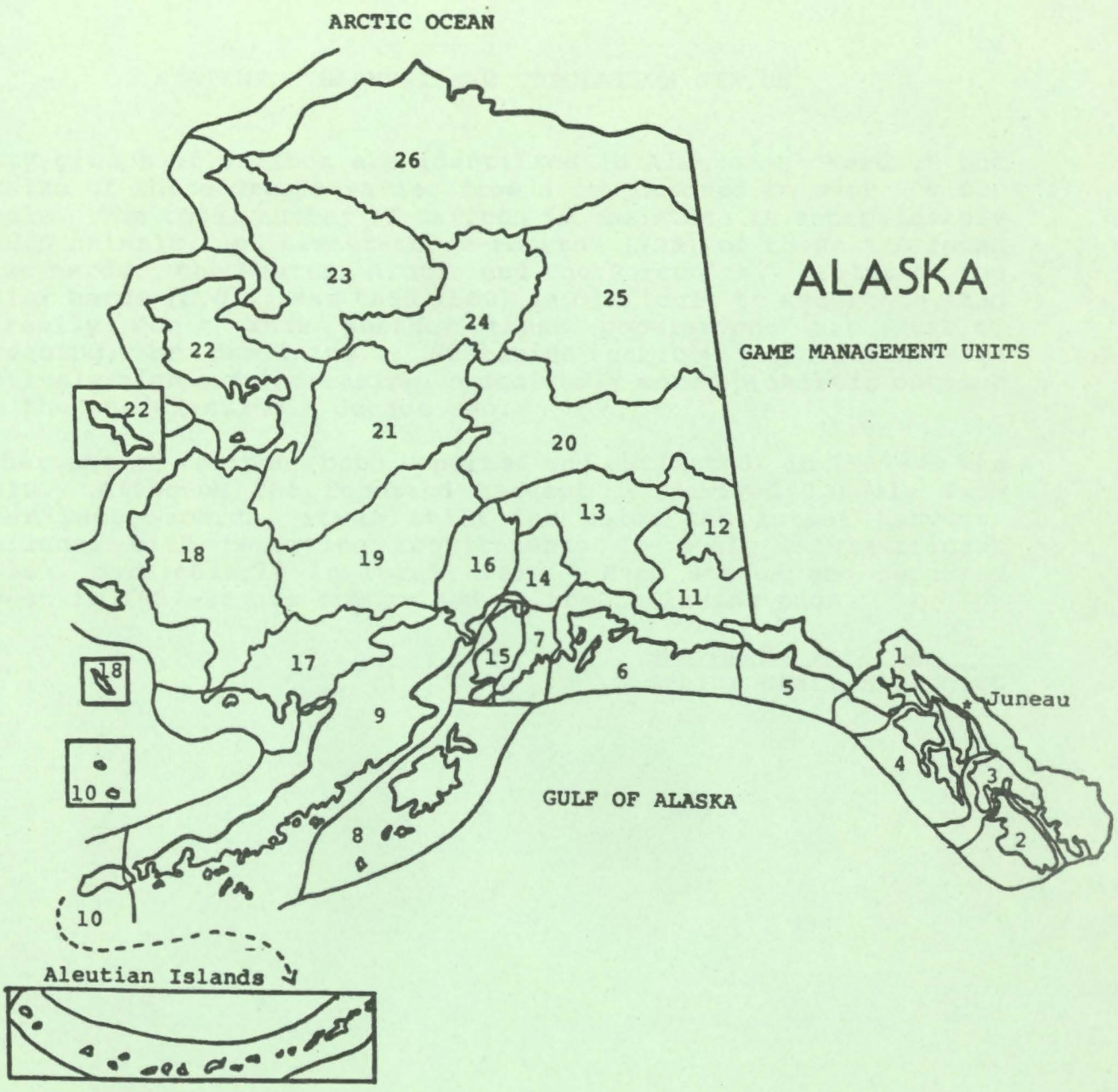
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STATEWIDE HARVEST AND POPULATION STATUS

Thirty groups of caribou are identified in Alaska as "herds," but the size of these groups varies from a few hundred to over 300,000 animals. The total number of caribou in the state is approximately 715,000 animals, and almost three-fourths (72%) of these are found in two herds: the Western Arctic and the Porcupine. Status of the smaller herds (e.g., less than 1500) 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) in 1987-88 was 22,810. Although the reported harvest is derived largely from hunter report cards, it is still far below the actual harvest. Compliance with reporting requirements is still a significant problem, particularly in rural areas. Herd status and reported harvest in 1987-88 are summarized on the following page.

Steven R. Peterson
Senior Staff Biologist

Herd Name	Game Management Unit (GMU)	Population estimate	Population trend	Total Harvest (Reported & estimated)
Kenai Mountains	7	400	Increasing	50
Mulchatna	9A & B, 16, 17, 19	66,000	Increasing	2,000
N. AK Peninsula	9C & E	20,000	Stable	2,300
S. AK Peninsula	9D & 10 (Unimak I)	4,500	Decreasing	300
Adak	10 (Adak I)	500	Stable	121
Mentasta	11	2,000	Decreasing	112
Chisana	12	1,800	Increasing	82
Nelchina	13, 14B	33,000	Increasing	1,747
Kenai Lowlands	15A & B	100	Stable	4
Denali	13E, 20C	2,700	Increasing	0
Kilbuck Mountains	18	400	Increasing	75
Andreafsky	18	150	--	0
Beaver Mountains	19, 21	1,600	--	17
Kuskokwim Mountains	19, 21	300	--	--
Sunshine Mountains	19	550	--	2
Big River	19	750	--	43
Rainy Pass	19	1,500	--	85
Tonzona	19	1,000	--	45
Delta and Yanert	20A	10,600	Increasing	667
White Mountains	20B, 20F, 25C & D	1,000	Increasing	10
Macomb Plateau	20D	800	Increasing	57
Fortymile	20E	19,975	Increasing	260
Galena Mountain	20F, 21C & D, 24	500	--	3
Wolf Mountain	20F, 21C & D, 24	300	--	0
Ray Mountains	20F, 21C & D, 24	700	--	5
Western Arctic	21D, 22A & B, 23, 24, 26A	337,000	Increasing	10,000
Porcupine	25, 25C	180,000	Increasing	3,500[a]
Central Arctic	26B	16,000	Increasing	575
Teshekpuk	26A & B	11,000	--	750
Statewide Totals		715,125		22,810

[a] Includes Canadian harvest.

STUDY AREA

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

HERD: Kenai Mountain

GEOGRAPHICAL DESCRIPTION: Kenai Mountains and Lowlands

BACKGROUND

According to Spencer and Hakala (1964), little was known of the Kenai Peninsula's biological characteristics before 1875. Caribou had been extirpated form the Kenai Peninsula by about 1913, presumably because of unregulated hunting and natural mortality. In the early 1950's the U.S. Fish and Wildlife Service conducted feasibility studies to determine if historic caribou ranges on the Kenai Peninsula would support caribou (Alaska Game Commission 1952). Suitable range was found in the Chickaloon River-Mystery Creek area, the Skilak-Tustumena Lake area, and the Caribou Hills north of Homer.

In May 1965, 15 barren-ground caribou (12 females, 3 males) were released by the Department near the Chickaloon River in Unit 7. In April 1966, 29 caribou (26 females, 3 males) were released at Watson Lake in Subunit 15A (Glen 1967). Caribou for these highly successful transplants had been taken from the Nelchina herd near Glennallen.

As a result of these reintroductions there are 2 major groups of caribou on the Kenai Peninsula. The Lowland herd (115 caribou) summers in the area north of the Kenai Airport to the Swanson River and winters on the Moose River Flats near Bear Lake. The Mountain Herd (300 caribou) occupies the area drained by the Chickaloon River, Big Indian Creek, and the Resurrection Creek in Unit 7. The Lowland Herd has only been utilized once by sport hunters (1981), whereas the Mountain herd has been hunted annually since 1972 (Table 1).

As hunters became aware of the Mountain herd, the number of permits and harvests sharply increased. Because little was known concerning the carrying capacity of their range, in 1974 a harvest quota of 50 caribou was recommended to stabilize the herd at approximately 250 animals, an unlimited number of permits and extended seasons were allowed, and the season was closed by Emergency Order when it became necessary. In 1977 a limited permit system was employed, resulting in an annual success rate of about 22% for all permit holders.

POPULATION OBJECTIVES

To increase the posthunting population to 400 caribou in the Kenai Mountain herd, while maintaining an annual maximum harvest of 10%.

METHODS

During the reporting period, aerial surveys were conducted using a Piper Super Cub. In December 1987 a helicopter was used to obtain sex and composition data. On 1 June 1988 a natality survey was conducted by helicopter according to methods described by Bergerud (1964).

RESULTS AND DISCUSSION

Population Status and Trend

In 1984 the Mountain herd's carrying-capacity objective for after the hunting season was increased to 400 caribou, because the population had increased after several years of high recruitment and moderate harvests. Additionally, caribou appeared to be expanding their winter range during the early to mid-1980's, further supporting an increase in the population size objective; however, in 1985 when the highest number of caribou was counted (i.e., 401), the recruitment rate had significantly declined. This decline has continued through 1987. Studies have not been conducted to determine the factors controlling the size of the Mountain herd; however, deteriorated range caused by overgrazing during the early 1980's and predation may be two of the primary reasons.

Population Composition:

During the aerial fixed-wing surveys, the highest number of caribou counted was 303; two hundred seventy-three of these were classified during the December sex and age composition survey: 20 calves:100 cows, 44 bulls:100 cows. Calves composed 12% of the total.

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 harvesting 44 caribou during the 1987 season: 21 males and 23 females. Two-hundred fifty permits were issued, and 157 (63%) permit holders reported hunting; the success rate was 28%. Thirty (68%) of the successful hunters walked into their respective hunting areas, 11 (25%) used horses, one (2%) used aircraft, and two (5%) failed to report their method of transportation. Five (11%) of the 44 successful hunters were residents of the Kenai Peninsula, and 39 (89%) were other Alaskan residents. Chronology of harvest

suggests 20 caribou (45%) were harvested during the first 2 weeks of the season.

Natural Mortality:

From the 1 June natality survey data, we assumed that females with distended udders had given birth. Females with distended udders not accompanied by calves were assumed to have lost their offspring to some form of neonatal mortality. The sample of 71 females included 44 with distended udders, 14 without distended udders, and 13 classified as nonreproductive yearlings. Of the 44 adult females observed with distended udders, 30 (68%) were accompanied by calves. The Mountain herd had thus sustained a minimum neonatal mortality rate of 28% (14/44+6); a literature review by Bergerud (1980) suggests this to be a high but not disastrous early calf mortality.

The survey also suggests that the birth rate of 86% (44+6/58) is normal; however, the December composition of 12% calves is quite low. This information raises the question of the cause of calf mortality between June and December. Possible competing explanations include poor female nutrition and substantial predation rates.

Game Board Actions and Emergency Orders

A Departmental proposal was adopted by the Board of Game in the spring of 1988 to reduce the number of permits from 250 to 150 for the fall of 1988.

CONCLUSIONS AND RECOMMENDATIONS

Data from 1987 suggest the Mountain herd is about 100 animals below the population size objective (Fig. 1). 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 should result in a harvest of 20 to 25 caribou, representing a decrease from the 44 reported in 1987. This harvest level may allow the herd to increase gradually, if controlling factors other than human harvest do not change significantly. If neonatal mortality continues to be high and fall recruitment low during the 1988 surveys, I suggest we readjust the population size objective downward to 300 caribou until factors influencing calf recruitment have been identified. Mortality, recruitment, and census data should be collected on an annual basis.

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Table 1. Game Management Unit 7 Caribou Harvest, 1972-73 through 1987-88.

Year	Male	Female	Unid	Total	Permit issued	No. applicants	No. hunters	Percent success	Season
72-73	6	0	0	6	20	--	--	30	8/10-11/30
73-74	10	1	0	11	100	--	--	11	8/10-11/30
73-74	1	0	0	1	50	--	--	2	1/01-1/31
73-74	0	0	0	0	50	--	--	0	2/01-2/28
73-74	0	0	0	0	50	--	--	0	3/01-3/31
74-75	30	14	0	44	--	573	--	8	8/10-11/30 1/01-3/31
75-76	38	49	0	87	--	869	--	10	8/10-11/30 1/01-3/31
76-77	22	27	0	49	--	457	--	11	8/10-3/31
77-78	11	15	0	26	100	236	59	26	8/10-10/31
78-79	19	11	0	30	100	--	--	30	8/10-10/31
79-80	17	16	0	33	100	354	70	33	8/10-10/31
80-81	13	8	0	21	100	391	62	21	8/10-10/31
81-82	12	9	0	21	100	315	63	21	8/10-10/31
82-83	15	12	1	28	150	449	81	19	8/10-10/31
83-84	19	10	0	29	150	459	69	19	8/10-10/31

Table 1. Continued.

Year	Male	Female	Unid	Total	Permit issued	No. applicants	No. hunters	Percent success	Season
84-85	34	17	1	52	200	648	114	26	8/10-10/31
85-86	21	12	0	33	200	236	134	17	9/10-11/15
86-87	36	14	0	50	250	826	--	20	9/06-10/31
87-88	21	23	0	44	250	--	157	18	8/10-9/30

1. Unlimited number of permits issued.
2. Unknown number of hunters did not hunt.
3. Closed by emergency order 1/12/76.
4. Closed by emergency order 8/29/76.
5. Tier II subsistence hunt.

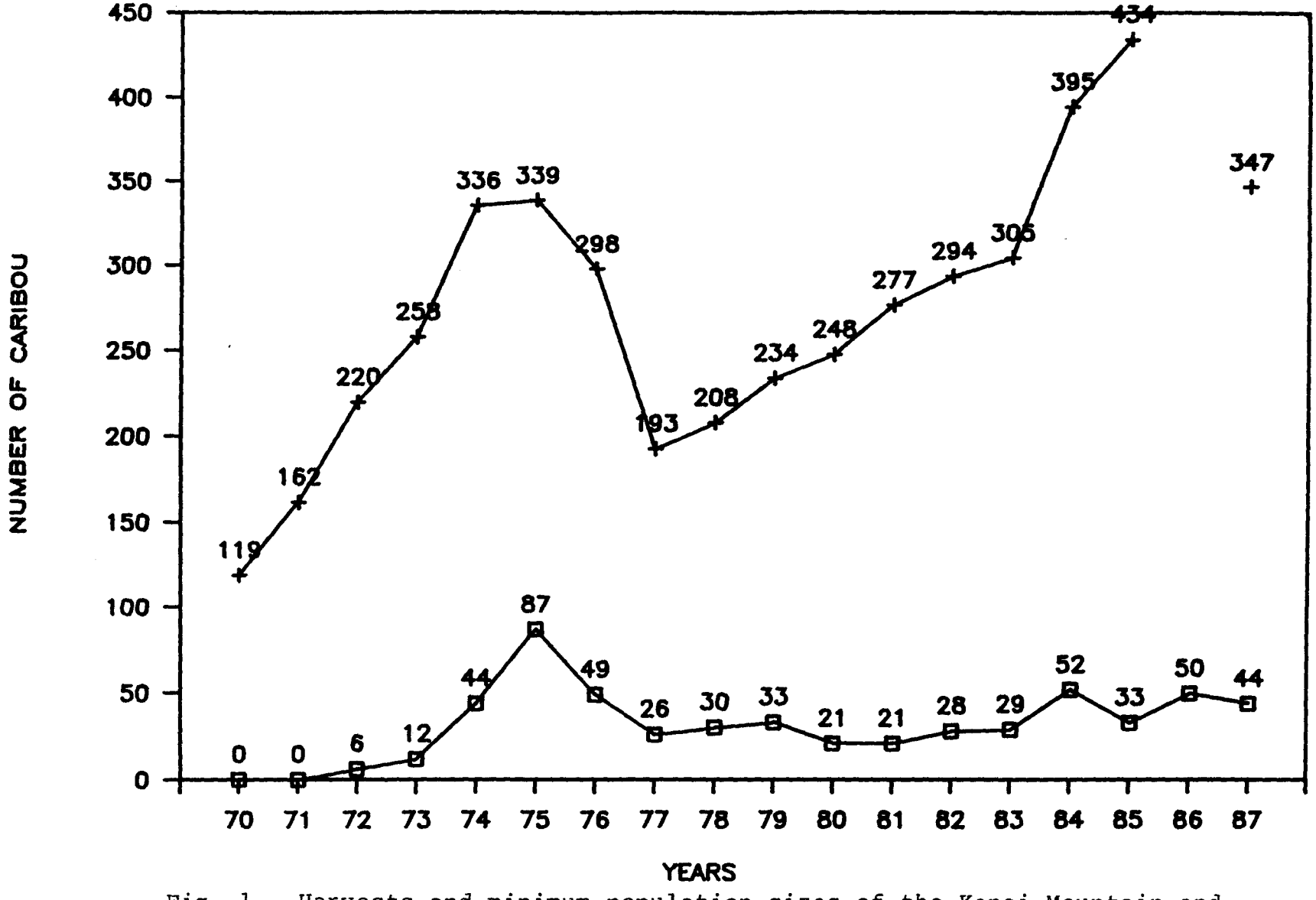

Fig. 1. Harvests and minimum population sizes of the Kenai Mountain and Lowland Herd, 1970-87.

STUDY AREA

GAME MANAGEMENT UNITS: 9A, 9B, 16, 17, and 19 (40,000 mi^2)

Herd: Mulchatna

GEOGRAPHICAL DESCRIPTION: Northern Bristol Bay and the Nushagak Hills

BACKGROUND

There is little information available on the Mulchatna Caribou Herd (MCH) prior to 1973. Skoog (1968) hypothesized that in the 1830's "A large caribou population occurred along the Bering Sea coast from Bristol Bay to Norton Sound." Records indicate that this herd ranged from the Yukon and Kuskokwim Rivers north to the Innoko River and the Taylor Mountains and that caribou calf hides were a major trading item with the Russians in Togiak during the 1800's. This herd reached peak numbers in the 1860's and began declining in the 1870's. Migrations of large numbers of caribou across the Lower Kuskokwim and Yukon Rivers ceased in the 1880's, and except for the relatively small migrations recorded in 1966 and 1972 across the Kvichak River, no major movements of this herd were observed until recently. Caribou numbers began increasing again in the Mulchatna area in the early 1930's (Ak. Game Comm. Repts. 1930-39), remaining relatively stable throughout that decade. There were indications that the herd began declining in the late 1930's (Skoog 1968); however, no substantive information was collected between 1940 and 1950 to support this.

Aerial surveys of the Mulchatna area were first conducted in 1949, when the population was estimated at 1,000 caribou (ADF&G files 1974). The population increased to approximately 5,000 by 1965 (Skoog 1968). 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 was counted at that time, providing a basis for an October estimate of 14,231 caribou (Table 1).

Photocensusing efforts continued through the 1970's, suggesting a declining trend in the population. Both seasons and bag limits were reduced continuously during this period. Poor counting conditions and reduced effort during census attempts may have contributed to this apparent decline.

Twenty radio transmitters were attached to caribou in this herd in 1981, providing assistance in locating postcalving aggregations. The 1981 photocensus was conducted on 30 June, and 18,599 caribou were counted. Photocensus estimates since

then have documented a rate of increase of approximately 17% annually for the MCH.

POPULATION OBJECTIVES

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

METHODS

A photocensus of the MCH was conducted during the postcalving aggregation period in cooperation with personnel from Lake Clark National Park. An aerial survey to determine fall sex and age composition was conducted in October, when an additional 10 radio collars were placed on caribou. Most of the 20 radio collars placed in 1981 had ceased to operate by this reporting period. Monthly radio- tracking flights were made by the National Park Service to continue the demographics study that began in 1981. Harvest monitoring and enforcement presence was maintained along the Mulchatna and upper Nushagak Rivers during the first half of September when hunting pressure is most intense. Harvest data were collected from statewide harvest reports. Data are of limited value because no reminder letters were sent to hunters who failed to report. Hunter "overlay" information was not computerized.

RESULTS AND DISCUSSION

Population Status and Trend

Since 1981 the MCH has been increasing at an annual rate of approximately 17%. This increase is 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.

Population Size:

A photocensus of the MCH was conducted on 30 June 1988; 60,328 caribou were observed, representing a 32% increase over the 45,742 observed in 1987 extrapolated to a population estimate of 52,527. In 1988 more effort was made to photograph all groups of males which may partially account for an increase of this magnitude.

Population Composition:

Sex and age composition surveys were conducted 13 October 1987 on caribou groups found along the Koktuli River drainage and in the Nikabuna Lakes region (Table 2). Groups ranging from less than 10 to 150 caribou were scattered along the Koktuli River and in the Nikabuna Lakes area. While some single bulls were observed, it appeared that the rutting season was not quite over. An unusually high proportion of males per 100 females (68:100) was observed during this survey. Survey conditions were poor, and it is possible that some adult females were misclassified as males; however, since 1981 the proportion of males in the herd has remained consistently high, despite the steady increase in hunting pressure.

Distribution and Movements:

The cooperative effort between ADF&G and Lake Clark National Park staff continued during this reporting period. The additional 10 radio transmitters placed on caribou in October were monitored monthly by NPS personnel. Range use patterns were similar to those in 1986-87, except caribou that crossed the Kvichak River during the winter went as far south as Big Creek. A portion of the Northern Alaska Peninsula Caribou Herd wintered as far north as Big Creek; therefore, some intermingling of herds may have occurred.

Summer and fall range use has been expanded primarily to the northwest as far as the Taylor Mountains and the Stony River drainage. Winter range use has expanded to the southeast across the Kvichak River as far south as the Alagnak River drainage and to the east as far as Kokhanak. Since 1986 significant numbers of caribou (300+) have been wintering on the west side of the Nushagak River between Kemuk Mountain and the Muklung Hills.

Several peripheral groups appear to be autonomous from the MCH. A group of 100-300 caribou is located near Etolin Point, and Rainy Pass has an estimated 200-400 that may remain in that vicinity all year. Approximately 600-800 caribou inhabit the Kilbuck Mountains to the west of the MCH range. A radiotelemetry study to determine population size and demographics of this group was conducted in 1986 by the Game Division and the Yukon Delta National Wildlife Refuge. This group has never been observed intermixing with the Mulchatna herd. The largest group peripheral to the main herd exists in the upper Koktuli and upper Stuyahok River drainages. This group appears to spend the spring, fall, and summer in this area, joining the main herd on the wintering grounds west of Iliamna Lake in late November or early December.

Mortality

Season and Bag Limit:

Hunting is prohibited in that portion of Subunit 17C west of the Nushagak River. The open season for subsistence and resident hunters in Subunits 9A, 9B, 17B, and the remainder of 17C is 10 August to 31 March; the open season for nonresident hunters there is 10 August to 31 October. The bag limit for subsistence and resident hunters is 3 caribou; however, not more than one may be taken before 1 November. The bag limit for nonresident hunters is 1 caribou. The open season for all hunters in Subunit 19B is 10 August to 31 March. The bag limit for subsistence hunters residing in Lime Village is 5 caribou and for other subsistence and resident hunters, 3 caribou; however, not more than 1 caribou may be taken before 1 November. The bag limit for nonresident hunters is 1 caribou.

Human-induced Mortality:

The reported harvest from the MCH during the reporting period was 985 caribou (Table 3). Of these, 334, 243, and 408 were taken in Subunits 9B and 19B and Unit 17, respectively. The estimated harvest during this period was 2050 carbou. Most of the unreported harvest is attributed to the Nushagak River villages in Unit 17. Without more comprehensive harvest information, it is impossible to accurately portray trends in the annual harvests.

Field observations indicate that the density of hunters in these units has increased steadily since the early 1980's during the fall season. Harvest levels have remained less than 5% of the total population, however, and do not appear to be limiting herd growth or range expansion.

Natural Mortality:

No natural mortality was documented during this reporting period. Snow depths were abnormally high in the Wood-Tikchik Mountains and along the King Salmon River drainage. Caribou avoided these areas and concentrated along the upper drainages of the Koktuli and Stuyahok Rivers and along the north and west shores of Iliamna Lake where snowdepths were generally minimal. Wolf populations were high throughout most of Subunits 17B and 19B, but trappers reported seeing evidence of predation only on moose.

Habitat Assessment

No effort to assess the condition of winter range utilized by the MCH was made during this reporting period. For the past years this herd has expanded its winter range annually to the east across the Kvichak River. I believe the carrying

capacity of the traditional wintering areas has been surpassed and that it will be necessary for this herd to continue to utilize new areas of winter range as it continues to grow.

Game Board Actions and Emergency Orders

During this reporting period, the Board of Game adopted a staff proposal that increased the length of the nonresident season, increased the bag limit in August from 1 to 2 caribou for subsistence hunters, and increased the total bag limit from 3 to 4 caribou for subsistence and resident hunters. Similar change were made to the seasons and bag limits for the Northern Alaska Peninsula Caribou Herd, making seasons and bag limits uniform for these herds.

CONCLUSIONS AND RECOMMENDATIONS

The MCH has experienced exceptionally rapid growth since 1980. The postcalving population estimates have increased from 20,618 in 1981 to 60,328 in 1988. While hunting pressure has grown at a rate exceeding that of herd growth in recent years, annual harvests remain at less than 5% of the population.

Concurrent with this population growth, the MCH has expanded into new ranges to the north and west in the summer and fall and to the south and east during the winter months. This herd has had difficulty establishing long-term use of habitat west of the Nushagak River because of hunting pressure from residents of the area during fall and winter seasons. The Board of Game closed most of the habitat west of the Nushagak River to caribou hunting prior to this reporting period, and more caribou have been using this area as a result.

Radiotelemetry has been a very valuable tool for managing this herd. Comparatively, few dollars have been spent annually on MCH management, and accurate 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 new transmitters were placed on caribou in 1986, 10 more were added in 1987, and another 10 are scheduled for October 1988. 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. Cooperative efforts with the Lake Clark National Park Service in conducting annual photocensus surveys and monitoring herd movements have been highly successful and cost-effective for both agencies; they should be continued.

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Table 1. Mulchatna caribou photocensus estimates, 1949-1988.

Date	Prelim. Estimate	Actual Count	Extrap. Estimate
1949	1,000	--	--
1965	5,000[a]	--	--
1973	6,030	--	--
1974	--	13,079	14,231
1975	--	--	--
1976	--	9,097	--
1977	--	--	--
1978	--	6,340	7,503
1979	--	--	--
1980[b]	10,000+	--	--
1981	--	18,599	20,618
1982	--	--	--
1983	--	25,416	--
1984	24,221	33,214	--
1985	36,706	42,945	--
1986[c]	--	--	--
1987	37,262	45,742	52,527
1988	45,456	60,328	--

[a] Skoog (1968)
[b] observation only, no photocensusing surveys conducted.
[c] photocensus discontinued because of bad weather.

Table 2. Sex and age composition counts of the Mulchatna Caribou Herd in the spring and fall, 1974 to 1988.

DATE	Males:100 Females	Calves:100 Cows	Calves (%)	Females (%)	Males (%)	Sample size
SPRING						
6/19/ & 6/20/74	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/ & 6/6/79	--	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/ & 6/17/83	52.2	51.4	25.2	49.1	25.6	1,926
6/16/ & 6/17/83	44.5	49.7	26.0	51.2	22.9	1,926
6/26/84	39.2	57.8	29.3	50.8	19.9	2,543
7/2/87	38.3	60.6	30.5	50.3	19.3	2,731
FALL						
10/16/ & 10/17/74	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	43.8	29.9	1,858

Table 3. Annual reported and estimated unreported harvests of the Mulchatna Caribou Herd, 1977 to 1987.

Year	Harvest Report Data				Estimated Unreported Harvest	
	No. males	No. female	No. unknown	Total	Both Sexes	Total Harvest
1977	286	168	19	473	--	473
1978	177	43	3	223	--	223
1979	190	43	3	236	--	236
1980	210	30	5	245	--	245
1981	239	34	4	277	--	277
1982	236	71	4	311	1019	1330
1983	342	61	12	415	--	415
1984	620	66	4	690	1370	2060
1985	763	189	10	962	1020	1982
1986	840	177	9	1026	1470	2496
1987	869	112	4	985	1270	2255

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 northward to the Naknek River drainage. Historically, the size of this population has fluctuated widely; peaks occurred just prior to the turn of the century and again in the early 1940's, when the population was estimated at 20,000 caribou. The last population low occurred during the late 1940's (i.e., 2,000 caribou). Since that time the herd experienced steady growth until 1984, when the population apparently stabilized.

POPULATIONS OBJECTIVES

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

METHODS

Radiotelementary-aided photocensus surveys were initiated in 1981; they are conducted in late June on the postcalving concentrations of the herd. Fall sex and age composition surveys are conducted in October during the rut. Using radiotelemetry techniques, general reconnaissance surveys are conducted throughout the year to monitor herd movement. Hunter success is monitored by harvest tickets and supplemented by hunter checks by Division staff in King Salmon.

RESULTS AND DISCUSSION

Population Status and Trend

The NAPCH has grown since the early 1950's. Photocensuses in 1984 and 1985 resulted in population counts of 19,000 caribou. In 1986 the census results were unreliable, because several radio-collared caribou could not be located and only slightly more than 15,000 caribou were found. In 1987 less than 16,000 caribou were counted, and it appeared the herd had declined. This year's count (i.e., 19,000) suggests the herd is fairly stable or within the range of the population objective.

Population Size:

Survey conditions in June 1988 were good, although clouds and winds near mountains prevented total coverage. Most of the radio-collared animals were located in large postcalving concentrations. The June 1988 photocensus accounted for 19,000 within the area normally covered. As in past years, this represents the minimum number; lack of sex and age composition classifications precluded extrapolation. During February 1988 a total of 163 caribou were captured and relocated to Subunit 17A; most of these were adult females.

Population Composition:

A sample of 1,536 caribou was classified in October 1987 as follows: 25% calves, calf:cow ratio of 52:100, bull:cow ratio of 54:100, and 13% medium to large bulls (Table 1). A sample of 1,154 caribou classified from the June 1988 photocensus showed 30% calves in the herd. Since 1983 the percentage of calves present during postcalving censuses of the NAPCH has ranged from 25% to 30%, while the Southern Peninsula Caribou Herd has had only 12% to 18% calves.

Distribution and Movements:

The primary calving ground for the NAPCH is in the Bering Sea flats between Cinder River and Port Moller. In recent years the postcalving migration north has started earlier; in 1988 a majority of the herd was north of the Egegik River by 1 August. Traditionally, this herd winters between the Egegik and Naknek Rivers; however, during the winters of 1986-87 and 1987-88 many caribou crossed the Naknek River and nearly intermingled with a portion of the Mulchatna herd that had ranged south of the Alagnak River.

Mortality

Season and Bag Limit 1987-1988:

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, not more than two may be taken from 10-31 August and not more than one may be taken from 1 September to 31 October. The bag limit for nonresident hunters is 2 caribou; however, not more than one may be taken from 1 September to 31 October.

Human-induced Mortality:

In 1987-88 the reported harvest from the NPCH was 1,003 caribou (Table 2), including 841 males (84%) and 158 females (16%). As in past years, most local and some nonlocal hunters did not report their harvests. In an effort to estimate the percentage of the nonsubsistence harvest that went unreported

during the fall of 1987, a total of 106 successful hunters were checked as they departed King Salmon. Harvest ticket numbers, hunter residency, and harvests were discretely recorded so that later reporting would not be seriously biased. These hunters had taken a total of 116 caribou. After harvest reports were returned, a comparison was made between field interviews and the reported harvest. Of the 106 hunters interviewed, 65 submitted the required harvest report indicating a harvest of 70 caribou. Thus over 60% of the known harvest was reported through hunter reports. McNay (1988) used a similar procedure in Unit 20, estimating the reporting rate at 56%. Although this is a crude procedure for estimating unreported harvests, the results suggest that nonsubsistence harvests may be as much as 40% higher than reported. Applying a 40% correction factor to the 1,003 caribou reported, the total nonsubsistence harvest is estimated at 1400. Based on surveys of all villages in Subunits 9C and 9E (ADF&G files), the unreported subsistence harvest is estimated at 900-1,000 caribou. Combining the 2 estimates, the total harvest is estimated at 2,300-2,400 caribou.

Chronology. The majority of the harvest from the NAPCH occurred between 10 August and 31 October, which corresponds 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 when October brown bear seasons occurred concurrently (Table 3). During the past 2 winters more caribou have crossed the Naknek River, where they became accessible to hunters using highway vehicles. This easy access, very low air fares from Anchorage in 1987, and a bag limit of 4 caribou attracted more hunting effort in November and December.

The subsistence harvest is primarily opportunistic, and the traditional hunting time for some of the villages in Subunit 9E is in March as the caribou migrate south. Because the spring migration was delayed in 1988, most caribou were north of the Ugashik River during March. Consequently, before the season closed there were not many caribou available to hunters from several villages in the southern portion of Subunit 9E.

Natural Mortality:

Although specific data on natural mortality is lacking, it is believed to be much lower than that for the Southern Alaska Peninsula Caribou Herd. Comparison of the percentage of calves observed during the postcalving census (30%) with the percentage classified in October (25%) suggests good calf survival. The 1987-88 winter was mild, and no evidence of winter mortality was noted.

Habitat Assessment

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

Game Board Actions and Emergency Orders

Season dates for Subunits 9C and 9E have generally been the same during the last 5 years; the only significant changes in bag limits were for the 10-31 August portion of the season. To stop herd growth, the Board of Game increased the August bag limit to 4 caribou in 1984. Even though few hunters were aware of this liberal limit, the August harvest increased dramatically, and concern was expressed that if the limit remained that large during August an unacceptably high harvest would occur in subsequent years. Consequently, the Board reduced the August bag limit to 2 caribou for 1985, 1986, and 1987. Because of a photocensus indicating a decline in the herd and a record harvest during 1987-88, reductions in bag limits and an 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 Subunit 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, 1 month later than in the past.

An Emergency Order was adopted by the Board to allow up to 40 bulls to be taken in Subunit 9E south of the Cinder and Aniakchak Rivers during 11 and 12 April. All hunting took place near Port Heiden, and approximately 25 hunters participated. The harvest during the 2 days was about 20 caribou.

CONCLUSIONS AND RECOMMENDTIONS

The Northern Alaska Peninsula Caribou Herd has remained at the upper end of the population objective, despite increasing harvests. Our concerns for a declining population in the NAPCH , which were based on the 1987 census, appear unfounded. To maintain this herd at or slightly below 20,000, it may be necessary to increase the harvest. With the Mulchatna herd still growing, I recommend the regulations for both herds be consistent. More specific recommendations for changes in regulations will be made for the 1989-90 season.

For several years we have suggested the need for either a range analysis or a comprehensive analysis of animal condition to determine if the population objectives for the herd are

appropriate. These analyses would also enable us to make some comparisons with the Southern Alaska Peninsula herd. Although funding and personnel limitations have prevented us from undertaking this project, it remains a high priority.

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Table 1. Northern Alaska Peninsula herd composition counts, total counts, and population estimates, 1983-87.

Date	Males: 100 females	Percentage med. or lg. males	Calf: 100 females	Calves in herd	Sample size	Total[a] count	Estimated pop.
6/83	--	--	--	29	--	18,000	19,000
10/83	39	12	27	16	1,410	--	--
6/84	--	--	--	25	1,047	19,000	20,000
10/84	39	11	39	22	1,087	--	20,000
7/85	--	--	--	27	2,186	18,978	20,000
6/86	--	--	--	28	2,451	15,274	15,300+[b]
10/86	51	23[c]	34	18	2,540	--	--
7/87	--	--	--	30	653	15,629	17,000
10/87	54	13	52	25	1,536	--	--
6/88	--	--	--	30	1,154	19,000	20,000

[a] Radiotelemetry, aerial photo-direct census.

[b] Poor count conditions; could not estimate total population size.

[c] Bull classification by John Payne; it may not reflect other counts.

Table 2. Northern Alaska Peninsula herd annual reported harvest and estimated harvest, 1983-87.

Year	Reported	Unreported Estimate		Grand		
	Male	Female	Total[a]	Sport[b]	Subsistence[c]	Total
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

[a] Includes unknown sex.

[b] Computed using the number .40 that 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 prior years.

[c] Computed using the number 1 equalling 1 caribou per person which approximates results of subsistence use studies (J.M. Morris, unpubl. data); the subsistence harvest also assumes an unchanging population of subsistence users, availability, and need for caribou.

Table 3. Northern Alaska Peninsula reported harvest chronology by time period, 1983-87.

Year	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Unk.	Total
1983-84[a]	76[b]	198	126	75	23	7	65	44	25	639
1984-85	167[c]	296	111	102	13	2	25	26	1	743
1985-86[a]	93[d]	288	163	97	8	13	28	61	--	751
1986-87	186[d]	257	96	74	37	10	19	38	--	720
1987-88[a]	131[d]	310	231	192	57	8	5	67	2	1,003

[a] Concurrent brown bear season

[b] One caribou August bag limit

[c] Four caribou August bag limit

[d] Two caribou August bag limit

STUDY AREA

GAME MANAGEMENT UNITS: 9D and 10 (Unimak Island only)
(10,000 mi^2)

HERD: Southern Alaska Peninsula

GEOGRAPHICAL DESCRIPTION: Southern Alaska Peninsula and Unimak Island

BACKGROUND

The range of the Southern Alaska Peninsula Caribou Herd (SAPCH) includes Unimak Island and extends northward to Port Moller Bay. Historically, the size of caribou populations on the Peninsula have fluctuated widely. The SAPCH's population highs occurred prior to the turn of the century and again in the late 1920's. The most recent population lows occurred in the late 1940's or early 1950's, with an estimated 500 animals on the mainland and 500 animals on Unimak Island. In 1976 there were an estimated 4,000 animals on the mainland portion and 5,000 animals on Unimak Island. Since then the relative distribution of herd changed; i.e., in 1983 an estimated population of 10,200 animals on the mainland and 300 animals on Unimak Island. A census in October 1987 resulted in a population estimate of 6,400 caribou on the mainland (Table 1).

The SAPCH had a harvest high of approximately 900-1,100 animals in 1983. With more restrictive hunting regulations a harvest low of 130-180 caribou occurred in 1987 (Table 2). Range conditions are believed to be stressed for the mainland portion of the herd.

POPULATIONS OBJECTIVES

To maintain the midsummer population at 5,000-6,000 caribou and an October sex ratio of 40 bulls:100 cows.

METHODS

With the aid of radiotelemetry, direct photocensus surveys are usually conducted in late June on postcalving concentrations. Fall sex and age composition surveys are usually conducted in October and early November. General reconnaissance flights (i.e., radiotelemetry) are conducted throughout the year to monitor herd movement. In 1986 and 1987 late-fall surveys were conducted along systematic transects by the staff of the Izembeck National Wildlife Refuge (Izembek NWR). The harvests are monitored by harvest tickets as well as hunter checks at Cold Bay.

RESULTS AND DISCUSSION

Population Status and Trend

The Unimak Island portion of the SAPCH has had low numbers (i.e., 300 caribou) since the early 1980's showing no signs of herd growth. The mainland portion of the herd probably stopped growing in about 1983, when 10,200 animals were counted. Since then the herd has been in decline (Table 1).

Population Size:

Survey conditions in June 1988 were good, although clouds and winds near mountains prevented total coverage. All of the radio-collared animals were located, and caribou were found in large postcalving concentrations. A total of 3,407 caribou were counted in the SAPCH, representing the lowest number recorded during the 1980's. A more extensive survey in October 1987 resulted in a count of 6,400 caribou. Actual herd size is probably closer to the October 1987 count than to the one in June 1988.

Population Composition:

The mainland segment of the SAPCH (i.e., 1,769 caribou) was classified in October 1987 as follows: 16% calves, calf:cow ratio of 26:100 and bull:cow ratio of 36:100 (Table 1). Photos from the June 1988 census showed 16% calves in the postcalving aggregations (n = 1,162).

Distribution and Movements:

The SAPCH calves in the eastern portion of the range near the Black Hills and Caribou River. Calving on Unimak Island occurs in the eastern portion of the island about 1 week later than that for mainland populations. The majority of the mainland portion of the SAPCH winters in the western portion of the area between Cold Bay and the Black Hills. During October 1987, staff of Izembeck National Wildlife Refuge accounted for 4,732 (73%) and 1,669 caribou (27%) west and east of the Black Hills, respectively.

Mortality

Season and Bag Limit:

Although the open season for subsistence, resident, and nonresident hunters in Subunit 9D had been established at 10 August to 31 March, 10 August to 31 October, and 1 September to 31 October, respectively, they were altered by Emergency Order. The bag limits for all hunters in Subunit 9D were also changed (see Game Board Actions and Emergency Orders, p.28) from the established 2 caribou for subsistence and resident hunters and 1 caribou for nonresident hunters. The open

season for all hunters on Unimak Island (Unit 10) is 10 August to 31 March; the bag limit is 4 caribou.

Human-induced Mortality:

During the reporting period the reported harvest for the SAPCH was 81 caribou (Table 2); i.e., 41 males (51%) and 40 females (49%). This low harvest reflects the Emergency Order closing the season from 1 September to 17 November.

As has been noted for the Northern Alaska Peninsula Caribou Herd, the reported caribou harvest did not appreciably increase during odd-numbered years; i.e., those concurrent with October brown bear seasons (Tables 3). The 1987 caribou season was closed in Subunit 9D during the brown bear season.

The harvest chronology for the SAPCH generally corresponded with the least-expensive hunter access; hunting occurred mostly in November and December while the herd was available along the road system during it's migration to the wintering areas near Cold Bay (Table 3).

Natural Mortality:

Although specific data on natural mortality is lacking, both predation and nutritional status needs to be evaluated. Since 1983 the percentage of calves (6-8%) for the mainland segment of the SAPCH (Table 1) has been substantially lower than that for the corresponding NAPCH (25-30%). The reason for the chronic low calf production in the SAPCH is unknown; calf production may be related to range and weather conditions as well as predation.

Adult mortality for the SAPCH may have exceeded 30% for this reporting period, if one assumes that uncollared caribou have the same mortality as radio-collared animals; e.g., of 20 and 10 caribou radio-collared in April and October 1987, six and four were dead by June 1988, respectively.

Habitat

From general observations during photocensuses conducted in June 1987 and 1988, it appeared that plant phenology on the range of the SAPCH was behind that occurring north of Port Moller. Robustness of animals sometimes correlates with range and/or climatic conditions. It appeared that NAPCH was in better condition than the SAPCH, when animals were compared during radio-collaring and transplanting activities.

Game Board Actions and Emergency Orders

Game regulations for the SAPCH in Subunit 9D and Unit 10 (Unimak Island) were relatively stable and consistent with those for the NAPCH until 1986, when an Emergency Regulation in November reduced bag limits to 1 caribou in Subunit 9D and Unit 10 (Unimak Island). For 1987 the bag limit for Subunit 9D was 2 caribou for subsistence hunters and 1 caribou for all other hunters; however, on 31 August 1987 the season was closed by Emergency Order to all hunting. Following the Izembek NWR October census, the subsistence hunting season in Subunit 9D was reopened by Emergency Order: 17 November to 17 January with a bag limit of 2 caribou.

The reasons for the closing and reopening of the season in Subunit 9D was concern for possible overharvesting. The herd had been censused in November 1986 and June 1987; i.e., 4,543 and 4,067 caribou, respectively. These counts led ADF&G staff to believe the herd was below the minimum objective of 5,000 and still declining; however, in November 1987 Izembeck NWR staff counted 6,400 caribou. Accordingly, the hunting season was reopened for subsistence hunting with a bag limit of 2 caribou.

CONCLUSIONS AND RECOMMENDATIONS

I recommend continuing the objective of reduced harvests by retaining the 1988-89 hunting regulations for the 1989-90 season. It is critical to obtain good information on general herd and range condition as well as specific data on animal condition and body size. Studies in Norway have demonstrated that poor range conditions resulted in reduced female body size and decreased calf recruitment (Skogland 1983, 1984). These studies used caribou jaw-length measurements to obtain relative body size of female caribou. Hopefully, by correlating jaw length data over time, much of the objective of obtaining a useable trend in herd health in relation to range carrying capacity can be economically obtained.

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_____. 1984. The effects of food and maternal conditions on fetal growth and size of wild reindeer. Rangifer 4: 39-46.

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Table 1. Caribou composition counts, total counts, and population estimates for Subunit 9D, 1983-88.

Date	Males:100 females	Med./Large male%	Calf: 100 females	Calf %	Sample size	Total count	Estimated pop. size
1/83	--	--	--	--	--	5,641[a]	5,641+
6/83	--	--	--	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	13	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]	4,008

[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 for Subunit 9D; 1983-87.

Year	Male	Female	Total[a]	Subsistence and sport	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

[a] Includes unknown sex.

Table 3. Reported harvest chronology by time period for Subunit 9D, 1983-87.

Year	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Unk.	Total
1983-84[a,b]	4	17	24	158	28	11	6	3	3	254
1984-85[b]	5	12	27	179	131	26	9	3	--	392
1985-86[a,b]	2	16	30	97	123	54	14	9	--	345
1986-87[b,c]	1	8	8	8	11	9	9	0	--	54
1987-88[a,d,e]	2	0	0	21	14	44	--	--	--	81

[a] Concurrent brown bear season

[b] Bag limit of 4 caribou

[c] Bag limt reduced to one caribou in November by emergency order

[d] Bag limit of 2 caribou for subsistence, 1 caribou for all others

[e] Season closed August 31 and reopened November 17 by emergency order

STUDY AREA

GAME MANAGEMENT UNIT: 10 (Adak Island only) (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 a recreational resource for military personnel stationed there.

The herd grew rapidly, reaching 189 caribou by 1967. Because of the high productivity of the herd and the lack of predators, human harvest was the only feasible method of controlling 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 annual harvest approached 100. Since then, the posthunting population size has ranged from 200 to 300 caribou and the harvest from 69 to 149 per year.

Adak has proven to be a difficult area to manage caribou. The island's notoriously fickle weather and its physical distance from human population centers often make research and hunting prohibitively expensive. Management has only been possible because of the cooperative efforts of the Alaska Department of Fish and Game (ADF&G), the U.S. Fish and Wildlife Service (FWS), and the U.S. Navy. The Department's management objective has been to provide for an optimum harvest of caribou. By maintaining the herd size below the carrying capacity through hunting, the range quality is expected to remain high and the herd is expected to maintain high productivity.

POPULATION OBJECTIVE

To maintain the precalving population at 150 animals.

METHODS

Aerial surveys of the Adak Island Caribou Herd 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 and caribou jaws are collected from hunters by the FWS at Adak and are sent to a Department biologist in Anchorage for analysis.

RESULTS AND DISCUSSION

Population Status and Trend

The estimated posthunting caribou population on Adak island has ranged from 177 to 300 from 1978 to 1987. Because of the lack of comparable survey data, no objective determination about recent trends can be made; FWS biologists stationed on Adak believe the herd has increased during the past few years.

Population Size and Composition:

The most recent survey of the Adak caribou herd was conducted in August 1985 (Table 1). At that time the herd was estimated to contain between 420 and 500 caribou. Sex and age composition data have not been collected for the past 5 years.

Distribution and Movements:

Caribou are distributed throughout Adak Island, but most of the herd resides on the south end of the island, away from the Navy base. Specific calving areas are believed to be in the upper Hidden Bay 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 121 caribou, including 65 males (54%) and 56 females (46%), from Adak Island during this reporting period, representing the lowest reported harvest for a complete season since 1978 (seasons were closed by Emergency Order for part of the 1982-83 season and all of the 1983-84 season). The sex ratio of the 1987-88 harvest is comparable to that reported for the previous 3 seasons (Table 2). Age data were not analyzed for caribou harvested in 1987-88 (Table 3).

Hunter Residency and Success. Personnel from the Alaska Maritime NWR at Adak Island issued 335 registration permits (Hunt No. 550) to 238 Alaska residents (71%) and 97 nonresident military personnel (29%). All but one of the permittees reported residing on Adak Island. Of the permittees who reported hunting (n = 232), 80 (34%) were successful and 152 (66%) were unsuccessful. About half (49%) of the successful hunters killed 1 caribou, and about half (51%) killed two. The mean number of days spent hunting by

successful hunters was 6.3 days; unsuccessful hunters spent an average of 5.7 days hunting.

Harvest Chronology. Sixty-nine percent of the harvest occurred during the first 3 months of the season. October and November were the most productive months, accounting for 51% of the harvest. Only 10% of the reported harvest was taken during the last 2 months of the season.

Transport Methods. Data on modes of transportation used by caribou hunters on Adak Island 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 the Adak Island caribou population would experience a population crash similar to that observed on Saint Matthew Island in the mid-1960's (Klein 1968), if it was not maintained at or below the carrying capacity of their range. This capacity has never been determined, but for management purposes the posthunting season population goal was set at 250 caribou. In 1980 the population objective was revised to a more conservative level of 150 caribou. In 1981 FWS initiated a research project entitled "Caribou Herd Productivity and Range Investigation". Results of that investigation were never published.

Game Board Actions and Emergency Orders

An Emergency Order closing the Adak Island 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 because a large portion of the herd had not been surveyed in 1982 and 1983, 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 Island from 4 to 2 caribou and that the hunt be administered by registration permit. The Board adopted these changes for the 1983-84 season. No Emergency Orders or Board actions have affected the Adak Island caribou hunt for the past 4 seasons.

CONCLUSIONS AND RECOMMENDATIONS

When caribou were transplanted onto Adak Island the potential for overpopulation and resultant range deterioration and caribou starvation were well understood. Since then there have been diligent efforts to census the herd, encourage hunting, and assess range condition. Efforts to obtain adequate population data are often hampered by poor weather and limited availability of aircraft. Hunting efforts are also hampered by weather, but they are 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.

In the past 3 years, there have been no surveys of the herd and the harvests have declined each year. Based on these data and the opinions of FWS biologists stationed on Adak Island, it appears that the herd is above the objective level and continuing to increase. If these trends are actually occurring, the herd may reach a level that is unmanageable by public hunting alone.

I recommend 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. No recommendations to the Board on changes to seasons or bag limits can be made until a survey is conducted.

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Table 1. Population size of the Adak Island Caribou Herd in Unit 10, 1983-1987.

Survey date	Caribou observed	Estimated herd size
22 Aug 1983	177	197-236
9 Jul 1984	360	
22 Aug 1985	313	420-500
1986	--	--
1987	--	--

Table 2. Annual harvest of Adak Island caribou, 1983-1988.

Regulatory year	Male(%)	Female(%)	Total
1983-84[a]	0	0	0
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

[a] Season closed by Emergency Order.

Table 3. Ages, based on tooth eruption and wear, of caribou harvested on Adak Island, 1983-1988 (percent in parentheses).

Regulatory	Age of harvested caribou				
Year	Calf	Yearling	2 years	3 years	>3 years
1983-84[a]	--	--	--	--	--
1984-85	12 (10)[b]	38 (31)	28 (23)	20 (16)	24 (20)
1985-86	--	--	--	--	--
1986-87	16 (23)	16 (23)	4 (6)	13 (19)	21 (30)
1987-88	--	--	--	--	--

[a] Season closed by Emergency Order.
[b] Percentage of harvest in parenthesis.

STUDY AREA

GAME MANAGEMENT UNIT: 11 (13,257 mi²)

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 on the herd was available; however, there was some speculation that it was a remnant group of the 40-Mile Caribou Herd when it had moved 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 has varied from approximately 1,800 to 3,100 and averaged 2,500 caribou. Although there has been no obvious trend over this period, the data suggest a slight population increase in the mid-1980's, followed by a decline over the past year.

Hunting seasons were long and bag limits liberal during the 1960's and early 1970's, when regulations were standardized with those for the adjacent Nelchina Caribou Herd (NCH). From 1963 through 1972 seasons varied from 7 to 8 months, with a bag limit of 3 to 4 caribou. From 1968 through 1971 substantial numbers of Nelchina caribou wintered on and adjacent to Mentasta caribou range, and some of the caribou harvested on Mentasta range were probably Nelchina animals. Reported harvests for this period varied from 288 to 1,693 caribou. In conjunction with comparable regulatory changes for the NCH, beginning in 1972 the season and bag limit were reduced to 50 days in the fall and 1 caribou, respectively. Harvests were substantially reduced as a result, ranging from 81 to 236 animals per year from 1972 to 1976. Beginning in 1977 Mentasta caribou hunting was regulated by drawing permit only. These permits were instituted because of increasing harvests as well as an expected displacement in hunting pressure from Unit 13 to Unit 11 after the Nelchina permit hunt had 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 falls within the boundaries of Wrangell-Saint Elias National Park and Preserve (WRST), which was established in 1980.

POPULATION OBJECTIVES

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

METHODS

An aerial postcalving aggregation survey and associated postcalving and fall sex and age composition surveys have been conducted since 1983 (Table 1). The proportions of calves and bulls in the population were estimated from results of these surveys. These proportions were used, in conjunction with the postcalving cow base, to extrapolate a total fall population estimate. Aerial sex and age composition counts in the fall are also used to estimate herd composition and to evaluate calf production and survival. In the spring of 1987 an aerial sex and age composition survey was conducted to estimate the overwinter survival of calves.

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

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

The MCH was estimated at 3,159 in 1987, based on the postcalving aggregation count and fall sex and age composition survey conducted in June and October, respectively. I consider this estimate to be high, reflecting the high percentage of cows and low percentage of bulls in the postcalving survey (Table 1). This bull:cow ratio was probably biased as a result of focusing composition-sampling activity on the areas where most radio-collared cows were found. In prior years these surveys tended to be more widespread and more representative of the animals counted in postcalving aggregations. A comparison of the 1987 count with comparable counts in previous years (Table 1) is probably more indicative of population trend than the extrapolated herd estimates.

Population estimates obtained over the past 5 years are presented in Table 1, suggesting the MCH had been slowly increasing prior to 1986 or 1987. Postcalving aggregation counts and the proportion of calves in the herd (Table 1) suggest that the herd is decreasing. Over the 4-year period from 1981 to 1985 the MCH increased at an average annual rate of approximately 3%. This is a change from the lack of trend observed from 1975 to 1981. Although annual estimates are not always precise, the available data suggested that there was a positive growth trend in the mid-1980's. Because of poor calf survival in 1987, this trend appears to have been temporarily reversed. Based on an estimated herd

range size of approximately 3,700 mi^2, the density is approximately 1.2 caribou/mi^2.

Population Composition:

From 1983 to 1987 composition data collected during postcalving and fall sex and age composition surveys are presented in Table 1. The 1987 postcalving calf:cow ratio was 18:100, down substantially from the 1983 to 1985 average of 44 calves:100 cows. The 1987 fall survey resulted in a ratio of 12 calves:100 cows, also down from the 1983-85 average of 34 calves:100 cows.

Only 6 bulls:100 cows were observed in the postcalving composition survey, well below the 1983-85 average of 18 bulls:100 cows. In the fall survey 41 bulls:100 cows were observed, approximately the same as the 1983-85 average of 40 bulls:100 cows.

During the spring survey conducted in early May 1987, 13 calves:100 cows were observed. Because we radio-collared 10-month-old calves on the Mentasta range at that time, we discovered that substantial numbers of Nelchina juvenile caribou were present with the Mentasta herd. Because the NCH had a high calf:cow ratio of 50:100 in the fall; the derived spring ratio of calves:100 cows for the MCH is considered inflated.

Distribution and Movements:

Approximately 35 female caribou have been radio-collared as part of the MCH study. These animals were monitored on a monthly basis during 1987-88. Much of the distribution and movements observed in 1987-88 were similar to those observed over the past 5+ years.

In early July radio-collared cows were distributed on their postcalving grounds from the Nadina River north and east to the Upper Copper River in an elevational zone of 1,800 to 5,000 feet ($\underline{x}$ = 4,900 ft). Areas of use were characterized as brushy and timbered flats and benches to high tundra slopes and ridges. In mid-August these cows were found over much of the same range utilized during the early summer, but locations ranged from elevations of 1,800 to 7,200 feet and averaged 4,100 feet. This was the widest elevational distribution (5,400 ft) observed during the year. Thirteen radio-collared cows were located below an elevation of 3,600 feet in timbered or tall-brush habitat. By the end of September, with the snow line at about 4,000 feet, animals had shifted downhill and to the northeast; about 65% of the radio-collared animals were on the Drop Creek-Upper Copper River flats. A few animals were found on the flats from Moose Point to the Sanford River and south of the Sanford River to the Nadina River. Elevational distribution extended from 2,000 to 4,200 feet ($\underline{x}$ = 3,100 ft).

By the first of November there was complete snowcover over the Mentasta range. About half of the radio-collared caribou were found on the east side of the Mentasta Mountains as far as the

lower Nabesna River. Most remaining radio-collared caribou were on the Drop Creek-Upper Copper River flats, and a few radio-collared animals were on the Sanford River Flats. Animals ranged from an elevation of 1,800 to 4,400 feet ($\bar{x}$ = 2,800 ft). By midwinter three-quarters of the radio-collared animals were on the east side of the Mentasta Mountains, utilizing an elevational band extending from 2,000 to 3,600 feet ($\bar{x}$ = 2,800 ft). During late winter (early March), animals began moving back west across the mountains, and by the end of the 1st week in March over three-quarters of the radio-collared cows were located on the west side of the Mentasta Mountains; most of these from Drop Creek to the Little Tok River divide. The elevational distribution ranged from 2,200 to 3,800 feet ($\bar{x}$ = 2,700 ft).

In mid-November 1987 Nelchina caribou were shifting into wintering areas. Most of the herd was spread out on the Lake Louise Flat, but about one-quarter were spread out in Unit 11 and adjacent portions of Subunit 13C, where there was apparent intermixing with Mentasta caribou. A few Nelchina caribou moved further east with most of the Mentasta caribou across the Mentasta Mountains and into the western drainages of the Nabesna and Tok Rivers. By early spring more Nelchina caribou had shifted east and approximately one-third of the herd was in the Upper Copper River area of Unit 11 with most of the Mentasta herd. Spring migration occurred in late April; Nelchina caribou left Unit 11 and crossed the Richardson Highway from Sourdough north to Meiers Lake.

These recent observations suggest that the level and frequency of past contact between Mentasta and Nelchina caribou may have been greater than formerly recognized. The effects of such common range use and intermingling on the smaller Mentasta herd is unknown.

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 1987 was 112 caribou for the combined drawing and registration permit hunts (Table 2). This harvest represented a 22% increase over the prior 4-year-mean annual harvest of 92 caribou. Since hunting became regulated by permit in 1977, the highest harvest has been 149 (1978).

The 1987 harvest was composed of 91 (81%) males, 20 (18%) females, and 1 (1%) caribou whose sex was not determined. The average percentage of males in the harvest from 1983 to 1987 was 76%.

Some illegal and unreported harvests of Mentasta caribou have been documented, but we have insufficient information to estimate total numbers. Few, if any, road kills occur with this herd because it seldom is found near roads.

Hunter Residency and Success. By law, only Alaskan residents can hunt the Mentasta herd; in 1987 local hunters took 17 and nonlocals 95 caribou (Table 3). For local hunters, this represented a decrease from the 1983-86 average annual harvest of 27 caribou. For nonlocals the 1987 harvest represented a substantial increase over the prior 4-year average of 65 caribou. The decreased harvest by local residents occurred because they hunted the adjacent, larger, and more accessible NCH instead. The increased harvest by nonlocal residents was due to their increased participation. Total hunter success in 1987 was 53%, about the same as the 52% mean for 1983-86.

Permit Hunts. From 1983 to 1987 the number of drawing permits issued has ranged from 170 in 1985 to 350 in 1983 and 1984. In 1985 all drawing-permit hunts were limited to qualified subsistence hunters; because many permit applicants chose to apply for the Nelchina hunt, only 170 applications were received for the Mentasta hunt. The number of sport-hunting permits available for drawing has not increased in recent years, because the herd has not grown enough to allow increased harvests.

The subsistence registration permit hunt was initiated in 1986. The number of hunters participating has remained small because of local preference for the Nelchina subsistence hunt. This latter hunt is preferred because (1) the NCH is larger and more accessible from the road system and (2) a winter season is offered. In 1986, 154 Mentasta permits were issued to qualified local residents, whereas in 1987, 64 permits were issued. The difference between these 2 years was caused by a delayed Nelchina caribou hunt opening in 1986, when locals 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 relate, in part, to changes in season dates of the sport and subsistence hunts. In general, harvests have been fairly evenly distributed over the hunting season; sport hunters have focused more effort during the portion of the season corresponding with the moose season. Subsistence hunters, on the other hand, have focused more effort prior to and after the moose season, possibly because of the greater convenience of living close to the Mentasta caribou range.

Transport Methods. Methods of transportation used by successful hunters are listed in Table 5. Subsistence hunters used airplanes less than sport hunters: 50% vs. 73%, respectively. Thirty-nine

percent of subsistence hunters used ORV's and highway vehicles, compared with 23% for sport hunters. Except for increased use of three- and four-wheelers, strong transportation trends were not apparent. Reduced use of ORV's by sport hunters after 1983 may have been related to restrictions instituted and enforced by the NPS.

Natural Mortality:

Predation by wolves and grizzly bears is a potentially significant mortality factor for the MCH. Wolf and grizzly bear harvests by sport hunters and trappers have been relatively low on the Mentasta range over the past few years. Land-and-shoot trapping was discontinued in the Wrangell-Saint Elias National Preserve in 1986, and available evidence suggests that these predators are at relatively high levels throughout the Mentasta range. Good calf production, but poor calf survival, was observed in 1987 (Lieb et al. 1989). We propose that the study be modified in subsequent years so that causes of calf mortality can be evaluated.

Habitat Assessment

A comparative study of the Mentasta range was initiated in 1982 by ADF&G and National Park Service to monitor successional development of undisturbed vegetation within exclosures and compare it with adjacent vegetation exposed to grazing and trampling. The study plan called for these exclosures to be examined every 5 years. 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. Little additional information concerning range condition 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 action by the Board of Game, hunting of the MCH was permitted only under a Tier II subsistence drawing-permit hunt for which all Alaskan residents could apply. Permit applications were graded according to a formula that favored rural residents dependent on game as the major portion of their diet and with few alternative available resources. Permits were issued to those with the highest scores. With only 170 applicants, all received permits.

In 1986 separate sport and subsistence hunts were instituted and 154 subsistence registration permits were issued. To accommodate the anticipated subsistence harvest while maintaining the harvest at 5% of herd size, the number of drawing permits was reduced from 350 to 275. In 1987 after reviewing the results of the 1986 Mentasta harvest, the Board increased the number of drawing permits

to 300. Concerned with the apparent reduction in herd size and poor survival of calves in 1988, 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 (i.e., Unit 12, Nelchina Caribou Herd) for residents of the Tetlin-Northway area. The winter hunt was requested by local residents after 7,000 NCH and 1,500 MCH caribou, respectively, migrated into the Tetlin flats area. A total of 85 permits for Nelchina caribou were allotted. In 1984 a 2nd winter hunt was held in the same area after about 1000 caribou migrated there. Ten permits were issued, but because only a few Nelchina caribou migrated east that winter, most animals harvested were from the MCH. No special hunts were authorized in 1985 and 1986. In 1987 a hunt was again requested by local residents, and the Board conditionally authorized 85 registration permits; the hunt could occur only if Mentasta caribou were not present in the hunt area. This condition was imposed because the hunt has the potential to adversely impact the Mentasta herd. 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 from the Mentasta caribou study, the Mentasta herd declined approximately 15% from 1986 to 1987 because of the poor survival of the 1986 calf cohort. This followed an approximate 3- to 4-year period during which the herd appeared to be increasing at the low rate of 3% per year.

Concerns and problems associated with management of the Mentasta herd include (1) accurately estimating population status and trend, (2) determining the extent and effects of common range use and interaction between Nelchina and Mentasta caribou, (3) managing predator populations at levels appropriate to the caribou management objectives, (4) providing for variable hunting demands in the face of declining numbers, (5) resolving Mentasta caribou use conflicts with the NPS, and (6) minimizing illegal harvests from this herd.

I recommend that we initiate an effort to determine the causes of neonatal calf mortality in this herd. Without this information we will not be in a position to consider remedial options. I also recommend that we continue to focus efforts on evaluating the extent and ramifications of common range use by Nelchina and Mentasta caribou and document any interchange between these two herds.

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Table 1. Mentasta caribou herd composition counts and population estimates, 1983-87.

Year	Calves:100 cows (summer)	Calves:100 cows (fall)	Calf % (fall)	Bulls:100 cows (summer)	Post-calving bulls:100 cows (fall)	Extrapolated aggregation count	Aggregation estimate
1983	36	28	16	16	44	2,667	2,766
1984	44	29	18	20	36	3,032	2,722
1985	51	46	25	17	41	3,108	3,140
1986	--	--	--	--	--	3,032[a]	--
1987	18	12	8	6	41	2,583	3,159[b]

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

[b] Thought to be a high estimate.

Table 2. Mentasta caribou herd harvest data by permit hunt, 1983-87.

Hunt No.	Year	Permits issued	Did not hunt	Unsucc. hunters	Successful hunters	Bulls	Cows	Total[a]
510	1983	350	158	89	90	66	24	90
	1984	350	142	87	119	84	34	119
	1985[b]	170	53	50	67	51	16	67
	1986	275	127	78	63	54	9	63
	1987	300	122	76	95	77	18	95
511	1986	154	44	56	29	23	6	29
	1987	64	20	24	17	14	2	17
510 & 511	1987	364	142	100	112	91	20	112

[a] Includes unknown sex.

[b] In 1985 Hunt No. 510 was a Tier II Subsistence Hunt for all Alaska residents.

Table 3. Mentasta caribou herd hunter residency and success, 1983-87.

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

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

[b] Includes unknown residency.

Table 4. Mentasta caribou herd harvest chronology percentages, 1983-87.

Hunt No.	Year	Week Ending 8/19	8/27	9/03	9/10	9/17	9/24	10/01
510	1983	--	30.1	9.1	20.5	12.5	5.7	21.6
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

[a] In 1985 season opened on 10 Sept.

[b] In 1986 season opened on 6 Sept.

Table 5. Tranportation methods used by successful hunters (%) of Mentasta Caribou, 1983-87.

Hunt No.	Year	Airplane	Horse	Boat	3- or 4-wheeler	Snow machine	ORV	Hwy vehicle	n
510	1983	59.1	6.8	0	0	0	20.5	13.6	88
	1984	86.4	2.5	0	2.5	0	5.9	2.5	118
	1985[a]	67.7	0	0	3.1	0	7.7	21.5	65
	1986	74.2	0	1.6	8.1	0	8.1	8.1	62
	1987	72.6	1.1	4.2	7.4	0	6.3	8.4	95
511	1986	53.6	3.6	0	7.1	0	10.7	25.0	28
	1987	47.1	11.8	5.9	17.6	0	11.8	5.9	17
510 & 511	1986	67.8	1.1	1.1	7.8	0	8.9	13.3	90
	1987	68.8	2.7	4.5	8.9	0	7.1	8.0	112

[a] Tier II Subsistence Hunt.

STUDY AREA

GAME MANAGEMENT UNIT: 12 (3,500 mi^2)

HERD: Chisana (includes some information on Macomb Plateau, 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 herd caribou are present in Unit 12 year round, and some Mentasta herd caribou may also be year-round residents. Caribou were more abundant in Unit 12 in the 1960's than now, particularly caribou associated with the Nelchina herd that frequents the eastern Alaska Range. Skoog (1968) estimated the Chisana herd at 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 Herd 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 recently 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, which divides Unit 12 and Subunit 20D. During the past 4 years, however, Macomb caribou have moved eastward as far as Moon Lake in fall and early winter; as many as 400 caribou have been 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 staff from the National Park Service's (NPS) Wrangell-Saint Elias National Park/Preserve was initiated in October 1987. Fifteen female caribou were darted and radio-collared to determine seasonal movements, calf production and survival, and adult mortality as well as to facilitate spring and fall composition counts. A similar Department effort was also initiated on the Macomb herd in the spring of 1988. The Glennallen area office staff is also involved with monitoring collared Nelchina caribou and is cooperating with NPS in a baseline study of the Mentasta Herd.

MANAGEMENT OBJECTIVES

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

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

To maintain annual harvests of no more than 5% of the herd.

METHODS

There has never been an intensive photocensus of the Chisana Caribou Herd, because knowledge of when or where these caribou aggregate has been lacking. If possible, a census will be conducted in the future to determine herd size.

We conducted a sex-age composition survey by helicopter in October 1987 to determine bull, small (yearling) bull, and calf:100 cow ratios and the percentages they present in the population. We also conducted a May 1988 sex and age composition survey to document calf production and early calf survival. Cows were also classified as having or not having distended udders so that an estimate of the pregnancy rate could be made.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

Approximately 900 caribou ≥12 months of age were counted while in the company of 8 of the 12 collared caribou in June 1988, or about 113 caribou per collared caribou. On this basis, the Chisana herd probably numbered 1,350 adults in the spring of 1988. If this estimate is accurate, present herd size is very close to the objective of 1,500 to 2,000. To date, no photocensus of the herd has been conducted to verify this estimate. The recent trend of the herd is not known, but residents of Chisana believe that the herd is increasing slowly.

Population Composition:

The fall 1987 composition survey was conducted from 8 to 10 October (Table 1). The calculated bull:cow ratio of 39:100 was very close to the minimum population management objective of 40:100.

Although calves composed 15% of 313 caribou classified on 24 May 1988 (Table 2), most cows still had hard antlers, the peak of calving was about 24 May, and many of the calves had not been born. One hundred and five of 157 cows (67%) had distended udders, indicating they had or would bear a calf. Pregnancy rates in most Interior caribou herds exceed 80%, indicating that either the pregnancy rate of the Chisana Herd is relatively low or that counts were conducted too early (all udders not yet distended).

Distribution and Movements:

The Chisana herd is essentially nonmigratory, inhabiting the area east of the Nabesna River (i.e, well into Canada), north of the crest of the Wrangell Mountains, and south of the Northway Flats.

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 1987 (Table 3); this is only slightly greater than the 5-year mean of 43 bulls per year. If the herd numbers approximately 1,200 adults, the 4% rate of harvest in 1987 satisfied the population management objective of limiting annual harvests to below 5% of the herd.

In addition to those caribou taken from the Chisana Herd in 1987, hunters reported taking 15 bulls from the Mentasta Herd in the Nabesna Road area, seven from the Macomb Herd in the Cathedral and Sheep Creek area, and two from the Nelchina Herd in Gillette Pass, representing a total reported harvest of 73 bull caribou for Unit 12 (Table 4). No caribou were reported harvested from the Fortymile herd in Unit 12 in 1987, because it ranged well north of Unit 12 during the season. While reporting by Chisana caribou hunters is believed to be high because many of them are nonresidents hunting with guides, the same cannot be said for hunters seeking caribou elsewhere in Unit 12. Observations indicated a harvest of approximately 20 caribou from the Macomb herd in Unit 12, yet only 7 successful hunters reported (Table 4). The fall of 1987 was the 1st year that local hunters discovered these animals just south of the Alaska Highway.

Nearly all 15 Mentasta herd caribou harvested were taken in the vicinity of the Nabesna Road. This harvest compares with reported harvests of 12 in 1986 and 30 in 1985. I believe that nonreporting is at least as bad as in other areas (about 40%), so an additional 5 to 20 caribou may have been killed.

There appeared to be a high incidence of caribou poaching in the Northway-Tetlin Flats (i.e, where Mentasta herd caribou wintered) in the winter of 1987-88. Numerous wandering snow machine trails in the vicinity of both Northway and Tetlin were observed throughout the winter, and 3 dead caribou were seen from the air. One poacher from Northway killed 2 caribou in the same area near the Nabesna River but failed to salvage the meat from either

carcass. Additionally, hunting effort was directed toward both Mentasta and Nelchina caribou in conjunction with funeral potlatches during winter. The harvests were not reported.

Hunter Residency and Success. No data were available concerning the residency status caribou hunters in Unit 12 because harvest reports were not cross-referenced with overlays. However, it is known from past analyses that a high proportion of successful hunters in the Chisana area are guided nonresidents. Because the Nabesna Road area does not appear to be that popular with nonresidents, it is assumed that most caribou from the Mentasta Herd are taken by residents. The situation for the Macomb herd is similar to that of the Mentasta herd.

One hundred forty-three hunters reported hunting caribou in Unit 12 during the 1987 season; 73 caribou were harvested, for a 51% rate of hunter success. Reported hunter success was 84% for the Chisana herd, 37% for the Macomb herd, and 34% for the Mentasta herd. Two Nelchina herd caribou were reportedly taken by 3 hunters. These hunter success rates are most likely biased on the high side, because it is believed that a lower proportion of unsuccessful hunters return harvest reports than do successful hunters.

Harvest Chronology. Most caribou (72%) were taken during the 1st week of the season (1-6 Sep); 25% were harvested during the 2nd week (7-13 Sep), and 21% during the last week (14-20 Sep).

Transport Methods. Most successful hunters of Chisana caribou used aircraft for access (45%), followed by horses (37%), three- or four-wheelers (14%), boats (2%), and unknown transportation (2%). The Chisana herd inhabits a fairly remote area, and virtually all hunters reach the area initially by aircraft. Nonresidents generally reach the caribou using aircraft and horses provided by their guides, while resident hunters use aircraft or three- and four-wheelers.

Because of easy road access, most successful hunters of Mentasta herd caribou used highway vehicles (61%), followed by horses (17%), airplanes (11%), and three- or four-wheelers (11%). Successful hunters of the accessible Macomb caribou used either highway vehicles (86%) or three- and four-wheelers (14%). One Nelchina caribou was taken by a hunter using an ORV and other by a hunter using a highway vehicle.

Natural Mortality:

I believe that predation is the greatest source of natural mortality affecting caribou in Unit 12, based upon incidental observations of caribou kills. 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 over the winter.

Field notes taken during the May 1988 survey during the peak of calving in the Chisana area indicated the observation of 9 golden eagles, two of which were actively trying to kill a newborn calf; 1 wolf; 1 coyote; and both grizzly bear and wolf tracks.

Predation losses of both calf and adult caribou are probably contributing to the recent decline of the Mentasta Caribou Herd. Wolf density in wintering areas in the Mentasta Mountains and the Northway-Tetlin Flats is moderately high. It is likely that the combination of winter predation by wolves and illegal harvest by humans has resulted in a relatively high loss of Mentasta caribou in Unit 12 during the winter of 1987-88.

Habitat

Assessment:

No quantified assessment of caribou range has been conducted; however, P. Valkenburg (pers. commun.) suggested 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. 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 caribou. This herd has only wintered in Unit 12 in noticeable numbers since the early 1980's, so winter range conditions are probably good.

Enhancement:

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 in preserves.

CONCLUSIONS AND RECOMMENDATIONS

The Chisana Caribou Herd appears to be a small resident herd that is either stable or growing slowly. Present regulations have resulted in the maximum allowable harvest of this herd and have met suggested population management objectives. There may be some room for herd growth if it 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, 1977-87.

Year	Bulls: 100 cows	Small bulls: 100 cows	Calves: 100 cows	% Yrlgs (n)	% Calves (n)	Bulls: % Cows (n)	Bulls: % Bulls (n)	% Small (n)	% Med (n)	% Large (n)	Total caribou
1977	41		44	6 (15)	22 (61)	51 (139)	21 (58)				273
1978	34		18	6 (6)	11 (11)	62 (62)	21 (21)				100
1980					14.4 (84)	73.4 (427)[a]				12.2 (71)	582
1982	36	12	21	16 (64)[b]	13 (54)	64 (261)	23 (94)	8 (32)	19 (42)	5 (20)	409
1986	43	8	33	9 (48)[b]	19 (94)	57 (288)	23 (125)	5 (24)	13 (64)	7 (37)	507
1987	39	21	28	25 (188)[b]	17 (126)	60 (456)	23 (178)	12 (94)	6 (47)	5 (37)	760

[a] Includes cows and small and medium bulls.

[b] Calculated by doubling number of small bulls.

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

Year	% Yrlgs (n)	% Calves (n)	% Adults (n)	Unidentified	Total caribou
1976		20 (41)	80 (167)		208
1978		9 (30)	91 (286)		316
1980		12 (16)	88 (121)		137
1981		15 (66)	85 (360)		426
1982[a]		13 (34)	87 (225)		259
1983		16 (26)	74 (136)	100	263
1984		15 (49)	85 (268)		317
1987		17 (88)	83 (436)		524
1988[b]	27 (84)	15 (46)	85 (267)[c]		313
$\bar{x}$		15	85		

[a] March survey 1981, calves were 9 months old.

[b] May survey, calving not yet completed (105 of 157 cows with distended udders).

[c] Includes yearlings.

Table 3. Reported caribou harvests from the Chisana herd, Unit 12, 1983- 87.

Year	Bulls	Total hunters	% Success
1983	28	28	100
1984	31	43	72
1985	65	90	72
1986	41	45	91
1987	49	58	84
$\underline{x}$	43	53	84

Table 4. Caribou harvests from all herds in Unit 12, 1987.

Herd	Reported harvest	Total hunters	% Success	Estimated harvest		
				Unreported	Illegal	Total
Chisana	49	58	84	5-10	5	59-64
Mentasta	15	59	34	5-20	10-30	30-65
Macomb	7	19	37	10-12	2-3	19-22
Nelchina	2	3	67	0	0	2
Fortymile	0	0	0	0	0	0
Total	73	143	51	20-42	17-38	110-153

STUDY AREA

GAME MANAGEMENT UNITS: Portions of 12 and 20D (1,900 mi^2)

HERD: Macomb Plateau

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 hunting 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 to 1 caribou 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 (Mile 1357.3). In 1974 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 (Larson 1976).

Hunting pressures 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 the 1974 levels. In 1976 there were 70% more hunters than in 1975 (Larson 1977). By 1975 the MCH totaled 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. Despite the larger known herd size, the harvest equalled or exceeded recruitment.

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

In addition to concerns about excessive harvest of Macomb caribou, there were concerns that predators were limiting the herd. Predator control in the eastern Alaska Range during the winter of 1980-81 removed most of the wolves that preyed on Macomb caribou; fall calf survivals increased from 13 calves:100 cows in 1980 to 33 calves:100 cows in 1981.

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

Previous management objectives for the MCH (ADF&G 1976) included maintaining a population of at least 350 caribou in Subunit 20D south of the Tanana River. This herd size was based upon incomplete data on the movements and identity of the MCH. Information gathered from local residents suggests that historically there were many more caribou between the Robertson and Delta Rivers than there are today. I therefore revised the population size objective upward to between 1,000 and 1,500 caribou. At the present 6% annual rate of increase, the lower boundary of this goal would be met by about 1993.

MANAGEMENT OBJECTIVES

To increase the size of the MCH to 1,000-1,500 caribou by 1997 by maintaining a minimum finite rate of growth of 1.05 (5%) annually.

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

METHODS

Thirteen female caribou were captured and radio-collared on 27 April 1988. The caribou were captured with a helicopter-mounted capture net operated by staff from Soloy Helicopters of Wasilla, Alaska. Terrain on the Macomb Plateau was ideal for use of the capture net; it was relatively level and there were no trees or woody vegetation to hang up the net. Data collected on each caribou included weight; neck circumference; girth; and length of the metatarsus, hind foot, and jaw.

A photocensus was conducted on the MCH on 29 June 1988. A pilot-observer team in a Bellanca Scout searched for caribou from the Johnson to Robertson Rivers. This team located aggregations of caribou by radio-tracking and by visually searching. A 2nd pilot-observer team in a Piper Super Cub searched west of the Johnson River, including the drainages of the Gerstle and Little Gerstle Rivers, upper Jarvis Creek, and upper McCumber Creek and the Granite Mountains; this team visually located caribou only. Aggregations of approximately 1-25 caribou were counted visually by both teams. Larger aggregations were photographed with a 35-mm camera.

RESULTS AND DISCUSSION

Population Status and Trend

The size of the MCH has generally been reported at 700 to 800 caribou since 1975; its size was stable or decreasing from 1972 to 1983 and stable or increasing slowly from 1984 to 1987.

Population Size:

The 29 June 1988 photocensus resulted in a count of 713 caribou. The actual population is at least 800 caribou. The herd had a finite rate of growth of approximately 1.06 (6%) from October 1985 to June 1988.

The most Macomb caribou counted prior to June 1988 was 610 during an October 1985 photocensus, when 2 pilot-observer teams in 2 Super Cubs spent approximately 9 hours searching under excellent survey conditions. Therefore, the June 1988 and October 1985 results are considered comparable.

Conditions were excellent for the photocensus; the sky was clear, temperature was +55 F on the Macomb Plateau, and winds were calm in the morning and 5-8 miles/hour in the afternoon. There was no turbulence in the morning; light turbulence occurred in the afternoon. Insects were out, and caribou were found predominantly on snow banks at elevations of approximately 3,200 to 5,300 feet.

The 2 aircraft spent approximately 6.5 hours searching from the Robertson River to upper Jarvis Creek. Aggregations of cows ranged from 1 to 313. Aggregations of bulls ranged from one to nine. Because bulls were scattered in smaller aggregations than cows, a larger percentage of them may have been missed.

Population Composition:

No sex and age composition data were collected in 1986 or 1987. From 1981 to 1985, the mean bull:cow ratio was 38:100 (range = 21-53) and the mean calf:cow ratio was 31:100 (range = 27-40) (Table 1).

Distribution and Movements:

Radio-collared caribou were located 5 times from 17 May to 29 June 1988 to determine the peak of calving and the location of the herd during calving. During May radio-collared cows were located between the Johnson River and Bear Creek. At the peak of calving on 25 May, 2 adult females were located on the Macomb Plateau, three were located in the Johnson River drainage from upper Elting Creek to near Prospect Creek, and four were located in the upper Bear Creek drainage. One nonpregnant adult and 2 subadult cows

tended to remain on the Macomb Plateau during this time, while 2 other subadult cows were located in Berry and Bear Creeks.

Distribution of radio-collared cows during June was similar to their distribution during May. With 1 exception, all radio-collared cows were located between the Johnson River and Bear Creek on 10 and 29 June. The exception was a cow that had been located on the Macomb Plateau in late May, could not be located on 10 June, and was located again in the Gerstle River on 29 June.

During the 29 June photocensus, caribou were distributed from Bear Creek on the east to Jarvis Creek on the west. No caribou were observed in the Robertson River. Cows and calves were found predominantly east of the Johnson River. Bulls were found predominantly west of the Johnson River. Eight of 14 radio-collared cows were located in 1 aggregation of 313 caribou in Bear Creek. Two other radio-collared cows were also located in Bear Creek in different aggregations.

Approximately 200-250 Macomb caribou moved out of Subunit 20D and into the Yerrick Creek area in Unit 12 during September 1987 (D. Kelleyhouse, pers. commun.). Air taxi operator Ron Warbelow (Cassaron Helicopters, Tok, Alaska) thinks the caribou moved into Yerrick Creek on 12 or 13 September. This is not the 1st time Macomb caribou have moved into Yerrick Creek, but it is the largest number of caribou to have made the move. Approximately 20 Macomb caribou were in Yerrick Creek during the fall of 1985, and 70 were in Yerrick Creek during the fall of 1986 (D. Kelleyhouse, pers. commun.).

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:

Hunters with Macomb permits reported killing 33 caribou during the 1987 season. This is the second-largest harvest by permit hunters since the drawing-permit hunt began in 1978 (Table 3). The large 1987 harvest is attributed to an increasing number of permits and hunters as well as herd size, resulting in higher success rates among hunters. The second-largest harvest in 1982 was attributed to mild September weather that prolonged good hunting conditions.

An additional 7 Macomb caribou were harvested in Unit 12 when the herd moved toward Yerrick Creek. Although 2 unreported harvests

have been verified, D. Kelleyhouse (pers. commun.) estimates as many as 20 Macomb caribou were killed in Unit 12.

The subsistence harvest in 1987 was 4 bulls. During the 1986 subsistence registration hunt, 6 subsistence hunters killed 1 caribou each. Based on reported harvest in Subunit 20D and Unit 12, the subsistence harvest, and the additional harvest reported by D. Kelleyhouse, a total of 57 Macomb caribou (7% of the herd) were taken during the 1987 hunting season.

Hunter Residency and Success. The number of nonlocal hunters pursuing Macomb caribou has been declining steadily. During 1987, 81% of the permit hunters were locals (Table 4). Only 1 nonresident hunted during 1987, and only three have hunted in the last 3 years. Hunting caribou in the MPCUA is extremely difficult, and the access restrictions may have discouraged nonlocals from hunting.

Hunter Effort. Forty-seven percent of Macomb caribou permit hunters were successful (Tables 3 and 4). This is the highest success rate since 1982. Successful hunters spent a mean of 3.1 days in the field and unsuccessful hunters a mean of 4.3 days (Table 5). There is no clear trend in mean days hunted. As the herd size increased, hunter effort should have decreased instead of increasing; however, weather and herd movements have had a significant influence on hunter effort. There are relatively few good access points onto the Macomb Plateau, and hunters do not walk very far from those points. Therefore, if caribou are not readily available near the main access points, hunters will spend more time waiting for them.

Permit Hunts. The Department received 199 applications for 150 Macomb permits (Table 6), resulting in 1.3 applications for each permit. This is the lowest interest expressed in the Macomb permit hunt since 1979, excepting 1985 when local residents received a subsistence priority.

Forty-seven percent of the people receiving permits hunted. Hunt reports were returned by 128 of the permittees (85%). No reminder letters were sent to the 22 permittees who did not return hunt reports.

Harvest Chronology. Most caribou (73%) killed during the permit hunt were killed during the 1st 20 days of the season (Table 7). Most permit hunters hunted during August, because weather can be poor on the Macomb Plateau in early September.

Transport Means. Highway vehicles were used for access to Macomb caribou by 47% of the hunters with permits (Table 8). This is slightly less than in previous years. The decrease in use of highway vehicles is accounted for by the slight increase in hunters using three- or four-wheelers for access to areas in southern Subunit 20D outside the MPCUA.

Caribou Harvest Locations. Most hunters with Macomb permits (83%) hunted on the Macomb Plateau, and 82% of the caribou killed by Macomb permittees were killed there. Thirteen percent of the permit hunters reported hunting outside the MPCUA in areas such as the Granite Mountains and the Little Gerstle, Gerstle, and Johnson Rivers. Hunters outside the MPCUA are probably responsible for the increase in the use of three- or four-wheelers for hunting Macomb caribou (Table 8). Hunters who reported harvesting Macomb caribou in Unit 12 outside the permit area killed them in the area of Sheep Creek, Cathedral Bluffs, and the Robertson River.

Natural Mortality:

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

CONCLUSIONS AND RECOMMENDATIONS

The Macomb Plateau Herd appears to be slowly increasing. Since 1975 the size of the herd has been estimated at 700-800 caribou; however, the accuracy of that estimate is unknown. Because bulls and cows were separated so widely during the June census, another photocensus should be conducted during October 1988 to confirm the population estimate.

If interest in acquiring a Macomb permit remains low and limited primarily to local hunters, it may be possible to eliminate the permit requirement for the MCH. However, permits should be continued at this time to determine if future harvests will continue to be as large as that in 1987 and if subsistence hunting accounts for an insignificant portion of the total harvest.

Herd movements should be monitored during the 1988 hunting season to determine if Macomb caribou move into Unit 12. If they continue to move into Unit 12 during the hunting season, it may become necessary to close the hunting season by Emergency Order along the north face of the Alaska Range, west of Yerrick Creek. A long-term solution to this problem would be to 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 summary of sex and age composition of the Macomb Caribou Herd, 1974-88.

Date	Bulls: 100 cows	Yrlgs: 100 cows	Calves: 100 cows	% Yrlg in herd	% Calves in herd	% Cows in herd	No. cows	% Sm bulls in herd	Sm bulls	% Med bulls in herd	Med bulls	% Lg bulls in herd	Lg bulls	% Total bulls in herd	Sample size
10/25/74	43	8	15	5	9	60	269	--	--	--	--	--	--	26	445
10/16/76	41	13	20	8	12	57	159	--	--	--	--	--	--	23	277
10/21/77	42	18	32	9	17	52	167	--	--	--	--	--	--	22	321
10/26/78	--	--	--	--	12	--	--	--	--	--	--	--	--	--	234
11/14/78	--	--	--	--	12	--	--	--	--	--	--	--	--	--	234
10/80	--	--	--	--	--	--	--	--	--	--	--	--	--	--	306
11/13/81	53	20	33	10	16	48	215	--	--	--	--	--	--	26	445
10/82	20	13	26	--	18	68	148	63	19	30	9	10	3	14	217
05/31/83	--	--	16	--	14	86	116	--	--	--	--	--	--	--	135
10/83	33	16	24	--	15	64	152	48	24	--	--	--	--	21	238
05/20/84	6	--	85	--	44	52	33	--	--	--	--	--	--	3	63
06/11/85	--	--	38	--	28	72	374	--	--	--	--	--	--	--	516
10/30/85	45	19	31	--	17	57	295	43	57	38	50	20	26	26	518
06/11/87	1	2	48	1	32	66	105	--	--	--	--	--	--	1	158
10/16/88	46	19	32	--	18	56	377	41	70	31	54	28	48	26	671

Table 2. Seasons, bag limits, and harvest for the Macomb Caribou Herd from 1972 to 1987.

Year	Season	Bag limit	Reported harvest M	F	Total	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	53	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
	6-30 Sep	1 bull				
1987	10 Aug-30 Sep	1 bull	57	0	57	Subsistence season
	10 Aug-30 Sep	1 bull				150 drawing permits

Table 3. Annual harvests, number of hunters with Macomb permits, success of permittees, and number of Macomb permits issued from 1978 to 1987.

Year	Harvest	Number hunters	% Hunter success	Number permits
1978[a]	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 + Subsis.
1987	57[b]	70	47	150 + Subsis.

[a] When drawing permits were first required.
[b] 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 1987.

	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

[a] Total in these years includes nonlocal resident and nonresident hunters.

Table 5. Mean days hunted for successful and unsuccessful Macomb caribou permit hunters from 1982 to 1987.

Year	Days hunted		
	Successful hunters	Unsuccessful hunters	Total hunters
1982	3.0	4.6	3.8
1983	2.1	2.9	2.8
1984	3.7	3.5	3.5
1985	2.4	2.8	2.7
1986	1.9	2.8	2.5
1987	3.1	4.3	3.7

Table 6. Number of applications, number of permits issued, and number of applications per permit for Macomb caribou from 1979 to 1987.

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

Table 7. Harvest chronology for caribou killed during the Macomb permit hunt, 1987.

Year	Week ending 8/15	8/22	8/29	9/5	9/12	9/19	Unk
1987	8	6	10	3	4	1	1

Table 8. Transportation methods used by hunters for the Macomb caribou permit hunt from 1982 to 1987.

Year	Number 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)

STUDY AREA

GAME MANAGEMENT UNITS: 13 and 14B (25,000 mi²)

HERD: Nelchina

GEOGRAPHICAL DESCRIPTION: Nelchina Basin

BACKGROUND

In the late 1940's the Nelchina Caribou Herd (NCH) population was estimated at 5,000-15,000 caribou. Aided by intensive predator control, the herd began increasing in size in the early 1950's. The herd continued to expand through the late 1950's and early 1960's, peaking at 60,000-70,000 caribou in the mid-1960's. This was followed by a dramatic decline in numbers in the late 1960's and early 1970's, reaching a low point in 1972-73 (i.e., 7,000-10,000 caribou). Beginning in about 1973-74, the NCH again began to increase, continuing 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 1980 over 100,000 Nelchina caribou were killed by hunters. With the increases in the size of the NCH that began in the mid-1950's, bag limits of more than 1 caribou as well as extended seasons were instituted. From 1955 until 1971 the bag limits varied from 2 to 4 caribou and the seasons from a split 2 months in September and November to 7 months from August through 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, seasons and bag limits were curtailed. From 1972 through 1976, the bag limit was 1 caribou and the seasons ranged from 15 to 40 days in the fall. Even with these restrictions, the harvests (i.e., ranging from 560 to 1,200 caribou) exceeded management guidelines required to allow herd growth. In 1976 the season was closed by Emergency Order after 800 caribou had been harvested 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 the hunting of Nelchina caribou has been regulated by permit only.

POPULATION OBJECTIVE

To increase the Nelchina caribou herd to 30,000 overwintering adults.

METHODS

An aerial postcalving aggregation census and a sex and age composition survey are conducted annually. The proportion of calves and bulls in the population was estimated from results of the fall sex and age composition survey. These proportions were used in conjunction with the results of the postcalving census

(i.e., cow base) to extrapolate a total fall population estimate. Aerial sex and age composition counts were conducted during the fall to determine herd composition and to evaluate calf production and survival.

Radio-collared caribou are located seasonally to delineate herd distribution for sex and age composition surveys and censuses. In addition, identified range use patterns are evaluated in relation to land use decisions. Radio collars on caribou are replaced when necessary. All hunts are monitored by use of permit reports, periodic check stations, and hunter field checks. Forage condition and use are monitored approximately once every 5 years at established range stations.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

The NCH numbered 30,276 caribou in 1987, based on the postcalving aggregation census and fall sex and age composition survey conducted in June and October, respectively. Population estimates obtained over the past 5 years (Table 1) show the size of the NCH as steadily increasing over this period. Over the past 9 years the herd has increased at an average annual rate of approximately 7%. While the apparent rate of growth has varied from year to year in response to a number of factors, including errors in population estimation, the available data suggest that the annual growth rate has declined from the 8% observed in the early 1980's to approximately 5% over the past 2 years. Based on an estimated herd range size of approximately 17,500 mi^2 (Skoog 1968), a density estimate of 1.7 caribou/mi^2 was derived.

Population Composition:

Composition data collected during the 1987 postcalving and fall sex and age composition surveys are presented in Table 1. Corresponding information for the years 1983 through 1986 are also presented in this table. The calf:cow ratio observed during the 1987 postcalving survey was 61 calves:100 cows, up substantially from the prior 4-year average of 49 calves:100 cows. Neonatal calf survival varies from year to year and may, in part, reflect weather conditions during the calving period. In the 1987 fall survey a ratio of 51 calves:100 cows was observed, also up substantially from the prior 4-year average. The drop of approximately 10 calves:100 cows between summer and fall is typically what has occurred in recent years.

The bull:cow ratio observed in the fall survey was 50 bulls:100 cows, exactly the same as the prior 4-year average. Recent bull:cow ratios represent a substantial decline from those observed in the early 1980's (1980-83), when fall bull:cow ratios averaged 60:100. This decline is probably the result of a harvest regime

in which approximately 85% of the caribou killed each hunting season are bulls. Simulations of herd composition changes over the period 1980-87 support this hypothesis. Spring surveys to estimate overwinter survival of calves have not been conducted in recent years.

Distribution and Movements:

With the end of NCH studies funded by the Susitna Hydroelectric Project in 1985, the frequency that this herd has been monitored to determine distribution and movements has declined substantially. A limited number of radio-tracking flights were made during the reporting period at key periods of the year.

During the summer postcalving period in 1987, caribou were found throughout the eastern Talkeetna Mountains from Fog Lakes to the Little Oshetna River. Caribou were also in the Nelchina drainage south of Eureka. By late summer caribou had spread out from the calving grounds into high basins of the eastern Talkeetna Mountains; across the Susitna River to the Deadman, Watana, and Jay Creek drainages; and east into the Alphabet Hills. By the end of hunting season in September, caribou were spread widely over lower elevation hills of the eastern Talkeetna Mountains, Lake Louise Flat, and the Alphabet Hills. Some animals had moved east into the Gakona and Chistochina River drainages during the hunting season. Substantial numbers of caribou were harvested by hunters while they crossed the Richardson Highway.

Fall migration occurred the first week of October and brought most of the herd into the upper Gakona and Chistochina River drainages for the rut; small numbers of caribou remained in the area west from the eastern Talkeetna Mountains to the eastern Alphabet Hills. By mid-November, Nelchina caribou were shifting into wintering areas. The vast majority of the herd had moved back to the west and were spread out on Lake Louise Flat; about 25% of the herd spread out into Unit 11 and the immediately adjacent areas of Subunit 13C, where there was apparently intermixing with some Mentasta caribou; and a few caribou moved further east across the Mentasta Mountains and into the western drainages of the Nabesna and Tok Rivers, as had most of the Mentasta herd. By early spring more Nelchina caribou had shifted east and approximately 33% of the herd was in the Upper Copper River area of Unit 11, as was most of the Mentasta herd. Spring migration occurred in late April; eastern Nelchina caribou moved west across the Richardson Highway between Sourdough and Meiers Lake. During the 1988 calving period most of the herd was concentrated on the Talkeetna Mountains calving grounds; i.e., from Sanona Creek to the Fog Lakes area.

Much of the range use and movements observed in 1987-88 were similar to those observed over the past 5 years; however, the level and lateness of use by Nelchina caribou of the upper Copper River wintering grounds of the Mentasta herd were unusual. From recent observations it is becoming apparent that the level and frequency

of contact between these 2 herds is substantially greater than formerly recognized. The effects of such common range use and contact, especially on the smaller Mentasta herd, are unknown. As observed in 1986-87, there was substantial use of the Nelchina and eastern Matanuska River drainages by Nelchina caribou during both the winter and summer seasons.

Mortality

Season and Bag Limit:

The open seasons for subsistence hunters is 10 August to 20 September and 1 December to 28 February. The bag limit is 1 caribou by registration permit only. The season will be closed when 325 caribou have been taken; up to 1/2 of this quota may be taken in the fall season. During the 1 January-28 February season, hunting may occur in Unit 13, except for Subunit 13B and that portion of Subunit 13A within one-half 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 1,700 permits will be issued. The season will be closed when 925 caribou have been taken.

Human-induced Mortality:

The reported harvest in 1987 was 1,747 caribou for the combined drawing and registration permit hunts (Tables 2, 3), representing a 76% increase over the prior 4-year (1983-86) mean annual harvest of 995 caribou. Since initiation of the drawing-permit hunt in 1977, the largest harvest prior to 1987 was 1,063 caribou in 1984. The 1987 harvest was composed of 1,370 (78%) males and 364 (21%) females; the sex of 13 caribou (1%) was unknown. This represents a slight shift in the harvest to females. In 1986, 19% of the harvest were females, and from 1983-86 females composed 17% of the harvest. This shift relates, in part, to the regulatory changes in 1987 that allowed any caribou to be harvested during the winter subsistence hunt. Prior to this only antlerless (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. Although road kills occur primarily during the winter, they represent less than 3% of reported mortality (Table 2).

Hunter Residency and Success. By law, only Alaskan residents can hunt Nelchina caribou. In 1987 local and nonlocal hunters harvested 519 and 1,228 caribou, respectively. (Table 4). Both of these harvests represent a dramatic increase over the previous year's totals (i.e., 278 and 680, respectively) and the 1983-86 averages (i.e., 267 and 728, respectively). Although the subsistence harvest quota was increased from 275 to 325 caribou in 1987, the large increase in harvest by local residents was primarily a result of the winter hunt in 1987. In 1986 the scheduled winter hunt was not held because the subsistence quota

was harvested during the fall hunt. The increase in harvest by nonlocal residents was primarily the result of an increase in the number of drawing permits issued (i.e., +400) and an increase in the success rate of nonlocal hunters from 68% (1983-86) to 82% (1987). Total hunter success in 1987 was 74%, 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. During the period from 1983 to 1987, the number of drawing permits issued (primarily to nonlocal hunters) increased from 1,300 to 1,700, while the number of subsistence permits issued increased from 450 to 1,183 (Table 3). The number of sport hunting permits available for drawing has increased gradually as the NCH has grown. There have been very few problems associated with administering this hunt; however, as the number of hunters increased in recent years, congestion at access points and range damage by ORV's began to occur.

The subsistence permit hunt has changed over the past 5 years. Originally a small drawing-permit hunt (150 permits), it grew in the early 1980's as the number of available permits were increased (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 was 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 half could be taken in the fall. With a 40-day fall season in effect, the fall quota (165) was reached in less than 20 days and the season was closed by Emergency Order (EO). Although the winter hunt was closed by EO after only 4 days, the winter quota was exceeded by more than 175 caribou. It is apparent that with a 3-day permit reporting requirement it is very difficult to keep from exceeding the quota, if closure of the hunt is based strictly on permit reports.

Harvest Chronology. The chronology of the Nelchina caribou harvest for the past 5 years is listed in Tables 5-7. Changes in chronology over this period for the drawing-permit hunts were primarily related to changes in season dates for the sport and subsistence hunts. Much of the harvest for these 2 hunts was fairly evenly distributed over the hunting season. The chronology of subsistence harvests, since they became regulated by registration permit and a harvest quota, reflects season dates and the effects of anticipated closures under the quota.

Transport Methods. Methods of transportation used by successful hunters are listed in Tables 8-10. For subsistence hunters there have been few, if any, changes in the methods of transportation used over the past 5 years, except in those years when a winter hunt was held and snowmachines became an important transportation means. For sport hunters there are 2 apparent trends over the

period from 1983 to 1987. Airplane use has declined, while "3- and 4-wheeler" use has increased. Current field observations suggest that the use of "4-wheelers" is growing. Such transportation greatly increases the mobility of hunters and opens up much of Unit 13's back country. I anticipate the need to regulate this use in the near future as the impact on caribou and moose increases.

Natural Mortality:

Predation by wolves and grizzly bears is potentially a significant mortality factor for the NCH; however, wolf and grizzly bear harvests by sport hunters and trappers have been relatively high on the Nelchina range over the past few years. Such predator harvests have aided the growth of the NCH. Few wolves have been observed on the Nelchina calving grounds over the past decade, and this factor may be responsible for the high calf survival seen through the calving period. With the elimination of land-and-shoot as a legal trapping method this year, I anticipate wolf numbers and associated calf mortality to increase on the Nelchina calving grounds. Mortality attributable to severe weather is considered to have been low during the years 1983 through 1987. Winter snow accumulations have been average or below average over this period, and the only adverse calving weather occurred in 1983; 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 have been examined at approximately 5-year intervals from 1957 through 1983. Evaluations of the range stations demonstrated that lichen standing crop increased over much of the range from the early 1970's until at least 1983. By 1983, with the herd doubling in size over the prior decade, increases in lichen biomass in areas of substantial caribou use had generally come to a halt. In areas of light use, lichen development was continuing. The calving and summering grounds in the western Talkeetna Mountains, with a history of nearly continuous heavy caribou use for over 30 years, supported 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."

The potential for loss of habitat because of land disposal and mining is also a concern. Interests in mining and increased mining activity in and adjacent to the Nelchina calving grounds and in land disposals, including recent ones on Lake Louise Flat, have the potential of causing a significant loss of habitat. A 3rd development of particular 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 form a barrier to caribou movement, it would cut the herd off from up to one-half of its winter range. These types of developments should be designed and controlled to minimize loss of caribou habitat as well as adverse disturbance to caribou.

Game Board Actions and Emergency Order

In 1983 the management goal of 20,000 adult caribou was reached. With composition data indicating continued good reproduction and survival and with range evaluation studies indicating at least some of the range to be in fair-to-good condition, the board approved a management plan revision allowing the herd to increase to 30,000 adult caribou.

In 1984, in compliance with the Nelchina Caribou Management Plan, the harvest was allowed to increase with herd growth, as long as the harvest did not exceed 5% of the herd. The number of sport drawing permits issued was increased from 1,300 to 1,400 and the number of subsistence drawing permits was increased from 450 to 500.

In 1985, in response to changes in the state subsistence law, hunting of the Nelchina herd was permitted only as Tier II subsistence hunting. Under this new designation there was only one 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 in the state 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 regulation of the subsistence hunt was changed to a registration permit and harvest quota. Approximately 1,100 registration permits were issued; a combined quota of 275 caribou for the fall and winter seasons. The quota was reached as the 3-week fall season closed; as a result, an Emergency Order closure was announced and the winter hunt was not held.

In 1987 the number of sport drawing permits was increased to 1,700, after the Board agreed to begin slowing the rate of herd growth by

allowing up to a 7% harvest of the herd. 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; a maximum of up to one-half of this quota was to be taken in the fall. Approximately 1,200 registration permits were issued. To reduce the harvest of bulls, the bag limit for the winter season was changed from antlerless to any caribou. Composition data suggested that the bull:cow ratio was declining, and management no longer focused on maximizing herd growth.

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 current growth rate (5%), we anticipate reaching the management goal of 30,000 adult caribou in 1991 (38,000 total caribou).

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

I recommend annual censuses and composition counts be conducted. 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 examine the population trend over a number of years. Without annual censuses and composition counts, the real population trend or growth rate is much more difficult to determine in a timely manner. Changes otherwise may go unrecognized for several years. Even with a yearly census, there is no guarantee of an accurate determination of trend. With the recent increases in herd size, a counting error in excess of ± 10% is probable. Given this situation and recent overharvests, there may be an inclination to harvest conservatively, potentially allowing the herd to exceed the population goal set by the Board of Game.

We need to explore ways of improving the accuracy of our herd counts. Special photography techniques should be employed for counting large groupings of caribou. I also recommend initiating surveys once every 4 years of potential calving and postcalving sites throughout the Nelchina range, in order to estimate the numbers of caribou in Nelchina subherds.

In addition to continuing the periodic examination of 39 Nelchina range stations, approximately 10 range evaluation sites should be established in key calving, summering, and wintering areas. Information on the relative use of forage species is needed, and the nutritional status of the herd should be investigated, possibly through analyses of fecal pellet samples. A program should be initiated to monitor the body condition of Nelchina caribou. Growth and size measurements (e.g., lower-jaw measurements) and other indicators of condition, such as fat deposition, parasite load, and possibly blood parameters, should be examined.

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. In recent years wolf numbers throughout 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 or if harvests are increased to stabilize herd growth, it will become increasingly important to have good information on wolf numbers and predation levels on Nelchina caribou, especially on the critical calving grounds. With higher wolf numbers, the 10-11% annual herd increment potentially available for harvesting over the past few years could be substantially reduced.

Both the fall and winter subsistence hunts were closed by EO when the reported harvest equaled the quotas. The fall hunt was closed after 2-1/2 weeks of the 6-week season, and the winter hunt was closed after only 4 days. Because additional harvest reports were received after the closures, the quota was substantially exceeded in both of these hunts. With subsistence demand greatly exceeding recent quotas, I foresee continued problems with exceeding quotas as well as the closure of these hunts 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 opportunities 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 harvest of caribou, because those hunters taking moose will probably not take as many caribou.

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Table 1. Nelchina caribou herd composition counts and population estimates, 1983-87.

Year	Calves:100 cows (summer)	Calves:100 cows (fall)	Calf % fall	Bulls:100 cows (fall)	Population estimate
1983	39	27	14	61	24,825
1984	53	34	20	40	24,095
1985	55	46	23	54	27,528
1986	--	42	23	44	--
1987	61	51	25	50	30,276

Table 2. Nelchina caribou herd annual harvest and accidental deaths, 1983-87.

Year	Reported harvest M	F	Total[a]	Illegal harvest	Accidental harvest (Road kills)	Grand total
1983	827	137	969	--	--	969
1984	891	166	1063	--	--	1063
1985	809	184	989	--	--	989
1986	766	184	958	18[b]	43	1019
1987	1370	364	1747	--	27	1774

[a] Includes unknown sex
[b] estimate

Table 3. Nelchina caribou herd harvest data by permit hunt, 1983-87.

Hunt No.	Year	Permits issued	Did not hunt	Unsuccessful hunters	Successful hunters	Bulls	Cows	Total
515[a]	1983	1300	223	297	762	636	123	762
	1984	1400	290	318	777	632	141	777
	1985[b]	1800	225	526	995	815	174	995
	1986	1300	236	366	680	553	124	680
	1987	1700	207	241	1228	1064	159	1228
516W[c]	1983	450	68	158	207	191	14	207
	1984	500	76	123	286	259	25	286
562W[d]	1986	1132	434	354	278	213	60	278
562W	1987	1183	328	274	519	306	205	519
1987 total all hunts		2883	535	515	1747	1370	364	1747

[a] Drawing permit sport hunt except for 1985.

[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, 1983-87.

Year	Successful				Unsuccessful			
	Local res.	Nonlocal res.	Nonres.	Total	Local res.	Nonlocal res.	Nonres.	Total
1983	207	762	--	969	158	297	--	455
1984	286	777	--	1,063	123	318	--	441
1985	297	692	--	989	207	305	--	512
1986	278	680	--	958	354	366	--	720
1987	519	1,228	--	1,747	274	241	--	515

Table 5. Harvest chronology percentages of Nelchina Caribou Herd by time period, all hunts combined, 1983-87.

Year	8/13	8/20	8/27	9/03	9/10	9/17	9/24	10/01	Jan.	Feb.	Mar.
1983	--	16.8	20.1	14.8	15.4	13.3	8.8	--	2.6	1.6	6.5
1984	--	--	27.1	15.2	16.6	12.3	10.9	--	4.6	3.2	10.1
1985	--	--	--	--	--	30.1	19.1	--	20.2	30.6	--
1986	--	--	--	14.4	34.3	25.7	15.2	10.3	--	--	--
1987	20.7	14.1	11.2	10.4	11.4	13.5	--	--	18.7	--	--

Table 6. Harvest chronology percentages of Nelchina Caribou Herd by time period, Hunt No. 515, 1983-87.

Year	8/13	8/20	8/27	9/03	9/10	9/17	9/24	10/01	Jan.	Feb.
1983	--	21.0	21.8	16.7	16.8	14.5	9.2	--	--	--
1984	--	--	35.0	16.9	19.7	15.6	12.8	--	--	--
1985[a]	--	--	--	--	--	30.1	19.1	--	20.2	30.6
1986	--	--	--	16.2	35.9	22.8	14.4	10.7	--	--
1987	23.4	16.1	10.8	13.8	16.0	20.0	--	--	--	--

[a] In 1985, Hunt 515 was a Tier II subsistence hunt for all Alaska residents.

Table 7. Harvest chronology percentages of Nelchina Caribou Herd by time period, Hunt Nos. 516W and 562W, 1983-87.

Year	8/13	8/20	8/27	9/03	9/10	9/17	9/24	10/01	Jan.	Feb.	Mar.
1983	--	1.0	13.8	7.7	9.7	8.7	7.7	--	12.3	7.7	31.3
1984	--	--	5.6	10.5	8.4	3.5	6.0		16.8	11.9	37.2
1985[a]	--	--	--	--	--	--	--	--	--	--	--
1986	--	--	--	10.4	30.1	33.1	17.1	9.3	--	--	--
1987	13.9	9.6	14.7	--	--	--	--	--	61.8	--	--

[a] In 1985 the only Nelchina caribou hunt was a Tier II drawing permit subsistence hunt (#515) for all Alaska residents.

Table 8. Successful hunter percentages by transport methods for all hunts combined (Nelchina Caribou Herd), 1983-87.

Year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Hwy vehicle	n
1983	22.2	00.8	12.6	—[a]	3.4	33.1	27.8	963
1984	17.4	01.4	11.4	15.5	4.1	16.7	33.5	1,047
1985	11.1	00.6	9.3	9.2	17.0	11.3	41.5	986
1986	14.0	01.3	13.1	16.1	--	19.0	36.6	946
1987	10.5	00.9	10.2	21.7	7.4	16.5	32.8	1,716

[a] In 1983 the 3/4-wheeler category was included in the ORV category.

Table 9. Successful hunter percentages by transport methods for Hunt No. 515 (Nelchina Caribou Herd), 1983-87.

Year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Hwy vehicle	n
1983	24.8	0.5	14.9	—[a]	--	36.2	23.6	759
1984	21.1	1.7	14.8	20.4	--	19.8	22.2	771
1985[b]	11.1	0.6	9.3	9.2	17.0	11.3	41.5	986
1986	13.8	0.9	15.7	17.6	--	21.6	30.5	676
1987	13.3	0.9	12.7	26.8	--	19.3	26.9	1,218

[a] In 1983 the 3/4-wheeler category was included in the ORV category.

[b] In 1985 Hunt 515 was a Tier II subsistence hunt for all Alaska residents.

Table 10. Successful hunter percentages by transport methods for Hunt Nos. 516W and 562W (Nelchina Caribou Herd), 1983-87.

Year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Hwy vehicle	n
1983	12.7	2.0	3.9	—[a]	16.2	21.6	43.6	204
1984	6.9	0.7	1.8	1.8	15.6	8.0	65.2	276
1985[b]	--	--	--	--	--	--	--	--
1986	14.4	2.2	6.7	12.2	--	12.6	51.9	270
1987	3.6	0.8	4.0	9.4	25.5	9.6	47.0	498

[a] In 1983 the 3/4-wheeler category was included in the ORV category.

[b] In 1985 the only Nelchina caribou hunt was a Tier II subsistence Hunt (#515) for all Alaska residents.

STUDY AREA

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

HERD: Kenai Lowlands

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

BACKGROUND

The Kenai Lowland Caribou Herd (KLCH) was established through transplants of 15 and 29 animals from the Nelchina Caribou Herd in 1965 and 1966, respectively. These transplants were successful, and since the late 1960's caribou have been observed in 2 distinct areas on the Kenai Peninsula: Subunits 15A and Unit 7. The potential caribou range in Subunits 15A and 15B (West) for the KLCH is not suspected to be a limiting factor at the current population size. However, population growth since the mid-19790's has been slow. Predation from free-ranging domestic dogs on calves and other wild predators is believed to be the major factor controlling this herd's growth. Although hunting was allowed during the 1981 season and illegal hunting has been documented, the legal harvest was restricted to bulls only and illegal harvests have also been on large bulls. Since legal and illegal harvests have focused on bulls, hunting is not suspected to be a significant controlling factor.

POPULATION OBJECTIVES

To allow the existing caribou population to increase to a minimum of 150 by maintaining an annual harvest not exceeding 5% of the population and restricting harvest to bulls only.

METHODS

Spring and fall sex and age composition aerial counts were scheduled throughout the known range for this herd.

RESULTS AND DISCUSSION

Population Status and Trend

An aerial survey was conducted on 16 June 1988 to assess population size and calf production. A total of 115 caribou were classified as adults or calves (i.e., 102 adults and 13 calves).

Comparing the results of this survey with a similar survey conducted on 5 June 1987 (i.e., 98 caribou observed) suggests that the KLCH increased during 1987. However, because of the low percentage of calves in the herd (11.3%), the KLCH is not expected to demonstrate a similar increase for 1988.

Mortality

Season and Bag Limits:

There is no open season in Subunit 15A

Natural Mortality:

Predation from free-ranging domestic dogs and wild carnivores on all age classes of caribou is suspected to be the primary controlling factor on this herd's growth.

Habitat Assessment and Enhancement

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

Game Board Actions and Emergency Orders

Hunting of the KLCH has not been allowed since 1981, when 5 permits were issued, resulting in a harvest of 4 bulls. A proposal was presented at the 1988 Board of Game meeting by a local resident to reestablish a hunting season for fall 1988. The proposal was adopted, and 3 permits for bulls only will be issued.

CONCLUSIONS AND RECOMMENDATIONS

Low recruitment has been the primary management concern for this herd for the past decade. It is suspected that predation is limiting this herd's ability to grow; 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.

Since one of the purposes of reestablishing caribou on the Kenai Peninsula was for hunting, the Department should support a continued harvest during years that adequate numbers of caribou are observed. In addition to allowing a limited harvest, it would demonstrate to the nonhunting public that this highly visible wildlife resource can support a controlled harvest. If a sufficient number of animals are observed in the 1988 fall survey, a season from 1-20 September with 5 (or less) permits for bulls would be appropriate.

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STUDY AREA

GAME MANAGEMENT UNIT: 18 (42,000 mi²)

HERDS: Kilbuck Mountains and Andreafsky

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

BACKGROUND

Historically, a large caribou population inhabited the Bering Sea coast from Bristol Bay to Norton Sound. Caribou ranged over much of the Yukon-Kuskokwim (Y-K) Delta, including Nunivak Island, and probably reached peak numbers during the 1860's (Skoog 1968). However, by the early 1900's, apparently few caribou used the lowlands of the Y-K Delta. Today, only 2 small herds occur in Unit 18: the Kilbuck and Andreafsky Mountains Caribou Herds.

Although the Kilbuck Caribou Herd (KCH), which is located in the Kilbuck and Kuskokwim Mountains southeast of Bethel, is small, it is apparently growing. The current population estimate for the KCH is 800-900 caribou. Kilbuck caribou calve on high ridges in the western portion of the Kuskokwim Mountains, summer in alpine meadows, and winter in valleys, wind-blown slopes, and ridgetops. Radio-collared caribou from the KCH have recently moved to the edge of the Y-K Delta lowlands, the first such case documented in over 100 years.

Limited information is available for the Andreafsky Caribou Herd (ACH), estimated to number less than 100 animals. I believe that the population is declining, presumably from excessive harvests. The herd apparently calves and winters in the vicinity of Needle Mountain (i.e., headwaters of the Andreafsky River drainage) and in the southern portion of Subunit 22A.

POPULATION OBJECTIVES

To increase the caribou population in Unit 18.

METHODS

The caribou population in the Kilbuck Mountains has been surveyed periodically by ADF&G 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 ADF&G-USFWS management study (Hinkes 1988a). Systematic biweekly aerial surveys of the Kilbuck and southern Kuskokwim Mountains began in 1987.

During March and April 1987, 12 caribou were captured and radio-collared by ADF&G and USFWS personnel. Three caribou (1 male and 2 females) died soon after capture, leaving 1 male and 8 females

with active radio collars. Radio collars from the dead caribou were subsequently recovered and placed on other animals. An additional 7 males and 2 females were captured and collared in February 1988. The radio collars of 4 males began transmitting on mortality mode within 2 months of capture and release. The radio collars on the bulls were attached loosely to allow for neck-swelling during rut, and when these animals lost their antlers, they probably slipped their collars.

Radio-collared caribou were relocated using fixed-wing aircraft. Visual contact was made for most relocations. Poor weather conditions occasionally allowed only triangulated locations. Caribou locations were determined using LORAN C and subsequently mapped.

The ACH was surveyed by fixed-wing aircraft in March and May 1988 (Hinkes 1988b). The numbers of adults, short-yearlings, and calves were counted, and their locations were mapped. Because of its remoteness, this herd is difficult to study and has not received the attention given the KCH.

RESULTS AND DISCUSSION

Population Status and Trend

Substantial progress has been made in the last several years in understanding the population status of the KCH. Kilbuck caribou are now known to form a distinct, resident herd. Calving by Kilbuck caribou was first documented by Patten (1985). Since then, calving has been documented in the same general area of the upper Kisaralik River drainage.

The distinct identity of the KCH is supported by relocation data obtained from radio-collared animals during 1987-88. All radio-collared caribou remained in the western and central Kuskokwim and southern Kilbuck Mountains throughout the study period; there was no apparent overlapping in distribution with the large Mulchatna herd to the east. Immigration from the rapidly expanding Mulchatna herd may be occurring, but it has not yet been documented.

Andreafsky caribou were observed with calves in the vicinity of Needle Mountain in mid-May 1987 and 1988 (Hinkes 1988a). There has been considerable speculation that the ACH is composed largely of feral reindeer descended from the herds of reindeer historically kept in the area. Because portions of the Western Arctic Caribou Herd occasionally migrate into the area during winter, the ACH may also be composed of reindeer-caribou hybrids.

The largest count of Kilbuck caribou (n = 685) was made during an October 1987 composition survey. Comparisons between photographic and visual estimates of some groups indicated that visual estimates may have underestimated actual numbers by as much as 28% (Hinkes 1988a). Because some groups were not photographed, the actual number of Kilbuck caribou may have been more than 800 animals. If

the 93 calves observed during May 1988 are considered, the Kilbuck herd numbers 800-900 animals.

The current estimate of population size is considerably higher than last year's estimate of 300 caribou. The apparent increase is due to several factors. Estimates may have been low because we have relied solely on visual surveys. Radio-collared animals have provided a means of locating a large percentage of the herd. A second contributing factor may have been reduced mortality. As a result of heavy harvests during the winter and spring of 1985, caribou hunting in Unit 18 south of the Yukon River was closed by the Board of Game for the 1985-86 season; it remains closed. Although some illegal harvests occurred in 1986, none have been subsequently documented. A third factor may have been the undocumented immigration of caribou from the Mulchatna herd east of the Kuskokwim Mountains.

The caribou population in the Andreafsky Mountains of northern Unit 18 is not well understood. Less than 100 animals were counted during 1987 and in each of 2 aircraft surveys in 1988. A USFWS survey flight on 19 May 1987 identified 86 caribou with a minimum of 8 neonate calves immediately north of Needle Mountain. A total of 61 caribou were observed in 3 groups within one-half mile of each other in the headwaters of the Andreafsky River in March 1988. Thirty-nine caribou, including 7 calves, were observed in 6 groups near Needle Mountain in May 1988 (Hinkes 1988b).

Population Composition:

Sex and age composition data were collected on Kilbuck caribou whenever time and survey conditions allowed. Because radio-tracking and survey flights were conducted in fixed-wing aircraft, accurate age and sex classification of observed caribou was usually not possible. Photographs were used to supplement and modify visual estimates whenever possible.

Composition data on Kilbuck caribou were collected during 3 survey flights in October and November 1987; 1,130 of 1,268 caribou observed were classified. On successive days, some groups of caribou were classified more than once. The average bull:cow ratio was 26:100. This low ratio is inaccurate because many young bulls had been misclassified as cows.

Accurate information on calf production and survival of Kilbuck caribou is lacking for 1986 and previous years because of small sample sizes. Observed calf production was 80 calves:100 cows in late May 1986, 82 calves:100 cows in early June 1987, and 66 calves:100 cows in late May 1988. Composition counts conducted in fall 1987 indicated a range of 12-20 calves:100 cows, a significant reduction from the time of calving. This ratio is also inaccurate, because many young bulls had been misclassified as cows (Hinkes 1988a).

Distribution and Movements:

Kilbuck caribou concentrated during October though December on plateaus and in foothills along the Kisaralik River and adjoining drainages. Most caribou moved to higher mountain slopes and ridgetops in the southwestern portion of the Kuskokwim Range during January through March. The observed changes in distribution were likely related to snow cover. Strong winds created hard-packed snow conditions on plateaus and foothills; however ridgetops, peaks, and higher mountain slopes were free of snow, providing better foraging conditions in late winter.

Two radio-collared caribou demonstrated unusual winter movements during 1988. A radio-collared male and 11 other males moved west to Eek Lake and then onto the lowlands west of Great Ridge, remaining through April. A radio-collared female with 25 other caribou moved west of Greenstone Ridge, immediately south of the Kisaralik River. These observations were the furthest westward movements documented for Kilbuck caribou, representing the first ones observed on the delta lowlands since the 1800's. During April most Kilbuck caribou moved out of higher mountains and returned to the plateaus and foothills they had occupied during early winter. These areas become snow-free earlier than higher elevations. Kilbuck caribou were widely dispersed by mid-May; the bulls and some cows remained at lower elevations. Pregnant cows and yearlings returned to higher, rugged terrain. Calving occurred on mountain tops and ridges, both north and south of the Kisaralik River and immediately west of Kisaralik Lake.

Caribou remained widely dispersed in the Kuskokwim Mountains during the summer; however, most cows, calves, and yearlings remained in the "core" area around Kisaralik Lake, moving to high alpine cirques, meadows, and snowpatches in late summer. Bulls moved further north and south; e.g., a radio-collared male summered in the southern Kilbuck Mountains along the upper Quicksilver drainage. Four groups of large bulls were observed in the upper Kipchuk drainage in Subunit 19B in late July 1987. Cow and calf caribou from the KCH remained near Kisaralik Lake during early fall. Commuter airline pilots sighted 7 caribou along the upper Arolik River near Arolik Lake in early September 1987, but the herd affiliation of these animals is unknown. By October and the onset of the rut, radio-collared cows were joined by bulls moving from the north and south. Rutting aggregations were concentrated at lower elevations along Crooked Creek and the Kisaralik River.

Mortality

Season and Bag Limit:

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 in Unit 18 was closed by the Board of Game in 1985. Some poaching was documented in 1986, but none was reported during 1987. Several bulls, probably KCH animals, were taken legally by guided hunters in the upper Kipchuk drainage in Subunit 19B. Reduction in human harvest is believed to be the major factor influencing the current growth of the KCH.

Because harvest reporting rates for the ACH were extremely poor, we have no information on them, other than anecdotal and unsubstantiated reports; however, I believe that human-induced mortality may be excessive. The occasional proximity of large groups of Western Arctic Herd caribou in the vicinity of the Andreafsky Mountains complicates management options considerably, although closure of the season is certainly a possibility.

Natural Mortality:

Little information is available on natural mortality. A female caribou was killed by wolves in the southern Kilbuck Mountains in February 1988. A wolf pack of 8-12 animals has ranged over the study area during the past 2 years, and several moose kills have been observed.

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 in May 1988. Although no kills were observed, these bears may have been attempting to take caribou calves. The selection of calving sites on high, rugged ridges suggests predator avoidance.

Habitat Assessment

According to the U.S. Soil Conservation Service, the lichen range in the southern Kuskokwim Mountains is among the best in Alaska. Neither the Andreafsky or the Kilbuck Mountains have been substantially grazed by caribou or reindeer for over 50 years. Habitat conditions in the montane regions of Unit 18 do not appear to be limiting caribou population growth. I believe that both areas could support much higher numbers of caribou (i.e., 10,000 each).

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 the harvest had exceeded sustained-yield limits. The rapid growth and recovery of the KCH since that time confirms our belief that human harvest was probably a major factor limiting herd growth.

CONCLUSIONS AND RECOMMENDATIONS

Substantial progress was made during the reporting period in evaluating the population status and distribution of the Kilbuck Caribou Herd. This herd has been studied on a cooperative basis by the USFWS and ADF&G since 1985. The KCH, estimated at 800-900 animals, resides in the Kilbuck and southern Kuskokwim Mountains southeast of Bethel. Some animals from this herd have calved for 3 consecutive years on high ridges in the vicinity of Kisaralik Lake. This herd has continued to expand in numbers and range, and it is now approaching a size at which some hunting can take place. Once the population goal of 1,000 caribou is reached, ADF&G, in consultation with local residents and advisory committees, will approach the Board of Game to request that limited hunting be allowed; however, the management goal for the KCH will be for continued population growth. Additional bulls should be radio-collared to document distribution. Caribou immediately east of the Kuskokwim Range (Mulchatna herd) should be radio-collared and tracked to determine their relationships to the KCH.

The Andreafsky Caribou Herd is not well understood. A calving area was identified for the 2nd consecutive year in the vicinity of Needle Mountain. The ACH appears to number less than 100 animals, and it may be declining. This herd is logistically difficult to study and has received little attention to date. A proposal to close hunting on ACH is under consideration.

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STUDY AREA

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

HERDS: Beaver Mountains, Big River, Kuskokwim Mountains, Mulchatna, Rainy Pass, Sunshine Mountains, Tonzona

GEOGRAPHICAL DESCRIPTION: All drainages of the Kuskokwim River upstream of the village of Lower Kalskag, that area in the Yukon River drainage from Paimiut upstream to but not including the Blackburn Creek drainage, including the entire Innoko River drainage and the Nowitna drainage upstream from the confluence of the Little Mud and Nowitna Rivers.

BACKGROUND

Caribou have doubtless played an important historic role in this area. Although documentation is largely nonexistent, discussions with village elders support the idea that caribou sporadically existed in far greater numbers and over a greater range than they presently do. As testament to their previous occurrence, a large mountain in the western Kuskokwim Mountains is called Horn Mountain, a reference to the fact that caribou horns were traditionally gathered here for use as implements and tools in the surrounding Native communities. Caribou no longer use this area. I suspect that the Mulchatna Caribou Herd once roamed throughout the Kuskokwim Basin, but as numbers dwindled, they retreated to more favorable habitats to the south. As the Mulchatna Herd increases (1988 spring estimate is 60,000 animals), it appears to be expanding its range northward and reoccupying portions of Unit 19.

In the Kuskokwim Mountains, which largely divide Unit 19 from Unit 21, small caribou bands have apparently existed since the late 1800's. Early in the 1900's, reindeer herders from the Yukon communities of Holy Cross and Shageluk herded their animals to summer range in these mountains. Reportedly, it was common for herders to lose reindeer in the area, and I suspect that they freely interbred with the existing caribou. Presently, 7 herds (i.e., defined as those caribou sharing a common calving area) are recognized in Units 19 and 21. The identity of these herds, which is based primarily on limited radio-collaring (Pegau 1986) and surveys by Alaska Department of Fish and Game (ADF&G) staff since the late 1960's, is still not well understood. There has been little management planning effort on the smaller herds, although caribou in Units 19 and 21 were discussed briefly in a previous ADF&G management plan (ADF&G 1976).

MANAGEMENT OBJECTIVES

To develop a strategy and timetable for estimating current population levels and trends in the various caribou herds by the summer of 1990.

To determine the target population levels of the various herds and develop working seasons and bag limits to attain those goals by the fall of 1990.

METHODS

During the reporting period, caribou management effort consisted solely of reviews and tabulations of hunter harvest reports. Incidental observations of caribou numbers and calving areas were made, but no formal surveys have been conducted since 1985 (Pegau 1986).

RESULTS AND DISCUSSION

Population Status and Trend

Population Size and Composition:

No additional information is available beyond that reported by Valkenburg (1988).

Distribution and Movements:

A spring census was conducted during 1988 on the Mulchatna Caribou Herd. That herd generally calves south of Unit 19 in Unit 17, but a recent increase in population (i.e., 1988 estimate of 60,000 caribou) has led to a northward range expansion into Unit 19. With this northward movement, the harvests in Unit 19 have increased throughout Subunit 19B and into portions of Subunit 19A. As this herd continues to expand, I suspect that additional harvests will occur throughout Subunits 19A, 19B, and portions of 19C.

Mortality

Season and Bag Limit:

The open season for subsistence, resident, and nonresident hunters in Subunit 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 1 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 is 3 caribou; however not more than 1 caribou can be taken before 1 November.

The open season for all hunters in Subunit 19C is 10 August to 30 September. The bag limit is 1 caribou. The open season for all hunters in Subunit 19D south and east of the Kuskokwim River and North Fork of the Kuskokwim River; the remainder of Subunit 19D; and 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 subsistence and resident hunters in Subunit 19D south and east of the Kuskokwim River is 1 November to 31 January; the bag limit is 1 caribou.

Human-induced Mortality:

Harvests in Unit 19 and Subunits 21A and 21E have increased over the past 5 years (Table 1). Even discounting those caribou harvested from the Mulchatna Herd, the reported harvest and the number of hunters have nearly tripled since 1986-87: 127 vs. 44 and 165 vs. 55, respectively. The unreported take is also quite high.

Hunter Success and Residency. Reported hunter success has averaged about 80% during the past 5 years. Because of disproportionate returns, the actual success rates are probably much lower, averaging about 50%. Although residency of hunters has not been documented, the Subunit 19B and 19C hunters are equally distributed in the resident and nonresident classes. Caribou hunters who hunt in Subunits 19A, 19D, 21A, and 21E are predominantly resident hunters. Hunters (both successful and unsuccessful) reported hunting an average of 5.1 days, with hunts lasting from 1 to 30 days.

Harvest Chronology. Over half of the reported caribou harvest occurred in September, about a third in August, and the remainder in December and January. The harvest chronology has not significantly changed over the past 5 years.

Transport Methods. One hundred forty of 164 (85%) caribou hunters reported using airplanes. The remaining methods were distributed among horses, boats, snow machines, and off-road vehicles.

Natural Mortality:

Although no specific data have been collected concerning natural mortality rates during this reporting period, wolf predation is relatively high within most of the caribou herds in Units 19 and 21. Most herds are relatively small, and prey:wolf ratios are probably low within the ranges of most herds. The mild winters during the past 2 years have not contributed substantially to natural mortality.

Game Board Actions and Emergency Orders

The Board of Game has continued to liberalize hunting seasons and bag limits to promote additional harvest of caribou from the Mulchatna Herd.

CONCLUSIONS AND RECOMMENDATIONS

To meet the objectives stated previously in this report, reconnaissance flights must be conducted during spring and early summer 1989 to identify calving and bull aggregation areas. To adequately manage the various herds, additional money and manpower must be devoted to assessing herd sizes and trends. Increased enforcement of the requirement to report harvests should occur to adequately document the actual harvest.

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Table 1. Caribou harvest ticket returns for Game Management Unit 19 and Subunits 21A and 21E for 1987-88.

Herd	Total returns	No. harvested	
		Bull	Cow
Beaver Mountains	11	9	1
Big River-Farewell	45	24	2
Kilbuck Mountains	7	5	0
Kuskokwim Mountains	1	0	0
Rainy Pass	64	47	4
Sunshine Mountain	2	1	0
Tonzona	27	26	1
Unspecified herd	9	7	0
Total	165	119	8

STUDY AREA

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

HERDS: Delta and Yanert

GEOGRAPHIC DESCRIPTION: Central Alaska Range and Tanana Flats

BACKGROUND

During the last 20 years the size of the Delta and Yanert Caribou Herds have fluctuated dramatically. The caribou population in Subunit 20A declined from 5,000 in 1969 to 2,000 by 1975; by 1982 the population had increased to approximately 7,000. Since 1982 the rate of population growth has slowed. A minimum estimate of 8,300 caribou was obtained from the June 1988 census. The population decline between 1969 and 1975 was caused by poor recruitment and harvests that consistently exceeded the annual increment. Hunting was stopped in 1974, but the population did not begin its recovery until 1976, when wolf reduction began throughout Subunit 20A.

Prior to 1974 harvest of the Delta and Yanert Herds was managed by liberal either-sex seasons. Hunting was closed from 1974 to 1979; since 1980 hunting has been allowed under increasingly complex regulations. Davis et al. (1988a) summarized the regulatory history of the Delta and Yanert Caribou Herds. Reported annual harvests of Delta and Yanert caribou ranged from 175 to 750 caribou between 1968 and 1973. In 1980, 104 bulls were harvested under a drawing-permit hunt. Beginning in 1982 reported harvests increased, averaging 521 caribou annually from 1982 to 1987.

During the mid-1970's when the Delta Herd was relatively small, the Department (ADF&G) proposed managing hunting to provide an opportunity to hunt caribou under aesthetically pleasing conditions (ADF&G 1976). In 1984 the primary goal was changed (ADF&G files) to provide people with the maximum opportunity to participate in caribou hunting. A secondary goal of providing the opportunity for hunters to take large bulls was also proposed. The secondary goal was unpopular, and there was considerable public opposition to a regulation proposal to restrict take of large bulls. The population objective in 1976 was 4,000; however, uncertainty about the optimum population level prompted managers to increase the population goals, and the herd continued to grow.

In 1987 the Board of Game determined that there had been no significant subsistence use of the Delta Herd. Therefore, subsistence use has not been a major consideration in management planning.

MANAGEMENT OBJECTIVES

To maintain a combined postcalving herd of at least 8,000 caribou in Subunit 20A, while maintaining posthunting sex ratios in both herds above 30 bulls:100 cows.

To maintain a bull composition throughout the herds of at least 20% large bulls and no more than 50% small bulls in October composition counts.

To establish harvest goals by fall 1989.

METHODS

On 5 October 1987, ADF&G staff estimated the sex and age composition of the Delta and Yanert herds (herds were intermingled at the time) by classifying caribou from a helicopter into the following 6 categories: large bulls, medium bulls, small bulls, cows, male calves, and female calves. To sample adequately, we located all 40 radio-marked caribou dispersed throughout the herd and then selected composition samples around each marked animal.

Between 15 and 17 June 1987, we censused the combined Delta and Yanert herds by photographing all large groups (i.e., over 100 caribou) and counting caribou in all small groups we could locate (Davis et al. 1979). The area in which aggregations of caribou were likely to occur was divided into 3 sections and searched simultaneously with 3 aircraft. Two of the aircraft were equipped with radio-tracking gear, and during the course of the 1st day, these aircraft located all but three of the approximately 40 radio-marked caribou in the herd. Although the remaining 3 caribou were not found during the census, they were located later, indicating that not all caribou were included in the census.

Department personnel interviewed hunters during the 1st 2 weeks of September 1987 to determine the frequency of harvested caribou not being reported through the harvest ticket system. Hunters were not told the purpose of these interviews, because I thought that would bias reporting. We contacted hunters in hunting camps by landing at most known landing areas daily. We also operated check stations at Gold King airstrip and on the Parks Highway near the Yanert River.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

The 15 and 17 June 1988 census documented 8,338 caribou in the combined Delta and Yanert Herds. That value represents the minimum documented population size. Three radio-collared caribou were unaccounted for during the census. They may have accompanied

additional caribou. In addition, survey coverage of the Cody Pass and Mystic Mountain areas was incomplete and Jim Davis (ADF&G biologist, pers. comm.) felt a minimum of 200 caribou were missed in that area. Hence the estimated population size approached 8,600 caribou.

In 1987 the estimated population size was 8,380 caribou, representing a more complete count than the 1988 census. Minimum known populations in 1985 and 1986 were 8,083 and 7,804 caribou, respectively. Although census results suggest that the population may be growing slowly, the census technique is not precise enought to firmly establish that population growth has occurred.

The Yanert herd has not been adequately censused since 1983 because the Delta and Yanert herds have been overlapped when photo-censusing usually occurs. 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. Davis et al. (1987) found no strong evidence that the Yanert herd ever numbered more than 600 caribou.

Population Composition:

Composition counts of the Delta herd were conducted on 5 October 1987 and 6 April 1988. While the October count is probably the best estimate of population composition, the April survey is the best one for yearling recruitment and overwintering survival of calves. During October 1987 the bull:cow ratio was 32:100 and the calf:cow ratio was 31:100 (Table 1). In April 1988, the calf:cow ratio was 29:100, indicating calf mortality was not substantially greater than mortality among adult cows.

A composition survey of the Yanert herd was also conducted on 5 October, but the sample contained many radio-collared Delta caribou, indicating the herds were mixed. The bull:cow ratio was 41:100; the calf:cow ratio was 38:100.

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 32:100 in 1987. During the 3 years from 1985 to 1987, small bulls (yearlings) averaged 53% of the total bull sample in October composition counts; large bulls averaged 21% of the sample (Table 2). If the bull:cow ratio continues to decline, regulation changes will probably be necessary to meet the management objectives for large bulls.

Distribution and Movements:

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 (Figure 1). The Yanert Caribou Herd calves between the upper Yanert River and upper Wood River. Radio locations have demonstrated overlapping between the 2 herds during calving (Davis et al. 1988a).

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 River/Yanert River divide during late June and early July.

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

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

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

6. Dispersal over the western foothills, Gold King Benches, and northward onto the western Tanana Flats from October through February.

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

Snow depth and timing appear to influence caribou in both their selection of specific calving sites and initiation of major seasonal movements. During late August and early September 1987, caribou were dispersed throughout the eastern foothills. On 11 September 1987 a significant 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 1986 caribou remained distributed throughout the eastern and western foothills until late September because of the absence of significant snow.

As the Delta Caribou Herd continues to grow, it may expand 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 residents 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 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 subistence season.

Human-induced Mortality:

Reporting rates are low for both successful and unsuccessful caribou hunters. During 1987, 430 caribou were reported killed by 655 caribou hunters in Subunit 20A; however, the actual 1987 harvest in Subunit 20A was estimated at 667 caribou by 1,648 hunters. That estimate was based on hunter reporting rates determined from hunter field interviews in 1986 (McNay 1988). During 1987 hunter interviews were also completed. Those results will be analyzed during the next reporting period. Distribution of the harvest and hunting effort between the general and permit hunts are summarized in Tables 3, 4, and 5.

Harvest Chronology. In the Yanert Controlled Use Area, 59 caribou were harvested in the early season and 9 hunters reported taking caribou in January. The season was closed by Emergency Order on 19 January to prevent further harvest. Of 122 successful hunters in the Hunt No. 570 permit area, 38% hunted in August, 22% in September, 25% in October, 3% in November, and 11% in December.

Permit Hunts. Since 1985, 200 either-sex permits have been issued annually for Hunt No. 570 in southwestern Subunit 20A (Table 5).

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- to 24-month animals and of animals >24 months.

Wolf predation is a major source of natural mortality of Delta and Yanert caribou. Wolf predation appears to have increased in recent years, based on mortality of radio-collared animals (Davis et al. 1987).

Game Board Actions and Emergency Orders

In January 1988 the winter Yanert caribou season was closed by Emergency Order; Emergency Orders were also issued in 1987 and 1985. To prevent the recurring potential for overharvesting Yanert caribou, the Department recommended and the Board implemented drawing permit Hunt No. 571 for the Yanert Controlled Use Area beginning 1 January 1988. Hunt No. 571 will allow for 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 have shown essentially no growth since 1985, but the population has remained above the minimum combined population objective of 8,000 caribou. As hunting has focused on bulls, bull:cow ratios have declined, and although the bull:cow ratio remained above the minimum management objective, it may soon be necessary to reverse the declining trend in that ratio.

Reporting by hunters was shown to be poor; an estimated 40% or more of the harvested caribou go unreported in the general season hunt. A media campaign to encourage hunters to promptly return harvest reports will be used during the next reporting period. Hunter interviews will continue to provide an estimate of harvest reporting rates. No changes in season or bag limit were recommended.

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Table 1. October sex and age composition of the Delta Caribou Herd, 1983-87.

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

Table 2. Size class distribution of bulls classified on fall composition counts, Delta Caribou Herd, 1983-87.

Year	Small bulls (%)	Medium bulls (%)	Large bulls (%)	Total bulls (N)	% of bulls in herd
1984	28	32	40	258	24
1985	57	24	19	306	26
1986	49	30	21	468	24
1987	53	23	24	329	20

Table 3. Summary of reported Delta and Yanert caribou harvest Subunit 20A, 1983-87.

Year	Delta Herd									Yanert			Total 20A (Delta & Yanert)		
	General season			Permit hunt[c]			Total Delta Herd								
	Bulls	Cows	Total[a]	Bulls	Cows	Total[a]	Bulls	Cows	Total[a]	Bulls	Cows	Total[a]	Bulls	Cows	Total[b]
1983	576	98	694	--	--	--	576	98	694[e]	40	12	54	616	110	748
1984	--	--	--	258	153	413	258	153	413[e]	77	22	99[e]	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[e]	404	110	520
1987[d]	237	3	240	88	33	122	325	36	362	66	2	68[e]	391	38	430

[a] Totals include animals of unspecified sex.

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

[c] During 1984, all hunting of the Delta herd was by registration permit. Beginning in 1985 a drawing permit Hunt No. 570 was used in the western portion of the Delta herd's range, the remainder of 20A was open to general hunting.

[d] Beginning in 1987 the general season was bulls only; drawing permit Hunt No. 570 remained either sex.

[e] Years in which season was closed by Emergency Order.

Table 4. Summary of reported hunter participation in Delta & Yanert caribou hunts in Subunit 20A, 1983-87[a].

Year	Delta		Yanert		Total 20A	
	Total hunters	% success	Total hunters	% success	Total hunters[c]	% success
1983	1,029	67	93	58	1,122	67
1984[b]	1,665	--	--	--	--	--
1985	435	73	136	47	603	66
1986	593	69	142	51	735	71
1987	552	66	133	51	655	66

[a] Includes permit hunts, overall reporting rates for nonpermit holders was believed to be ≤50% during 1985, 1986 and 1987.

[b] During 1984, 1,665 registration permits were issued for the Delta herd, data for number of unsuccessful hunters in both the Delta and Yanert herds was unavailable.

[c] Total includes hunters for which no location was specified.

Table 5. Summary of caribou permit Hunt No. 570, 1985-87.

Year	Harvest			Unsuccessful hunters	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

STUDY AREA

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

HERD: Fortymile

GEOGRAPHICAL DESCRIPTION: Charley, Fortymile, and Ladue River drainages

BACKGROUND

Davis et al. (1978) thoroughly reviewed the history of the Fortymile Caribou Herd (FCH); therefore, only a brief summary is presented here. In the 1920's the FCH was one of the largest herds in North America; i.e., 528,000 (Murie 1935). For unknown reasons, the FCH declined to only 10,000-20,000 by the 1940's (Skoog 1954). Coinciding with a federal wolf control program, the FCH then began increasing. By 1960 the herd had grown to about 60,000 (Skoog 1968). Subsequently, the wolf population as well as the human harvest increased, contributing to another decline in the herd. The population reached its recent historic low in the mid-1970's, when only about 6,500 caribou remained in the herd.

The FCH increased from 6,500 in 1973 to about 9,000 in 1982 Conservative caribou hunting seasons, a natural decline in wolf numbers in the mid-1970's, and a wolf control program (1981 to 1983) helped to reduce the mortality, promoting herd growth. After 1982 the growth rate of the FCH increased to 11% and by 1986 had numbered about 15,300.

MANAGEMENT OBJECTIVES

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

To maintain average annual harvests of 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 maintain and improve caribou habitat conditions.

METHODS

Division of Wildlife Conservation (DWC) and National Park Service (NPS) staff surveyed the FCH on 22 June 1988, using the photo census method developed by Davis et al. (1979). The DWC supplied the plane used for photographing the herd as well as 2 spotter planes, while NPS supplied 2 additional spotter planes.

In 1987 DWC staff in Tok monitored caribou harvest through hand-tallied harvest reports, check stations, and roving patrols on the Taylor Highway. On 28 September 1987 area and regional DWC staff

sampled the sex composition of the herd and recruitment of calves to 4 months. We used the Division's Bellanca Scout to locate radio-collared caribou; we then used a Hughes 5000 helicopter to classify caribou associated with the collared animals. DWC staff submitted a proposal to the Board of Game to allow subsistence hunting while caribou are more accessible from the Taylor Highway.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

We counted 19,950 caribou during the June 1988 census. Considering that some additional scattered caribou, primarily bulls, were also present in areas not censused, the fall 1988 (prehunting) population was about 20,000.

Population Composition:

While there does not appear to be any apparent trend in calf survival from 1983 through 1987 (Tables 1 and 2), there does appear to be a declining trend in the proportion of bulls in the population as a result of several years of bulls-only harvests (Table 2).

Distribution and Movement:

The FCH generally summers in the northern and western portions of Subunit 20E, after aggregating in late June 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. 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 those for other herds; calving has occurred on or near the winter range in recent years. Te herd's range has not increased noticeably since 1976,even though it has tripled in size (Valkenburg and Davis 1988). Range expansion should occur if 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 29 February. The bag limit for all hunters is 1 bull.

Human-induced Mortality:

The reported harvest during the 1987-88 seasons was 156 bull caribou (Table 3), representing a decline of 33% from the previous year's harvest of 232 bulls. The 1987-88 harvest was also 28% below the 5-year mean of 217 bulls. Road Patrols and hunter contacts in the fall of 1984 revealed that only 63% of successful caribou hunters had reported their harvest. Therefore, the actual harvest in 1987-88 was probably closer to 250 caribou; i.e., less than 1.5% of the herd.

More hunters (i.e., 618) reported hunting FCH caribou in 1987-88 than in 1986-87 (i.e., 532); therefore, decreased hunting pressure must be dismissed as the cause of the lower harvest. It is likely that herd distribution during both the fall and winter hunting seasons reduced the availability of caribou in accessible hunting areas during the 1987-88 seasons.

Hunter Residency and Success. Because harvest reports were hand-tallied, no complete assessment of hunter residency is possible; however, an analysis of the harvest chronology indicates that 21% (n = 33) of it occurred during the subsistence seasons. Since much effort was expended by local hunters early in the fall season as well, these hunters probably accounted for 35% to 50% of the total harvest. Few nonresident hunters hunt FCH caribou. Because of caribou distribution and movements during the open seasons, hunter success (25%) was much lower in 1987-88 than in previous seasons (Table 3).

Harvest Chronology. The number of caribou harvested each week during the general fall hunting season (10 Aug-20 Sep) ranged from 16 to 33. Sixty-eight bulls, or 44% of the fall harvest, were taken between 10 and 29 August before the moose season opened.

Transport Methods. Use of aircraft, three- or four-wheelers, and highway vehicles was approximately equal, accounting for 89% of all transportation (Table 4). Hunters using airplanes, three- or four-wheelers, and highway vehicles accounted for 57% of the harvest, resepctively.

Of 89 successful hunters using aircraft for access, 33 (37%) flew into the Molly Creek airstrip and 56 (63%) flew into various other smaller, undeveloped airstrips. All of the 202 hunters reporting the use of highway vehicles hunted in the vicinity of the Steese (n = 33) or the Taylor Highways and the short Boundary Cutoff (n = 169). Most of the 175 hunters reporting the use of three- or four-wheelers hunted either on the Taylor Mountain trail or the Chicken Ridge trail west of Chicken.

Over one-half (52%) of all hunters using aircraft were successful because they were able to access the herd in the remote northwest portion of its range during fall. Nineteen percent of hunters

using three- and four-wheelers were successful, largely because of a few small scattered bands of caribou that moved into the Taylor Mountain and Chicken Ridge Over one-half (52%) of all hunters using aircraft were successful because they were able to access the herd in the remote northwest portion of its range during fall. Nineteen percent of hunters using three- and four-wheelers were successful, largely because of a few small scattered bandt of caribou that moved into the Taylor Mountain and Chicken Ridge areas in late September. People hunting in the vicinity of the Taylor Highway were outside the range of the FCH nearly all of the fall and most of the winter; all the road-hunting effort resulted in only a 10% success rate (i.e., 21 bulls).

These 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 access the FCH. 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 to reach the herd has not been great enough to reach harvest quotas, nor have the activities of these hunters affected caribou movements toward the Taylor Highway. Restrictions on the use of aircraft for hunting the FCH would not be expected to 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 crossed the highway during its fall migration.

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. Annual composition counts have provided some indication of the chronology of calf mortality (Table 2). These data suggest that calf mortality is highest from late May to late June. The particularly low calf:cow ratio observed in June 1987 either reflects poor early calf survival or an artifact of sampling (Table 1).

Valkenburg and Davis (1988) reported that from 1983 to 1987 the adult mortality rate of the FCH was approximately 13-16%, mostly caused by wolf predation. Intensive aerial surveys indicated that 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 probably consumed 2,250 caribou (16% of the FCH >3 months) 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 is comparable to 10% estimated rate of annual growth from 1984 to 1986.

Habitat

Assessment:

Davis et al. (1978) believed that habitat conditions in the range of the FCH during the 1960's were adequate for at least 50,000 caribou. The FCH is expected to expand into historical range as it continues to grow, availing itself of ungrazed range.

Enhancement:

There is some evidence (Viereck and Schandelmeir 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. The enhancement of caribou range can only be achieved through manipulation of wildfire. Production of lichens begins about 15 years after a fire and continues for another 110 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, is also benefited by 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 in the future. About 60% of the FCH's range in Alaska is categorized as Limited Suppression which provides only for simple monitoring of wildfires.

Game Board Actions and Emergency Orders

At their November 1987 meeting, the Alaska Board of Game voted to end the practice of land-and-shoot taking of wolves and to shorten the wolf trapping season by 1 month. These actions were taken in spite of Department recommendations to increase wolf harvests so that predation losses for both caribou and severely depressed moose populations in Subunit 20E could be reduced. Most wolves harvested by trappers using the land-and-shoot method have been taken in the extreme western and northern parts of Subunit 20E. This is the area where the FCH commonly calves, aggregates during postcalving, and winters. In short, these actions are expected to aggravate efforts to meet both strategic goals and population management objectives for the FCH.

Furthermore, the Board of Game did not approve the Department's proposal to liberalize the bag limit to 1 caribou of either sex during the winter subsistence season. This lack of action will serve to keep winter subsistence harvests far below demand, even though additional caribou could be taken without exceeding the 3% annual harvest objective.

The anticipated impacts of these Board decisions are contrary to goals and objectives for management of the FCH: (1) allocation of caribou to predators will increase, (2) rate of herd growth will either stabilize or decline, and (3) allocation to all hunters will decrease.

CONCLUSIONS AND RECOMMENDATIONS

The primary management goal has been satisfactorily met since the mid 1970's. The secondary goal of providing for subsistence use was not met during this reporting period. The bag limits of 1 bull during the fall season and 1 anterless bull during the winter season, in addition to a season closure during the fall migration, have served to limit subsistence harvest far below the local demand. 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 rather restrictive seasons and bag limits, especially for nonlocal hunters.

Nonlocal hunters have had only a bag limit of 1 bull, 10 days less to hunt in the fall season than subsistence hunters, and have been excluded from the winter hunt entirely. A substantially larger herd would help meet all 3 stated goals.

In the 1920's the FCH was the largest herd in North America; however, by the mid-1970's the herd had declined to nearly nothing. Management since that time has allowed the herd to increase to about 20,000 caribou (i.e., 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 is virtually undeveloped. The FCH is a potentially accessible herd that could provide great benefits to Alaskans, if former levels of abundance are attained. Increased caribou abundance would also benefit other species of big game and furbearers occurring within the herd's range.

Historical observations and recent research findings indicate that the 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 because it could be slowed or stopped by a significant increase in wolf numbers. Furthermore, 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 the 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, while the harvest of moose and caribou should be restricted to mostly low numbers of males to allow

populations to expand. To this end, I recommend that the Board of Game (1) continue to authorize the liberal hunting seasons and limits on grizzly bears, (2) reauthorize land-and-shoot hunting of wolves, and (3) extend the trapping season for wolves.

The Board of Game should also consider regulatory changes to better address human subsistence needs for FCH caribou. Most local hunters lack the means to access the herd during the fall season, when caribou are usually located far west of the Taylor Highway. Also, most local people lack the means to access the herd in the winter, when snows close the unmaintained road and the FCH is distributed widely in scattered small bands. Extension of the hunting season during October and November, when caribou cross the Taylor Highway, would help immensely. Providing for the harvest of some female caribou, under terms of a registration permit, would also help satisfy subsistence needs and simultaneously allow a greater degree of Departmental control over the harvests. 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.

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Table 1. Summary of late June sex and age composition data for the Fortymile Caribou Herd, Subunit 20E, 1984-88.

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]	N/A	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

[a] March survey of short yearlings.

[b] April survey of short yearlings.

[c] April data only.

Table 2. Summary of fall sex and age composition data for the Fortymile Caribou Herd, Subunit 20E, 1983-87.

Year	Bulls: 100 cows	Yrlgs: 100 cows	Calves: 100 cows	Yrlg % (n)	Calf % (n)	Cow % (n)	Bull % (n)	Total sample
1983	61	39[a]	36	17 (162[a])	18 (180)	51 (498)	31 (302)	980
1984	No survey							
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

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

Table 3. Summary of reported and calculated harvests of the Fortymile Caribou Herd, Subunit 20E, 1983-87.

Year	Reported						Estimated unreported harvest[c]	Total
	No. males	No. females	No. unk.	Total harvest	No. hunters	Percent success		
1983-84	200	0	0	200	378	42[a]	117	317
1984-85	245	0	0	245	176	80[a]	144	389
1985-86	251	0	0	251	692	38[b]	147	398
1986-87	232	0	0	232	532	44[b]	88	370
1987-88	156	0	0	156	618	25[b]	92	248
X	217			217	479	45	118	350

[a] Some hunters took the legal 2-bull bag limit. Winter season not held due to Emergency Order.
[b] Bag limit, 1 bull beginning in 1985.
[c] Estimated number of caribou taken but not reported assuming a 63% reporting rate for successful hunters determined in 1984.

Table 4. Transportation methods and success by method for hunters using the harvest reporting system in Subunit 20E, 1987-88.

No. of hunters Method	Number using method (%)	Number successful (%)	% of unsuccessful	harvest
Aircraft	170 (28)	89 (52)	81	57
Horse	1 (--)	1 (100	0	1
Boat	9 (1)	4 (44)	5	3
3- or 4-wheeler	175 (28)	29 (17)	146	19
Snow machine	9 (1)	5 (56)	4	3
ORV	38 (7)	5 (13)	33	3
Highway vehicle	202 (33)	21 (10)	181	13
Unknown	14 (2)	2 (--)	12	1
Total	618	156	462	100

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, Kokrine Hills, and Ray Mountains

BACKGROUND

Caribou are distributed throughout the Kokrine Hills and Ray Mountains, north of the Yukon River from the Dalton Highway to the lowlands northwest of Galena Mountain. Galena is the local name for the 3,274-foot mountain northeast of the community of Galena. There is speculation that these animals are either feral reindeer left from a commercial operation in the Kokrine Hills or remnants of a portion of the Western Arctic Caribou Herd (WAH) that has wintered near the area sporadically since the 1960's; however, the reindeer venture ended its operation in 1935 and, apart from some animals having a pale coloration during summer, there is no evidence of reindeer characteristics in the population. The mid-May calving dates indicate that the animals are caribou.

Although there is some confusion over the "name" of the herd that resides in these mountains, I believe there are 3 distinct herds, each associated with the mountain peaks where the animals calve. The western group, composed of approximately 250-500 animals, calves east of Galena Mountain and winters west of the mountain. The middle group calves on Wolf Mountain and winters to the north and east in the Melozitna and Little Melozitna Rivers; it contains approximately 250-500 animals. The eastern group calves on the north side of the Ray Mountains and winters throughout the Ray Mountains. The 1984 population estimate was 500-1,000 animals. There have also been sightings of caribou on Moran Dome, Kokrine Hills, Caribou Mountain, and along the Yukon River.

The Galena and Wolf Mountain Caribou Herds appear to be slowly increasing in size, but survey conditions continue to hamper accurate population estimates. During winter months the Wolf and Galena Mountain caribou make extensive use of black spruce forest, where sightability is poor and clouds, fog, and winds frequently limit the Ray Mountains surveys. The herds are rarely in large aggregations; rather, they are often in very small, widely scattered groups ranging from 1 to 20 animals.

Hunter harvesting of the caribou is thought to be low; few reports are submitted, and the caribou are mostly inaccessible during the open season. The total reported and unreported harvest has averaged less than 10 caribou per year for the last 10 years.

MANAGEMENT OBJECTIVES

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

METHODS

Caribou were monitored through a cooperative radiotelemetry study involving staff from the USFWS, BLM, and ADF&G to track movements and mortality (Robinson 1988a). Annual census surveys were conducted on the Galena Mountain segment of the herd during October, and fall and spring counts were made on the Ray Mountains segment of the herd. Hunting mortality was monitored from caribou harvest reports and subsistence interviews.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

There is some evidence that the caribou found in the 3 mountains are distinct herds. The Galena Mountain Herd probably contains from 300 to 400 caribou. The slowly increasing trend occurred from 1981 to 1986, based on October counts (Table 1) in the upper Holtnakatna Creek drainage. From 1986 to 1988 the caribou were widely scattered and not enough data were collected to determine trend; however, of the 117 caribou found in 1988, 12% were calves. If mortality remains low this may provide for continued expansion of the herd. Although part of the justification for collaring the caribou was to help locate the animals during the October postrut aggregation counts, use of the collars has not helped to find more caribou. During the past 3 years few caribou have been found in the upper Holtnakatna Creek area; rather, they have been found around the Hozatka Lakes-Natlaratlen River area where the habitat is composed of fairly dense black spruce.

Because caribou are found throughout the year in the Melozitna and Little Melozitna drainages and calve on the slopes of Wolf Mountain, I think that it is a distinct herd; however, at least 1 female that winters west of Galena Mountain has been found on Wolf Mountain during summer. No winter surveys have been conducted since 1983, and the trend is unknown; it is probably slowly increasing, because calf production is similar to the other herds (Table 2). I estimate the population at 250-300 caribou. The caribou occasionally found on Moran Dome and those hunted at Birches on the Yukon River probably come from this herd.

The trend of the Ray Mountains Herd is unknown. Harvest is low, and predation is probably the main limiting factor (Robinson 1985). Based on an October 1987 survey, Robinson (1988b) estimated the population at 600 to 800 caribou. It has not been possible to estimate the numbers of caribou that are missed during surveys.

Caribou are occasionally found at Caribou Mountain between the Ray Mountains and the Dalton Highway. I suspect that these animals are wandering members of the Ray Mountains Herd, but it is not known if they occupy that area throughout the year.

Population Composition:

The Galena Mountain group was very scattered during October 1986, and snow conditions were not good enough to allow tracking of the groups. Even with 4 radio collars on animals, only 47 caribou were found during the survey. The groups contained 18 bulls and 8 calves. Almost all the caribou were lying in thick black spruce and would not have been detected without the radio collars.

In the Ray Mountains, Scott Robinson (BLM staff member) attempted to classify caribou on 4 separate surveys during October and November 1986. Inclement weather interfered with these efforts, although he counted 200 animals without classifying them. In November he found 167 caribou, including 11% calves. Although he had better conditions in October 1987, he was only able to conduct a partial survey of the northern slope of the Ray Mountains. Five hundred and eleven animals was the highest count obtained.

Distribution and Movements:

Six caribou each were radio-collared during April 1986 and 1987 from the Galena Mountain Herd. One animal in 1986 and two in 1987 died as a result of drug overdoses. There have been 17 tracking flights since the initial caribou were collared. Not all collared caribou were relocated during every flight, but the preliminary movement data showed that the Galena Mountain caribou winter (Nov-Mar) in the lowland black spruce-lake country from Galena north to Hozatka Lakes. Males range farther westward, and most females, especially those with calves, stay around the Holtnakatna Creek drainage.

Migration started in April; the animals headed toward the alpine areas east of Galena Mountain. In May 1987 the radio-collared females without calves were back in lowland black spruce habitats, while those with calves were in alpine areas. All caribou were in the alpine areas from June to September. During October caribou migrated from the alpine areas across Galena Mountain toward Holtnakatna Creek. Upper Holtnakatna Creek is the area where most of the previous October population composition surveys have been conducted for this herd.

In June 1987 a female collared in the Galena Mountain Herd wintering area was found with a calf among a group of 100 caribou on Wolf Mountain, 75 miles east of her last location. In February 1988 the female was found west of Hozatka Lakes with the Galena Mountain Herd again. During the summer of 1988 she again calved on Wolf Mountain with a hundred other caribou. It is not known if she is a Wolf Mountain animal wintering with the Galena animals or

a Galena animal calving on Wolf Mountain. Obviously, animals from the 2 herds intermix; accordingly, the herds may not be distinct.

None of the other caribou herds have radio collars; however, based upon tracks encountered during surveys, a general migration pattern for the Wolf Mountain Herd can be surmised. The herd calves on the slopes of Wolf Mountain and spends most of the summer in the surrounding alpine habitat. During October it then moves northward toward Lost Lakes on the Melozitna River. The location of the herd during midwinter has not been recently determined, but in 1978 caribou were seen on the mountains north of the Melozitna River. During May caribou were observed strung out on a 30-mile long track from Gold Hills toward the calving areas on Wolf Mountain. There were old tracks leading from the middle Little Melozitna River toward the Gold Hills.

Movements of the Ray Mountains herd are not well known; however, Robinson (1988a) found them north of the Ray Mountains and south of the Tozitna River. Based on the trails he found, he suspected that this herd makes seasonal migrations between the 2 areas.

Mortality

Season and Bag Limit:

The open seasons for subsistence 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 season or a 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:

There was no reported hunter harvest of any caribou from the area in 1987. Hunter access during the open season is severely limited. The Galena Mountain Herd is most accessible for hunting as they cross the Galena-Huslia winter trail during winter months (i.e., when the season is closed). The Wolf Mountain Herd is almost never accessible for hunting because of the scarcity of aircraft landing areas. The Ray Mountains Herd is accessible during summer by aircraft and during winter north of Tanana by snowmachine.

The reported and unreported harvests average less than 10 caribou per year. Each year 1 or 2 caribou are taken along the Yukon River near Ruby and 3 to 5 caribou are taken along the Yukon River in the Rampart-Tanana section. These are mainly bulls that occasionally wander to the river during September. In addition, 5 to 7 caribou

are estimated to be taken by hunters from Tanana and the Tozi River settlement, using snow machines for access. Within the Unit 24 range of the Ray Mountains Herd, including Caribou Mountain and the Dalton Highway, 19 caribou have been reported killed since 1981.

Natural Mortality:

Natural mortality of caribou in the area is high. Grizzly bears are probably the primary summer predator. There are also 50 to 60 wolves in 4 to 6 packs in Subunit 21C, 2 packs with 10 to 15 wolves in Subunit 21D, and a minimum of 1 pack of 5 wolves in Subunit 20F that prey on these herds. Of 9 caribou collared in the Galena Mountain Herd, four have died during the late summer in the montaine areas east of Galena Mountain. None of the dead caribou were necropsied, but predators were believed to have been responsible, indicating a very high predation rate limiting herd growth.

Game Board Actions and Emergency Orders

Within Unit 21 the seasons and bag limits have been the same for the last 10 years. In 1984 the Board of Game recognized the status of the Ray Mountains Herd, and because of concern by ADF&G Fairbanks and BLM staffs, they adopted proposals to shorten the season length and reduce bag limits in the herd's range within Unit 24 and Subunit 20F. At the request of the Tanana Fish and Game Advisory Committee, in 1985 the Board added a March either-sex season in Subunit 20F.

CONCLUSIONS AND RECOMMENDATIONS

The mountains between Galena and the Dalton Highway on the north side of the Yukon River contain from 1,150 to 1,500 caribou centered in 3 main calving areas. Although there are open hunting seasons in the area, very few caribou are taken by hunters. The management objectives for the caribou herds are to allow expansion of the herds until they are large enough to have a viable hunt during a season when caribou are more accessible. In order to keep the human harvest low and still allow a limited or opportunistic harvest, the season is opened only when access to these herds is difficult; those animals harvested are usually the ones that have wandered to the Yukon River during fall. Predation is thought to be keeping the herds small, providing little opportunity for expansion or, at best, very slow growth.

I recommend a redefining of the management objectives, after determining population size, trend, mortality factors, and distribution. Until funding levels allow for the gathering of the above data, only very general management goals relating to preservation of the herd will be proposed and hunting seasons and bag limits will 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 (%)	Bulls	Total
Jan 1978[a]	170	13 (8)	--	183
Aug 1978	--	--	--	50
May 1982	111	--	19	130
Oct 1982	42	14 (18)	21	77
May 1983	15	--	--	15
Oct 1983	114	39 (24)	10	163
Nov 1983	18	2	11	31
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
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.

STUDY AREA

GAME MANAGEMENT UNITS: 21D, 22A, 22B, 23, 24, and 26A

HERD: Western Arctic

GEOGRAPHICAL DESCRIPTION: Northwest Alaska

BACKGROUND

Caribou are believed to have existed in northwest Alaska for thousands of years. The Western Arctic Caribou Herd (WAH) ranges over approximately 60,000 mi^2 of mountain, forest, and tundra habitat during their annual migratory cycle. During recent years, the annual spring migration route of the WAH has run northward from winter ranges located near the Selawik Hills to the calving grounds located near the Colville and Utukok Rivers on the North Slope. The peak of calving normally occurs during the first week of June. During the first 2 weeks of July, postcalving aggregations of up to 100,000 animals have been observed on the northern coastal plain east of the Lisburne Hills.

During the early 1970's, the size of the WAH was estimated at approximately 240,000 caribou (Hemming 1971); by 1976 the herd had declined to about 75,000 caribou. Since 1976 Department staff have attempted to annually or biennially conduct an aerial photocensus of the herd during the postcalving aggregation period to document changes in population size. Recent censuses indicate that the WAH has been steadily increasing at a rate of 7-17% annually (James and Larsen 1987). The WAH is now the largest caribou herd in Alaska; its estimated size is 250,000 caribou.

For centuries caribou have been an important source of food and clothing for indigenous people living in northwest Alaska; however, during the past 5 years, caribou have been increasingly sought by resident and nonresident recreational hunters. Despite the increased harvest, the combined recreational and subsistence harvests are believed to be well below the sustained-yield capacity of the herd.

POPULATION OBJECTIVES

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

To minimize conflict between caribou management goals and 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 manage ment goals.

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 been used since 1979 to obtain population information on the WAH. In September 1987, 40 caribou were radio-collared (i.e., 34 cows and 6 bulls). The approximately 85 radio collars that are currently functioning in the WAH are used for 4 primary purposes: (1) to determine annual movement patterns and distribution of the herd; (2) to assist with collection of spring age composition data; (3) to assist with collection of summer calf count data; and (4) to assist in conducting the biennial photo census.

Net guns and drug-filled darts were initially used to capture caribou for collaring; however, since 1981, Department biologists have used boats to capture caribou swimming across the Kobuk River at Onion Portage, a well-used crossing point located 18 river miles downriver of the village of Ambler. We found that to effectively capture and collar caribou while they are swimming, a minimum of 2 boats equipped with stern-controlled outboard engines and 5 people were needed. Three people were placed in the collaring boat and 2 people were placed in the 2nd boat that was used to catch calves accompanying captured females.

While one person drove the collaring boat, a 2nd person sitting at the bow grabbed the antlers of a targeted caribou. Once the caribou was caught, the person driving the boat shut off the engine and dropped the anchor overboard, ensuring that the boat did not drift into shallow water during the collaring operation. Caribou were safely restrained in this fashion only when their feet were unable to touch the river bottom. Meanwhile, the 3rd person grabbed the caribou's tail, thus keeping the animal close to side of the boat. With the animal secured, the collar was affixed on the neck of the animal. Generally less than 5 minutes was required to affix the collar and release the caribou.

Capturing calves involved 2 people; 1 person to drive the boat and the other to catch and hold the calf. Calves were held with 1 hand under the lower jaw and the other behind the ears. Like the adults that were collared, calves were held in the water during the collaring operation.

When releasing captured cows and calves, every effort was made to release the two as close together as possible. The boat used to capture the calf motored to within a few feet of the collaring boat. When the cow and the calf were as close together as possible, they were released simultaneously. This usually resulted in the cow swimming towards shore, the calf pursuing closely, and

the two reuniting on the beach. Occasionally, however, the two became separated on the same side of the river by as much as 300 feet.

Three of the collared cows were outfitted with Argos Data Collection and Location System (DCLS) satellite transmitters manufactured according to specifications (Table 1) outlined in Fancy et al. (1988). The life of the satellite collars is approximately 18-24 months. During each day the transmitter is scheduled to be on, it transmits its location for a period of 6 hours. Because the satellite makes an overpass approximately once per hour, up to 6 locations per 6-hour period are received by the satellite. Because the signal received by the satellite must be of a certain minimum quality before a location fix can be made, usually less than 6 locations are reported per 6-hour period. Because the battery life of satellite transmitters is dependent on how often location data are transmitted to the orbiting satellite, we elected to vary the transmission interval for 2 collars in order to learn what interval is optimal for obtaining prolonged battery life as well as meaningful data. The 3rd collar transmits its location data every 3 days for its entire life.

Fixed-wing aircraft were used to determine the movement and distribution patterns of caribou outfitted with conventional radio collars. The raw satellite location data were retrieved from the Argos DCLS computer in Landover, Maryland by personnel from the Alaska Fish and Wildlife Research Center (U.S. Fish and Wildlife Service) in Anchorage and supplied to us on microcomputer diskettes in IBM System Data Format (ASCII) files. We wrote special computer programs to convert the ASCII data files to DBASE III+ format files in order to compile, edit, and plot the location data onto digitized base maps. If more than 1 location was received for a 6-hour period, the computer averaged the longitudes and latitudes to yield one composite location for that period. All data processing was conducted at our office in Nome using IBM PC-compatible microcomputer equipment.

Aerial spring composition surveys were conducted during April 1988 to determine short-yearling recruitment. Although most (90%) of the surveys were conducted in the vicinity of the Waring Mountains, a limited amount was also conducted near the Mulgrave Hills. Caribou were classified as either adults or short-yearlings. Supercub aircraft flying parallel to bands of caribou were used to conduct the surveys.

Radiotelemetry was used to locate groups of caribou during the spring composition surveys. When collared animals were located, the composition of up to 200 caribou in the immediate vicinity was determined. In this way we were able to more objectively distribute our sampling effort. 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.

Summer calving surveys were conducted during the first week of June on the calving grounds to determine parturition rates. Cow caribou were relocated using radiotelemetry. Once visually observed, we determined whether the cow had antlers or was accompanied by a calf. Supercub and Cessna 185 and 206 aircraft were used to conduct the surveys.

In the past we collected mandibles and blood samples from hunter-killed bull caribou on the Kobuk River during August and early September; however, none were collected in fall 1987. Diastema lengths on each mandible were measured and catalogued by year. If growth rate for diastema length is related to nutritional status, we hopefully will be able to document changes in the health of the herd. Blood sera were checked for possible disease vectors by Department staff in Fairbanks.

RESULTS AND DISCUSSION

Population Status and Trend

The WAH has continued to increase since 1976, when the population size was estimated at 75,000; however, the annual rate of increase has steadily declined (Table 2). If the rate of increase continues to decline, we may be approaching the upper limit of the herd's growth capacity. The need for successfully completing the biennial photocensuses and composition surveys is becoming increasingly important.

Population Size:

Our 1986 photocensus for the WAH resulted in a minimum count of 229,443 caribou (Table 2). In July 1988 we again conducted a photocensus of the WAH. Although results from the 1988 photocensus are not yet available, we expect the count to be approximately 250,000 caribou.

As a direct result of the increase in the size of the WAH, there has been an associated increase in the density of the herd. Using 60,000 mi^2 as a rough approximation for the range of the WAH, the density has increased from 1.2 caribou/mi^2 in 1976 to 3.8 caribou/mi^2 in 1986 (Table 2).

Population Composition:

Spring composition surveys were conducted during April 1988 (Table 3), and 18% of the 7,359 (i.e., 1325) caribou were classified as short-yearlings. Although lower than the 1986 and 1987 estimates, this figure is within the range of the 15-26% percent observed since 1977 (Table 4).

Sixty-three radio-collared caribou were located during surveys conducted on the North Slope calving grounds from 3 to 5 June 1988. One of these caribou was a bull, 27 were cows accompanied by newborn calves, 28 were cows without calves, and seven were cows

that had not been visually observed. Although only 49% of the observed cows were accompanied by calves, the actual percentage of parturient cows was probably higher, because the survey was conducted before all calves had been born. If the survey had been conducted later (after 5-8 June), we believe that a substantially greater percentage of collared cows would have been accompanied by calves. In the future, we recommend conducting calving-ground surveys after 5 June.

Distribution and Movements:

The July 1987 postcalving migration appeared to follow the same pattern observed annually during the past 10 years or more. Likewise, the fall migration pattern was normal; large numbers of caribou crossed the Kobuk River at Onion Portage and in the vicinity of Kiana.

During late October 1987, 23 radio-collared caribou were located south of the Selawik Hills. Since no flights were conducted north of the Kobuk River during October, we do not know how many collared caribou may have been present in the northern portion of their range at that time.

In late November 1987, 22 radio-collared caribou were located south of the Waring Mountains. During the same time period, 3 collared caribou were found in the Brooks Range in the vicinity of Gates of the Arctic National Park. Since no flights were made in the western Brooks Range during November, the distribution of caribou on the North Slope is not known with certainty; however, we suspect that only a small percentage of the WAH overwintered north of the Brooks Range.

Radio-tracking flights during February and March 1988 resulted in 109 collar relocations; many animals were relocated more than once. One radio-collared caribou was relocated north of the Kobuk River, 56 were south of the Waring Mountains in the vicinity of the Selawik Flats, and 52 were in the vicinity of the Selawik Hills.

Forty-six collared caribou were relocated during short-yearling composition surveys conducted in April 1988. Of these, one was in the vicinity of the Red Dog Mine in the DeLong Mountains, two were in the Mulgrave Hills, and 43 were between the Kobuk River and the Selawik Hills. The pattern of southward winter range extensions observed in recent years apparently did not occur during 1987-88, because no movement of collared caribou south of the Unalakleet River was documented.

Although the 3 cows outfitted with satellite transmitters were collared within several days of each other, they did not exhibit similar southward migration patterns during the fall and winter (Figures 1, 2 and 3). Cow No. 7908 wintered near the headwaters of the Selawik River (i.e., Purcell Mountain in Unit 23). Cow No. 7871 initially made a long trek to the headwaters of the Shaktoolik River in Subunit 22A, but it ended up wintering in Unit

23 near the confluence of the Tagagawik and Selawik Rivers. Cow No. 7870 wintered in Unit 24 in the upper Huslia River drainage.

All 3 satellite-collared animals, however, exhibited very similar migration patterns northward to the calving area, crossing the Kobuk River in close proximity to where they had been collared (i.e., Onion Portage). It is particularly interesting that they crossed the Kobuk during a very narrow time period from 13 to 18 April. All 3 animals made a westward trek on the North Slope in Subunit 26A during June and early July and an eastward trek through the Brooks Range during mid- to late July. The analysis of the satellite collar data is still preliminary, and it will be reported more completely in future progress reports.

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:

Reported harvest during 1987-88 was 2,062 caribou, much less than the 3,808 caribou reported harvested last year (Table 5); however, the 1987-88 data are incomplete because the final reminder letter for the WAH harvest registration system has not yet been sent to hunters who have failed to return their harvest reports. Nevertheless, the 1986-87 harvest tabulated prior to the mailing of the final reminder letter was 3,398 caribou, a figure still much higher than the 2,062 caribou reported for 1987-88 (Table 6). A finalized harvest estimate for 1987-88 will be included in the next annual progress report.

The lower harvest for 1987-88 is believed to have resulted from the changing distribution of caribou. Caribou spent very little time near the Seward Peninsula during the 1987-88 winter, and local residents from Unit 22 and the southern portion of Unit 23 reportedly harvested less than a third of what they took the prior year.

We believe that the reported harvest is much lower than the actual harvest. Anderson and James (1986) estimated that the reported harvest may represent as little as 25% of the actual harvest. The assumptions used for determining this percentage have not changed significantly, and we believe the current harvest may range as high as 10,000 or more caribou. The problem is not due to low reporting rates but to the reluctance of some hunters to purchase licenses

and register to hunt. Most hunters who made the effort to obtain licenses and register to hunt WAH caribou eventually reported their harvest; the reporting rates since 1984-85 have averaged 80% (Table 7).

Hunter Residency and Success. Assuming that all hunters who complied with the reporting system for the Eastern Arctic Caribou Herd and the statewide harvest ticket system were nonlocal hunters, most of the reported harvest (83%) was taken by local hunters residing in the range of the WAH. This assumption is probably valid, because neither reporting system was used in northwest Alaska. Because reporting under the WAH registration system is still in progress, the proportion of the harvest attribut able to local residents is actually much higher, probably exceeding 90%.

Although quantitative data for measuring hunter success are not available, we believe that success rates were very high for both local and nonlocal hunters. Most hunters who reported taking caribou harvested more than one (82%); 21% reported taking more than 10 caribou during the 1987-88 season (Table 7).

Harvest Chronology. As reported previously, substantial numbers of caribou were taken during both the fall and the spring. Most of the caribou taken during the fall were harvested during August through October. Although caribou were taken throughout the winter, most were harvested during January through April.

Differences in harvest chronology between 1986-87 and 1987-88 are especially noticeable for Units 22 and 23 (Table 8). Because the WAH spent very little time near the Seward Peninsula, the harvest by residents of Unit 22 and southern Unit 23 for 1987-88 was much less than that reported for 1986-87 for both the spring and fall. The spring harvest for Unit 23 was also much lower in 1988 than it was in 1987, presumably because the herd wintered farther from population centers than it previously had.

Habitat Assessment

No efforts were made to directly assess the quality and quantity of the range for the WAH. Indirect monitoring of herd nutritional status is being attempted by collecting and measuring diastema lengths of caribou mandibles. Although this technique may eventually provide useful information concerning the status of the range, its actual utility remains conjectural. It is a process that requires many successive years of data in order to identify trends. Another more expensive approach would be to set up study plots and quantify vegetation changes within them. Possible establishment of such plots will be discussed during the coming year.

CONCLUSIONS AND RECOMMENDATIONS

Since 19876, the WAH has continued to grow at a rate of 7-17% annually; the estimated population is approximately 250,000

caribou; however, the rate of increase has steadily declined, suggesting that the herd may be approaching its upper size limit. Survey-inventory activities that aid in monitoring herd status should be continued.

Harvest reporting remains a problem that needs to be addressed. Additionally, we need to continue to encourage public involvement in the regulatory process and in the formulation of management objectives for the WAH.

The Department, together with the National Park Service and the NANA Regional Corporation, has continued to monitor caribou movements and activities in the vicinity of the Red Dog Mine (i.e., roads, and port site). Although some hunting of caribou by mine employees occurs, no other impacts from the development project have been observed. Likewise, no conflict between the WAH and the reindeer industry has been reported. No regulatory changes are proposed at this time.

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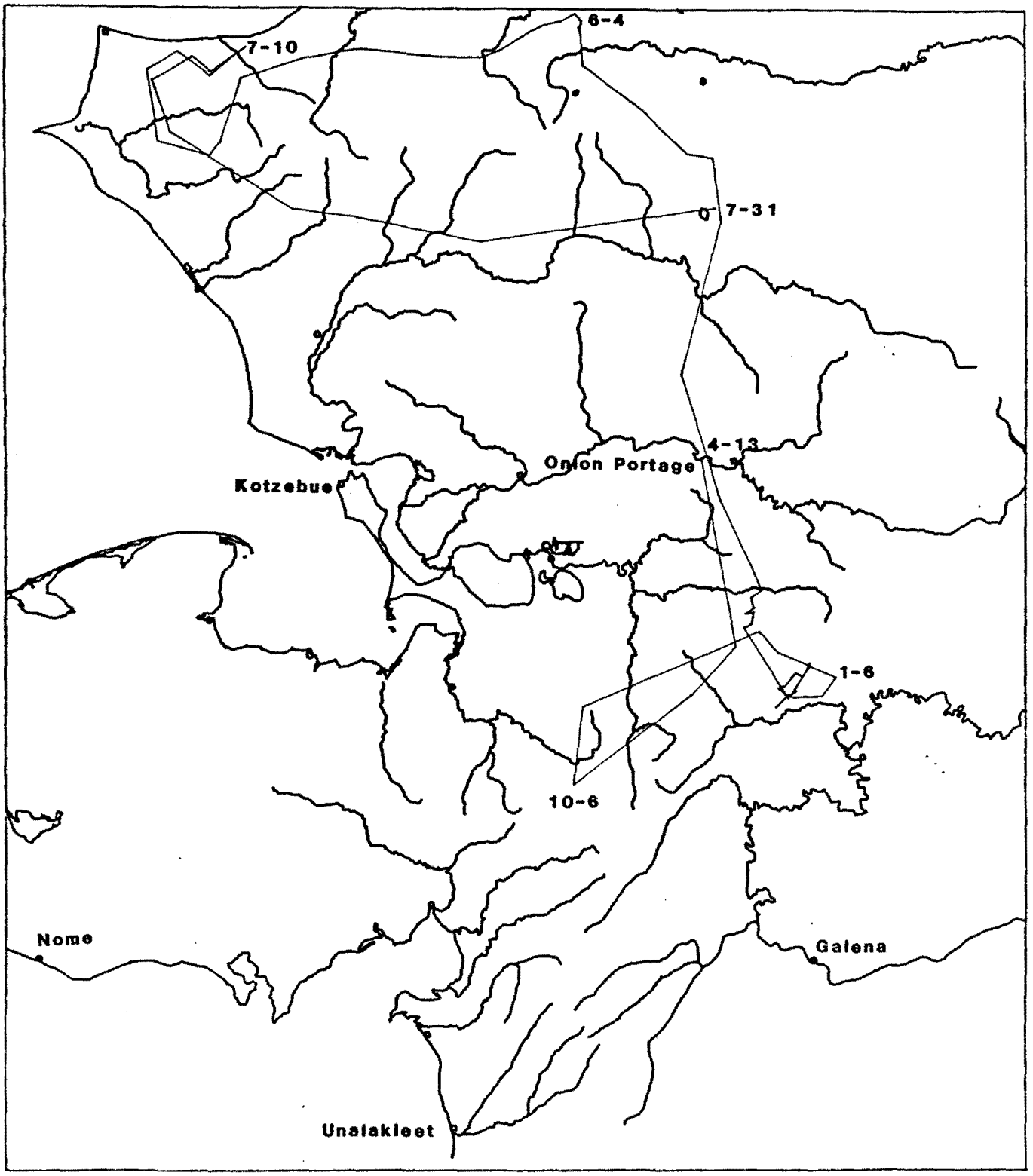

Figure 1. Movement of satellite-collared cow caribou (No. 7870) during September 10, 1987 to July 31, 1988.

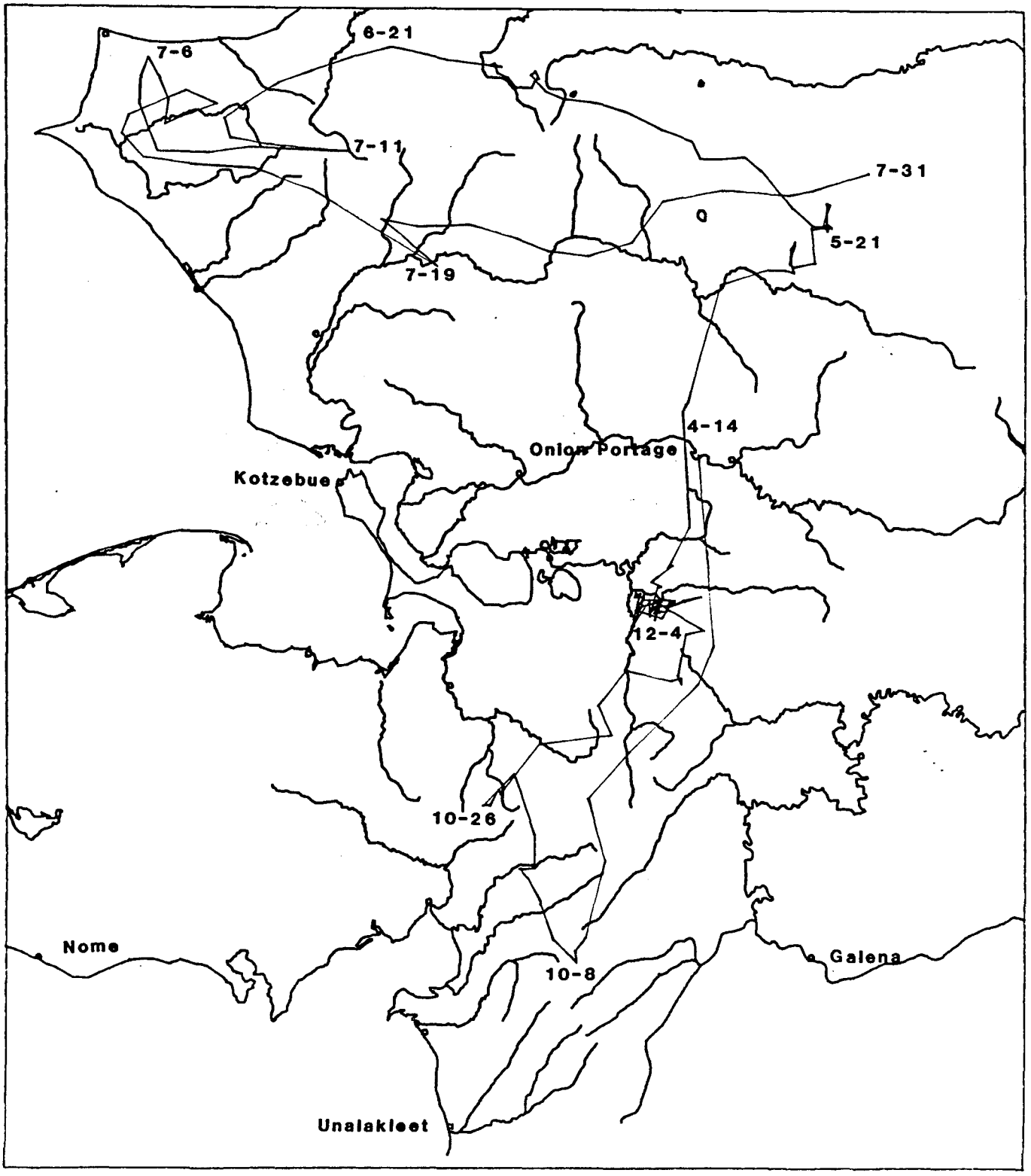

Figure 2. Movement of satellite-collared cow caribou (No. 7871) during September 10, 1987 to July 31, 1988.

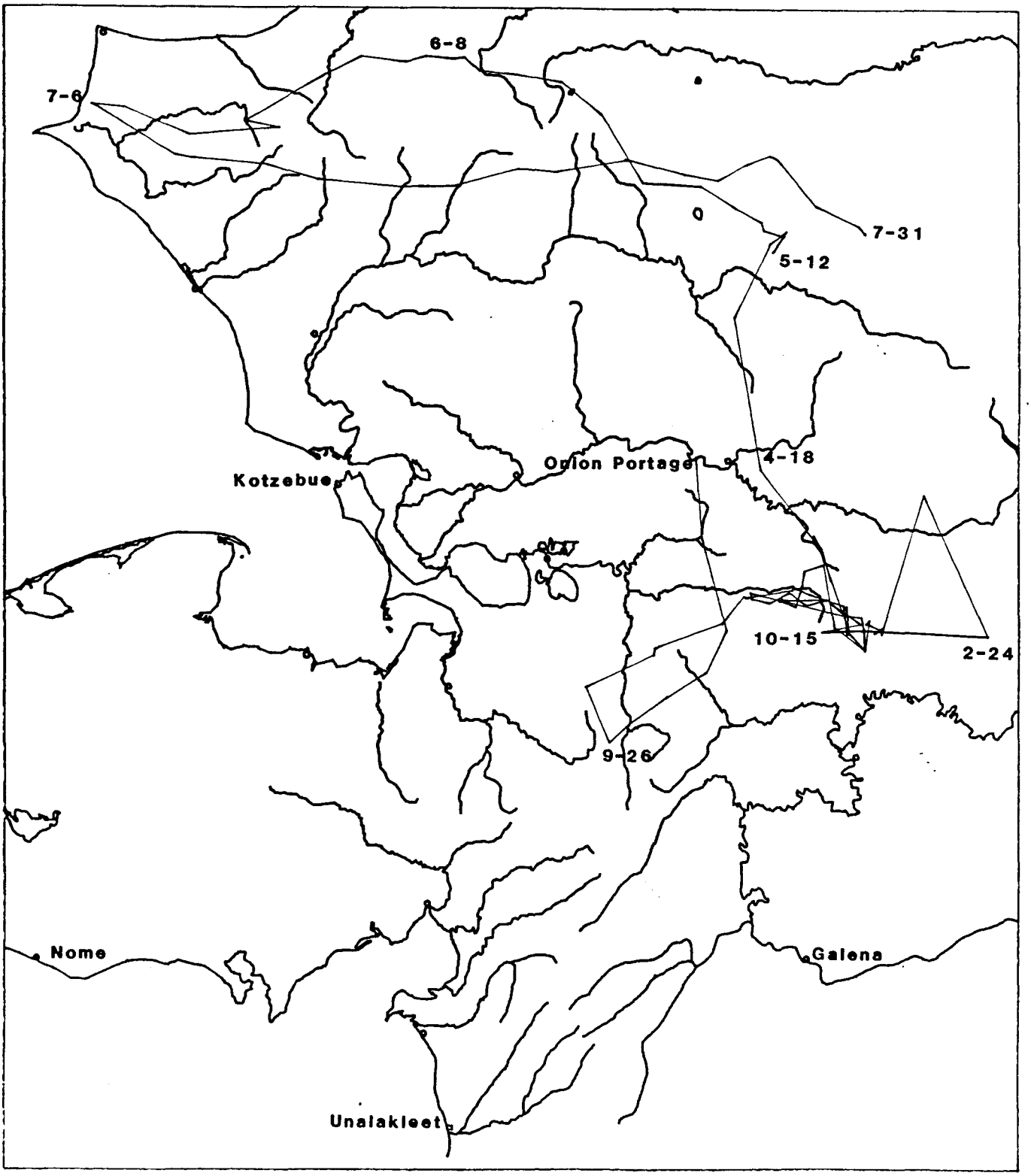

Figure 3. Movement of satellite-collared cow caribou (No. 7908) during September 10, 1987 to July 31, 1988.

Table 1. Design specifications for Argos DCLS satellite transmitters (PTT's) used on WAH caribou beginning 9 September 1987.

Transmitter (PTT) No.	Time period	Duty cycle (period PPT is "on")
7908	Entire life	6 hrs on/42 hrs off
7870	May 25 - July 15	6 hrs on/42 hrs off
	Remainder of life	6 hrs on/142 hrs off
7871	May 15 - July 31	6 hrs on/18 hrs off
	Aug 1 - Nov 30	6 hrs on/66 hrs off
	Dec 1 - Feb 28	6 hrs on/162 hrs off
	Mar 1 - May 14	6 hrs on/42 hrs off

Table 2. Population estimates, average annual rates of change, and density of the Western Arctic Caribou Herd, 1976-1986.

Year	Population estimate	Average annual rate of change	Density (caribou/mi²)[a]
1976	75,000[b]		1.2
1978	106,635[c]	17.5%	1.8
1980	138,000[c]	12.9%	2.3
1982	171,699[c]	10.9%	2.9
1986	229,433[c]	7.2%	3.8

[a] Based on an estimated range of 60,000 mi².

[b] Davis and Valkenburg 1978.

[c] Derived using aerial photocensus.

Table 3. Spring composition data for the Western Arctic Caribou Herd, 1988.

Date	Location[a]	Adults[b]	Short-yearlings	Total caribou	% Short-yearlings
8 April	Mulgrave Hills	201	71	272	26
8 April	Delong Mtns.	57	14	71	20
8 April	Middle Selawik R. drainage	555	117	672	17
11 April	Kobuk R.[c]	455	96	551	17
11 April	Lockwood Hils	830	234	1,064	22
11 April	Purcell Mtn.	1,240	247	1,487	17
11 April	Middle Selawik R. drainage	270	48	318	15
13 April	Middle Selawik R. drainage	1,610	304	1,914	16
13 April	Selawik Hills	829	181	1,010	18
	TOTAL	6,047	1,312	7,359	18

[a] All locations were within Unit 23.

[b] All caribou older than short-yearlings.

[c] 20 miles west of Ambler.

Table 4. Summary of spring composition surveys of the Western Arctic Caribou Herd, March and April 1977-1988.

Year	Unit	Adults	Short-yearlings	% Short-yearlings
1977[a]	NA	9,313	3,204	26
1978[a]	NA	7,814	1,567	17
1979[a]	NA	2,992	1,035	26
1980[a]	NA	7,823	2,559	25
1981[a]	NA	1,404	414	23
1982[b]	23,26A	5,536	1,253	18
1983[c]	23,24,26A	6,727	1,648	20
1984[d]	23,26A	4,047	936	19
1985[e]	23,26A	7,207	1,275	15
1986[f]	23	5,372	1,227	19
1987[g]	23	7,981	2,150	21
1988	23	6,047	1,312	18

[a] Davis and Valkenburg (1985).

[b] Anderson and James (1983)

[c] Anderson and James (1984).

[d] Anderson (1985).

[e] Anderson and James (1986).

[f] James and Larsen (in press).

[g] James and Larsen (1988).

Table 5. Reported harvest of caribou from the Western Arctic herd, according to 3 nonoverlapping reporting systems, 1986-87 and 1987-88.[a]

Unit	WAH harvest report		Arctic harvest report		Statewide harvest report		Total	
	1986	1987	1986	1987	1986	1987	1986	1987
21D	36	36	0	0	0	0	36	36
22	734	208	0	0	5	1	739	209
23	2163	1523	37	114	98	112	2298	1749
24	0	1	0	12	4	0	4	12
26A	322	294	9	63	15	11	346	368

[a] 1987-88 data incomplete. Harvest reporting still in progress.

Table 6. Summary of Western Arctic Caribou Herd harvest report system by hunter residency, 1987-88.

Residency	Reports issued	Reports returned (percent)	Harvest
Alaska resident (nonlocal)	62	43 (69)	24
Local resident	778	528 (68)	1974
Nonresident	92	71 (77)	64
Total	932	642 (69)	2062

Table 7. Western Arctic harvest as reported by the harvest registration system, 1984-88.

Year	No. hunters harvesting (percent) 1 caribou	1 or more caribou	5 or more caribou	10 or more caribou	Overlays issued	Reports returned (percent)	Harvest
1984-85	95 (22)	344 (38)	166 (15)	65 (15)	1063	864 (81)	2336
1985-86	103 (17)	489 (83)	294 (50)	127 (21)	1178	903 (77)	3791
1986-87	58 (11)	456 (89)	284 (55)	134 (26)	1154	934 (81)	3686
1987-88[a]	53 (18)	234 (82)	128 (45)	59 (21)	932	642 (69)	2062

[a] Data incomplete; harvest reporting still in progress.

Table 8. Number of Western Arctic caribou taken during fall and spring, 1986-87 and 1987-88.

GMU	Fall harvest		Spring harvest	
	1986-87	1987-88	1986-87	1987-88
21D	19	17	17	19
22	141	58	593	150
23	1211	1002	952	521
24	0	0	0	1
26A	208	169	114	125

STUDY AREA

GAME MANAGEMENT UNITS: 25 and 26C (59,000 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 in Canada. The herd moves between winter and summer calving ranges across approximately 250,000 km^2; most of that area is a roadless wilderness bisected by the Porcupine River (USFWS 1986).

The northeast coastal plain of Alaska, within the Arctic National Wildlife Refuge (ANWR), contains the major portion of the PCH's summer calving range. It also contains potential oil reserves that both industry and government wish to explore. The 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 stable at about 100,000 animals during the 1960's and 1970's (Table 1). The population began increasing in 1979, reaching 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).

MANAGEMENT OBJECTIVES

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

To maintain a sustained subsistence harvest (including Canada) of 2,000-6,000 caribou per year.

To provide high-quality recreational hunting opportunities within ANWR.

METHODS

The PCH population size was estimated using the modified aerial photo-direct, count-extrapolation (APDCE) technique (Davis et al. 1979) in July 1987. This census was conducted in cooperation with

U.S. Fish and Wildlife Service (USFWS) and Canadian agencies. Caribou on 7 reference photos were counted by each of 10 observers. A mean for each photo was calculated, and a correction factor was determined for each observer.

Composition counts were conducted by ground-based observers in July 1987. 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.

Harvest reports submitted by nonsubsistence hunters provided most of the data on harvest of caribou. Because subsistence harvest data were gathered opportunistically by field interview, they are incomplete.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

In the July 1987 photocensus, 172,362 caribou were counted; however, some of those animals 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 1983 count, representing a mean rate of increase of about 5.5% per year.

Population Composition:

Composition of the PCH was estimated in July 1987 by helicopter-supported ground counts (Table 2). The ratio of 26 yearlings:100 cows in 1987 was about the same as the ratio for 1986 (28:100). Whitten (1987) pointed out that yearling:cow ratios represent minimum recruitment, because yearlings are often mistaken for adults during composition surveys. The observed proportion of calves and bulls apparently increased in 1987. There were 51 and 62 calves:100 cows in 1986 and in 1987, respectively. The observed ratio of bulls:100 cows increased from 58 in 1986 to 72 in 1987. The PCH is likely to continue increasing.

Distribution and Movements:

The central Yukon Territory and northeastern Alaska compose the 2 major PCH winter ranges (USFWS 1986). In Alaska the herd usually winters near Arctic Village, but it has often wintered near Venetie too. For the first time in several years, the herd wintered as far southwest as Beaver on the Yukon River in 1986-87 (Whitten 1987); however, in 1987-88 the majority of the herd wintered in Yukon Territory. The winter range of the PCH may overlap at times with winter ranges of the Fortymile herd to the south and the Central Arctic herd to the west. Winter range is typified by rolling forested hills or by windswept ridges (USFWS 1986).

The Richardson Mountains, Old Crow area, and Brooks Range are the 3 major spring migration routes of the PCH (USFWS 1986). Pregnant females usually begin the herd's move to the north in early March; juveniles and bulls follow. Spring migration normally takes the herd toward the northern Yukon Territory and then west across the Alaskan coastal plain. Average daily movement is 7 to 8 km/24 hours and maximum movement has been measured at 25 km/24 hours (USFWS 1986).

The PCH arrives at its calving grounds in mid- to late May, and calving is usually completed by 15 June. Calving occurs along the arctic foothills and coastal plain down to the Beaufort Sea and between the Babbage River in Canada and the Canning River in Alaska (USFWS 1986). Calving most often concentrates in the "core" area between the Sadlerochit and Aichilik Rivers, centering near the Jago River. Relative lack of snow, insects, and predators are some of the characteristics of calving grounds. Postcalving aggregations of nursery bands form in early July; their movements increase during summer and peak when insect harassment from mosquitoes and bot flies becomes intense (USFWS 1986).

The PCH begins to move south through the Brooks Range and British Mountains in late July and August, as the herd breaks into smaller groups from the large postcalving aggregations. Caribou may be scattered from the east fork of the Chandalar River in Alaska to the Richardson Mountains in Canada. The PCH movement within this broad area varies considerably; much of the herd may move farther southeast into Canada or southwest toward Arctic Village, Alaska. Rutting occurs during a 2-week period in mid-October as the caribou migrate. Harems are not formed, and sex and age classes are generally evenly mixed. The PCH then completes its movement to winter ranges.

Movement data for the PCH, as determined by radiotelemetry from 1978 to 1987, indicate that the herd has no fidelity to a particular winter range in Alaska or Canada and no clear pattern of winter range use or long-term group association (Fancy et al. 1989a in press). Conventional and satellite radiotelemetry observations from 1985 to 1987 showed daily movement rates of PCH cows were highest in July and lowest in February or March (Whitten and Regelin 1988). The mean annual distance traveled by the cows was 4,355 $\pm$ 150 (SE) km, with the range as high as 5,055 km/year.

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:

Reported hunter harvest was higher in 1987-88 than in the previous 4 years (Table 3). Of the 128 caribou reported taken, 83% were bulls and 17% were cows. The 92% of the harvest that occurred in Subunits 25A and 26C was consistent with past harvests. Although the subsistence harvest continued to be largely unreported, the PCH subsistence harvest from Kaktovik was estimated at 162 $\pm$ 20 caribou (i.e., 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, they may have been less than 500 caribou. The Canadian harvest is also unknown, but based on estimates from other years when the bulk of the PCH was in Canada, it may have been between 2,000-4,000 (Whitten 1986). Maximum harvest of the PCH in 1987-88 was probably only 3-4% of the total population.

Hunter Success. A comparison of the number of harvest overlays to reports indicated that only about 50% of people who obtain harvest tickets return them to ADF&G. This discrepancy occurs annually, and it is probably due to people obtaining harvest tickets just in case they may want to hunt caribou. Returned harvest reports indicated that about 50% of the people did not hunt. Of those who did hunt, 61% were successful (Table 4). Generally, few subsistence hunters obtain harvest tickets; consequently, their level of success has been difficult to estimate. One hunter reported using a bow and arrow to take a caribou; all other successful hunters who reported used firearms. Residency of hunters was not determined for 1987-88.

Transport Methods. In 1987-88, 80% of the successful hunters used aircraft to transport caribou, 11% used boats, and the remainder (9%) used snow machines, ORV's, highway vehicles, or horses (Table 4). Only aircraft and boats were used in Subunit 26C.

Natural Mortality:

During June 1987, 51 radio-collared cows gave birth to 40 calves; i.e., a parturition rate of 78.4%. Twelve calves died within the month, resulting in a mortality rate of 30%. Mortality of calves <48 hours old appears to have declined from 1983 to 1985, 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, but more calves have been dying each year as the herd has increased. Late snow cover has apparently contributed to higher levels of predation (K. Whitten, pers. commun.). Calving occurred along the southern edge of the coastal plain in 1987, because northern areas were still covered in snow. The greater density of wolves and grizzly bears in the foothills to the south and east of the coastal plain resulted in higher-than-normal predation.

Habitat Assessment

The carrying capacity of the PCH range is not known. The population density is approximately 0.66 caribou/km^2, based on its overall range size of 250,000 km^2 (USFWS 1986). Certain areas of the herd's range regularly support higher densities of caribou during periods of concentration, but other areas rarely visited by the PCH may have long-term importance to the herd. The PCH's migration across its extensive range allows it to use a variety of habitat types, depending upon environmental conditions. Several studies have identified important environmental factors affecting caribou; e.g., snow conditions and vegetation phenology largely determine where caribou choose to winter and calve. Current research on PCH habitat relationships centers 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

Hunting seasons for the PCH have remained the same over the last 5 years. The bag limit was raised in 1984 from 5 to 10 caribou, and hunters were allowed to transport 5 caribou instead of 3 out of the area. These changes had essentially no effect on the PCH because of it's large size and inaccessibility to most hunters. Population growth and light harvest are expected to continue; therefore, no regulatory changes are recommended.

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 greater harvest than appears to have been occurring. An improved system for recording subsistence harvest needs to be found. The present system of using the "Arctic Caribou Harvest Report" is practically useless, because subsistence hunters traditionally have not reported their harvest. In addition, resident and nonresident caribou harvests should be documented centrally, as 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 a 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.

Year	Population estimate[a]	Types of estimate
1961	115,000	Calving ground census
1964	140,000	Calving ground census
1972	102,000	APDCE
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] Data from 1961 to 1986 are from USFWS (1986).

Table 2. Composition of the Porcupine Caribou Herd, July 1987.

Parameter	Cows	Calves	Yrlgs	Immature bulls	Adult bulls	Total bulls	Sample total
Number	12,719	7,882	3,275	4,494	4,674	9,168	33,044
% of herd	38	24	10	14	14	28	100
No.:100 cows	--	62	26	35	37	72	--

Table 3. Annual Porcupine Caribou Herd harvest from 1985 to 1987 as well as the 1987 harvest for Subunits 25A, 25B, 25D, and 26C.

Year	Reported harvest				Estimated unreported harvest			Total harvest
	M	F	Unk	Total	Alaska	Canada	Total	
1983				81	400	No data	400	481
1984	49	4		54	500-700	4,000	4,500-4,700	4,554-4,754
1985	52	12	1	64	500-700	4,000	4,500-4,700	4,564-4,764
1986	70	14		84	1,000-2,000	500-1,000	1,500-3,000	1,584-3,084
1987	106	22	1	129	<500	2,000-4,000	2,500-4,500	2,629-4,629
Subunit								
25A	60	10	1	71				
25B	13	3		16				
25D	0	0		0				
26C	33	9		42				

Table 3. Annual Porcupine Caribou Herd harvest from 1985 to 1987 as well as the 1987 harvest for Subunits 25A, 25B, 25D, and 26C.

Year	Reported harvest				Estimated unreported harvest			Total harvest
	M	F	Unk	Total	Alaska	Canada	Total	
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1984	49	4		54	500-700	4,000	4,500-4,700	4,554-4,754
1985	52	12	1	64	500-700	4,000	4,500-4,700	4,564-4,764
1986	70	14		84	1,000-2,000	500-1,000	1,500-3,000	1,584-3,084
1987	106	22	1	129	<500	2,000-4,000	2,500-4,500	2,629-4,629
Subunit								
25A	60	10	1	71				
25B	13	3		16				
25D	0	0		0				
26C	33	9		42				

Table 4. Hunter success for Subunits 25A, 25B, 25D, and 26C, 1987-88.

Hunters	Unit					
	25	25A	25B	25D	26C	Total
Successful	68	60	8	0	38	106
Unsuccessful	43	28	8	2	24	67
Total Hunters	111	88	16	2	62	173

Table 5. Successful hunter transport methods for Subunits 25A, 25B, 25D, and 26C, 1987-88.

Subunit	Transport method					
	Airplane	Horse	Boat	Snow machine	ORV	Unknown
25A	47	2	6	1	1	1
25B	2	1	4	--	--	1
25D	--	--	--	--	--	--
26C	36	--	2	--	--	--

STUDY AREA

GAME MANAGEMENT UNITS: 26 (26,000 mi^2)

HERD: Central Arctic

GEOGRAPHICAL DESCRIPTION: Central Arctic Slope and Brooks Range

BACKGROUND

The Central Arctic Caribou Herd (CAH) is an important subsistence resource for Native Eskimos of the region. The CAH ranges west of the Porcupine Caribou Herd, but it is much less migratory than the latter. Most of the CAH's calving range lies within or near the industrial area around Prudhoe Bay, and it winters to the south and southeast along the foothills of the Brooks Range.

The exploration and development of oil on the North Slope since the early 1970's has generated extensive research on the CAH's distribution, movements, and population dynamics as well as the effects of industrial activity on the herd. Research has shown that this activity has affected local distribution of the CAH but apparently not its productivity (Whitten 1987).

Hunting pressure reached a peak in 1985, largely because of access from the Dalton Highway and the unenforceable restrictions along the road. Changes in the 1987-88 game regulations to reduce harvests appear to have helped reverse a rapidly increasing trend over the last few years. The proximity of the CAH to the expanding oil development complex on the North Slope and it's potential for greater harvest will require continued research and management to maintain the herd's status as well as provide for subsistence uses.

MANAGEMENT OBJECTIVES

To maintain a minimum population size of 10,000 caribou, while allowing natural regulatory mechanisms to operate.

To maintain a sustained subsistence harvest of 100-200 caribou.

METHODS

The composition, distribution, and movements of the CAH were monitored during May and June 1987 between the Colville and Canning Rivers. Caribou were classified on the basis of genitalia, body size, and antler development. Fixed-wing aircraft were used between 23 May and 17 June to sample 5 areas (i.e., 1.6-km-wide strip transects) spaced at 1.6- to 4.8-kilometer intervals. A helicopter was used between 11 and 15 June to sample transects (i.e., 3.2 km wide) spaced at 3.2- to 9.7-kilometer intervals across the calving grounds. A survey was conducted by light truck along 69 kilometers of the road system in the Kuparuk Oilfield. Thirty-eight cows with conventional radio collars were monitored

on the calving grounds between 5 and 14 June, and 6 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 the harvest of caribou. Subsistence harvest data were gathered by Subsistence Division staff through field interviews with hunters.

RESULTS AND DISCUSSION

Population Status and Trend

High calf production and yearling recruitment and low natural and hunting mortalities indicate that the CAH had continued to grow. The population increased at about 13% per year between 1975 and 1983, and it has been increasing at about 7% per year since then.

Population Size:

The CAH was estimated to be about 5,000 animals in 1975 and 13,000 in 1983 (Whitten 1987). The most recent estimate placed the population at roughly 16,000 in the summer of 1986 (Lawhead and Cameron 1988). Whitten (1987) believes population growth may have slowed since 1983 because of increased hunter harvest and the lower yearling recruitment in 1987 attributed to poor weather conditions. There has been no census since 1983.

Population Composition:

The percentage of cows in the CAH in 1987 was the highest recorded since 1981 (Table 1). Bulls were underrepresented in the 1987 counts because of sexual segregation at that time of year; the bulls stayed farther south (Lawhead and Cameron 1988). Initial calf:cow ratios were higher in 1987 than in 1986 (Table 1). Cameron et al. (1988) suggested that poor nutritional condition of cows during the fall and winter of 1985-86 resulted in low natality in the summer of 1986. Poor recruitment of yearlings in 1987 followed the possibly poor 1986 natality (Table 1).

Distribution and Movements:

The CAH is relatively nonmigratory, compared with the Porcupine Caribou Herd. It ranges north of the Brooks Range between the Colville River in the west to Camden Bay and the Sadlerochit Mountains in the east (USFWS 1986). The foothills on the north side of the Brooks Range are the primary wintering grounds, although scattered groups of the CAH may winter on the coastal plain. The caribou follow plant phenology as it progresses from the foothills to the north in spring. Males show a strong affinity for riparian areas throughout summer and generally remain segregated from females until fall. Female caribou calve along the coastal plain from the Colville to the Canning Rivers. Postcalving

aggregations move east along the coast toward the Canning River. As summer progresses and insects harass the caribou, groups will move back and forth across the plain and out along coastal beaches (USFWS 1986). Mixed groups move southward in late August and September toward their wintering grounds. CAH caribou movement rates are highest in midsummer and lowest in midwinter (Fancy et al. 1988).

Most of the information of CAH distribution relates to its movements on or near the calving grounds, which encompass the oilfield complex on the coastal plain. Lawhead and Cameron (1988) summarized caribou distribution on calving grounds in 1987 as follows:

> The number of caribou counted in the western concentration areas, encompassing the Kuparuk Oilfield and vicinity, was among the lowest on record, particularly in terms of proportional use (given herd expansion over the past decade). The numbers of adult caribou counted in the overall area near the coast between the Colville and Kuparuk Rivers remained stable or increased slightly during the calving period. Within that area, however, the numbers observed on transects between Kalubik Creek and the Milne Point Road (including all Kuparuk Oilfield facilities) decreased, indicating redistribution of caribou during the period. In late May, before peak calving, use of dust shadows along roads in the oilfield was extensive, but caribou moved away from roads by peak calving and thereafter this movement was attributed primarily to increased forage availability as snow melted and to the sensitivity to disturbance of cows with young calves.

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 subsistence 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 of CAH peaked at an estimated 762-862 caribou in 1985-86. Since then, reduced bag limits and restricted access along the Dalton Highway have resulted in a declining harvest (Table 2). In 1987-88, reported harvest by nonsubsistence hunters was 181 caribou, of which 97% were bulls and 1% were cows. Subsistence harvest from Kaktovik was estimated to be 142, of which about 64% were bulls, 33% were cows, and 3% were unknown (S. Pedersen, Subsistence Resource Specialist, pers. commun.).

Subsistence harvests by residents of Anaktuvuk Pass and Nuiqsut were largely unreported. Overall harvest of the CAH in 1987-88 was estimated to be about 2%, based on a population size of 16,000 animals. This level of harvest was well below herd production.

Hunter Success. In 1983-84, 108 hunters had a success rate of 84%. There were 180 and 283 successful hunters in 1984-85 and 1985-86, respectively. Seventy-six percent of 287 hunters were successful in 1986-87. In Subunit 26B in 1987-88, only about half of the people who obtained harvest tickets returned them to ADF&G, and only about half of those people actually hunted. There were 174 successful hunters and 51 unsuccessful hunters: a success rate of 77.3% for 1987-88.

Firearms were the primary harvest method for hunters in 1987-88, but 33.5% used bow and arrow. This reflects the regulation restricting hunters to that method within 5 miles of the Dalton Highway.

Harvest Chronology. Nonsubsistence harvesting occurred primarily in the fall of 1987 and was much lower in the spring of 1988. Subsistence hunters from Kaktovik took twice as many caribou in summer as in winter; CAH caribou were harvested more heavily than usual in 1987-88 because the Porcupine Caribou Herd was unavailable all winter and much of the summer (S. Pedersen, pers. commun.).

Transport Methods. Successful hunters predominantly used aircraft and highway vehicles for transportation. Eighty-three hunters used aircraft, 71 used highway vehicles, and 11 used boats. Four of the remaining 8 hunters used a horse, snow machine, or ORV for transport. This was the 1st year since 1983 that hunters used aircraft more than highway vehicles; it can probably be attributed to better enforcement of Dalton Highway restrictions. Aircraft versus highway means of transport for 1983 to 1987 were as follows: 1983, 30 vs. 61; 1984, 40 vs. 140; 1985, 61 vs. 222; 1986, 85 vs. 133.

Natural Mortality:

Predation is an important source of mortality for caribou across North America, but its influence on CAH caribou is not clear (USFWS 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 (Lawhead and Cameron 1988), road surveys (Dau and Cameron 1986), and radiotelemetry data (Lawhead and Cameron 1988) indicated the use of calving areas by the CAH has been 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 0.33 caribou/km^2 (USFWS 1986), but the carrying capacity of the herd's range is unknown. The winter range of the CAH is in the foothills and valleys to the south, which are outside most of the oilfields; however, the calving and insect-relief areas of 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 habits.

Game Board Actions and Emergency Orders

Because of the growth of the CAH, the season and bag limit were liberalized for the 1983-84 season. The season was changed from 10 August-30 April to 1 July-30 April, which was an increase of 40 days. However, cows could only be taken from 1 October to 30 April. The bag limit was raised from 3 to 5 caribou. The bag limit for 1987-88 was changed from 5 to 1 caribou for residents and nonresidents in Subunit 26B because of the ready availability of caribou near the Dalton Highway and the rapid rise in their harvest (Whitten 1987). The subsistence bag limit remained at 5 caribou, because that harvest was believed to have remained about the same as it had been before the regulation changes. Regulations for the Nanushuk River drainage in Subunit 26A were made the same as those for Subunit 26B, since it is used primarily by the CAH.

CONCLUSIONS AND RECOMMENDATIONS

I believe the population and harvest objectives are being met. The CAH appears to be growing and harvest is well below production. The current season for the harvesting of cows from 1 October to 30 April only applies to subsistence hunters. All other hunters may take 1 caribou from 1 July to 30 April. I propose the 1 October-30 April restriction for the take of cows be applied to all other hunters as well. I believe this would be a more equitable regulation and would serve to protect cows with young calves, particularly along the Dalton Highway.

The rise in harvest of CAH caribou, which peaked in 1985-86, was due to the easy access hunters had to caribou along the Dalton Highway. Restriction of highway vehicles traveling north of Disaster Creek was poorly enforced, and prohibitions on ORV travel from the road were unenforceable. The Department of Transportation operated a check station from July through November 1986 to allow passage of only authorized vehicles along the Dalton Highway. This

was probably effective in reducing the harvest during the 1986-87 season, but hunters using the road were still very successful (Whitten 1987). More restrictive regulations were instituted regarding use of the Dalton Highway and ORV's. Motorized transport of game along the road corridor will only be permitted by aircraft, licensed highway vehicle, or boat (Whitten 1987). These latest regulation changes have apparently been successful in curbing the rapidly increasing CAH harvest. I recommend the current regulations be retained along with the change in the cow season that I have proposed.

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. 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 Department 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. Cooperation should continue with Research Projects 3.29, 3.34, and 3.35.

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Table 1. Central Arctic Caribou Herd population composition classified during aerial surveys, summer 1981-87[a].

Year	Sample size	Percent of population			N:100 cows			
		Bulls	Cows	Calves	Yrlgs	Bulls	Calves	Yrlgs
1981	1,562	1.7	47.8	41.7	8.8	3	87	19
1982	1,103	5.4	49.1	34.2	11.2	11	70	23
1983	1,859	3.9	43.6	39.6	12.9	9	91	30
1984	2,692	4.1	44.8	39.8	11.3	9	89	25
1985	2,357	6.9	41.7	36.8	14.6	16	88	35
1986	891	4.0	51.0	28.0	17.0	7	56	33
1987	7,887	2.0	51.0	38.0	10.0	4	75	19

[a] Data sources: 1981-85, Smith and Cameron (1986); 1986, R. D. Cameron (pers. commun.); 1987, Lawhead and Cameron (1988).

Table 2. Annual Central Arctic Caribou Herd harvest, 1983-87.

Year	Reported harvest			Total	Estimated unreported harvest	Total
	M	F	Unk			
1983	164	6	--	170	100-200	270-370
1984	313	55	--	368	100-200	468-568
1985	482	177	3	662	100-200	762-862
1986	311	34	--	345	100-200	445-545
1987	176	2	3	181	100-200	281-381

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