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CARIBOU

Mary V Hicks, Editor

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Study 3.0
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STATE OF ALASKA
Tony Knowles, Governor

DEPARTMENT OF FISH AND GAME
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DIVISION OF WILDLIFE CONSERVATION
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LOCATION

GAME MANAGEMENT UNITS: 7 and 15 (8,397 mi^2)

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

GEOGRAPHIC DESCRIPTION: Kenai Peninsula

BACKGROUND

There are 5 small caribou herds on Kenai Peninsula following reintroductions in 1965-66 and 1985-86. The Kenai Mountains caribou herd (KMCH) occupies that portion of Unit 7 drained by Chickaloon River, Big Indian Creek, and Resurrection Creek. The Kenai Lowlands caribou herd (KLCH) summers in Subunit 15A north of the Kenai airport to the Swanson River; the herd winters on the lower Moose River to the outlet of Skilak Lake. In the past couple years, this herd has extended its winter range to include the area around Brown's Lake in Subunit 15B. The Killey River caribou herd (KRCH) is found in the upper drainages of Funny and Killey rivers in Subunit 15B. The Fox River caribou herd (FRCH) occupies the area between upper Fox River and Truuli Creek in Subunit 15C. The Twin Lakes caribou herd (TLCH) occupies the area drained by Benjamin Creek in Subunit 15B. The fall 1995 estimated population sizes of the KMCH, KLCH, KRCH, FRCH and TLCH were 450, 100, 300, 90 and 48 caribou, respectively.

The KMCH has been hunted annually since 1972. The number of permits issued and animals harvested sharply increased as hunters became aware of the KMCH. In 1974 a harvest quota of 50 caribou was recommended to stabilize the herd at approximately 250 animals. The carrying capacity of their range was unknown. From 1972 to 1976 the department issued an unlimited number of registration permits and the season was closed by emergency order when necessary. In 1977 a limited permit system began that still remains in use. During the past 5 years, the mean annual success rate was 23%. Following the 1985 peak in population numbers, the KMCH began to decline for unknown reasons. The department reduced harvest from 1987 to 1990. Biologists surveyed the herd in fall 1992 and tallied 390 caribou; however, calf recruitment was only 14%. A March 1996 survey revealed the herd had grown to at least 425 animals, with a slightly increased calf percentage of 17%. Population trends correlated with harvest data, collected since the early 1970s, indicated the carrying capacity for this herd's range was 350 to 400 caribou.

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

The Killey River, Fox River, and Twin Lakes herds have grown steadily since the reintroduction of 80 caribou in 1985 and 1986. The herds occupied subalpine habitat rarely used by moose; however, the caribou may have competed with Dall sheep for winter range. Caribou have been absent from this area since 1912 (Palmer 1938). Biologists documented 3 instances of wolves killing caribou.

As the caribou population builds, and the moose population declines, wolf predation on caribou should increase.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

The management objective for the Kenai Mountains caribou herd is to maintain the posthunting herd at 350 to 400 animals until we can determine the carrying capacity of the winter range.

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

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

METHODS

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

POPULATION STATUS AND TREND

Population Size

Kenai Mountains Caribou Herd. The KMCH has had 2 population peaks in its 31-year history and is currently increasing to a possible record size. The original introduction grew to a preseason population of 339 animals by 1975. Hunters reduced the population to 193 by 1977. The herd reached another preseason peak of 434 in 1985 and declined to an estimated 305 animals in 1988. Since 1988 the herd has increased to 450 animals, postseason 1996 (Table 1).

Kenai Lowlands Caribou Herd. The KLCH reached a peak of 117 caribou during spring 1989. The population was stable for a year then declined to 98 animals in spring 1991 to 75 caribou in spring 1993 (Table 2). In spring of 1994 the herd increased, remained stable for 1 year, and increased again in 1996. The primary management concern was low recruitment caused by predation.

Killey River, Fox River and Twin Lakes Caribou Herds. The KRCH (Table 3), FRCH (Table 4) and TLCH (Table 5) have grown steadily since their introductions in the mid-1980s. The KRCH increased at a mean annual rate of increase of 22% (range = 13-31%) between fall 1991 and 1993. The herd remained stable over the next 2 years at about 300 animals. The Fox River herd's mean annual rate of increase was 29% (range = 14-49%) between fall 1991 and 1994 and only increased 7% by fall 1995. The Twin Lakes herd followed a similar growth pattern with a mean

annual increase of 25% between fall 1992 and 1994 and remained stable in 1995. These growth rates appeared normal for recently introduced herds on excellent range; however, the KRCH has been difficult to survey and may have been larger during fall surveys. The indication that all 3 herds have decreased growth indicates that available range is fully utilized or mortality rates have increased.

Population Composition

Kenai Mountains Caribou Herd. There were 29 calves:100 cows and 41 bulls:100 cows in March 1996. Calves composed 17% of the herd. We did not collect herd composition data during fall 1995 because of poor counting conditions. Data from fall 1992 were included for comparisons. Herd composition for 1992 was 24 calves:100 cows and 43 bulls:100 cows; calves composed 14% of the caribou observed. Calf recruitment increased slightly between fall 1992 and March 1996. The mean percentage of calves in the herd between 1990 and 1995 was 17%, with a high of 20% in 1990. The ratio of bulls to cows remained relatively stable from 1990 to 1995 with a mean of 41:100 (range = 39-43:100).

Kenai Lowlands Caribou Herd. Biologists only surveyed the KLCH during spring because of poor fall survey conditions. Area where this herd aggregated during the fall rutting period was heavily timbered and difficult to locate and classify caribou. Data collected from 1992 to 1996 indicated the mean June calf percentage was 25%, (range = 22-28%) (Table 2). Surveyors counted a low of 16 calves in 1993, compared to a high of 27 young in 1996, as the population increased from 66 to 96 caribou during the same period. Staff conducted surveys in fall, and bull to cow ratios were not available. Incidental observations indicated the ratio was probably stable and similar to KMCH.

Killey River Caribou Herd. Biologists surveyed the KRCH during fall 1993 and tallied the following ratios: 44 calves:100 cows and 56 bulls:100 cows; calves composed 22% of the 281 caribou observed (Table 3). Although surveyors did not classify bulls as small, medium, or large, field notes indicated many bulls were in the medium to large category. Composition surveys were not conducted in fall of 1994 or 1995. The mean annual calf recruitment from 1992 to 1993 was 21%.

Fox River Caribou Herd. Biologists completed composition surveys on the FRCH in fall of 1992 and 1993. They counted 50 caribou in 1992 with the following ratios: 44 calves:100 cows and 74 bulls:100 cows; calves composed 20% of the caribou observed (Table 4). In 1993 the following ratios were observed: 23 calves:100 cows and 61 bulls:100 cows; calves comprised 12% of the 57 located caribou. Calf percentage of the total observed decreased from 44% in 1991 to 12% by 1993. Only aerial surveys to assess the herd's population size were completed in 1994 and 1995. These data indicate the herd increased to about 85 caribou in 1994 and 90 in 1995.

Twin Lakes Caribou Herd. A fall composition count was completed on the Twin Lakes caribou herd in the fall of 1993. The following ratios were observed: 26 calves and 30 bulls:100 cows. Calves composed 17% of the 36 animals classified (Table 5). In 1994 and 1995 we conducted only aerial surveys revealing 45 and 48 animals, respectively. The size of this herd increased 66% from 1992 (29) to 1995 (48).

MORTALITY

Harvest

Season and Bag Limits.

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

Kenai Lowlands Caribou Herd — Open season for resident and nonresident hunters in that portion of the Kenai National Wildlife Refuge of Subunit 15A was 1-20 September; the bag limit was 1 bull caribou by drawing permit only and up to 3 permits could be issued. The season was closed beginning fall 1993.

Killey River Caribou Herd — Open season for resident and nonresident hunters in Subunits 15B south and west of Killey River in the Kenai National Wildlife Refuge was Aug. 10 to Sep. 20; the bag limit was 1 caribou by drawing permit only and up to 150 permits could be issued.

Fox River Caribou Herd — Open season for resident and nonresident hunters in Subunits 15C, that portion north of Fox River and east of Windy Lake, was Aug. 10 to Sep. 20; the bag limit was 1 caribou by drawing permit only and no more than 30 permits could be issued.

Twin Lakes Caribou Herd — The Board of Game has not authorized hunting on this herd.

Board of Game Actions and Emergency Orders. The following actions were taken by the Board of Game during this reporting period: the season was closed for KLCH in spring of 1993; number of permits available for KMCH was increased from 200 to 250, and the season opened for KRCH in spring of 1994. The season was opened for FRCH in spring of 1995.

Permit Hunts.

Kenai Mountains Caribou Herd — Hunting of this small introduced population was regulated by registration or drawing permit. Number of permits issued was unlimited between 1972 and 1976. Since 1977 permits have been limited in number and issued through a drawing. The department received over 1372 applications for 200 permits in 1994 and 1550 applications for 200 permits in 1995.

The mean annual harvest for the past 5 years was 21 caribou (range = 15–29), and bulls averaged 62% of the harvest (Tables 6 and 10). Permittees harvested 17 bulls and 11 cows in 1994 and 10 bulls and 8 cows during 1995.

Kenai Lowlands Caribou Herd — The department received 899 applications in 1991 and 954 applications in 1992 for the 3 permits issued annually to hunt the KLCH. This hunt was the most difficult permit to draw. Permittees harvested 2 bulls in 1991 and 1 bull in 1992 (Tables 7 and 11). The bull taken in 1992 exceeded the minimum score for entry into the records of North American Game. The season was closed during this reporting period.

Killey River Caribou Herd — The department received 376 applications in 1994 and 272 applications in 1995 for the 25 permits issued annually to hunt the KRCH. Permittees harvested 10 bulls and 1 cow in 1994 and 8 bulls in 1995 (Tables 8 and 12).

Fox River Caribou Herd — The department received 174 applications in 1995 for the 15 permits issued to hunt the FRCH. Permittees harvested 5 bulls in 1995 (Tables 9 and 13).

Twin Lakes Caribou Herd — The TLCH was not open to hunting during this reporting period.

Hunter Residency and Success.

Kenai Mountains Caribou Herd — Forty-two percent of permittees reported they did not hunt in 1994, while 47% did not go afield in 1995 (Table 10). Twenty-eight (24%) of the 116 hunters in 1994 and 18 (9%) of the 103 hunters in 1995 were successful (Tables 10 and 14). Local residents harvested 2 caribou and nonlocal residents harvested 26 caribou in 1994 (Table 14). Local residents took 8 caribou, and nonlocal residents harvested 9 animals in 1995. Unsuccessful hunters comprised 8 local residents and 79 nonlocal residents in 1994. No nonresidents hunted this herd in 1994. In 1995 2 nonresidents hunted unsuccessfully, compared to 27 local and 56 nonlocal residents.

Kenai Lowlands Caribou Herd — The department issued 3 permits in 1992 and 1993; all permittees hunted (Table 11). Hunters harvested 2 caribou in 1992 and 1 in 1993. Local residents killed 1 animal in 1992 and 1 in 1993. A nonlocal resident killed the second caribou in 1992 (Table 15). The unsuccessful hunters in 1992 and 1993 were nonlocal residents.

Killey River Caribou Herd — The department issued 25 permits in 1994 and 1995. Forty percent of the permittees in 1994 and 52% in 1995 did not hunt (Table 12). Hunters harvested 11 caribou in 1994 and 8 in 1995. Hunter success rate was 73% in 1994 and 67% in 1995. Five local, 5 nonlocal residents, and 1 nonresident were successful in 1994, compared to 7 local, 1 nonlocal resident and no nonresidents in 1995 (Table 16).

Fox River Caribou Herd — The department issued 15 permits in 1995, and 8 (53%) permittees hunted (Table 13). Hunters harvested 5 bulls. Hunter success rate was 63%. Local residents killed 3 animals, compared to 1 by a nonlocal resident and 1 by a nonresident (Table 17). The 3 unsuccessful hunters were local residents.

Harvest Chronology.

Kenai Mountains Caribou Herd — The harvest chronology was similar in 1993 and 1994, showing the most effort early in the season. In 1995 hunting pressure was low during the first and last hunting periods, with the highest effort midseason (Table 18). In 4 of the past 5 years, hunters have harvested 50% or more of the harvest before September 1. Permittees took 13 (46%) of the 28 caribou harvested in 1994 during the first 6 days of the season, compared to 2 (11%) of 18 during the same reporting period in 1995

Kenai Lowlands Caribou Herd — In 1991 hunters harvested both caribou during the last 5 days of the 20-day season. In 1992 the successful permittee harvested her caribou during the first 10-day hunting period (Table 19).

Killey River Caribou Herd — Hunting effort in 1994 was distributed evenly over the first 3 hunting periods with no harvest during the last period. In 1995 the effort was split evenly between the last 2 hunting periods (Table 20).

Fox River Caribou Herd — In the first year the FRCH was hunted, 40% of the effort was in the first hunting period, 20% in the next, 40% in the third, and none in the last (Table 21).

Transport Methods.

Kenai Mountains Caribou Herd — In 1994 and 1995 most successful hunters used highway vehicles for access and then hiked into the areas they hunted (Table 22). In 1994 21 (75%) successful hunters walked, while 4 (14%) used horses and 2 (7%) used aircraft. The following year 12 (67%) successful hunters walked while 4 (22%) relied on horses, 1 (6%) used an aircraft, and 1 (6%) used a mountain bike (ORV). Unsuccessful hunters followed a similar pattern of reliance on foot travel.

Kenai Lowlands Caribou Herd — The 2 successful hunters in 1991 reported using 4-wheelers for access. In 1992 the successful hunter used a highway vehicle to access the hunt area (Table 23). The hunting season was not open during this reporting period.

Killey River Caribou Herd — In 1994 and 1995 hunters used 2 primary methods to access their hunting areas: boat across Tustumena Lake then walk to the hunting area or boat across the lake and use horses to the hunt area. Forty-five percent of the hunters in 1994 used horses, compared to 75% the next year. In 1994 55% of hunters used boats, compared to only 13% in 1995. Only 1 (13%) successful hunter in 1995 used aircraft (Table 24).

Fox River Caribou Herd — Three successful hunters used a boat and 2 used horses to access the hunting area in 1995.

HABITAT

Assessment

Biologists have not thoroughly investigated the habitat components of the Kenai Mountains herd. There are approximately 1407 km^2 (563 mi^2) within the known range of the KMCH. Winter range was approximately 532 km^2 of the total identified range. The department initially discussed habitat concerns during the mid-1980s when the herd started to decline. Between 1980 and 1984 the KMCH had high calf:cow ratios and the herd was growing in size. Subsequent declines in the calf:cow ratios and herd size between 1985 and 1990 raised concerns over habitat adequacy. Hunting mortalities probably became additive around 1985; while hunting may have accelerated the decline, it provided some habitat protection. The herd declined to 300 animals by 1988 and remained at that size until 1990. The calf:cow ratio improved with 34:100 in fall 1990. As the herd increased, the percentage of calves observed declined from 20% in 1990 to 14% in fall 1992. A

March 14, 1996 composition survey revealed the herd size has continued to increase since 1992. We observed 425 caribou and 403 were classified. Classification indicated the bull:cow ratio has remained relatively unchanged at about 41:100 since 1990 and the calf:cow ratio has increased slightly from 14:100 in 1992 to 17:100 in 1996. However, since this recent survey was conducted in March, it can not be directly compared to the previous November survey, assuming calf and adult mortality over winter is not equal. Since recruitment was a reliable indicator of herd health, the KMCH appeared more productive when stabilized around 350 to 400 caribou.

The Kenai Lowlands herd has declined to a level where hunting is no longer justifiable and viewing by locals and tourists is rarely successful. The suspected reason for the sharp decline is twofold. First, this herd has sustained high calf mortality during summer and moderately high adult mortality during winter. The suspected primary predators are wolves during winter and free-ranging domestic dogs and coyotes during summer. In addition to low annual recruitment, there was a second reason for concern that this herd may not recover. The herd increased in size from about 40 animals in 1978 to 115 in 1989, but the annual recruitment was not high enough to offset the aging trend in the population. In 1991 and 1992, for example, 13 randomly captured adult caribou comprised 6 (46%) 10+-year-old, 5 (39%) 6–9 year-old, and 2 (15%) 3–5-year-old animals. If the assumptions that this herd comprises mostly aged adults and recruitment will remain low are correct, the probability of this herd recovering without assistance is low.

Although some caribou in the KLCH have been observed south and east of Kalifornsky Beach Road, Subunit 15B, in winter, most of the herd migrates east to winter on the Kenai National Wildlife Refuge along Moose River to the outlet of Skilak Lake and south to Brown's Lake. Unlike ranges for other herds on the Kenai Peninsula, summer and winter ranges were separate for this herd. The summer range was 254 km^2 (101 $mi.^2$), compared to 925 km^2 (370 $mi.^2$) for the winter. This herd occupies a large range and habitat is not limiting the growth of the KLCH at this time.

In cooperation with Fish and Wildlife Service, biologists captured 30 caribou by helicopter darting in 3 of 5 Kenai Peninsula herds between April 9 and 12, 1996. The primary purpose of this capture effort was to replace failing radio collars on adult females in Killey and Fox River herds and capture short yearling females to determine their mean weight in Killey River and Kenai Mountains herds. In addition to comparing mean weight of caribou calves among Kenai herds, we were also interested in comparing Kenai calf weights to calf weight of other herds. Data will also be available for baseline data to compare size of calves captured in these herds in the future. The Kenai Mountains and Lowland herds resulted from the 1965 and 1966 releases, whereas Killey River, Twin Lakes, and Fox River herds were established from the 1985 and 1986 efforts. All Kenai caribou are descendants of the Nelchina herd.

Capture efforts resulted in the handling of 2 adult females in the Fox River herd (1 recapture from 1991 collaring and 1 new capture); 6 adult females from the Killey River herd (2 recaptures from 1985 release nr. 11 and 38, 1 recapture from 1986 release nr. 65, 1 recapture from 1991 collaring and 2 new captures); 10 11-month-old female calves in the Killey River herd (2 radiocollared); 1 yearling female (23 months) in the Kenai Mountains herd (collared) and 11 11-month-old female calves in the Kenai Mtn. herd (no collars). Adult females were not weighed; estimated weights ranged between 125 and 136.4+ Kg (275 to 300+ lb.). Mean calf weights were

Kenai Mountains - 57.6 Kg (126.6 lb., n = 11, r = 109.0 to 146.0) and Killey River calves - 65.7 Kg (144.5 lb., n = 10, r = 140.0 to 151.0). We also recorded morphometric measurements.

Technique used to capture animals was standard helicopter darting using a Palmer dart rifle with brown charges. We attempted to minimize dart wounds to calves by pushing the dart about 10 inches farther down the barrel then is achieved with the standard dart insert. This procedure was practiced with about half of the calves captured with no visible benefit. We used the dosage recommended by Pat Valkenburg (ADF&G) for calves of 1 mg carfentanil and 65 mg xylazine loaded in a 2.5 ml Palmer dart. Reversal was accomplished with 125 mg naltrexone (IM) and 12.5 mg yohimbine (IV). Adult females were immobilized using 3.0 mg carfentanil and 100 mg xylazine. Reversal for adult females required 250 mg naltrexone (IM) and 17.5 mg yohimbine (IV). Mean down time for all ages immobilized with 1 injection (n = 25, 83%) was 6.5 minutes with a range of 4 to 15 minutes. Five (17%) of the animals required a second dart. In each of these 5 cases, a solid, intramuscular injection was not achieved, either from the dart falling out or poor shot placement. Because 17 of 25 single dart immobilizations were achieved in 4 to 6 minutes, dosages used were considered acceptable.

We changed from 1 1/8-inch dart needles to 3/4 needles to reduce dart injury. Dart injury was reduced, but capture technique was revised slightly to compensate for the shorter dart needles. We found that animals darted from a helicopter position directly behind the animal and low generally resulted in the dart striking the animal at such a low angle the dart bounced off. Approaching the caribou from a position above and darting more directly down corrected this problem.

A comparison of the mean weights for calves indicates Killey River calves are 8.1 Kg (12%) larger than calves from Kenai Mountains herd. The 425 caribou in the Kenai Mountain herd currently occupy a 1407 km^2 area, a density of 0.3 animals/km^2. The 300 Killey River caribou occupy about 371 km^2, a density of 0.8 animals/km^2. It is interesting to note that the Killey River herd density is over twice the density of Kenai Mountains but their calves are larger.

The fact that mean calf weight of Killey River calves appears to be the highest in the known herds of the state is interesting; however, several influencing factors need to be reported to make these finding applicable to future capture efforts. Calves captured this spring were born following one of the most severe winters on record for the Kenai Peninsula. The severe winter of 1994–95 was also followed by one of the best growing seasons due to warm days with a record amount of rain. The winter of 1995–96 was, in contrast, one of the mildest on record. As a result, although these weights seem appropriate for the range conditions, they are probably the highest mean weights one could expect from these herds and may not represent an average calf weight following a normal summer growing season and winter. Similar environmental conditions should be noted for the Kenai Mountains herd.

Department and Kenai National Wildlife Refuge biologists conducted preliminary habitat assessments for the Killey and Fox River herds before reintroduction in the mid-1980s. These results, published in the Kenai Peninsula Caribou Management Plan, indicated the KRCH's range (371 km^2) should sustain a minimum of 350 caribou, the FRCH (85 km^2) could sustain

approximately 80, and the TLCH range of 216 km^2 could support 200 animals. Calf recruitment for these herds has been high and habitat has not limited their growth.

CONCLUSIONS AND RECOMMENDATIONS

Recent survey and harvest data indicate the department is exceeding the KMCH postseason population objective of 400 caribou. Limited habitat, inclement weather, predation, and human harvests are plausible explanations for the herd's decline from 434 in 1985 to 310 animals in 1990. Reductions in harvests during the early 1990s allowed the herd to increase, reaching a record high of 450 caribou before the 1996 season. I suggest we change the population objective to a maximum of 400 caribou before the fall hunting season and allow for an annual harvest that maintains the population between 350 and 400 (preseason) until we identify factors influencing calf recruitment.

The KLCH has slowly increased over the past four years from 1992 to 1996. Low calf recruitment is still the primary management concern for this herd. Department and FWS biologists suspect predation coupled with insufficient annual recruitment to offset the aging trend rather than available range is limiting herd growth. If the herd continues to increase, I recommend not allowing harvest until the herd increases to approximately 150 animals.

The Killey and Fox River herds have increased significantly and annual recruitment indicates these herds have sufficient range to achieve projected population sizes. A secondary management objective was to allow hunting as these herds increased. I recommend the department continue harvesting a limited number of caribou in these herds to decrease the herd's growth rate. A decreased rate of growth will allow biologists time to determine the optimum density for these herds. Several years of assessing hunters' success may be necessary to properly manage annual harvests because hunter access is difficult.

The Twin Lakes caribou herd increased steadily between 1991 and 1994 and slowed its growth in 1995 to only a 7% increase from the 1994 count. Because this herd has the habitat potential to increase to about 200 animals, I recommend we monitor the herd to determine if the low 1995 count was a 1-year event or caused by currently unknown limiting factors. I recommend we propose a limited permit hunt for this herd when its density reaches 0.5 caribou per km^2. Initiating a controlled hunt before the herd reaches its habitat potential will allow biologists time to evaluate the herd's health and still allow for growth.

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Table 1 Kenai Mountains caribou fall composition counts and estimated population size, 1991-1995

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Total bulls (%)	Composition sample size	Estimate[a] of herd size
1991/92[b]	--	--	--	--	--	--	--	--	--
1992/93[c]	43	24	14	60	--	--	26	390	406
1993/94[b]	--	--	--	--	--	--	--	--	--
1994/95[b]	--	--	--	--	--	--	--	--	--
1995/96[d]	41	29	17	59	--	--	--	403	450

[a] Estimated herd size postseason.
[b] Surveys were incomplete.
[c] Survey conducted on 11 November 1992, after the end of this reporting period
[d] Survey conducted on 14 March 1996.

Table 2 Kenai Lowlands caribou composition counts and estimated population size, 1991-1995

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Total bulls (%)	Composition sample size	Estimate[a] of herd size
1991/92[b]	--	--	24	--	--	--	--	74	74-80
1992/93[c]	--	--	24	--	--	--	--	66	66-75
1993/94[d]	--	--	28	--	--	--	--	86	86-90
1994/95[e]	--	--	22	--	--	--	--	86	86-90
1995/96[f]	--	--	28	--	--	--	--	96	96-100

[a] Estimated herd size in June.
[b] Survey date 6 June 92.
[c] Survey date 8 June 93
[d] Survey date 20 June 94.
[e] Survey date 21 June 95.
[f] Survey date 21 June 96.

Table 3 Killey River caribou composition counts and estimated population size, 1991-1995

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Total bulls (%)	Composition sample size	Estimate[a] of herd size
1991/92[b,c]	--	--	--	--	--	--	--	--	--	--
1992/93[d]	67	43	20	48	--	--	--	32	222	222
1993/94[e]	56	44	22	50	--	--	--	28	281	290
1994/95[f,c]	--	--	--	--	--	--	--	--	259	300
1995/96[g,c]	--	--	--	--	--	--	--	--	261	300

[a] Estimated herd size in fall.
[b] Survey date 11 November 1991.
[c] Aerial survey using fixed-wing aircraft - total count only
[d] Survey date 11 November 1992.
[e] Survey date 15 November 1993.
[f] Survey date 31 October 1994.
[g] Survey date 28 November 1995.

Table 4 Fox River caribou fall composition counts and estimated population size, 1991-1995

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Total bulls (%)	Composition sample size	Estimate[a] of herd size
1991/92[b,c]	--	--	--	--	--	--	--	--	--	40
1992/93[d]	74	44	20	46	--	--	--	34	50	50
1993/94[e]	61	23	22	54	--	--	--	33	57	57
1994/95[f,c]	--	--	--	--	--	--	--	--	83	85
1995/96[g,c]	--	--	--	--	--	--	--	--	89	90

[a] Estimated herd size in fall. Not hunted.
[b] Survey date 11 November 1991.
[c] Aerial survey using fixed-wing aircraft - total count only
[d] Survey date 11 November 1992
[e] Survey date 15 November 1993.
[f] Survey date 31 October 1994.
[g] Survey date 9 April 1996.

Table 5 Twin Lakes caribou fall composition counts and estimated population size, 1991–1995

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Total bulls (%)	Composition sample size	Estimate[a] of herd size
1991/92[b,c]	--	--	--	--	--	--	--	--	--	14
1992/93[d,c]	--	--	--	--	--	--	--	--	--	29
1993/94[e]	30	26	17	64	--	--	--	19	36	36
1994/95[f,c]	--	--	--	--	--	--	--	--	45	45
1995/96[g,c]	--	--	--	--	--	--	--	--	48	48

[a]Estimated herd size in fall.
[b]Survey date 11 November 1991.
[c]Aerial survey using fixed-wing aircraft - total count only.
[d]Survey date 11 November 1992.
[e]Survey date 15 November 1993.
[f]Survey date 31 October 1994.
[g]Survey date 28 November 1995.

Table 6 Kenai Mountains caribou harvest and accidental death, 1991–95

	Hunter Harvest									
	Reported					Estimated				
Regulatory year	M	(%)	F	(%)	Unk.	Total	Unreported	Illegal	Total	Accidental death	Grand total
1991/92	9	(56)	7	(44)	0	16	--	--	--	--	16
1992/93	11	(73)	4	(27)	0	15	--	--	--	--	15
1993/94	19	(66)	10	(34)	0	29	--	--	--	--	29
1994/95	17	(61)	11	(39)	0	28	--	--	--	--	28
1995/96	10	(56)	8	(44)	0	18	--	--	--	--	18

Table 7 Kenai Lowlands caribou harvest and accidental death, 1991–95

Regulatory year	Hunter Harvest: Reported M (%)	F (%)	Unk.	Total	Estimated: Unreported	Illegal	Total	Accidental death	Grand total
1991/92	2	0	0	2	--	--	0	2[a]	4
1992/93	1	0	0	1	--	--	0	1[c]	2
1993/94	0	0	0	0[b]	--	--	0	7[d]	7
1994/95	0	0	0	0[b]	--	--	0	2[c]	2
1995/96	0	0	0	0[b]	--	--	0	1[c]	1

[a] Road killed adult female & calf. [b] No hunting season. [c] Road killed adult. [d] Road killed: 3 adults & 4 calves.

Table 8 Killey River caribou harvest and accidental death, 1991–95

Regulatory year	Hunter Harvest: Reported M (%)	F (%)	Unk.	Total	Estimated: Unreported	Illegal	Total	Accidental death	Grand total
1991/92	0	0	0	0[a]	--	--	0	0	0
1992/93	0	0	0	0[a]	--	--	0	0	0
1993/94	0	0	0	0[a]	--	--	0	0	0
1994/95	10 (91)	1 (9)	0	11	--	--	0	0	11
1995/96	8 (100)	0	0	8	--	--	0	0	8

a No hunting season.

Table 9 Fox River caribou harvest and accidental death, 1991-95

Regulatory year	Hunter Harvest							Accidental death	Grand total
	Reported				Estimated				
	M (%)	F (%)	Unk.	Total	Unreported	Illegal	Total		
1991/92	0	0	0	0	--	--	0	0	0
1992/93	0	0	0	0	--	--	0	0	0
1993/94	0	0	0	0	--	--	0	0	0
1994/95	0	0	0	0	--	--	0	0	0
1995/96	5 (100)	0	0	5	--	--	0	0	5

Table 10 Kenai Mountains caribou harvest data by permit hunt, 1991-95

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
501/ Unit 7	1991/92	100	45	29	71	56	44	--	16
	1992/93	100	47	28	72	73	27	--	15
	1993/94	200	47	27	73	66	34	--	29
	1994/95	200	42	24	76	61	39	--	28
	1995/96	200	47	19	81	56	44	--	18

Table 11 Kenai Lowlands caribou harvest data by permit hunt, 1991-95

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
506/15A	1991/92	3	0	67	33	2 (100)	0	0	2
	1992/93	3	0	33	67	1 (100)	--	--	1
	1993/94[a]	0	--	--	--	--	--	--	0
	1994/95[a]	0	--	--	--	--	--	--	0
	1995/96[a]	0	--	--	--	--	--	--	0

[a] No hunting season.

Table 12 Kenai Lowlands caribou harvest data by permit hunt, 1991-95

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
608/15B	1991/92[a]	0	--	--	--	--	--	--	0
	1992/93[a]	0	--	--	--	--	--	--	0
	1993/94[a]	0	--	--	--	--	--	--	0
	1994/95	25	40	73	27	10 (91)	1(9)	0	11
	1995/96	25	52	67	33	8(100)	0	0	8

[a] No hunting season.

Table 13 Killey River caribou harvest data by permit hunt, 1991-95

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
608/15B	1991/92 [a]	0	--	--	--	--	--	--	0
	1992/93 [a]	0	--	--	--	--	--	--	0
	1993/94 [a]	0	--	--	--	--	--	--	0
	1994/95 [a]	0	--	--	--	--	--	--	0
	1995/96	15	47	63	37	5(100)	0	0	5

[a] No hunting season.

Table 14 Kenai Mountains caribou annual hunter residency and success, 1991-95

	Successful					Unsuccessful					
Regulatory year	Local [a] resident	Nonlocal resident	Nonresident	Total [b]	(%)	Local [a] resident	Nonlocal resident	Nonresident	Total [b]	(%)	Total hunters
1991/92	2	13	1	16	(29)	2	35	0	37	(67)	55
1992/93	1	13	1	15	(28)	4	30	2	38	(72)	53
1993/94	4	25	0	29	(26)	5	78	2	85	(74)	111
1994/95	2	26	0	28	(24)	8	79	0	88	(76)	116
1995/96	8	9	0	18	(18)	2	56	2	85	(83)	103

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

Table 15 Kenai Lowlands caribou annual hunter residency and success, 1991-95

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	
1991/92	1	1	0	2	(67)	0	1	0	1	(33)	3
1992/93	1	0	0	1	(33)	0	2	0	2	(67)	3
1993/94[b]	--	--	--	--		--	--	--	--		--
1994/95[b]	--	--	--	--		--	--	--	--		--
1995/96[b]	--	--	--	--		--	--	--	--		--

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

Table 16 Killey River caribou annual hunter residency and success, 1991-95

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	
1991/92[b]	--	--	--	--		--	--	--	--		--
1992/93[b]	--	--	--	--		--	--	--	--		--
1993/94[b]	--	--	--	--		--	--	--	--		--
1994/95	5	5	1	11	(73)	1	3	0	4	(27)	15
1995/96	7	1	0	8	(67)	3	1	0	4	(33)	12

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

Table 17 Fox River caribou annual hunter residency and success, 1991-95

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	
1991/92[b]	--	--	--	--	--	--	--	--	--
1992/93[b]	--	--	--	--	--	--	--	--	--
1993/94[b]	--	--	--	--	--	--	--	--	--
1994/95[b]	--	--	--	--	--	--	--	--	--
1995/96	3	1	1	5 (63)	3	0	0	3 (37)	8

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

Table 18 Kenai Mountains caribou annual harvest chronology percent by time period, 1991-95

Regulatory year	Harvest periods				*n*
	8/10-8/15	8/16-8/31	9/1-9/15	9/16-9/30	
1991/92	13	40	20	27	15[a]
1992/93	7	13	53	27	15
1993/94	38	31	17	14	29[a]
1994/95	46	29	14	11	28
1995/96	11	39	39	11	18

[a] One hunter failed to report harvest chronology.

Table 19 Kenai Lowlands caribou annual harvest chronology percent by time period, 1991-95

Regulatory year	Harvest periods 9/1-9/15	9/16-9/30	*n*
1991/92[a]	0	100	2
1992/93[a]	100	0	1
1993/94	no season		
1994/95	no season		
1995/96	no season		

[a] Season dates 1-20 September 1991/92 and 1992/93.

Table 20 Killey River caribou annual harvest chronology percent by time period, 1991-95

Regulatory year	Harvest periods 8/10-8/15	8/16-8/31	9/1-9/15	9/16-9/30	*n*
1991/92	no season				
1992/93	no season				
1993/94	no season				
1994/95	36	27	36	--	11
1995/96	--	--	50	50	8

Table 21 Fox River caribou annual harvest chronology percent by time period, 1991-95

Regulatory year	Harvest periods 8/10-8/15	8/16-8/31	9/1-9/15	9/16-9/30	*n*
1991/92		no season			
1992/93		no season			
1993/94		no season			
1994/95		no season			
1995/96	40	20	40	--	5

Table 22 Kenai Mountains caribou harvest percent by transport method, 1991-95

Regulatory year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1991/92	--	19	--	--	--	6[a]	75	0	16
1992/93	7	27	--	7	--	--	60	0	15
1993/94	10	21	--	--	--	--	59	10	29
1994/95	7	14	--	--	--	--	75	4	28
1995/96	6	22	--	6	--	--	67	0	18

[a] ORV includes mountain bike.

Table 23 Kenai Lowlands caribou harvest percent by transport method, 1991-95

Regulatory year	Percent of harvest								*n*
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk.	
1991/92	--	--	--	100	--	--	--	0	2
1992/93	--	--	--	--	--	--	100	0	1
1993/94				no season					
1994/95				no season					
1995/96				no season					

Table 24 Killey River caribou harvest percent by transport method, 1991-95

Regulatory year	Percent of harvest								*n*
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk.	
1991/92				no season					
1992/93				no season					
1993/94				no season					
1994/95	--	45	55	--	--	--	--	0	11
1995/96	13	75	13	--	--	--	--	0	8

Table 25 Fox River caribou harvest percent by transport method, 1991-95

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk.	*n*
1991/92				no season					
1992/93				no season					
1993/94				no season					
1994/95				no season					
1995/96	--	40	60	--	--	--	--	0	5

LOCATION

GAME MANAGEMENT UNITS: 9B, 17, 18 (south), 19A, and 19B (60,000 mi^2)

HERD: Mulchatna

GEOGRAPHIC DESCRIPTION: Drainages into northern Bristol Bay and Kuskokwim River

BACKGROUND

Little objective information is available on the Mulchatna Caribou Herd (MCH) before 1973. The first historical accounts of caribou in the area are contained in the journals of agents of the Russian-American Fur Company (Van Stone 1988). In 1818, while traveling through areas now included in Game Management Units 17A and 17C, Petr Korsakovskiy noted that caribou were "plentiful" along Nushagak Bay and there were "considerable" numbers of caribou in the Togiak Valley. Another agent, Ivan Vasilev, wrote that his hunters brought "plenty of caribou" throughout his journey up the Nushagak River and into the Tikchik Basin in 1829. Skoog (1968) hypothesized that the caribou population at that time extended from Bristol Bay to Norton Sound, including the lower Yukon and Kuskokwim River drainages as far inland as Innoko River and Taylor Mountains. This herd apparently reached peak numbers in the 1860s and began declining in the 1870s. By the 1880s, the large migrations of caribou across the Lower Kuskokwim and Yukon Rivers had ceased.

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

Reindeer were brought into the northern Bristol Bay area during the early part of the 20th century to supplement the local economy and food resources. Documentation of the numbers and fate of these animals are scarce, but many local residents remember a widespread thriving reindeer industry before the 1940s. Herds ranged from the Togiak to the Mulchatna River drainages, with individual herders following small groups throughout the year. Suspected reasons for the demise of the reindeer herds include wolf predation and the expansion of the commercial fishing industry. Local residents also suggest that many reindeer interbred with Mulchatna caribou and eventually joined the herd.

Aerial surveys of the MCH range were first conducted in 1949, when the population was estimated at 1000 caribou (ADF&G files 1974). The population increased to approximately 5000 by 1965 (Skoog 1968). In 1966 and 1972 relatively small migrations across the Kvichak River were recorded; however, no major movements of this herd were observed until recently. An estimated 6030 caribou were observed during a survey in June 1973. In June 1974 a major effort was made to accurately census this herd. That census yielded a total of 13,079 caribou, providing a basis for an October estimate of 14,231 caribou.

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

was a problem, and biologists often underestimated the herd size. Twenty radio transmitters were attached to MCH caribou in 1981, providing assistance in finding postcalving aggregations. During a photocensus on 30 June 1981, 18,599 caribou were counted. Photocensus estimates of the MCH since then have documented a steady rate of increase.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

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

Additional objectives include:

1 Manage the MCH for maximum opportunity to hunt caribou

2 Manage the MCH in a manner that encourages range expansion west and north of the Nushagak River.

METHODS

We have conducted a photocensus of the MCH during the postcalving aggregation period in late June or early July in most years from 1980–1996. In recent years, the censuses have been scheduled on an alternate year basis, occurring in even years. The department coordinates censuses out of the Dillingham area office, in cooperation with personnel from Lake Clark National Park (LACL), Togiak National Wildlife Refuge (TNWR), and Yukon Delta National Wildlife Refuge. Biologists, using Super Cub (PA-18) and Cessna 185 aircraft, radiotrack and survey the herd's range, estimating the number of caribou observed and photographing discrete groups using hand-held 35-mm cameras. Since 1994 we've photographed large aggregations with an aerial mapping camera mounted in a DeHavilland Beaver (DH-2) aircraft flown by department staff from Fairbanks. We estimate herd size by adding 3 components of the survey: 1) the number of caribou counted in photographs, 2) an estimate of caribou observed but not photographed, and 3) the estimated number of caribou in areas not surveyed during the census.

We conducted aerial surveys to estimate the sex and age composition of the herd with a Cessna 185 and a Robinson R-22 helicopter in October 1993 and a R-44 helicopter in 1996. These surveys are scheduled in alternating years, occurring in odd years.

We have captured and radiocollared MCH caribou in most years from 1980 to 1992. Beginning in 1992, collaring programs were put on an alternating yearly basis, occurring in even years. Between 16–18 April 1996, we radiocollared 28 female caribou in the Koktuli, Swan, and Chulitna River drainages, using a Hughes 500-D helicopter with a skid-mounted net gun. This effort was a cooperative effort between the department, LACL, and TNWR.

We conducted periodic radiotracking flights throughout this reporting period to continue the demographics study that began in 1981. Supplemental funding from the Bureau of Land Management (BLM) and U.S. Fish and Wildlife Service allowed us to schedule monthly flights in 1995 and 1996. Staff from BLM plan to enter radiotracking data from these flights into a statewide interagency GIS database.

We monitored the harvest and maintained an enforcement presence via fixed-winged aircraft and helicopter during the last of August and throughout September, when hunting pressure was most intense. Harvest data are collected from statewide harvest reports. Hunter "overlay" information is not keypunched and reminder letters are not sent to hunters who failed to report.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Between 1981 and 1996, the MCH increased at an annual rate of 17% (Figure 1). From 1992–1994, the annual rate of increase appeared to be 28%, but this was probably an artifact of more precise survey techniques. The dramatic growth of the herd is attributed to a succession of mild winters, movements onto virgin range, low predation rates, and an estimated annual harvest rate of less than 5% of the population since the late 1970s.

Population Size

We conducted a photocensus of the MCH on 29 June through 3 July 1996. Based on results of that survey, the minimum population estimate for the MCH was 192,818 (Table 1). These data indicate the herd continued to increase in size during this reporting period, but the rate of increase during the past few years maybe slowing down.

Population Composition

We conducted a sex and age composition survey on a large aggregation of caribou (ca. 50,000) about 25 miles long and 5 miles wide in the Mosquito River and Keefer Creek drainages in October 1993. The group consisted of all sex and age classes, but many of the large bulls were lagging behind the rest of the group. Bull:cow and calf:cow ratios appeared to be relatively high within this sample (Table 2). No composition surveys were conducted in 1994 or 1995. In October 1996 we surveyed a small group of caribou near Portage Creek. We were uncertain whether these animals were part of the main herd or members of the Portage Creek subherd.

Radiotelemetry flights to delineate calving areas were conducted on 21, 22, and 31 May 1996. The peak of calving appeared to be during the census period. About 100,000 adult caribou were in the headwaters of the King Salmon and Klutuspak Creeks, and a survey of several bands of caribou yielded a ratio of 75 calves:100 cows, the highest ever recorded for this herd and considerably higher than the 48:100 noted in 1995. A few cows were observed nursing 2 calves at the same time, indicating twinning.

Distribution and Movements

The MCH continued to increase its range as it increased in number. To follow the movements of the herd, we had 75 caribou with active radio collars in July 1996. These included 22 deployed in range of the Kilbuck caribou herd.

Wintering Areas. The most significant wintering area for the MCH during the 1980s and early 1990s was along the west side of Iliamna Lake, north of the Kvichak River. While there, MCH animals appeared to intermingle with caribou from the Northern Alaska Peninsula Caribou Herd (NAPCH). Analysis of radio telemetry data indicated that the MCH had been moving its winter

range to the south and west during most of the late 1980s and early 1990s (Van Daele and Boudreau 1992).

Most of the herd did not move into traditional wintering areas in large numbers during this reporting period due to abnormally low snow levels. Approximately 30–40,000 caribou moved into lower Kuskokwim River drainages during the late fall of 1994 and 1995 and remained there until spring. During the fall of 1996, the size of this group swelled to 50,000, with 20–30,000 moving into the Togiak drainage. During the winters of 1995 and 1996, the remainder of the herd was scattered throughout their post-rut areas, with the largest concentrations along the Buckstock River in the Aniak drainage and in the Hoholitna and Stony River drainages. Use of these non-traditional wintering areas relieved the grazing pressure on more typical winter ranges.

Calving Areas. The MCH has changed its calving areas in recent years. Taylor (1988) noted the main calving area for the MCH included the upper reaches of the Mulchatna River and the Bonanza Hills, and that small groups were observed in the Jack Rabbit and Koktuli Hills, Mosquito Creek, and the Kilbuck Mountains. In 1992, only 10–15,000 adult female caribou were along the upper Mulchatna River and fewer than 1000 were in the Bonanza Hills area. During that year, the Mosquito River drainages contained about 20,000 calving females, and an estimated 20,000 adult females were located near Harris Creek, northeast of the village of Koliganek. Large male aggregations (>10,000) were along Vukpalik Creek (Nushagak drainage) and Hook Creek (Hoholitna drainage) (Van Daele 1993).

During our survey in May 1994, the main calving group was in the Tikchik Basin, east of Upnuk and Nishlik Lakes, an area typically used during postcalving aggregations. Large groups were throughout the basin, with trails coming from the north, east, and west. We estimated 50,000 adult females were in the area; the calf:cow ratio was 70:100. We also found 10 of the 18 radio-collared Kilbuck caribou in the basin.

Most of the MCH and several Kilbuck caribou calved in the Tikchik River basin again in 1995. Productivity within the core area was lower and later than we had observed in the previous 4 years. From 18–22 May 1995, productivity was 30:100; by 31 May 1995 the number of caribou had decreased, but productivity rose to 48:100. We looked at approximately 10,000 caribou during each period. There was an obvious distinction between groups of barren and productive cows. There was no evidence of predation on the calving grounds, other than a few ravens.

In 1996 most of the MCH and the radiocollared Kilbuck caribou calved east of the Tikchik River basin at the head of the King Salmon and Klutuspak Rivers. Another large group of MCH caribou calved in the Mosquito River drainage. Productivity within the core area was the highest yet recorded at 75 calves:100 adult cows. Other than a couple of brown bears in the calving area, there was little evidence of predation.

Summer/Fall Range. During the summer and fall of 1995 and 1996, the MCH moved throughout their range from the Kvichak River in the southeast to the Kuskokwim drainage in the northwest. Their general movement pattern after calving was along the Hoholitna drainages into the Mulchatna drainages. Postcalving aggregations were preceded by a southward movement into Tutna and Iliamna Lakes areas. The large groups broke up after about a week or two, as bands of

caribou scattered and moved north into the Nushagak Hills and the Holitna/Aniak River drainages, where they remained during the late summer and early fall.

Several peripheral groups seem independent from the MCH. A group of about 1300 caribou range between Portage Creek and Etolin Point. Caribou in the Kilbuck Mountains and in Rainy Pass appear to be distinct from the MCH, but there is overlap during the year. Radiotelemetry data confirmed another group that resides in the upper Stuyahok and Koktuli River drainages (Van Daele and Boudreau 1992, Van Daele 1994). These subherds periodically intermingle with the main herd, but they typically remain within their traditional ranges.

MORTALITY

Harvest

Season and Bag Limit. Hunting is prohibited in Subunit 17A (east of the Togiak River) and that portion of Subunit 17C west of the Wood River. The open season for Alaska resident, subsistence, and nonresident hunters in Subunits 9B, 17B, 17C (remainder), 19A (south of the Kuskokwim), and 19B, is 1 August to 15 April. The bag limit for resident hunters is 5 caribou; however, no more than 2 can be bulls. The bag limit for nonresidents is 2 caribou. The western portion of 17A may be opened by emergency order during the winter (residents only - 2 caribou). Subunit 17C, between the Kokwok and Wood Rivers, is open from 1 August to 30 September and by emergency order during the winter season (same bag limit as the remainder of 17C). Unit 18, south of the Yukon, can be opened by emergency order when caribou from the MCH migrate into the area.

Board of Game Actions and Emergency Orders. During their 1993 spring meeting, the Board of Game recognized the increase in the size of the MCH and liberalized the season and bag limit. The Board authorized same-day-airborne hunting of caribou in subunits 9B, 17B, and 17C (east of the Nushagak) in 1994 (effective Jan 1995). In 1995 the Board opened the fall caribou season between the Kokwok and Wood Rivers and authorized the department to issue emergency openings during the winter when 10,000 or more MCH caribou were in the area. Similar authority was granted for the portion of Subunit 17A west of the Togiak River.

Hunter Harvest. The reported harvest from the MCH was 4449 caribou during the 1995–96 hunting season (Table 3). This total was the highest harvest ever recorded for the MCH. As in previous years, most of the harvest was males (75%).

Data from harvest reports must be viewed with caution because overlays are not keypunched and we have no way of objectively analyzing the rate of return. The estimated unreported harvest during this period was at least 2800, yielding an estimated total harvest of over 7249 caribou.

Most of the unreported harvest was attributed to local and other Alaska residents. Subsistence Division household surveys conducted in local villages from 1983 to 1989 indicated an estimated annual harvest of 1318 caribou (P. Coiley, ADFG–Subsistence pers. commun.). The number of caribou harvested by local residents has undoubtedly increased since the Subsistence surveys due to increases in the size and range of the herd. Unreported harvest by other Alaska residents is more difficult to quantify.

Since the early 1980s, we have seen a steady increase in the density of hunters in range of the MCH during the fall season, yet harvest levels have remained less than 5% of the total population and harvests do not seem to be limiting herd growth or range expansion. Conservative management of areas occupied by the MCH probably contributes to increased caribou use of new areas.

Hunter Residency and Success. Nonresidents made up 46% of the reporting hunters (n = 1449/3127) during the 1995–96 season. Nonlocal Alaska residents accounted for 49% and local residents 5% of hunters who returned harvest reports. Eighty-seven percent of the reporting hunters successfully harvested at least 1 caribou (Table 4).

Harvest Chronology. Most (83%) of the reported harvest in 1995–96 occurred during August and September. March was also an important month for harvesting caribou, accounting for 5% of the reported harvest and a large portion of the local unreported harvest. These data are comparable to the harvest chronology reported for previous years (Table 5).

Transport Methods. Aircraft were the most common (88%) means of hunter transport during the 1995–96 hunting season (Table 6). Boats (9%) and snowmachines (2%) were other important means of transportation reported. Boats and snowmachines were the main transportation methods for local hunters and were probably underreported in our harvest data.

Other Mortality

There were several observations and reports of wolf and brown bear predation on caribou during this reporting period, but predation rates still appeared low. An increasing number of hunters along the Nushagak and Mulchatna Rivers reported having encounters with brown bears, including bears on fresh kills, bears on hunter-killed carcasses, and bears raiding hunting camps. It appeared that individual bears were learning to capitalize on a newly abundant autumn food source.

HABITAT

Assessment

We have not objectively assessed the condition of the MCH winter range. Taylor (1989) reported the carrying capacity of traditional wintering areas had been surpassed by 1986–87, and it was necessary for the MCH to utilize other winter range to continue its growth. The herd has been using different areas at an increasing rate since then.

Portions of the range are showing overt signs of heavy use. Extensive trailing is evident along migration routes. Some of the summer/fall range near the Tikchik Lakes is trammeled and heavily grazed, and winter range on the west side of Iliamna Lake is also showing signs of heavy use. Many areas the MCH are moving onto have not been used by caribou for over 100 years or by reindeer for over 50 years and have vast quantities of essentially virgin lichen communities.

CONCLUSIONS AND RECOMMENDATIONS

The MCH continued to increase and extend their range during this reporting period. The minimum postcalving population estimates have increased from 18,599 in 1981 to 192,818 in

1996. In 1994 the herd surpassed the Porcupine caribou herd in size, making the MCH the second largest caribou herd in the state.

Although annual harvests have remained at less than 5% of the population, the total harvest and the number of hunters afield have steadily increased. The MCH is an important source of meat and recreation for hunters throughout Southcentral Alaska. Establishment of the 2-caribou bag limit, coupled with the reputation for large antler and body sizes, has also made this herd increasingly popular with nonresident hunters. The mobility of the herd and the inaccessibility of much of its range to hunters make hunting logistics challenging.

Local residents, guides, Fish and Wildlife Protection (FWP) officers, and department personnel have all noted an increasing problem with inadequate meat salvage by hunters utilizing the MCH. The degree of waste is variable from removal of only the head and antlers to improper boning of the ribs and neck. In 1995 FWP issued over 50 citations to MCH hunters, in spite of a limited enforcement presence. The department has an obligation to coordinate efforts to reduce and eliminate these illegal, unethical, and disrespectful practices. If we do not, the resource and the hunting tradition will suffer greatly.

During the past 15 years, the MCH has made dramatic changes in its range. In the early 1980s, the herd spent most of the year east of the Mulchatna River between the Bonanza Hills and Iliamna Lake. Their range now encompasses almost 60,000 mi^2, and large portions of the herd are pioneering new winter, calving, and summer ranges in good to excellent caribou habitat. There is some evidence of localized overutilization in portions of the range, but most of the areas used by the MCH are in good condition.

We do not know how long the tremendous growth rate of this herd can continue. There are currently few, if any, signs of stress in the herd. Virtually all of the adult females captured in the spring were pregnant and in good physical condition, calf production and survival appeared high, and there was little evidence of disease (although caribou in the adjacent NAPCH had a high incidence of lung worm in 1995 and 1996). There were low predation rates and the herd continued to move into good habitat.

In spite of these indicators, such rapid population growth cannot continue indefinitely. We should continue to monitor the herd closely to watch for indications of population decline. Hunting regulations in most of the MCH range should remain liberal to slow the population increase and to take advantage of the meat resource available from this herd. We should also continue our practice of encouraging range expansion by recommending conservative hunting seasons in newly occupied ranges. The department should assist hunters and air taxi operators by providing up-to-date information on the herd's movements and by developing and distributing educational materials on caring for caribou meat while in the field.

Increased harvest pressure on the MCH is also affecting other big game populations in the area. Moose populations near villages are experiencing less pressure, and illegal moose harvests are decreasing as local hunters increase their use of caribou meat. However, the increased number of caribou has also attracted more nonlocal hunters interested in "combination hunts." Consequently, moose harvest in Unit 17 has doubled in the past 10 years. The Board of Game

addressed this issue by imposing stricter bag limits on moose hunters in Unit 17 in an effort to divert hunting pressure away from the moose and onto caribou.

The MCH presents new management challenges as it grows and extends its range. Since the main portion of the herd is migratory, using areas from the western slopes of the Alaska Range to the Kuskokwim and Yukon Rivers, it seasonally occupies ranges used by smaller resident caribou herds. These subherds, and new ones that establish themselves as the herd expands, may be the key to a quicker recovery from any future crash of the MCH. The MCH also overlaps with larger, more established herds as they move into the southern fringes of the Western Arctic caribou herd range and the northern portion of the NAPCH range. We should strive to recognize the impacts on these potentially unique demographic components when setting management objectives and proposing regulatory formulas.

Current harvest data for the MCH are of limited value because there is no objective method to determine the rate of return of harvest tickets. Overlay data have not been keypunched and reminder letters have not been send to nonrespondents since 1986. Important harvest management decisions have necessarily been based on assumptions rather than objective data. The department should strive to improve the quality of harvest data so that we can better manage the MCH and the smaller herds on the same range. Improved harvest data will also be vital if it becomes necessary to limit harvest pressure.

RECOMMENDED MANAGEMENT ACTIONS FOR THE NEXT FEW YEARS

1 Conduct an annual photocensus of the MCH during postcalving aggregations in 1998 and 2000;

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

3 Collect a sample of at least 10 yearling caribou from the main winter range of the MCH each April to investigate body condition;

4 Conduct calving surveys in May of each year;

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

6 Maintain at least 1 active radio collar per 2000 caribou in the MCH by scheduling capture operations in April 1998 and 2000;

7 Develop an improved method of collecting harvest data and implement the method before the 1999–2000 hunting season;

8 Continue to work with other land and resource management agencies and landowners on MCH management activities and directions; and,

9 Work with local advisory committees and state and federal Boards to coordinate MCH hunting regulations with those for adjacent herds and develop contingency plans for managing the herd when the population begins to decline.

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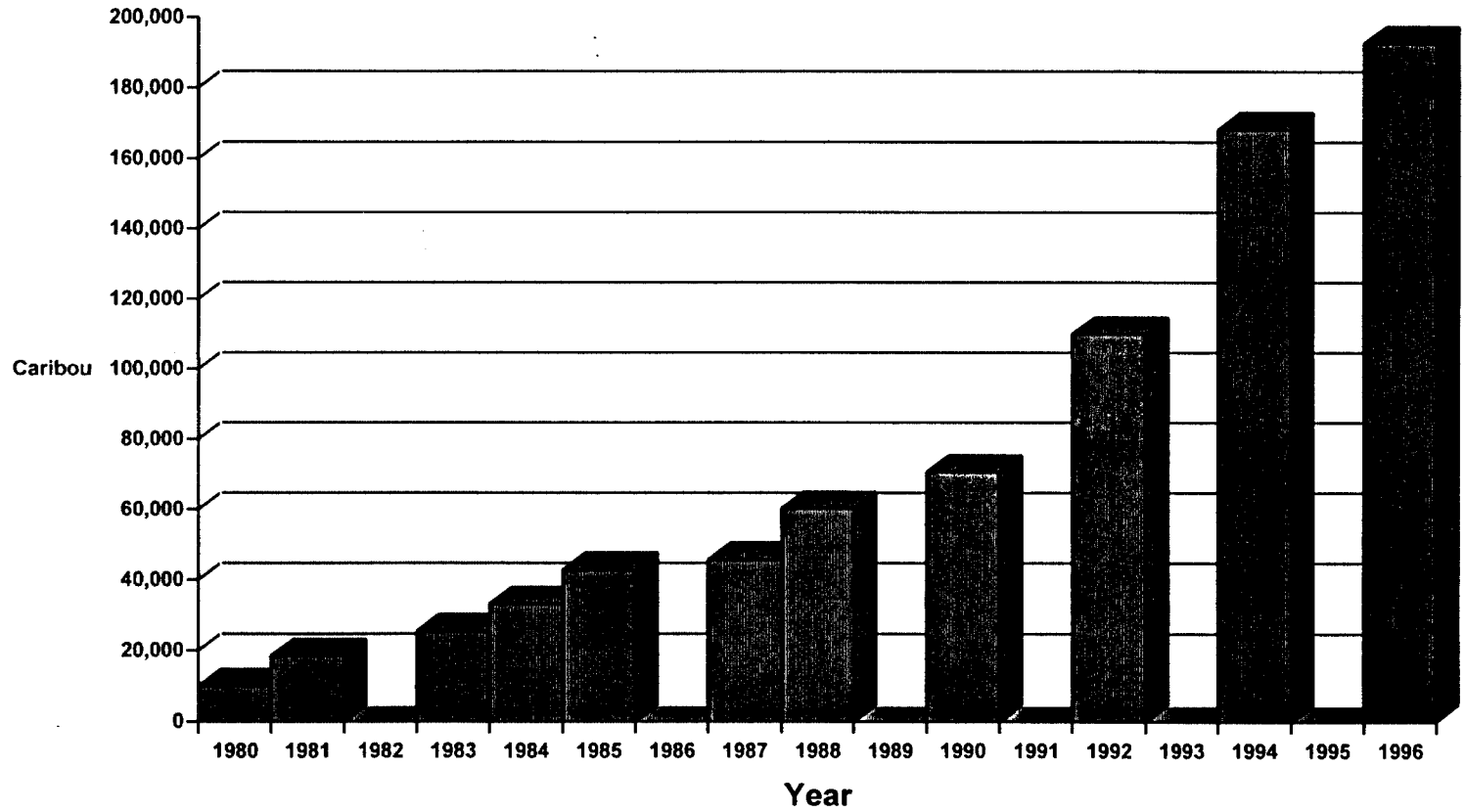

Figure 1 Minimum estimated population size of Mulchatna caribou herd, southwest Alaska, 1980–1996

Table 1 Mulchatna caribou herd estimated population size, 1991–1996

Regulatory year	Date	Preliminary estimate[a]	Minimum estimate[b]	Extrapolated estimate[c]
1991/92	02 Jul 91	60,851	--	90,000
1992/93	07/08 Jul 92	90,550	110,073	115,000
1993/94	--	---	---	150,000
1994/95[d]	28/29 Jun 94	150,000	168,351	180,000
1995/96	--	--	--	190,000
1996/97	28 Jun - 3 Jul 96	200,000	192,818	200,000

[a] Data based on estimated herd sizes observed during the annual aerial census.

[b] Data derived from photo-counts and observations during the annual aerial census.

[c] Estimate based on observations during census and a subjective estimate of the number of caribou in areas not surveyed.

[d] Although this survey was actually conducted in the 1993/94 regulatory year, it should be considered a 1994/95 estimate.

Table 2 Mulchatna caribou fall composition counts and estimated population size, 1991–1996

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls (%)	Composition sample size	Estimated herd size[a]
1991/92	---	---	---	---	---	---	---	---	---	90,000
1992/93	---	---	---	---	---	---	---	---	---	115,000
1993/94	42.1	44.1	23.7%	53.7%	---	---	---	22.6%	5,907	150,000
1994/95	---	---	---	---	---	---	---	---	---	180,000
1995/96	---	---	---	---	---	---	---	---	---	190,000
1996/97	42.4	34.4	19.5	56.6	49.8	28.5	21.7	24.0	1,727	200,000

a Estimate derived from photo-counts, corrected estimates, and subjective estimate of the number of caribou in areas not surveyed. census.

Table 3 Mulchatna caribou harvest and accidental death, 1991–95

Regulatory year	Hunter Harvest: Reported M (%)	Reported F(%)	Reported Unk.	Reported Total	Estimated Unreported	Estimated Illegal	Estimated Total	Accidental death	Grand total
1991/92	86%	13%	1.1%	1,573	1,700	--	1,700	--	3,273
1992/93	74%	9%	17%	1,602	1,800	--	1,800	--	3,402
1993/94	80%	20%	0.4%	2,804	2,000	--	2,000	--	4,804
1994/95	78%	21%	0.7%	3,301	2,700	--	2,700	--	6,001
1995/96	75%	24%	0.6%	4,449	2,800	--	2,800	--	7,249

Table 4 Mulchatna caribou annual hunter residency and success, 1991–95

Regulatory year	Successful: Local resident	Successful: Nonlocal resident	Successful: Nonresident	Successful: Total (%)	Unsuccessful: Local resident	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Total (%)	Total hunters[a]
1991/92	89[c]	562	599	85%	9	136	69	15%	1464
1992/93	82[c]	542	651	91%	12	82	26	9%	1391
1993/94	47[c]	718	725	86%	5	171	77	14%	2394
1994/95	61[b]	812	896	85%	11	227	124	15%	2954
1995/96	52[c]	1,035	928	87%	15	188	86	13%	3127

[a] Includes hunters of unknown residency.

[b] Includes residents of Game Management Unit 17.

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

Table 5 Mulchatna caribou annual harvest chronology percent by time period, 1991–95

Regulatory	Harvest Periods									
year	August	September	October	November	December	January	February	March	April	*n*
1991/92	29%	43%	6%	0.4%	2%	1%	4%	12%	0%	1,573
1992/93	30%	54%	5%	1%	0.3%	0.2%	1%	8%	0%	1,305
1993/94	36%	50%	5%	0.4%	1%	1%	1%	5%	2%	2,779
1994/95	35%	50%	5%	0.4%	1%	1%	1%	5%	2%	3,277
1995/96	33%	50%	6%	1%	2%	1%	1%	5%	2%	4,449

Table 6 Mulchatna caribou harvest percent by transport method, 1991–95

	Percent of harvest								
Regulatory				3- or			Highway		
year	Airplane	Horse	Boat	4-Wheeler	Snowmachine	ORV	vehicle	Unknown	*n*
1991/92	81%	0.2%	9%	1%	9%	0.1%	0.2%	2%	1750
1992/93	88%	0.2%	8%	3%	3%	0.1%	0.1%	0%	1353
1993/94	86%	1%	10%	1%	2%	0.3%	1%	0%	2356
1994/95	85%	0.2%	12%	1%	2%	--	0.2%	0.2%	2913
1995/96	88%	0.2%	9%	1%	2%	0.1%	0.1%	--	3099

LOCATION

GAME MANAGEMENT UNIT: 9C and 9E (19,560 mi^2)

HERD: Northern Alaska Peninsula

GEOGRAPHIC DESCRIPTION: Alaska Peninsula

BACKGROUND

The Northern Alaska Peninsula Caribou Herd (NAPCH) ranges throughout Subunits 9C and 9E. Historically, the size of this population has fluctuated widely, reaching peaks at the turn of this century and again in the early 1940s (i.e., 20,000 caribou). The last population low was during the late 1940s (i.e., 2,000 caribou), and by 1963 the herd had increased to over 10,000 animals (Skoog 1968). The first radiotelemetry-aided census in 1981 estimated 16,000 caribou; and by 1984 the herd had increased to 20,000.

During the next several years, indicators such as the noticeable depletion of lichens and movements across the Naknek River were evidence that the traditional wintering area was overgrazed. In 1986 significant numbers of NAPCH animals began wintering between the Naknek River and Lake Iliamna, and there was reason to believe that excellent forage conditions in this region would sustain the NAPCH within the population objective of 15,000–20,000. However, up to 50,000 Mulchatna caribou also began using this area at about the same time. As both herds intermingled near Naknek and King Salmon, winter hunting pressure along the road system grew rapidly, and it became impossible to apportion the reported harvest between the 2 herds. Given this change in winter distribution of both herds and the increasing competition for winter forage, by the late 1980s it was decided that the NAPCH should be maintained at the lower end of the management objective, i.e. 15,000. During 1992–93 and 1993–94, harvests along the King Salmon road and trail system peaked, and many local residents complained about problems (wounded animals, gut piles, etc.) associated with a road system hunt with a multiple bag limit. Despite these problems, we viewed the large harvests as beneficial to reduce the NAPCH herd to 15,000 and to utilize those Mulchatna animals in the area.

During 1993–94, the record harvest of 1345 caribou and natural mortality estimated at >30% combined to reduce the NAPCH to 12,500 by June 1994. Despite this rapid decline below the management objective, the NAPCH has remained remarkably stable between 10,000 and 20,000 during the past 35 years.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

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

METHODS

In late June 1995 and 1996, we used an R-22 helicopter to conduct radiotelemetry-aided aerial photocensuses on postcalving concentrations. Photos of large groups allowed accurate enumeration. In addition, the Fish and Wildlife Service (FWS) surveyed peripheral areas along the Aleutian Mountains and Pacific coast as far south as Kujulik Bay. We determined the percent calves from close-up photos taken from the helicopter. We conducted sex and age composition surveys with an R22 helicopter in October of each year. We periodically conducted radiotelemetry flights to monitor herd movement.

The harvest was monitored by harvest ticket reports. A cooperative (FWS; ADF&G, Subsistence Division; and Bristol Bay Native Association) harvest survey was conducted in villages in 9C and 9E for the 1994–95 hunting season.

In April 1995 we used an R-22 helicopter to dart 18 female calves. We recorded standardized measurements and radiocollared all of them.

In October 1995 we collected 10 female calves and 1 male to obtain measurements and samples to assess body condition (Valkenburg et al. 1996). We noticed "pinhead" hemorrhagic lesions on a majority of lungs, so we collected several samples for submittal to a veterinary pathology lab. During postcalving surveys in 1995 and 1996, several recently dead calves were field-necropsied and the cause of death appeared to be pneumonia. Lung tissue from one dead calf in 1996 was sent to a pathology lab for diagnosis.

On 28 May 1996 using a Super Cub and on 2 June 1996 using an R-22 helicopter, we classified caribou on the calving grounds as parturient cow (with calf, hard antlers, or distended utter), nonparturient cow, calf, or bull (Whitten 1995). All 15 surviving radiocollared yearling cows were observed to determine if they were parturient.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Minimum counts from photocensuses during 1981–1993 ranged between 15,000 and 19,000 caribou. Annual variations in counts were caused by actual changes in herd size and/or sampling error (restricted coverage due to poor weather or errors in visual estimates). Because of concerns over winter range quality, in the late 1980s we decided to keep the herd at the lower end of the management objective. The actual postcalving count dropped from a minimum of 16,500 in 1992 to 15,000 in 1993. The 1994 postcalving count, which involved extended coverage of fringe areas, only tallied 12,000 caribou. The herd began a decline in 1992, although at first the decline was not viewed with alarm because the herd was at the desired level. We anticipated that harvest pressure would decline due to liberalized regulations for the growing Mulchatna herd and closure of the King Salmon Air Force Base.

Population Size

Over the past 14 years, the size of the NAPCH has been reported in 2 ways: the actual number of caribou counted during the postcalving photocensus, rounded to the nearest 100, and an

estimated total herd size which included 1000 to 1500 "uncounted" caribou believed to be in fringe areas. Actual counts from the 1995 and 1996 photocensuses were 11,500 and 11,700. In 1995 and 1996, the Alaska Peninsula/Becharof Refuge staff covered portions of the Aleutian Mountains and Pacific drainages where they counted 1537 and 2058 caribou, respectively. This area had not been counted since the early 1980s, so the 1995 and 1996 photocensus counts represent a more complete "minimum count" than obtained from photocensuses in previous years. We estimate the total herd size at 12,000 for the past 2 years (Table 1).

Population Composition

A sample of 1857 caribou was classified in October 1994 and included 34 bulls and 34 calves:100 cows (Table 1). A weighted sample of 3153 caribou classified from the June 1995 photocensus showed 21% calves in the herd. A sample of 2907 caribou classified in October 1995 had 41 bulls and 24 calves:100 cows. Calves made up 15% of the sample (Table 1). In June 1996 25% (n = 4388) calves were in postcalving aggregations. A sample of 2572 caribou was classified in October 1996 and included 48 bulls and 38 calves:100 cows (Table 1).

During 1970–80 when the NAPCH was growing, the average fall ratio was 50 calves:100 cows (range = 45–56). During 1981–92, the fall ratio varied from 27 to 52 calves:100 cows and averaged 41. Since 1992 the ratio averaged 34 (range = 24–39) calves:100 cows. The 1995 calf production was the lowest ever recorded for this herd; however, in 1996 the percentage of calves seen in June and October returned to the range when the herd was stable.

Distribution and Movements

The NAPCH's primary calving grounds are in the Bering Sea flats between the Cinder and Sandy Rivers. In recent years the postcalving migration north has begun earlier, and for the past 7 years most of the herd has been north of the Egegik River by 1 August. Traditionally, this herd wintered between the Ugashik and Naknek Rivers. In 1986 many caribou wintered between the Naknek River and the Alagnak River and even as far north as Big Mountain and upper Kaskanak Creek on both sides of Lake Iliamna, where they have intermingled with a portion of the Mulchatna herd. During the 1994–95 winter, an estimated 2000 NAPCH animals migrated north of the Naknek River, where they mixed with an estimated 5000 Mulchatna caribou. Only 2 radiocollared NAPCH animals, with 30 other caribou, were found north of the Naknek River during the 1995–96 winter. We estimate that less than 1000 NAPCH animals and virtually no Mulchatna caribou wintered in Unit 9C during 1995–96 possibly because of the exceptionally snow-free winter.

MORTALITY

Harvest

Season and Bag Limits. The 1994–95 season in Unit 9C was 10 August to 31 March with a resident bag limit of 4 caribou; however, not more than 2 could be taken from 10–31 August and the September–November bag limit was 1. The bag limit for nonresident hunters was 1 caribou. In Unit 9E the resident season within the Pacific drainages of Unit 9E southwest of Seal Cape opened on July 1, with a bag limit 2 bulls until August 10 when either sex could be taken. In all of Unit 9E the bag limit was 1 caribou during September–November and 4 during December–

March. From 1–30 April the limit was 2 caribou. The Unit 9E nonresident season was 10 August to 31 March with a 1 caribou limit.

Following the results of the 1994 postcalving census, emergency actions were initiated (see below) which reduced the 1994–95 winter bag limit in Unit 9C to 1 caribou per calendar month, with not more than 1 cow during the entire season.

The 1995–96 nonresident season in both 9C and 9E was 10 August to 31 October with a 1 bull limit. The resident season in 9C was misprinted in the 1995–96 regulation booklet and actually was 10 August to 31 March with a bag limit of 4 caribou, not more than 1 of which could be a cow. In 9C the total limit of 4 caribou could be accumulative at the rate of 2 during 10 August–30 November and 1 per calendar month during December–March. The 1995–96 resident season and bag limit in Unit 9E were the same as in 1994–95.

Board of Game Actions and Emergency Orders. In response to the 20–25% decline in the NAPCH, an emergency order (02-11-94) was issued on 22 September 1994 which closed the Smelt Creek and Big Creek portion of Unit 9C effective 1 October. This action was viewed as a temporary measure to provide protection when the herd typically moved into the area adjacent to King Salmon. The Naknek/Kvichak Fish and Game Advisory Committee met in October 1994 and, with the department's support, petitioned the Board to adopt an emergency regulation reducing the winter bag limit to 1 caribou per calendar month, with not more than 1 cow for the entire season. This proposal was adopted as an emergency regulation at the Board's November 1994 meeting, thereby superseding the earlier emergency order. The Board added regulations for the NAPCH to its call for proposals for the spring 1995 meeting. In considering the 2 proposals submitted for 9C, one by the department and one by the Naknek/Kvichak Advisory Committee, some confusion arose on an amended version. Part of the problem, i.e., the omission of the 1-cow yearly limit, was corrected by the commissioner's regulation effective October 27, 1995. Furthermore, both the department and Naknek/Kvichak Advisory Committee had agreed the fall bag limit should be 2 during August and only 1 during September–November, and only by a hunter who had taken no caribou after July 1. This concept was implicit in the Board's 1995 action, but was corrected at the spring 1996 Board meeting. Finally, the regulations for Unit 9A were intended to be the same as those for Unit 9C, which was accomplished at the spring 1996 Board meeting.

Hunter Harvest. Low reporting rates and the overlapping winter distribution of both NAPCH and Mulchatna animals complicates enumerating the annual harvest of the NAPCH. Although there are no indications that reporting rates have changed over the years, the availability of NAPCH and Mulchatna caribou within the Naknek drainage has fluctuated annually in recent years.

The 1994–95 reported harvest from the NAPCH was 569 caribou, including 478 males (84%) and 91 females (16%) (Table 2). Most local and some nonlocal hunters did not report the caribou they killed. The nonsubsistence reporting rate was estimated at 60% (Sellers 1989). Nonlocal hunters (nonresidents and Alaskans residing outside of Units 9C and 9E) reported killing 457 caribou in 1994–95. Correcting this number by the reporting rate provides an estimated total kill by nonlocals of 762 caribou. Results from village household surveys estimated that residents of villages in Units 9C and 9E killed a total of 1345 caribou during the 1994–95 season (ADF&G,

Subsistence Div., unpublished data). Similar estimates of village harvests derived from interviews conducted during 1983–1986 totaled 1124 (Morris 1985, 1987, Fall and Morris 1987, Fall 1993, Fall et al. 1995). Local residents reported taking 109 in 1994–95, leaving approximately 1240 caribou unreported on harvest ticket reports, for a reporting rate of 8%. Combining reported harvests, estimates of harvests by village residents, and unreported nonlocal harvests, the best harvest estimate for 1994–95 is 2100 caribou. However, of 643 caribou estimated (from harvest ticket reports and household surveys) to have been killed during December–March in the Naknek drainage, an unknown but substantial number were Mulchatna animals. Based on the distribution of radio collars from both herds, it is not unreasonable to estimate that as many as 50–70% of these 643 caribou were from the Mulchatna herd. Applying this adjustment to the total harvest of 2100, results in an estimated 1650–1800 harvest of NAPCH animals (Table 2).

The 1995–96 reported harvest from the NAPCH was 533 caribou, including 486 males (91%) and 47 females (9%) (Table 2). Applying the 60% reporting rate to nonlocal harvest results in an estimate of 790. Because virtually no Mulchatna animals moved into the Naknek drainage during the 1995–96 winter, it is not necessary to correct for Mulchatna caribou. However, the harvest by local hunters in 9C was undoubtedly lower than estimated from household surveys in 1994–95. For example, within the Naknek drainage, local residents reported 74 caribou in 1994–95 on harvest tickets but only 19 in 1995–96 (i.e., a 75% decrease). If this same decrease in harvests applied to the unreported kill within the Naknek drainage, the estimated local harvest is 190 for 1995–96. Three rounds of household surveys of villages in 9E estimated total harvests at 561 during 1983–86, 610 during 1989–91 and 581 in 1994–95. Despite the recent decline in the size of the NAPCH, village harvests in Unit 9E have remained relatively stable at an average of 584 animals per year. Combining the estimated village harvest in 9E (584) with the estimate for local harvest in 9C (190) and the adjusted nonlocal harvest (790) yields a total estimate of 1564 caribou (Table 2).

Hunter Residency and Success. Success rates for all hunters reported on harvest tickets averaged 79% for 1994–95 and 95–96 (Table 3), but it is believed the reporting rate for unsuccessful hunters is substantially lower than for successful hunters. Based on reconstructed harvest estimates in 1994–95, approximately 64%, 19%, and 17% of the total harvest went to local residents, nonlocal state residents, and nonresidents, respectively. In 1995–96, approximately 50%, 23%, and 28% of the total harvest went to locals, nonlocal state residents, and nonresidents, respectively. The scarcity of caribou north of the Naknek River and poor travel conditions during the 1995–96 winter accounted for the decline in harvests by local residents of 9C.

Harvest Chronology. Before 1994–95 there had been a dramatic shift in harvests to winter months as caribou became more available along the King Salmon–Naknek road system. Caribou distribution during 1994–95 was not drastically different from recent years, but the winter bag limit of 1 caribou per calendar month and the closure of the King Salmon Air Base discouraged many nonlocals from traveling to King Salmon. This decrease in winter hunting was even more pronounced in 1995–96 because few NAPCH caribou crossed the Naknek River and no Mulchatna caribou moved into the Naknek drainage. Poor travel conditions during 1995–96 further reduced winter harvests (Table 4).

September is still the single most important month, especially for nonresidents, because of the combination of relatively good weather conditions, the best chance for success at taking a trophy bull, and relatively easy access by boat and aircraft. The subsistence harvest is primarily opportunistic, and chronology of harvests varies between villages depending upon caribou availability.

Transportation Methods. Aircraft continue to be the single most important method of transportation reported from harvest tickets (Table 5), but as more of the harvest has occurred during the winter in the Naknek drainage, other methods, especially 3- 4-wheelers, have become more prevalent compared to modes of transport in the 1980s. The 1995–96 winter was one of the mildest in memory and precluded the use of snowmachines.

Other Mortality

The radio collars placed on the NAPCH cows were designed to facilitate annual postcalving photocensuses, so mortality censors were not used in most transmitters. Telemetry flights were sporadic. These two factors preclude precise dating of natural mortalities. There appears to be a higher rate of natural mortality of adult females in recent years. From October 1980 through March 1984, the average annual mortality rate was approximately 7%. During the next 4 years the annual mortality rate averaged 18%. Annual mortality rates, using modified Kaplan–Meier procedures, from 1992 to 1996 were 29%, 35%, 20%, and 19%, respectively.

HABITAT

Assessment

No quantitative data are available to assess range conditions. However, based on our preliminary analysis of data (i.e., weights and body size) from the caribou translocated in 1988 and from animals captured in April 1990, 1992, 1994, NAPCH adult females are intermediate in body size and condition between the Southern Alaska Peninsula herd (SAPCH) and Mulchatna herd animals (Pitcher et al. 1990). Progeny of the translocated caribou on the Nushagak Peninsula are larger than animals from the parent NAPCH (ADF&G unpublished data and Hinks and VanDeale 1994).

In April 1995 we captured 18 female calves to allow comparison of body size and condition with other herds. We used a standardized sex/age class to monitor the age at first reproduction. These calves were in average condition and weighed an average of 113 pounds (SE = 3.0). This weight was similar to the average for Mulchatna calves but was lower than the average of 125.8 pounds for the Nushagak herd (P. Valkenburg, unpublished data). Body measurements from these 3 herds were similar, but NAPCH animals were slightly smaller.

In October 1995 we collected 10 female calves to further assess body condition. Average whole body weight was 98.6 pounds (SE = 3.6), and average femur fat was 56.6%. Only Western Arctic caribou were lighter, and femur fat levels were intermediate compared to other herds (P. Valkenburg, unpublished data).

None of 14 radiocollared 2-year-olds alive during June 1996 produced a calf. While caribou from the NAPCH do not exhibit the severe signs of poor nutrition evident in the SAPCH, NAPCH animals are not as robust as caribou in the Mulchatna or Nushagak herds.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

A panel of caribou biologists chose this herd for experimental management because the NAPCH has been relatively stable for the past 30 years at a moderately high density and because of its importance to a variety of hunters. The panel proposed maintaining the population at 15,000–20,000 indefinitely and closely monitoring the herd, including population composition, distribution, and animal condition. It will be necessary to maintain 20–25 functional radios on females to accomplish this objective.

Recent advances in monitoring the condition of caribou herds (P. Valkenburg, memo dated 4 January 1995) include collecting or radiocollaring only female calves. The rationale for handing female calves is that they better reflect range quality and weather stress because their body condition is more sensitive and is not influenced by maternal status as are adult cows. Additionally, collared female calves will provide data on age at first parturition, which has proven to be a good indicator of nutritional status. In conjunction with determining the age of first reproduction for radiocollared calves, parturition surveys conducted just before peak calving (K. R. Whitten, memo dated 3 January 1995) provide a measure of natality rate. These procedures were implemented for the NAPCH in 1995 and will be followed in the future.

During routine postcalving counts in 1995 and 1996, several recently dead calves were located and necropsied. Pneumonia, as evidenced by purulent abscesses in the lungs, was the apparent cause of death, and was confirmed as bacterial bronchopneumonia by a diagnostic lab (R. Zarnke, per. com.). When we collected calves in October 1995, most calves exhibited numerous small pinhead hemorrhagic spots on the lungs. A veterinary pathology lab identified these as consistent with lungworm-induced pneumonia.

Given the potential for marginal nutrition and possible linkage to disease, it will be important to monitor the condition of NAPCH animals. Any indication of declining productivity should be detected immediately.

CONCLUSIONS AND RECOMMENDATIONS

The NAPCH has now dropped below the population objectives, and further significant declines are an ongoing concern. Harvests and population parameters need to be monitored closely. Considering the current status of this herd, a new long-term population objective should be considered at 10,000 to 15,000 animals. To accomplish this, in view of the recent decline, harvests, particularly of cows, must be reduced. In recent years department staff made a concerted effort to direct hunters to the Mulchatna herd. This effort seemed effective until the Mulchatna herd moved into a very remote area during September during the past 2 years. The Board of Game opened most of the range of the Mulchatna herd to same-day-as-airborne hunting after 1 January. This should provide more winter hunting opportunity and reduce the pressure on NAPCH animals near King Salmon.

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Table 1 NAP caribou fall composition counts and estimated population size, 1985–1996

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls (%)	Composition sample size	Estimate of herd size
1970/71	48	46	23							
1975/76	33	45	25							10,340
1978/79	48	55	25							
1980/81	53	56	27							
1981/82	34	39	23							
1982/83	43	52	26					22	1,392	18,000
1983/84	39	27	16		51	25	24	24	1,410	19,000
1984/85	39	39	22		67	16	17	22	1,087	20,000
1986/87	51	34	18	54				27	2,540	17,000
1987/88	54	51	25	49	51	32	17	26	1,536	17,000
1988/89	49	48	26	51	46	34	20	25	1,156	20,000
1989/90[a]			20						2,934	20,000
1990/91	41	29	17	59				24	1,484	17,000
1991/92	42	47	25	53	54	34	12	22	1,639	17,000
1992/93	40	44	24	54	44	38	19	22	2,766	17,500
1993/94	44	39	21	55	52	29	19	24	3,021	16,000
1994/95	34	34	20	59	58	28	14	20	1,857	12,500
1995/96	41	24	15	60	49	29	22	25	2,907	12,000
1996/97	48	38	19	54	71	19	10	26	2,572	12,000

[a] Composition survey from fixed-wing aircraft

Table 2 NAPCH harvest, 1990–95

Regulatory year	Hunter harvest: Reported M (%)	Reported F (%)	Reported Unk.	Reported Total	Estimated Unreported	Estimated total
1991/92	683 (86%)	114 (14%)	0	797	1,400	2,200
1992/93	816 (89%)	98 (11%)	0	914	1,600	2,500
1993/94	1165 (87%)	175 (13%)	0	1,340	1,800	3,100
1994/95	478 (84%)	91 (16%)	0	569	1,100-1,250	1,650-1,800
1995/96	486 (91%)	47 (9%)	0	533	1,000-1,100	1,500-1,600

[a] Estimated total is rounded off.

Table 3 NAP caribou annual hunter residency and success, 1991–95

Regulatory year	Successful: Local[b] resident	Successful: Nonlocal resident	Successful: Nonresident	Successful: Total (%)	Unsuccessful: Local[b] resident	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Total (%)	Total hunters
1991/92	56	283	282	621 (79%)	15	120	27	162 (21%)	783
1992/93	91	291	268	650 (81%)	18	110	21	149 (19%)	799
1993/94	86	465	287	978 (87%)	10	98	32	140 (13%)	1,118
1994/95	62	193	217	474 (82%)	13	55	34	102 (18%)	574
1995/96	28	167	263	458 (76%)	13	74	58	145 (24%)	603

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

Table 4 NAP caribou annual harvest chronology percent by time period, 1991–95

Regulatory year	Harvest periods									*n*
	August	September	October	November	December	January	February	March	April	
1991/92	14	35	20	2	9	7	8	6	na 797	
1992/93	9	35	13	3	7	8	13	12	0	898
1993/94	9	22	11	1	16	20	12	9	0	1335
1994/95	13	38	11	3	13	5	8	6	2	564
1995/96	18	43	23	4	4	2	1	1	0	533

Table 5 NAP caribou harvest percent by transport method, 1991–95

Regulatory year	Percent of harvest						
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle
1991/92	52	0	13	20	8	2	5
1992/93	41	0	14	28	5	3	9
1993/94	30	0	9	41	9	2	9
1994/95	44	0	14	23	4	2	12
1995/96	57	0	19	13	0	1	9

LOCATION

GAME MANAGEMENT UNITS: 9D and 10 (Unimak Island) (6,435 mi^2)

HERD: Southern Alaska Peninsula

GEOGRAPHIC DESCRIPTION: Southern Alaska Peninsula and Unimak Island

BACKGROUND

The range of the Southern Alaska Peninsula caribou herd (SAPCH) includes the Alaska Peninsula southwest of Port Moller and Unimak Island. There have been numerous reports of caribou moving between Unimak Island and the mainland, including what may have been a substantial emigration in 1976. Historically, the size of the SAPCH has varied widely, ranging from 500 to over 10,000. Skoog (1968) speculated that the Alaska Peninsula was marginal habitat for sustaining large caribou populations because of severe icing conditions and ash from frequent volcanic activity affecting food supply and availability. Recent herd history includes growth from 1975 to 1983 and decline from 1983 to the present. Numbers of caribou on Unimak Island have also varied substantially, ranging from 5000 in 1975 to 300 since 1983.

Harvest of the SAPCH was fairly high from 1980–1985, probably exceeding 1000 in several years. Starting in 1986 restrictive regulations reduced harvests as the herd continued to decline. By 1993 the herd was below 2500 and all hunting was closed. Poor nutrition appears to be playing a role in the decline of the SAPCH. Predation by wolves and brown bears and human harvest may also have contributed to the decline (Pitcher et al. 1990).

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

A cooperative, interagency management plan was adopted in April 1994. This plan sets the following population and management objectives:

1 Sustain a total population of 4000–5000 animals

2 Maintain a fall bull:cow ratio of 20–40:100

3 Discontinue harvest when the herd is below 2500 animals

4 Provide limited harvest of bulls when the herd exceeds 2500 animals as long as there are at least 20 bulls:100 cows

5 Phase in cow harvests when the population reaches 3500. If the population reaches 4000, harvests will be increased to prevent further growth.

METHODS

We have conducted a postcalving, aerial radiotelemetry survey in late June or early July in most years since 1984. We periodically conduct fall sex and age composition surveys with a helicopter

in October. Occasional radiotracking flights are used to monitor herd distribution. Staff of the Izembek National Wildlife Refuge (INWR) periodically conduct winter aerial counts along systematic transects. A study of causes of low calf recruitment in the SAPCH was completed during 1989–1990 (Pitcher et al. 1990), and range conditions were studied in 1991 and 1992 (Post 1995).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Following a peak of over 10,000 caribou in 1983, the SAPCH began a precipitous decline. By 1993 the herd was below the 2500 threshold for which a cooperative department and US Fish and Wildlife Service management plan specified all hunting was to be closed. The population appeared to stabilize briefly in 1994 but then continued to decline.

Population Size

In February 1995 the INWR staff counted 1806 caribou during their line transect surveys. Our 1995 postcalving survey tallied 1434 caribou, and the total herd size was estimated at 1600–1800 caribou. During March 1996, INWR staff counted 1403 caribou. No count was made during June 1996.

Population Composition

The fall helicopter survey in 1994 showed 18% (n = 531) calves (Table 1). Ratios were 29 bulls and 28 calves per 100 cows. During the 1995 postcalving survey, 10.7% of the caribou seen were calves. There was higher calf production on the Caribou River Flats (24%, n = 286) than in the Black Hills (8%, n = 1,148), as was documented previously (Pitcher et. al 1990, Sellers 1993, 1995). Fall compositions surveys were not done in 1995 or 1996. In July 1996 the FWS conducted a radiotracking flight during which less than 10% of the caribou seen were calves.

Distribution and Movements

Data from radiotracking surveys conducted by staff from both INWR and the Department indicate that the SAPCH calves were in 2 main subgroups in separate areas (Pitcher et al. 1990). Approximately 25% of the herd calves on the Caribou River flats. Many of these animals are relatively sedentary and remain in the area throughout winter. However, some have been located during the winter near Cold Bay. The remainder of the herd calves in the Black Hill–Trader Mountain area and winters around Cold Bay. Further radiotelemetry studies will be needed to clarify the discreteness of the 2 major calving components of this population. Additionally, a few caribou calve in the mountains east of the Caribou River flat. Exchange of caribou between Unimak Island and the mainland has not been documented in recent years.

During recent deliberations over whether a special federal subsistence hunt should be granted, local residents were skeptical about the fate of the SAPCH. Two general opinions, not withstanding the obvious contradiction, were voiced about why both our postcalving counts and the INWR winter surveys show a steady decline. Some members of the public contended that the herd had not declined at all and that the caribou were now using numerous valleys on the Pacific

side of the Peninsula. The distribution of radiocollared cows does not support that claim. Conversely, other local residents claim that the "missing" caribou simply migrated north into the range of the Northern Alaska Peninsula caribou herd (NAPCH). This theory does not explain how the NAPCH could have absorbed a significant number of SAPCH animals during a period when the NAPCH was declining. No radiocollared SAPCH animals have been located north of Unit 9D.

MORTALITY

Harvest

Season and Bag Limits. The 1993–94 and 1994–95 hunting seasons were closed by emergency orders, and no season was held in 1995–96.

Board of Game Actions and Emergency Orders. The 1993–94 state seasons and federal subsistence season was closed by emergency order when the herd fell below 2500 animals. Because the Board did not consider caribou proposals at the spring 1994 meeting, the 1994–95 season was closed again by emergency order. In 1995 the Board of Game reviewed the status of the SAPCH and closed the season.

Federal Subsistence Board Actions. In 1995 a proposal to the Federal Subsistence Board from 2 residents of King Cove requested reopening the caribou season. During spring 1996 the Federal Subsistence Board followed the recommendation of the Kodiak–Aleutian Federal Regional Subsistence Advisory Council to defer action on the proposal until additional information of the status of the herd became available. However, a "Request for Special Action" was made on August 15, 1996 by the Aleutians East Borough to grant a one-time hunt of 10–25 caribou for each of 5 villages because the 1996 commercial salmon fisheries did not meet expectations. A meeting of the Federal Subsistence Board on 29 August 1996 again deferred action, pending additional modification of the proposal and review by the Kodiak–Aleutian Regional Council at their 17–18 September meeting. The Federal Subsistence Board acted on the modified proposal in late September and rejected the proposal to harvest caribou from the SAPCH.

Hunter Harvest. No caribou were legally harvested during this reporting period.

Other Mortality

Annual survivorship of radiocollared adult females from the SAPCH was estimated at 0.61 from 1987–90, which was extremely low when compared to other Alaska caribou herds (Pitcher et al. 1990). Causes of death were not determined, although predation by wolves and bears was suspected. Both predators were relatively abundant on the SAPCH range. During 1990–94 average annual survival rate of radiocollared caribou increased to approximately 0.86. This apparent reduction in mortality may reflect a younger average age of the collared caribou and reduced abundance of wolves after the 1990 rabies outbreak. Annual survival rates were 0.71 from June 1994 through May 1995 and 0.87 from June 1995 through May 1996.

HABITAT

Assessment

Observations before 1990 indicated that lichens were scarce throughout the range of the SAPCH and that spring phenology was later in Unit 9D than within the calving areas of the NAPCH in Unit 9E.

A preliminary analysis of fecal pellets showed very high use of mosses (Pitcher et al. 1990), possibly indicating poor range condition. Pitcher et al. (1990) reported that adult female caribou from the SAPCH were smaller and weighed less than cows from either the NAPCH or Mulchatna herds.

Caribou productivity appears higher on the Caribou River flats than within the Black Hills. Post (1995) rejected the hypothesis that this difference in productivity was related to winter range because caribou wintering on the Caribou River flats had similar diets to those caribou wintering nearer to Cold Bay. He concluded that earlier spring green-up and more abundant grasses, sedges, and forbs accounted for the higher calf production.

CONCLUSIONS AND RECOMMENDATIONS

The rapid decline of the SAPCH is neither unusual in terms of the history of this herd nor is it inexplicable. The range of the SAPCH has probably never been exceptionally good, and the period of record high numbers of caribou during the late 1970s and early 1980s undoubtedly depleted the preferred forage species. Nutritional stress was manifest in poor body condition of caribou, resulting in low reproduction and survival. Given adult female mortality rates averaging 25% per year and fall ratios averaging about 20 calves:100 cows, the herd could not possibly sustain itself.

We believe further decline is possible without hunting. Even a limited harvest of bulls would exacerbate the plight of the SAPCH because a lowered bull:cow ratio could result in a protracted calving period which would contribute to lower calf survival rates. We have concerns that predators might prevent a small, low-density herd from recovering for an extended period, particularly in this instance in which caribou are the sole large mammalian prey. It may be difficult to manage this herd at a level between nutritional and predator limitation.

Close cooperation between the department and the INWR staff is essential for effective management and research. A sample of radiocollared females should be maintained to monitor movements and survival rates. Following the new protocol for caribou management, we recommend that future collaring efforts be directed at yearling calves. Given the high incidence of lungworm detected in 1995 and 1996 in the NAPCH, it might be worth collecting 5–10 calves during fall composition surveys. Typically females calves are collected to standardize comparisons of weights and measurements between herds; but because of the extremely fragile status of this herd, we recommend collecting male calves.

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Table 1 Southern Alaska Peninsula caribou composition and survey results, 1983-96

Regulatory year	% Calves		Fall composition							Post-calving survey results	INWR[a] counts
	Summer	Fall	Bulls: 100 cows	Calves: 100 cows	Cows (%)	Small bulls (% of bulls)	Medium (% of bulls)	Large bulls (% of bulls)	sample size		
1983		15[a]									10,203
1984	17[a]	15[a]									7,500
1985	6[a]	9[a]									4,044
1986	17	13	32	20	66	59	28	13	2,307		4,543
1987	12	16	36	26	62	54	25	21	1,769	4,067	6,401
1988	16	12	41	19	59	61	37	4	886	3,407	
1989	17	5							1,718[b]	3,386	3,957
1990	14	9	19	12	76				1,051	3,375	
1991	18	13	28	19	68	53	33	14	883	2,287	2,830
1992	15	15	22	22	70	46	32	21	746	2,380	
1993	16	16	30	24	65	59	24	17	745	1,495	1,929
1994	21	18	29	28	64	46	27	27	531	2,137	1,806
1995	11									1,434	
1996	10										

[a] Counts by Izembek National Wildlife Refuge staff
[b] Count from supercub

LOCATION

GAME MANAGEMENT UNIT: 12 (3300 mi^2) and adjacent Yukon Territory (500–1000 mi^2)

HERD: Chisana

GEOGRAPHIC DESCRIPTION: Upper Chisana and White River drainages in the Wrangell–St Elias National Park and Preserve in southeastern Unit 12 and adjacent Yukon Territory, Canada

BACKGROUND

Historically, the Chisana Caribou Herd (CCH) has been a small, nonmigratory herd. Skoog (1968) estimated the CCH to be about 3000 animals in the early 1960s. By the mid to late 1970s, the herd declined to an estimated 1000 caribou, similar to the trend of other Interior caribou herds. During the 1980s environmental conditions were favorable, and the herd increased to 1900 caribou. Since 1988 the herd has steadily declined. Weather and predation have been the primary causes for the recent decline. Harvest by humans has had a minor effect on population fluctuations since the 1950s.

During the early 1900s the CCH was an important food source for gold seekers and residents of the Athabascan villages at Cross Creek and later Cooper Creek. Between 1913 and 1929 the Chisana Gold Rush occurred and 8000 to 10,000 people lived in the area. Subsistence use of the herd declined after 1929 once the Gold Rush ended and also after the Cooper Creek village burned down in the mid 1950s (Record 1983).

Guided hunting became common after 1929 and has been the primary use of the CCH since the mid-1950s. Four guide/outfitters operate in Alaska and 1 in the Yukon. Few Alaskan residents fly into the area to hunt, and Native people living at Northway and Tetlin no longer hunt in the CCH range. Area use by tourists is also light.

Before the mid-1980s the CCH was not a high management priority because of its small size, the area's remoteness, and the light and selective (mature males) hunting pressure. In 1980 the Wrangell–St. Elias National Park and Preserve was created; the preserve boundaries encompassed most of the Chisana Herd's range. ANILCA mandates directed the National Park Service (NPS) to preserve healthy populations and also allow for consumptive uses of the herd. By the mid-1980s, because of differing mandates and philosophies between ADF&G and the NPS, Chisana caribou management became more complex and required more attention.

To meet the increasing management needs, we initiated a cooperative study with the NPS and the Yukon Department of Renewable Resources (YDRR) in October 1987. Initially, 15 adult female caribou were radiocollared to monitor movements and to facilitate spring and fall census and composition surveys. Subsequently, 14 calves and 2 adults were collared in early October 1990, 11 adult females were collared in late September 1991, 4 adult females in 1993, 8 adult females in 1994, and 6 adult females in 1996. The NPS has provided most of the funding for

radiocollaring and monitoring the herd since 1994; collaring and radiotracking costs have been shared between the state, NPS, and YDRR since 1994.

Study results have documented the herd's decline since 1988. Between 1991 and 1994 guides and local hunters first reduced harvest through voluntary compliance. In 1994 the bull population declined to a level below the management objective, and all hunting of Chisana caribou was stopped.

MANAGEMENT DIRECTION

Due to the different mandates and philosophies of ADF&G and the NPS, a cooperative Chisana Caribou Management Plan is being developed. The plan will recommend management direction for future population and harvest management. The population management goal was dropped in 1994 because of the Congressional mandate under the Alaska National Interest Lands Conservation Act (ANILCA) to manage for a "natural" population.

The following are interim Chisana caribou management goals and objectives:

MANAGEMENT GOALS

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

MANAGEMENT OBJECTIVE

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

METHODS

During the past 5 years, sex and age composition data were collected each year between late September to early October. Either a Hughes 500, a Bell Jet Ranger, or a Robinson R-22 helicopter was used by a pilot/observer team working together with a Bellanca Scout that was used for radiotracking. Each caribou was classified as either a female, calf, or bull. Bulls were further classified as small, medium, or large based on antler size.

We attempted a population estimate during late June in 1992, 1993, and 1995. All radiocollared caribou were located; if the herd was grouped sufficiently, all individuals were counted visually or photographed using a 35-mm camera. Prints were then enlarged and the caribou were counted with the aid of a magnifying glass. We estimated population size and trend by using a population model designed by P Valkenburg and D Reed (ADF&G). Sex and age composition, recruitment, and mortality data were the primary components of the model.

We captured and radiocollared Chisana caribou during 1991, 1993, 1994, and 1996 to meet the following objectives: 1) to improve the efficiency of the census and composition surveys; 2) to monitor seasonal distribution and movement patterns; 3) to determine natality rate and median calving date, 4) to evaluate herd condition; 5) to estimate annual mortality rates; and 6) in 1994 and 1995, to obtain blood samples to determine pregnancy rates, herd genetics, and incidence of disease. The number of active collars operating during the report period ranged from 11 to 23.

Between 1993 and 1996 we used up to 3 indices to evaluate herd condition: 1) percent pregnancy of radiocollared cows, 2) median calving date, and 3) percentage of calves of radiocollared cows dying during the first 48 hours of birth. We determined pregnancy by monitoring the radiocollared cows daily during late May 1993 and 1994 by determining the presence of hard antlers, distended udders, or the presence of a calf. In 1994 and 1995 we captured 30 and 20 adult cows, respectively, and collected blood to determine pregnancy, using a serum progesterone assay testing technique. In 1995 an 1996 we located the radiocollared cows just after the median calving date to determine natality rate. We assessed range condition by evaluating the percent lichen versus moss in the herd's winter diet during 1994 and 1995.

We monitored the CCH harvest using information from returned harvest ticket report cards and, in 1993, from a registration permit. Under the harvest ticket report system, in most areas of the state harvest is normally underestimated and a correction factor is needed. However, because most caribou in the Chisana caribou hunt are taken by guided clients and their reports were completed and turned in by their guides, the harvest report return rate in this area is high and no correction factor is needed. Registration permits were used in 1993 to ensure the harvest quota was not exceeded. Between 1994 and 1996 the hunting season was technically open but no registration permits were issued because of herd trend and low bull numbers.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The CCH increased through the 1980s and reached its peak in 1988 at 1900 caribou. Since 1988 the herd has declined by an average of 8.5% annually, and by fall 1996 we estimated herd size was 600 caribou. If recruitment continues at the current low level, the herd can be expected to decline more rapidly due to the advanced age of most cows.

Population Composition

From 1990 to 1994 the calf:cow ratio in the CCH was low, and the bull:cow ratio declined (Table 1). Modeling demonstrated the herd's declining bull:cow ratio was primarily a function of low calf recruitment during the past 6 years. Bulls are aging, and unless calves are recruited, the bull:cow ratio will continue to decline.

Natality

Estimated natality rates were low in 1993 and 1994; in 1993 only 50% of the cows were pregnant in March. On 31 May 1993 the calf:cow ratio was 38:100 but declined to 19:100 by 13 June 1993

(Table 2). In 1994 the pregnancy rate increased to about 86%, and on 30 May the estimated calf:cow ratio was 73:100. However, on 17 June 1994 the calf:cow ratio declined to 11:100. In 1995 and 1996 pregnancy rates increased to >93% and calf:cow ratios on 30 May were 52:100 and 38:100, respectively. By 20 June, calf:cow ratios were estimated to be 7:100 in both years. Fall composition data demonstrated that natality rate had a minor influence on fall calf:cow ratios (Table 1).

Distribution and Movements

The CCH's range is relatively small (3500 mi^2) and encompasses the Nutzotin and northern Wrangell Mountains between the Nabesna and Generc rivers. Seasonal movements are normally short (<50 mi). During the past 5 years most of the herd moved to the eastern end of its range in Canada and wintered within the spruce forests along the Beaver Creek drainages. In 1992 snowfall was very early (9 Sep) and deep. The herd moved farther north and wintered in the forested habitats near Wellesley Lake. Prior to 1991 in years of average snow, most of the herd remained on sedge–grass range primarily in Alaska and only used the eastern portion of its range during deep snow winters. During the past 5 years the herd has primarily formed its postcalving aggregations from the Solo Creek Flats west to the Chisana Glacier.

The CCH does not seem to have a core calving area but instead spreads out across most of its range. Calving was limited to higher elevations (4800 and 6600 ft) in 1993 but was in spruce to alpine habitats (3400 to 6600 ft) during 1994 to 1996. In 1993 and 1994 we monitored calving behavior and found that parturient Chisana cows sequester themselves and select high elevation habitats that offer escape from predators even though food is scarce there. During 1995 and 1996 more cows calved near trees (30% to 38%) than in previous years (0% to 10%); however, they still calved separately. The largest calving groups observed during 1993 and 1994 after a minimum of 10 days of monitoring consisted of 3 and 4 cows with calves. In 1996 during 5 days after peak calving only 1/13 (8%) of the calving cows were in a group larger than 4 caribou.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Subsistence/Resident Open Seasons	Nonresident Open Seasons
Unit 12, that portion east of the Nabesna River and south of the winter trail from the Nabesna River to Pickerel Lake to the Canadian border: 1 bull; by permit only; the season will be closed when 20 bulls have been taken.	1 Sep–20 Sep	1 Sep–20 Sep

Board of Game Actions and Emergency Orders. During spring 1993 the Board of Game created a registration permit hunt for Chisana caribou. To ensure against overharvesting, the board stipulated a 5-day report period and a harvest quota of no more than 20 bull caribou. The board gave ADF&G the authority to determine the annual quota and to temporarily close areas. Because of the current trend of the Chisana Herd, ADF&G decided on a harvest quota of zero and since 1994 has issued no permits for Chisana caribou.

Human-induced Mortality. There has been no legal harvest of Chisana caribou in Alaska or Yukon since 1994 (Table 3). Reports from local residents indicate an illegal harvest of 0 to 3 annually. In Yukon, First Nation band members can hunt Chisana caribou but since 1994 have voluntarily stopped. In 1996 7 Chisana caribou were taken illegally along the Alaska Highway in Yukon. Because the herd is inaccessible most of the year, little or no illegal harvest occurs in either Alaska or the Yukon.

Hunter Residency and Success. Nonresidents were responsible for 58% of the Chisana caribou harvest between 1990 and 1994 (Table 4). All of the nonresidents were guided; their success rate averaged 81%. Local residents took only 9% of the total Chisana caribou harvest during that period.

Hunter Effort. When the Chisana caribou season was open, the average number of days successful hunters spent hunting was 4.0 days, while unsuccessful hunters hunted 6.7 days (Table 5).

Harvest Chronology. Between 1987 an 1993 73% of the harvest occurred during the first 2 weeks of the season (Table 6). Slightly more were taken during the first week (42%) of September because most of the nonresident hunters on multiple-species hunts hunted during this period.

Transport Methods. All hunters of the CCH must initially use aircraft to reach the Chisana area. Most Alaskan residents hunt on foot from remote float or wheel-plane access points. The remainder of the Alaskan residents fly into an established airstrip and use either 3- or 4-wheelers or horses to hunt. In comparison, nonresidents hunt almost exclusively with horses after flying into one of the established guide camps. Between 1987 and 1994 most successful hunters used horses to access the caribou herd (Table 7).

Other Mortality

During 1990 and 1991 the annual mortality rate for collared adult females was 9.1%. We estimated overwinter mortality of calves at 64% between October 1990 and June 1991, based on the fate of 11 radiocollared female calves. Bears and wolves killed the 9 collared caribou that died during this period, evidenced by blood stained collars and sign at the death sites. Three of the deaths, 1 adult cow and 2 calves, can be attributed to wolves based on the timing of death (midwinter). Between 1992 and 1996 the annual mortality rate increased from 13% to 30%. Since 1994 the cause of death was determined for 7 of the radiocollared females; 6 were killed by predators and 1 died in an avalanche.

Insignificant calf recruitment occurred during 1990 through 1996 (0–11 calves:100 cows). High early summer calf mortality is the primary cause of the low calf numbers in fall. Pregnancy rates

were low in 1993 and possibly during 1991 and 1992, but even when annual pregnancy rates were high, no additional calves survived. Calf mortality during the first 48 hours seemed to be high in 1993. Adverse climate conditions were probably the cause of the reduced pregnancy rates and the high early mortality (<48 hrs). Winters 1991 and 1992 had severe deep snow and late spring snows, while summers 1990, 1991, and 1994 were much hotter and drier than normal. Favorable weather conditions (normal rainfall, low snowfall) persisted during 1995 and 1996. Pregnancy rates were high, but calf survival continued to be very low (4–5:100 cows).

Grizzly bears and wolves are the primary causes of calf mortality in the Denali and Mentasta herds, and each herd has the same population and calf recruitment trend as the CCH. Reports from the public and incidental sightings by ADF&G staff indicate that predators, primarily wolves and grizzly bears, move to calving areas. Between 1990 and 1992 coyotes, probably another important predator to this herd, were abundant within the Chisana range and were observed killing calves.

In Alaska the Chisana herd range supports at least 40 to 50 wolves in 6 packs. The grizzly bear population is moderately harvested within the Alaskan portion of the herd's range and only lightly harvested in the Yukon. The grizzly populations are probably at near natural densities. However, the coyote population declined in 1993, and coyotes are no longer plentiful. Even so, the high predator:caribou ratio is sufficient to cause high calf and adult mortality and possibly increased vulnerability to predation.

HABITAT

Assessment

Prior to the 1990s the most frequently used range of the CCH for both winter and summer was predominantly grass–sedge habitat with few lichens. During the early 1990s the herd wintered in timbered habitats along the Chisana River and Beaver Creek drainages in the eastern portion of the herd's range. No range condition data was collected from this area, but the area was thought to have a good standing crop of lichens. The CCH selected that area to winter in 1991, 1993, and 1994 through 1996. Fecal samples collected in 1994 and 1995 showed a sharp contrast in lichen distribution among the herd's winter ranges. Near Wellesley Lake, lichen availability is low (21% lichen and 75% moss and evergreen shrub fragments in samples). In the remaining portion of the winter range, lichen availability is moderate to high (50–80%). Boertje (1984) found that fecal samples containing high proportions of mosses and evergreen shrubs indicate the range was overgrazed or suboptimal. Overall, the Chisana winter range is suboptimal compared to other Interior herds. Nutritionally stressed caribou are presumably more vulnerable to predators which may explain the high levels of winter mortality the Chisana Herd has experienced the past 5 years.

Summer range quality determines body size and body condition in the fall. If cow caribou do not reach optimum condition, pregnancy rates decline. Pregnancy rates were very low in 1993 and possibly in 1991 and 1992. Adverse weather conditions affected the summer range during that period. Since 1993 pregnancy rates have been high, indicating summer range is adequate except during periods of unfavorable weather.

A graduate program designed to assess effects of summer climate on productivity and nutrition of Chisana caribou was initiated in summer 1994. Results of this study should be available in 1997.

Enhancement

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

CONCLUSIONS AND RECOMMENDATIONS

The CCH declined by 68% since 1988 due primarily to poor calf recruitment and, since 1992, high adult mortality. Since 1991 recruitment averaged less than 4 calves:100 cows. Causes of low calf numbers are not known, but low natality rates in 1993 and possibly in 1991 and 1992 caused by adverse weather conditions and predation were primary factors. Predation has been the cause of 89% of the mortality for radiocollared animals >4 months old. Hunting during the herd's decline removed about 2% or less of the population annually, but slightly accelerated the declining bull:cow ratio. Hunting did not limit the herd's ability to grow, although winter range quality is below average, compared with other Interior herds, which probably contributed to higher overwinter adult mortality. For the herd to stabilize, calf recruitment rate must increase to about 20 calves:100 cows and cow and bull mortality rates must decline to 0.10 and 0.15, respectively.

The extremely low recruitment rates experienced by the CCH over the past 7 years have never been documented in any other wild caribou herd. Sufficient funding to determine pregnancy and natality rates and fall composition counts should be continued.

In 1991 and 1992 harvest was reduced through a voluntary agreement with the principal hunters and guides and during 1993 by a harvest quota regulated by a registration permit system. Harvest removed <2% of the population during that period. Because of low calf recruitment for the past 6 years, even this low harvest had an effect on the bull:cow ratio. In 1993 the bull:cow ratio declined below the management objective of 30:100. Between 1994 and 1996 the Chisana caribou hunting season was not opened. Until calf recruitment improves and the bull numbers increase, the season will remain closed.

Since 1990 43% of the hunters participating in the Chisana caribou hunt were nonresidents and were responsible for 58% of the harvest. Local subsistence users have harvested only 8 (9% of the harvest) caribou during this period. Future harvest regulations should provide for guided nonresidents who are the primary users of this herd.

A Chisana caribou planning process was initiated in 1994. The completed plan will recommend management and harvest strategies for the Chisana Herd that will meet the mandates of ADF&G and NPS. Annual harvest rate and allocation will be the primary focus of the plan. Completion of the plan is not expected until 1998 due to conflicts with other management programs.

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Table 1 Chisana caribou fall composition counts and estimated population size, 1987-1996

Date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent small bulls (% of bulls)	Percent medium bulls (% of bulls	Percent large bulls (% bulls)	Percent bulls	Composition sample size	Total count of herd size[a]
10/9/87	39	28	17	60	53	26	21	23	760	1800
9/27/88	36	31	19	60	28	46	26	21	979	1882
10/16-17/89									625	1802
10/4-5/90	36	11	7	68	37	44	19	25	855	1680
9/29/91	40	1	1	71	45	42	13	28	855	1488
9/27/92	31	0	0[b]	76	34	43	23	24	1142	1270
10/5/93	24	2	2	79	30	45	24	19	732	869
9/29/94	27	11	8	72	20	44	35	20	543	803
9/30/95	21	4	4	80	30	23	47	17	542	690
9/30/96	16	5	4	83	40	18	42	13	377	602

[a] Based on population modeling.

[b] Only 1 calf was seen in this survey.

Table 2 Chisana caribou postcalving composition counts, 1989-1996

Date	Percent calves (*n*)	Percent adults (*n*)	Composition sample size
6/21/89	10 (160)	90 (1380)	1540
6/20/90	12 (147)	88 (1032)	1179
6/20/91	2 (21)	98 (1264)	1285
6/22/92	1 (10)	99 (1224)	1234
6/24/93	6 (39)	94 (612)	651
6/17/94	8 (37)	92 (449)	486
6/22/95	5 (34)	95 (689)	723
6/20/96	2 (9)	98 (533)	542

Table 3 Chisana caribou harvest and accidental death, 1989-1996

Regulatory year	Alaska harvest							Yukon harvest		Total
	Reported				Estimated					
	M	F	Unk	Total	Unreported	Illegal	Total	Reported	Unreported	
1989-1990	34	0		34	0	0	0	18	5-20	57-72
1990-1991	34	0	0	34	0	0	0	11	5-20	50-65
1991-1992	21	0	0	21	0	0	0	0	5-20	26-41
1992-1993	16	0	0	16	0	0	0	0	5-20	21-36
1993-1994	19	6	0	19	0	0	0	0	5-20	24-39
1994-1995	0	0	0	0	0	0	0	0	5-20	5-20
1995-1996	0	0	0	0	0	3	7	0	1-3	4-6
1996-1997	0	0	0	0	0	3	3	0	7	10

Table 4 Chisana caribou hunter residency and success of hunters in Alaska, 1990-1996

Regulatory year[a]	Successful				Unsuccessful				Total hunters
	Local resident	Nonlocal resident	Nonresident	Total[b] (%)	Local resident	Nonlocal resident	Nonresident	Total (%)	
1990-1991	3	9		33 (69)	4	11	0	15 (31)	48
1991-1992	0	8	13	21 (55)	0	9	8	17 (45)	38
1992-1993	2	4	10	16 (57)	0	11	1	12 (43)	28
1993-1994	3	8	8	19 (58)	2	9	3	14 (42)	33
1994-1995[c]									
1995-1996[c]									
1996-1997[c]									

[a] Before 1990-1991 harvest data had not been computerized.

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

[c] No open season.

Table 5 Mean days hunted for successful and unsuccessful hunters of Chisana caribou in Unit 12, 1984-1996

Regulatory year	Mean days hunted		
	Successful hunters	Unsuccessful hunters	Total hunters
1984-1985	3.8	6.1	4.5
1985-1986	3.7	5.8	4.2
1986-1987[a]			
1987-1988	4.3	6.5	4.7
1988-1989	4.5	6.8	4.8
1989-1990[a]			
1990-1991	4.5	8.6	5.9
1991-1992	3.2	5.0	3.6
1992-1993	3.6	7.0	5.0
1993-1994	4.0	8.0	5.4
1994-1995[b]			
1995-1996[b]			
1996-1997[b]			

[a] Data not available.

[b] No open season.

Table 6 Chisana caribou harvest by time period, 1987-1996

Regulatory year	Harvest periods			Unk	*n*
	9/1-9/7	9/8-9/15	9/16-9/20		
1987-1988	30	12	7	0	49
1988-1989	17	15	15	2	49
1989-1990	-[a]	-[a]	-[a]	34	34
1990-1991	15	14	5	0	34
1991-1992	5	10	6	0	21
1992-1993	6	8	2	0	16
1993-1994	10	5	4	0	19
1994-1995[b]					
1995-1996[b]					
1996-1997[b]					

[a] Data not available.

[b] No open season.

Table 7 Chisana caribou harvest by transport method, 1987-1996

	Percent of harvest							
Year	Airplane	Horse	Boat	3- or 4-Wheeler	ORV	Walking[a]	Unk	*n*
1987-1988	46	38	2	15	0	--	0	48
1988-1989	28	54	2	15	0	--	0	46
1989-1990	32	50	0	12	0	--	6	34
1990-1991	27	70	0	3	0	0	0	34
1991-1992	24	57	0	10	0	0	10	21
1992-1993	19	75	0	6	0	0	0	16
1993-1994	32	58	0	5	0	0	5	19
1994-1995[b]								
1995-1996[b]								
1996-1997[b]								

[a] Walking was not listed as a transportation type from 1986-1987 to 1989-1990.
[b] No open season.

LOCATION

GAME MANAGEMENT UNIT: Portion of Units 12 and 20D (1900 mi^2)

HERD: Macomb

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

BACKGROUND

Little was known about the Macomb Caribou Herd (MCH) and it received little sport harvest before 1972 (Jennings 1974), when herd size was estimated at 350 to 400 caribou. Hunting pressure increased on the MCH in 1972 when restrictions were placed on hunting other road accessible herds, including the Fortymile, Nelchina, and Mentasta herds.

With increased hunting pressure on the MCH, the bag limit was reduced from 3 to 1 caribou in 1973. The Macomb Plateau Management Area (MPMA) was established in 1974 to prohibit the use of motorized vehicles for hunting from 10 August through 20 September, except for floatplanes at Fish Lake. The MPMA included the area south of the Alaska Highway, draining into the south side of the Tanana River between the east bank of the Johnson River upstream to Prospect Creek and the east bank of Bear Creek (Alaska Highway Milepost 1357.3).

The MCH numbered about 500 during the early 1970s (Larson 1976). By 1975 the MCH was reported to number 700 to 800 caribou, but the apparent increase in herd size from 1972 to 1975 was probably because of increased knowledge about the herd rather than an actual increase in the number of caribou. Hunting pressure and harvest continued to increase, despite a reduced bag limit and restrictions imposed by the MPMA. In 1975 hunting pressure increased 72% over 1974 levels, and in 1976 there were 70% more hunters than in 1975 (Larson 1977). Despite the larger known herd size, the harvest was equal to or exceeding recruitment.

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

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

The MPMA was renamed the Macomb Plateau Controlled Use Area (MPCUA) in 1981 to more accurately reflect the access restrictions 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 Unit 20D south of the Tanana River. This population objective was based on incomplete data on herd size, movements, and identity of the MCH.

On 29 June 1988, a population estimate for the MCH resulted in an estimate of 800 caribou. Information gathered from local residents indicated that historically there may have been more caribou between the Robertson and Delta Rivers than there were in 1988. Therefore, a population size objective was established to increase MCH size to 1000 caribou by 1993.

MANAGEMENT DIRECTION

Provide for continued consumptive use of caribou.

- Manage for a population objective of 1000 caribou, with a minimum herd size of no less than 400 caribou.
- Manage for a sex ratio of no less than 30 bulls:100 cows after the hunting season.

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

- Maintain the Macomb Plateau Controlled Use Area.

Determine calf survival and factors affecting calf survival.

- Maintain 20 active radiocollars on caribou.
- Conduct fall composition counts annually.

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

METHODS

We used a Robinson R-22 helicopter in early October to classify caribou sex and age and to count total numbers. A fixed-wing aircraft accompanied the helicopter to help find radiocollared caribou groups without radios and to help count total numbers.

We radiocollared 8 4-month-old females on 20 October 1996. These caribou were immobilized using 1 mg carfentanil citrate (Wildnil®, Wildlife Pharmaceuticals, Fort Collins, Colo) and 65 mg of xylazine hydrochloride (AnaSed®, Lloyd Laboratories, Shenandoah, Ia). Caribou were weighed, measured, and subjectively rated for body condition.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Although the MCH met our minimum herd size objective during this reporting period, the herd remained below the management goal. In the 1995 aerial census, we counted 477 caribou. This was a minimum count due to lack of snow in the survey area. The following year we counted 586 caribou under ideal conditions with complete snow cover. In retrospect, the 1995 census was probably accurate (Table 1).

Population Composition

Survival of calves to fall continued to be poor in 1995 with only 10 calves:100 cows and 7% calves observed in the herd during the 1 October census. However, calf survival increased significantly in fall 1996 to 30 calves:100 cows and 17% calves observed during the 2 October census (Table 1).

The weight of 4-month-old calves captured during radiocollaring has increased since 1990. Calves captured during October 1996 had a mean weight of 128.3 pounds ($s_{\bar{x}} = 6.0$, $n = 8$) (Table 2).

The MCH bull:cow ratio met the management objective in October 1995 and 1996 for the first time since 1991 with 39 and 43 bulls:100 cows, repectively (Table 1).

Distribution and Movements

During the MCH census on 1 October 1995, caribou were located from the Sheep Creek tributary of the Littler Gerstle River, east to a point about 2 miles east of the Macomb Plateau. Most of the caribou were located on the Macomb Plateau.

During the MCH census on 2 October 1996, large groups of caribou were distributed from the West Fork of the Robertson River, west to the head of Dry Creek on the Macomb Plateau. One lone caribou was seen near Sheep Creek, a tributary of the Little Gerstle River.

MORTALITY

Harvest

Season and Bag Limit. The 1995–1996 and 1996–1997 hunting seasons were canceled because herd size was below the population objective and the bull:cow ratio was relatively low.

Board of Game Actions and Emergency Orders. The Alaska Board of Game determined that Unit 20D was appropriate for intensive management based on a proposal submitted by the Delta Fish and Game Advisory Committee. The determination was based, in part, on present and previous popularity of hunting the Macomb Herd.

The Alaska Board of Game also adopted a Wolf Predation Control Implementation Plan (5 AAC 92.125) for Unit 20D that established a new population goal of 600 to 800 caribou for the MCH, with a harvest goal of 30 to 50 caribou by the year 2002.

A proposal was submitted to the Alaska Board of Game by the department to reduce the size of the MPCUA. The proposal was to move the northern boundary from the Alaska Highway to a line 5 miles south of the highway. The benefits of the proposal were to allow increased moose hunting opportunity, easier access into the MPCUA, and increased opportunity for hunters to harvest brown bears in the area to help improve MCH calf survival. The proposal was rejected by the Board of Game based on objections from local residents in the area.

Hunter Harvest. No hunting occurred on the MCH during this reporting period (Table 3).

Permit Hunts. No permits were issued to hunt the MCH during this reporting period (Tables 4 and 5).

Hunter Residency and Success. No hunting occurred on the MCH during this reporting period (Table 4).

Harvest Chronology. No hunting occurred on the MCH during this reporting period (Table 6).

Transport Methods. No hunting occurred on the MCH during this reporting period (Table 7).

Other Mortality

No other mortality was recorded for the MCH during this reporting period. During the early 1990s mortality of collared caribou from unknown causes was relatively high. During the last 2 years mortality declined.

HABITAT

Assessment and Enhancement

No habitat assessment and enhancement were accomplished during this reporting period. Habitat assessment is needed in the range of the MCH range to determine condition and quality of forage.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

The addition of 8 radiocollars to the MCH brought the collared caribou total to 16 in fall 1996. This is below our goal of maintaining 20 active radiocollars on MCH but is the maximum number that funding will allow at this time.

CONCLUSIONS AND RECOMMENDATIONS

The MCH failed to meet the herd size objective of 1000 caribou; however, herd size increased and calf survival improved in fall 1996. The Alaska Board of Game established a new herd size goal of 600 to 800 caribou and a harvest goal of 30 to 50 caribou by 2002. The hunting season remained closed during this reporting period; however, consideration will be given to allowing

hunting of bulls during the 1997–1998 hunting season. Although the population is slightly below the herd size goal, the bull:cow ratio increased. Composition data also show an increase in the number of large bulls; a limited harvest of bulls would not be detrimental to the herd. Radio collars were placed on 8 caribou during this reporting period, resulting in 16 radiocollared caribou in the MCH in fall 1996.

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Table 1 Macomb caribou fall composition counts and estimated population size, regulatory years 1982–1996

Survey date	Bulls: 100 cows	Calves: 100 cows	Calves %	Cows %	Small bulls (% of bulls)	Medium bulls (% of bulls	Large bulls (% of bulls)	Total bulls %	Composition sample size	Count or estimate of herd size
10/82	21	26	18	68	61	29	10	14	218	700
10/83[a]	33	24	15	64	48			21	238	700
12/1/84	28	40	24	60	45	34	21	17	351	700
10/30/85	45	31	17	57	43	38	20	26	518	700
10/16/88	46	32	18	56	41	31	28	26	671	772
10/26/89	33	34	20	60	54	31	15	20	617	800
10/9/90	44	17	11	62	34	34	32	27	600	800
9/25/91	34	9	6	70	21	42	37	24	560	560
9/26/92	25	14	10	72	30	36	33	18	455	527
10/2/93	22	18	13	72	38	34	28	16	374	458
10/2/94	21	13	10	74	53	16	31	16	345	532
10/1/95	39	10	7	67	44	17	39	26	477	477[b]
10/2/96	43	30	17	58	29	31	40	25	586	586

[a] Large and medium bulls not classified in this survey.

[b] Poor survey conditions due to lack of snow cover.

Table 2 Weights of female calves from the Macomb Caribou Herd, 1990–1996

Date	Mean weight in lb	*s*	*n*
Apr 1990	107.3	2.6	12
Oct 1994	118.8	3.1	10
Oct 1996	128.3	6.0	8

Table 3 Macomb caribou harvest[a] and accidental death, 1985-1986 through 1996–1997

Regulatory year	Hunter harvest							Accidental death	Total
	Reported				Estimated				
	M	F	Unk	Total	Unreported	Illegal	Total		
1985-1986	12	0	0	12	0	2	2	0	14
1986-1987	10	0	0	10	0	2	2	0	12
1987-1988	57	0	0	57	0	2	2	0	59
1988-1989	42	0	0	42	0	2	2	0	44
1989-1990	44	0	0	44	0	2	2	3	49
1990-1991	42	0	0	42	0	2	2	0	44
1991-1992	48	0	2	50	0	2	2	0	52
1992-1993[b]	0	0	0	0	0	2	2	0	2
1993-1994[b]	0	0	0	0	0	2	2	0	2
1994-1995[b]	0	0	0	0	0	2	2	0	2
1995-1996[b]	0	0	0	0	0	2	2	0	2
1996-1997[b]	0	0	0	0	0	2	2	0	2

[a] Includes permit hunt harvest.

[b] Hunt canceled.

Table 4 Macomb caribou hunter residency and success of permit hunters, 1986–1987 through 1996–1997

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	
1986-1987[b]	9	0	1	10 (18)	19	27	1	47 (82)	57
1987-1988[b]	21	36	0	57 (61)	15	21	1	37 (39)	94
1988-1989[b]	15	18	0	33 (54)	4	22	0	28 (46)	61
1989-1990[b]	18	20	0	38 (54)	8	24	0	32 (46)	70
1990-1991[c]	28	14	0	42 (23)	80	64	0	144 (77)	186
1991-1992[c]	23	27	0	50 (24)	77	81	0	158 (76)	208
1992-1993[d]									
1993-1994[d]									
1994-1995[d]									
1995-1996[d]									
1996-1997[d]									

[a] Resident of Unit 20D.

[b] Hunt by drawing permit.

[c] Hunt by registration permit.

[d] Hunt canceled.

Table 5 Macomb caribou harvest data by permit hunt, 1985–1986 through 1996–1997

Hunt no.	Regulatory year	Permits issued	% did not hunt	% successful hunters	% unsuccessful hunters	Harvest			Total harvest
						Bulls (%)	Cows (%)	Unk	
530[a]	1985-1986	140	61	22	78	12	0	0	12
	1986-1987	100	62	26	74	10	0	0	10
570[b]	1986-1987	15	53	14	86	1	0	0	1
530[a]	1987-1988	150	53	76	24	53	0	0	53[c]
	1988-1989	150	57	55	45	36	0	0	36[d]
	1989-1990	150	47	55	45	44	0	0	44[d]
535[e]	1990-1991	351	42	21	79	42	0	0	42
	1991-1992	317	33	16	50	48	0	2	50
	1992-1993[f]	0							0
	1993-1994[f]	0							0
	1994-1995[f]	0							0
	1995-1996[f]	0							0
	1996-1997[f]	0							0
Totals for all permit hunts	1985-1986	140	61	22	78	12	0	0	12
	1986-1987	115	61	24	76	11	0	0	11
	1987-1988	150	53	76	24	53	0	0	53[a]
	1988-1989	150	57	55	45	36	0	0	36[b]
	1989-1990	150	47	53	48	44	0	0	44[b]
	1990-1991	351	42	23	77	42	0	0	42
	1991-1992	317	33	16	50	48	0	2	50
	1992-1993[f]	0							0
	1993-1994[f]	0							0
	1994-1995[f]	0							0
	1995-1996[f]	0							0
	1996-1997[f]	0							0

[a] Hunt 530 was a drawing permit hunt.
[b] Hunt 570 was a subsistence registration permit hunt for Dot Lake residents only.
[c] Thirty-three caribou killed during the permit hunt, an estimated 20 killed in Unit 12 outside the permit area, and 4 (not included in the total) killed by subsistence hunters.
[d] Non-permit subsistence harvest was 2 (not included in 1988 and 1989 total).
[e] Hunt 535 was a registration permit hunt.
[f] Hunt canceled.

Table 6 Macomb caribou harvest by time period, 1987-1988 through 1996–1997

Regulatory year	Harvest periods									
	8/10-8/16	8/17-8/23	8/24-8/30	8/31-9/6	9/7-9/13	9/14-9/20	9/21-9/27	9/28-9/30	Unk	*n*
1987-1988	8	6	10	3	4	1	0	0	1	33
1988-1989	2	4	6	4	5	3	3	8	1	36
1989-1990	1	6	8	4	5	6	5	6	0	41
1990-1991	1	3	6	11	4	2	6	1	7	41
1991-1992[a]	4	6	21	15	2	0	0	0	0	48
1992-1993[b]										
1993-1994[b]										
1994-1995[b]										
1995-1996[b]										
1996-1997[b]										

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

Table 7 Macomb caribou harvest percent by transport method, 1986-1987 through 1996–1997

Regulatory year	Percent of harvest[a]									
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Walking[b]	Unk	*n*
1986-1987	21	21	0	4	0	0	54		0	24
1987-1988	6	37	0	6	0	3	49		0	68
1988-1989	15	25	0	6	0	5	49		0	65
1989-1990	5	45	0	0	5	39	7		0	44
1990-1991	2	5	0	24	0	14	17	38	0	42
1991-1992	4	10	0	32	0	8	20	0	26	50
1992-1993[c]										
1993-1994[c]										
1994-1995[c]										
1995-1996[c]										
1996-1997[c]										

[a] Includes permit hunt harvest.

[b] Walking was not listed as a transportation type from 1986-1987 to 1989-1990.

[c] Hunt canceled.

LOCATION

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

HERD: Nelchina

GEOGRAPHIC DESCRIPTION: Nelchina Basin

BACKGROUND

The Nelchina Caribou Herd (NCH) population was between 5000 and 15,000 caribou in the late 1940s. The herd increased during the early 1950s, aided by intensive predator control. It continued to grow and peaked at about 70,000 caribou by the mid-1960s. A dramatic decline began in the late 1960s, and the herd fell between 7000 and 10,000 caribou in 1972. In 1973–74, the NCH began to increase and continued to grow through the mid-1990s.

The NCH has been important to hunters because of its accessibility and proximity to Anchorage and Fairbanks. The Board of Game (BOG) increased bag limits and extended seasons when the NCH began to increase in the late 1950s. From 1955 until 1971, the bag limits varied from 2 to 4 caribou, and season lengths fluctuated between a split 2-month season in September and November and a 7-month season from August to March. Annual harvests from 1955 through 1971 ranged from 2500 to more than 10,000 caribou. The department recognized a decline in 1972, and the board curtailed the season and bag limit. From 1972 through 1976, the bag limit was 1 caribou, and fall seasons varied from 15 to 40 days. Even with restrictions the reported harvests ranged from 560 to as high as 1200 caribou and exceeded the desired harvest level. In 1976 the season was closed by emergency order after hunters killed 800 caribou in 5 days. It became apparent that a short season was not controlling the harvest. Since 1977 Nelchina caribou have been hunted by permit only. Between 1977 and 1990 most permits issued were random drawing under a sport hunting season. Beginning in 1990 all Nelchina permits issued were for a subsistence hunt only. Both the number of permits and the allowable harvest have increased as the herd has grown, and during the last 10 years (1986–95), there have been close to 30,000 caribou harvested from the NCH.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

The management objective is to reduce the herd and maintain a population of 35–40,000 caribou, with a minimum of 40 bulls:100 cows and 40 calves:100 cows. To reduce the herd, the objective for the NCH hunt is to increase the harvest of cows.

METHODS

Biologists conducted yearly censuses and sex and age composition counts. The spring censuses involved aerial counts of caribou in postcalving aggregations and were followed immediately by sex and age composition surveys. Surveyors estimated the cow base and the proportion of calves and bulls in the postcalving aggregations. Fall aerial sex and age composition counts were also

done annually to estimate herd composition and to evaluate calf recruitment. Extrapolated fall posthunt population estimates were then calculated from the counts and composition data.

We located radiocollared caribou seasonally to delineate herd distribution, sex and age composition, and determine seasonal range use. Between 30 and 40 radiocollared caribou were maintained in the herd each year. Collars were placed on female calves to obtain survival and parturition data on radiocollared females of known age. All radiocollared cows were followed every other day during the calving period to determine pregnancy rates and calving dates.

Female calves were collected during the fall and spring to obtain body condition indices. Neonatal calves were captured to obtain estimates of birth weights.

Biologists used permit reports, periodic checkstations, and hunter field checks to monitor hunts.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The NCH fall population estimate increased from 44,093 caribou in 1994 to 50,281 in 1995 and declined to 44,273 in 1996 (Table 1). The 1995 spring count was an aerial photocensus with a camera mounted in the belly of a fixed-wing aircraft. This is the first time an aerial photocensus of the NCH has been completed in over 20 years. All other census results are from a combination of photographs taken with hand-held cameras and direct field counts. The use of aerial photocensus techniques for counting the NCH is on an every-other-year schedule. The estimated density was 1.0 caribou/km^2 in 1995 based on an approximate range of 44,200 km^2 (Lieb et al. 1988) and a population estimate of 50,281 caribou. We conducted the last Upper Susitna River subherd count in 1994 and counted 2014 caribou. This subherd is counted every 3–5 years.

Population Composition

Biologists observed 55 calves:100 cows during the 1996 postcalving survey. This was the highest calf:cow ratio in 3 years and signals a return to the 51–63 calf:100 cows productivity range observed during postcalving surveys between 1983–92. Calf production and survival between 1993 and 1996 ranged from 37–46 calves/100 cows. Typically, calf:cow ratios declined between summer and fall. The 1995 and 1996 fall ratios were both 38 calves:100 cows, somewhat below the 5-year average (1988–92) of 41 calves:100 cows but well above the 1993 figure of 24.

Surveyors observed 34 bulls:100 cows during both the fall 1995 and 1996 surveys. Fall bull ratios have been lower the last few years, especially when compared to figures of 50–60 bulls:100 cows observed most years during the 1980s. This reduction was the result of a harvest regime in which bulls were predominant in the harvest.

Distribution and Movements

Biologists monitored the distribution and movements of the NCH by periodic flights to locate radiocollared cows. Spring and summer caribou distribution and movement during the reporting period were similar to those in prior years. Calving took place in the eastern Talkeetna

Mountains from Fog Lakes southeast to the Little Nelchina River. The core calving area centered around the Oshetna River and Kosina Creek. This was also the area used during the postcalving and early summer period. By late summer and early fall, most of the herd were in the central portions of the unit, relatively inaccessible. This distribution coincided with the fall hunting seasons during 1995 and 1996. Instead of staying in the high country of the Talkeetnas or moving into the Alaska Range near the Denali Highway, caribou stayed in the Susitna River drainage, the Lake Louise Flats, or the southern portions of the Alphabet Hills. In 1995 the rut occurred on the Lake Louise Flats and caribou remained there until late October when virtually the whole herd migrated east out of the unit. In 1996 the herd started migrating out of Unit 13 by mid-September and, again, virtually the whole herd migrated east into Units 11 and 12 where the rut took place. There was little use of traditional wintering areas in Unit 13 during 1995 or 1996, and the migrations the past 2 years have been the most complete in years, with only a few scattered bands of caribou remaining in Unit 13.

Spring migrations usually start by mid-March when caribou gradually move west toward Unit 13. In 1996 caribou moved into the Mentasta Mountains in Units 12 and 11 in March. Some caribou were available to hunters along the Tok Cut-Off during the last month of the winter hunt, but most were just out of the unit. By late April or early May, caribou were crossing Unit 13 along a band extending west from Slana to Sourdough, across the Lake Louise Flats to the Talkeetna Mountains.

MORTALITY

Harvest

Season and Bag Limit. The season dates for the state Tier II subsistence hunt (566T) in Unit 13 were 10 August–20 September and 5 January–31 March in 1994. In 1995 the hunting season for this hunt increased with a late fall hunt from 15 November–31 December. The bag limit was 1 caribou during the August and September seasons, and changed to 1 antlered caribou for all late fall and winter hunts during both years. There was a state registration subsistence hunt (RC 460) for NCH in Unit 12 in late fall that was opened and closed by emergency order. The bag limit for this hunt was 1 bull. The Unit 13 federal subsistence seasons in 1994 and 1995 had similar season dates as the state, except for the fall season which closed 30 September. The federal bag limit was 2 caribou. The Unit 13 federal subsistence hunt was a registration hunt administered by the Bureau of Land Management and only residents of Units 11, 13, or 12 along the Nabesna Road were eligible. The Unit 12 federal subsistence hunt is by emergency order and was not held the last 2 years.

Board of Game Actions and Emergency Orders. In 1989 the Alaska Supreme court determined that local residency as a criterion for determining subsistence eligibility was unconstitutional. Consequently, the board determined all Alaskans were subsistence users. The sport harvest of Nelchina caribou was eliminated and only Tier II subsistence hunting was allowed between 1990 and 1995. In 1996 the board created a subsistence Tier I registration hunt for all state residents with no limit on the number of permits issued. The bag limit was 1 cow or 1 bull with 6 points or less on 1 antler. The intention of the board was to allow up to 10,000 cows to be taken, reducing the herd to a level consistent with the management objective. The Tier II hunt was made a bulls-only hunt with an allocation of 5000 bulls and 10,000 permits issued.

During its March 1995 meeting the board determined that Unit 13 was an area suitable for intensive management of predator and prey species. The purpose of the intensive management was to increase moose and caribou populations to allow for increased human use. Intensive management plans for Unit 13 are being drafted for the board.

In January 1995 an emergency closure of the caribou season was issued for Subunit 13E. There were insufficient numbers of main herd animals, and harvest was concentrated on a small subherd (Upper Susitna) that permanently inhabit Unit 13E. This subherd could not sustain a high harvest, so the area was closed to caribou hunting for the remainder of the 1994–95 season.

The Federal Government assumed control of wildlife management on federal lands following the McDowell decision. A federal board was created to establish subsistence seasons and bag limits on federal lands beginning with the 1990 season. The major difference between the federal and state caribou hunts is that only a very small portion of Unit 13B is federal land, which reduces the opportunity to take caribou under a federal permit. The federal season is 10 days longer, closing on 30 September; the bag limit is 2 caribou.

Hunter Harvest. The reported harvest in 1995–96 for the combined state and federal hunts was 4916 caribou (Table 2). The 1995–96 harvest was a 37% increase over the 1994–95 harvest. The 1995 harvest approaches the 1993 take of 5281 caribou, the highest kill from the NCH in 22 years. Compared to harvests in 1993, cow harvests declined in 1994 but increased to similar levels in 1995. Management efforts have been focused on increasing the cow harvest to reduce the herd. The winter bag limit was 1 antlered caribou to encourage the harvest of cows, although immature bulls were also legal because of a hunter identification problem. Most breeding bulls have shed their antlers prior to the winter season, although young bulls still have antlers during most of the winter hunt and look like adult cows.

Illegal and unreported harvests of Nelchina caribou are an additional source of mortality. Table 3 includes an estimate assigned to illegal and unreported harvest levels. These figures represent only an attempt to recognize these losses, and the estimates are not based on quantitative data. The most common type of illegal harvest occurs when a permittee fails to validate the permit after taking a caribou. Once a permittee transports a caribou from the field without punching the permit tag, there is minimal chance of citing them for taking additional caribou on the same permit. Individuals share permits with friends, similarly failing to validate the permit. Enforcement is increasing and permittees failing to validate permits before transporting their caribou are cited much more frequently.

Wounding loss of caribou is an appreciable source of additional mortality associated with the caribou hunt. Wounding loss is probably quite high because caribou are a herd animal where an individual is often shot in close proximity to other caribou. In some instances, more than 1 animal can be hit by a shot. Also, if a caribou is not knocked down with the first shot, it may be lost in the herd and different caribou shot until one drops.

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

reporting is incomplete. In some years up to 50 caribou have been reported killed by the Alaska Railroad in Unit 13E near Cantwell. In most years some caribou winter near Cantwell and are subject to railroad mortality.

Permit Hunts. Hunters harvested Nelchina caribou by 4 separate permit hunts; harvest data are presented in Table 2. From 1991 to 1995 the total number of Nelchina permits issued increased from 5943 to 14,748 (Table 2). There are 2 types of permits issued for the Nelchina caribou hunts. A State Tier II subsistence permit accounts for most of the permits issued. Applicants are scored based on subsistence criteria, and the highest scores qualify for a Tier II permit. As the herd grew, the Board of Game increased the number of Tier II permits issued and the yearly allowable harvest. The second type of permit hunt is the registration permit and is used for the federal subsistence hunts in Units 12 and 13 and the state winter hunt in Unit 12.

The State Tier II subsistence hunt is the largest of the 4 hunts for NCH and accounts for 90% or more of the total caribou harvest. All Alaskan residents may apply for this hunt, and permits are issued based on an applicant's score. This is one of the most popular hunts in the state, with over 17,000 applicants for the 12,000 permits issued. The hunt takes place entirely in Unit 13 and there are both fall and winter seasons. The total harvest for the hunt in 1995 was 4457 caribou, up 44% from the previous year's take of 3103 (Table 2). The cow harvest in 1995 was the second highest reported in recent years, only 84 cows lower than the 1993 record cow harvest of 1886.

The Unit 13 federal hunt, Hunt 513, is a registration hunt for residents of Units 13, 11, and 12 along the Nabesna Road. The number of participants and harvest have somewhat stabilized the last 2 years, following a decline in participation and harvest as available federal lands for hunting declined due to state land selections. The state selected most of the federal lands in Units 13B and 13E, previously open to caribou hunting, and selected lands are currently not open to federal subsistence hunting. The 1995 harvest of 212 is well below the 647 taken in 1991 (Table 2). The potential for a high harvest under this hunt still exists, however, because the major caribou migration corridor near Sourdough is still included in federal land open to hunting. Caribou use the Sourdough to Paxson area during their annual fall rutting and winter migration. Ideal access along the Richardson provides hunters an easy opportunity to kill caribou should large numbers of animals use this area during the open season. This easy access can create a problem of unacceptable hunt conditions. When hunters take a large number of caribou in view of a nonhunting public and leave gut piles visible along the road, anti-hunting attitudes may increase. Firing line situations along a major roadway also create public safety problems.

The state RC 460 registration hunt in Unit 12 is for bulls-only when the Nelchina herd migrates into Unit 12. This hunt allows Alaskan residents, especially Unit 12 residents, the opportunity to take a winter caribou when these animals are available. Season dates are controlled by emergency order. Harvests are low with only 200–275 bulls taken (Table 2).

The Unit 12 federal hunt, Hunt 512, is a local subsistence hunt for residents of Northway and Tetlin. The bag limit is 1 bull for residents of Northway and Tetlin. This hunt is held by emergency order when a sufficient number of Nelchina caribou migrate into the hunt area. U.S. Fish and Wildlife Service staff administer Hunt 512 at the Tetlin National Wildlife Refuge. Harvests are very low (Table 2).

Hunter Residency and Success. Only Alaskan residents are allowed to hunt Nelchina caribou. Because both federal hunts are only open to residents of the respective units, local rural residents take all the federal harvest. Residency data were not available for State Registration Hunt 560. Because most of the Tier II permits were issued to nonlocal Alaskan residents, the 1995 harvest by nonlocals (4198 or 94%) was much higher than that of local residents (Table 4).

Hunter effort varies somewhat between years, depending on caribou distribution and migration patterns in relation to the road system and hunter access points. Over the last few years, both successful and unsuccessful Tier II permittees spent considerably more time hunting because caribou have been in more remote portions of the unit and less available. In 1995 successful and unsuccessful hunters spent 8 and 12 days, respectively, in the field, compared to 4 and 7 days reported in 1992 when caribou were more available. Effort data were not available for other hunts.

Hunter success in 1995 was 47%, a decline from the 1989 rate of 80%. The decline in hunter success was attributable to both the way permits are issued and unavailability of caribou. Under the Tier II permit system, the same high-scoring individuals and families get permits every year. Because high-scoring applicants get a permit every year, a Nelchina permit is not the valued prize it was under the old drawing system when an individual was lucky to get drawn more than once for a permit. Because a household qualifies, up to 3 members of the household that applies receive a permit. Consequently, the number of permits may exceed the need for caribou in the household. An additional factor contributing to the lower hunter success observed in 1995 was the change in migrational behavior of the NCH. In 1995 caribou were in more remote portions of the unit and generally not available along the road system.

Harvest Chronology. Fall is the most important time to take caribou (Table 5); 63% of the 1995 Tier II harvest occurred during fall (Table 5). Chronology data indicate caribou hunting occurs throughout fall and is not concentrated either early or later during the moose season. The winter hunts are important and very popular when caribou are available. Weather and caribou location dictate when hunters go afield in January, February, or March. Heavy hunting pressure occurs at the start of the winter season when caribou numbers are limited, especially around Cantwell and the Western Denali Highway in Unit 13E. The problem with winter hunts is that caribou are often not available. In the last 2 years virtually all of the Nelchina herd migrated out of Unit 13 into Units 12 and 20E, out of the hunt area. Winter distribution of the caribou when they remain in Unit 13 also affects success rates. Caribou must be near a highway system during the winter in order to get a high harvest. Historically, hunters are much more successful when caribou winter along the Glenn or Richardson Highways or the Lake Louise Road. Chronology data for the federal hunt are not available, but historically harvest patterns have been similar to the Tier II hunt. Harvest in the Unit 12 state and federal hunt is entirely during early winter.

Transport Methods. Four-wheelers were the predominant form of transportation (31 %) in 1995–96, followed by highway vehicles and snowmachines for Tier II subsistence hunters (Table 6). For the last 2 years, the use of 4-wheelers has increased and even surpassed highway vehicles as the most important transportation method. The use of snowmachines fluctuated widely and was dependent on the availability of caribou during the winter hunt. Transportation data for federal

hunts are not available. In state registration hunt 560 for Unit 12, 64% of successful hunters used highway vehicles and 23% used snowmachines.

Other Mortality

Wolf predation is a potentially significant mortality factor for the NCH. During the early to mid 1980s, the number of wolves occupying the core Nelchina caribou range was relatively low because of human harvests. The low wolf population probably contributed to the high calf survival that aided the growth of the NCH. Since 1988, wolves have increased over much of the Nelchina caribou range. A wolf census in February 1996 resulted in a wolf density estimate for Unit 13A, including the core NCH calving area, of 9.02 wolves/100 km^2 (Becker, ADF&G files). Field observations of wolf-killed caribou indicated wolf predation on caribou has increased as the wolf population increased. Ballard et al. (1987) reported Unit 13 wolves preyed primarily on moose and did not follow migrating caribou out of the pack territory. Wolf packs may not migrate out of Unit 13 with the caribou, but recent field observations indicate wolves prey heavily on caribou when the herd moves through a pack's territory. The most important factor limiting total predation on caribou by wolves in Unit 13 is the winter migratory pattern of the NCH. A very large percentage of caribou in the NCH leave Unit 13 from October until April, wintering in Units 12 and 20, unavailable to Unit 13 wolves. Radio collars are not monitored frequently enough to determine if wolf predation could be the source of mortality when a radio-collared caribou is lost.

Winter snow accumulations have been above average in Unit 13 during recent years with the 6 winters prior to 1995 classified as severe. A severe winter has average snow depths exceeding 28 inches over much of the winter. The fact that every year caribou from the NCH winter in Unit 12, where snow depths are usually much lower, has reduced affects of deep snows on caribou. The strongest influence of deep snows during these years was in the increased energy costs to pregnant cows migrating to calving grounds. This would most likely result in lower productivity or a decline in body condition, or both, rather than increased mortality of adult cows. We have not documented an increase in caribou mortality specifically attributable to severe winter conditions during these past 6 severe winters. We did document a decline in calf production/or survival in 1993 following an especially severe winter in 1992.

HABITAT

Assessment

Between 1955 and 1962 the department established 39 range stations, including exclosures, throughout much of the Nelchina caribou range. Biologists examined these stations at approximately 5- to 6-year intervals from 1957 through 1989. A complete description of the Nelchina caribou range, range station locations, and results of long-term monitoring are presented by Lieb (1994). In this study Lieb concluded that lichen use was high during the 1960s when caribou were abundant, causing a decline in lichens on the Nelchina range. Following a decline in caribou numbers, lichen increased over much of the fall and traditional winter range from the early 1970s to 1983. However, as the herd doubled in size over the decade between 1974–1983, increases in lichen biomass ceased in areas of substantial caribou use. Between 1983 and 1989 continued increases in caribou numbers caused a decline in lichen biomass. Lieb

concluded that in 1989 77% of the Nelchina range exhibited poor lichen production, 2% was considered to have fair production, and only 21% good production. This compared to 33% of the range in each category in 1983. On the important calving and summer range in the Eastern Talkeetna Mountains, Lieb (1994) reported the lowest lichen biomass ever recorded, with preferred lichen species virtually eliminated. In this area caribou shifted from a diet of lichen to one comprised primarily of vascular plants. Lichen standing crops are expected to continue decreasing at the current herd size.

In 1990 the department initiated studies investigating body condition parameters of Nelchina caribou to assess the carrying capacity of the Nelchina caribou range in relation to herd objective. Researchers evaluated the body condition of adult cows captured in late April or early May. Initial analysis indicated Nelchina animals were in poorer body condition than animals from the Alaska Peninsula or the Mulchatna Caribou Herds (Pitcher 1991). The problem with this herd rank comparison by body condition is that the NCH is an Interior herd and the others used in the comparison are more coastal, living in milder climates. Comparison with other Interior herds with similar migrations would be more useful. Also, NCH animals were not classified as having poor body condition; caribou examined had just completed a migration from wintering areas that undoubtedly resulted in use of fat reserves. Ideally, this project would have provided insight as to changes in body condition within the NCH over time.

Management efforts to evaluate body condition parameters are focused on measuring changes between years within the NCH and between the NCH and other Interior herds. Since 1992 the focus of work attempting to evaluate body condition of NCH animals has involved monitoring fall and spring weights of female calves. In 1992 and 1993 respective spring calf weights averaged 124.4 lbs and 125.7 lbs for female NCH calves that wintered in Unit 12 compared to 109.4 lbs and 113 lbs for animals that wintered in Unit 13 (Valkenberg 1993). The weight differences were attributed to winter snow depth differences. Snow depths were, and historically have usually been, deeper in Unit 13 than in Unit 12. In spring 1994 and 1995 all the samples came from Unit 12, and the average weights were much lower at only 107.8 lbs and 105.0 lbs, respectively.

Fall weights were collected for the first time in 1995 in an attempt to separate weight differences due to summer and winter range conditions. Fall 1995 weights averaged 118 lbs Cow calves showed no weight change during the winter of 1995–96, averaging 118 lbs during spring 1996. The spring 1996 collection all came from calves that wintered in Unit 12. Fall 1996 weights declined appreciably, being 11.5 lbs below the previous year's, as female calves during fall 1996 weighed only 106.5 lbs Because of yearly variation in weight, it is obvious annual weather variations influence growth and overall range condition. Adverse weather conditions can affect the amount of nutrition available by either influencing plant growth or increasing the amount of energy expended feeding. It will take a long-term study to determine the source of annual variation in female calf weights. When weights of NCH female calves are compared with weights from other Interior herds, NCH calves are the smallest from any Interior herd and are only larger than those from the Western Arctic Herd (Valkenberg, pers. commun.). However, the potential for NCH calves to be large does exist. Cow calves weighed on the Kenai Peninsula in 1996 were some of the heaviest weighed (145 lbs) anywhere in the state (Spraker, pers. commun.), and they descend from NCH animals translocated to the Kenai in 1986 and 1987.

Beginning in 1996 we obtained neonatal calf weights on the calving grounds in Unit 13A during the peak of calving. From a sample of 40 calves, the mean weight for males was 18.2 lbs and 15.8 lbs for females. Additional data will be needed before we can reach conclusions concerning neonatal calf weights. These weights are, however, 1–3 lbs lighter than average weights of neonatal calves captured from the Mentasta Herd during the early 1990s (N. Barten, pers. commun.).

Enhancement

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

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

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

The concerns and problems associated with monitoring the size and condition of the Nelchina herd include: (1) accurately estimating population size and trend; (2) monitoring range condition; (3) monitoring body condition parameters and relating changes to population density; (4) Determining sources and rates of natural mortality; and (5) minimizing land-use activities that adversely affect the Nelchina range.

I recommend conducting an annual census and composition count. A census is needed every year because variations in caribou distribution, as well as weather during the spring, can influence census results or even prevent a count during a year. Without an annual census and composition count, population status and trend are more difficult to determine and actual trend changes may go unrecognized for several years. The census techniques used should alternate every other year between a photocensus, using the new fixed aerial camera and the standard count technique. I also recommend conducting surveys of peripheral calving and postcalving sites in the Upper Susitna every 3-4 years to estimate the numbers of caribou in this subherd. Concerns of overharvesting subherds, such as the upper Denali located near Cantwell, have been expressed because of heavy hunting pressure during winter seasons.

We should maintain and monitor the Nelchina range stations and establish additional stations as needed in important habitats such as the Eastern Talkeenta Mountains and wintering grounds in eastern Unit 13, 11, and 12. We need research on the calving grounds to determine the availability of alternative forage and the importance and effects of eliminating lichens. We should repair and monitor the NCH range stations no later than 1999, 10 years from the date of the last evaluation.

The department should continue to monitor the body condition of Nelchina caribou. Growth and size measurements along with other condition factors such as fat indices, parasite load, and blood parameters should be examined. Research should be initiated to investigate ways of utilizing an individual animal health approach as an indicator of population status in relation to the management objective for the NCH.

I also recommend developing a program to monitor mortality on the NCH. Wolf predation rates on Nelchina caribou are unknown, as are other sources of mortality. To determine sources of mortality, we would need more radio collars and increased monitoring. Currently radiocollared cows are monitored so infrequently that determining the source of mortality is not possible.

The use of ORV's in Unit 13, specifically 4-wheelers for caribou and moose hunting and recreational use, is probably great enough to potentially impact wildlife habitat in Unit 13 and increase disturbance of wildlife. I recommend ORV use in Unit 13 be examined and a plan for future use and regulations be developed. This activity should entail a joint planning process among landowners, other regulatory agencies, and the public. It should focus on all impacts and wildlife species and not be restricted to caribou.

CONCLUSIONS AND RECOMMENDATIONS

The 1996 NCH herd estimate indicates the size of the herd has started to decline. Because the 1995 survey was a photocensus and the 1996 a fixed-wing survey, variability between technique could account for some difference in the estimate. Modeling of population and harvest data, however, supports survey results that an actual decline in the NCH was possible due to increased cow harvests in 1995 and fall of 1996 (preliminary harvest data).

Productivity and early calf survival were good in 1996. Yearly fluctuations in calf productivity and survival are apparent in recent years, the best example being 1992 with the lowest calf ratios in years. Most declines between years have been attributed to severe winter conditions or cold summers with late spring and early fall snow conditions. Cameron and Ver Hoeff (1994) found that when body condition declined, caribou skipped a calving interval until body condition improved. Calf survival from spring to fall, as reflected by calf:cow ratios during fall composition counts during the rut, indicates a yearly decline in summer survival of calves. Predation and summer weather conditions caused the decline in the fall calf:cow ratio. Because of dispersal routes, the NCH was potentially subjected to more wolf predation as they spread out over more wolf territories. During the summer of 1996, the calving grounds and summer range of the NCH experienced drought conditions. Caribou left summer ranges 1-1/2 months early and spent the late summer and early fall on the Lake Louise Flats, where the vegetation was greener but insect harassment much higher. The calf:cow ratio for the fall of 1995 and 1996 are both below the management objective.

Bull:cow ratios in both 1995 and 1996 are the lowest observed in years and well below the management objective for bulls in the NCH. The reason for the decline in the bull:cow ratio is continued heavy harvests on the bull segment during the fall seasons by subsistence hunters. Even subsistence hunters select for larger bulls when they are available. Bull:cow ratios should

be increased to the management objective of 40:100 as soon as possible. To accomplish this, the number of Tier II bull permits should be reduced.

Caribou harvests have increased appreciably the last 5 years. Yearly fluctuations occur in both the total take and percent cows harvested. Changes in caribou harvests occur when the number of permits issued varies between years. Generally speaking, hunter success has declined as the number of permits issued has increased. It takes longer to kill a caribou than it did a few years ago. Some of this can be attributed to increased hunter pressure and competition for available caribou near the road system or accessible trails.

Caribou migration patterns also influence harvest rates, the composition of the harvest, and hunter success. Fall harvest declines when caribou disperse into the remote portions of the unit and avoid the Denali and Richardson Highways and major trail systems behind Eureka, as they did in 1995. Reasonable access to caribou is needed to effect large harvests. When caribou migrate from Unit 13 during winter, the harvest declines, as does the percent cows taken. Fall harvests are historically 70–80% bulls, while cows predominate during winter hunts because of regulations that promote the taking of cows and small bulls. Only when caribou become difficult to harvest because of competition or availability will an appreciable number of cows be taken during fall hunts unless cow-only fall hunts are mandated in regulation.

Cow harvests need to be increased if the herd is to be reduced to the management objective of 35–40,000. Recent Board of Game actions are directed at increasing cow harvests during the fall season before they leave Unit 13. Preliminary 1996 harvest data shows that the percent of cows taken during the fall did increase with approximately 49% of the 1996 fall harvest being cows under the new Tier I hunt. Continued pressure on the cow segment for 2–4 years should reduce herd size.

Continued monitoring of range and body condition of NCH animals is needed to evaluate management actions. The management objective of 35–40,000 caribou in the herd is one that can allow fairly high yearly harvest. High productivity should also maintain acceptable yearly harvests. This management objective is based on the assumption that by maintaining fewer animals on the range, body condition will improve and productivity and survival will remain high because of improved nutrition. Messier et al. (1988) hypothesized that increased density on the George River caribou herd lowered the nutritional level of individual animals and caused a decline in the productivity of the herd. Currently in the NCH an overall decline in body size of female calves is the trend, with yearly weather-created fluctuations. A trend in calf productivity based on June calf composition is not evident.

An important issue that needs to receive future consideration involves the hunting conditions experienced by Nelchina caribou hunters. Large numbers of hunters in the field create human-use conflicts. One example is the winter hunt near Cantwell where public safety factors and opinions of nonhunters resulted in a limited closure of the winter caribou hunt immediately around Cantwell. Roadside hunting, especially when caribou cross the Richardson Highway during the fall migration, is a source of problems. The increased use of 4-wheelers and associated habitat and animal disturbance are also areas of concern. Larger, improved snowmachines have added to increased winter travel. I recommend planning efforts on ORV use in Unit 13 be initiated as soon

as possible. Management actions recommended to alleviate roadside problems when large caribou migrations occur include 1/4-mile roadside hunting closures to force hunters off the road. These closures would be noticed by emergency order and roadside signs placed in closed areas.

Planning efforts on intensive management have been initiated in Unit 13 under direction of the Board of Game. A management plan for Unit 13, including the NCH, is currently being drafted. Future management actions for the NCH will depend on board actions concerning the Intensive Management Plan. Current draft recommendations are similar to research and management recommendations presented in this report. Changes in NCH management or research that result from the Intensive Management planning process will be reported in the future.

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Table 1 Nelchina caribou fall composition counts and estimated population size, 1991–96

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Total bulls (%)	Composition sample size	Total adults	Estimate of herd size	Postcalving[a] count
1991/92	51	45	23	50	26	2,187	34,594	44,903	46,634
1992/93	48	40	21	53	25	4,135	35,807	45,484	46,948
1993/94	41	24	14	61	25	4,220	34,491	40,361	46,226
1994/95	46	40	22	54	25	3,564	34,611	44,093	43,536
1995/96	34	38	22	64	20	5,086	39,172	50,281	49,808
1996/97	34	38	22	64	20	3,086	34,492	44,273	48,666

[a] Spring census.

Table 2 Nelchina caribou harvest data by permit hunt, 1991–95

Hunt No. /Area	Regulatory year	Permits Issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls	(%)	Cows	(%)	Unk.	Total Harvest
566T[a]	1991/92	2,802	11	80	20	1,476	(75)	488	(25)	9	1,973
	1992/93	6,503	19	66	34	2,187	(64)	1,232	(36)	20	3,439
	1993/94	9,003	20	67	33	2,828	(60)	1,886	(40)	24	4,738
	1994/95	7,500	23	55	45	2,299	(75)	786	(25)	18	3,103
	1995/96	12,000	20	47	53	2,633	(59)	1,802	(41)	22	4,457
513[b]	1991/92	2,201	22	46	54	482	(76)	151	(24)	14	647
	1992/93	2,013	19	46	54	291	(66)	151	(34)	12	454
	1993/94	1,690	35	35	65	202	(62)	124	(38)	5	331
	1994/95	1,619	30	20	80	158	(81)	36	(19)	1	195
	1995/96	1,662	19	18	82	110	(52)	102	(48)	--	212
RC460[c]	1991/92	822	19	42	58	257	(94)	3	(1)	13	273
	1992/93	No hunt									
	1993/94	686	18	38	62	196	(98)	5	(2)	--	201
	1994/95	978	9	31	69	250	(100)	--	--	1	251
	1995/96	1,086	12	27	73	243	(98)	3	(2)	1	247
512[d]	1991/92	118	35	40	60	22	(88)	3	(12)	2	27
	1992/93	No hunt									
	1993/94	34	44	58	42	11	(100)	--	--	--	11
	1994/95	97	35	38	62	24	(100)	--	--	--	24
	1995/96	No hunt									
Totals for all permit hunts	1991/92	5,943	16	64	36	2,237	(78)	645	(22)	38	2,920
	1992/93	8,517	20	61	39	2,505	(64)	1,386	(36)	36	3,927
	1993/94	11,379	21	62	38	3,226	(61)	2,015	(39)	29	5,281
	1994/95	10,194	26	48	52	2,731	(77)	822	(23)	20	3,573
	1995/96	14,748	22	43	57	2,986	(61)	1,907	(39)	23	4,916

[a] Tier II subsistence drawing permit.
[b] Subsistence registration for Unit 13 residents, administered by BLM as federal hunt 513 in 1990.
[c] A winter registration hunt for residents of Alaska in GMU 12.
[d] Subsistence registration for Unit 12 residents, administered by Fish and Wildlife Service as Federal Hunt 512.

Table 3 Nelchina caribou harvest and accidental death, 1991–96

Regulatory year	Reported						Estimated			Accidental death	Grand total
	M	(%)	F	(%)	Unk.	Total	Unreported	Illegal	Total		
1991/92	2,237	(78)	645	(22)	38	2,920	200	100	300	200	3,420
1992/93	2,505	(64)	1,386	(36)	36	3,927	200	100	300	200	4,427
1993/94	3,226	(61)	2,015	(39)	29	5,270	200	100	300	200	6,070
1994/95	2,731	(77)	822	(23)	20	3,573	200	100	300	200	4,373
1995/96	2,986	(61)	1,907	(39)	23	4,916	200	100	300	200	5,716

Table 4 Nelchina caribou Hunt 566T annual hunter residency and success, 1991–96

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	Local[a] resident	Nonlocal resident	Nonresident	Total	
1991/92	235	1,738	--	1,973	141	343	--	484	2,457
1992/93	215	3,189	--	3,404	258	1,466	--	1,724	5,128
1993/94	296	4,442	--	4,738	249	2,080	--	2,329	7,067
1994/95	157	2,945	--	3,103	336	2,245	--	2,581	5,684
1995/96	259	4,198	--	4,457	413	4,563	--	4,976	9,433

[a] Local resident means a resident of Units 13, 11, or 12 along the Nabesna Road.

Table 5 Nelchina caribou Hunt 566T annual harvest chronology percent by time period, 1991–96

	Harvest periods													
	Weeks (fall)								Months (winter)					
Regulatory year	1	2	3	4	5	6	7	8	Nov.	Dec.	Jan.	Feb	Mar.	*n*
1991/92	13	11	9	8	8	13	7	--	--	--	13	5	13	1,928
1992/93	7	13	10	7	7	10	7	--	--	--	12	7	19	3,369
1993/94	6	11	11	7	8	6	7	--	-	--	21	7	16	4,691
1994/95	4	9	11	9	15	13	14	--	--	--	21	1	3	3,069
1995/96	6	9	10	7	10	11	10	--	5	6	4	5	17	4,396

Table 6 Nelchina caribou Hunt 566T harvest percent by transport method, 1991–96

	Percent of harvest								
Regulatory year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk.	*n*
1991/92	7	1	7	19	12	8	45	3	1,973
1992/93	5	1	6	20	21	8	37	2	3,439
1993/94	5	1	6	22	26	8	31	1	4,738
1994/95	6	1	8	36	14	11	23	1	3,103
1995/96	6	1	10	31	19	8	23	1	4,457

LOCATION

GAME MANAGEMENT UNIT: 18 (41,159 mi^2)

HERD: Kilbuck Mountain and Mulchatna

GEOGRAPHIC DESCRIPTION: Yukon–Kuskokwim Delta

BACKGROUND

Historically, caribou ranged throughout the Yukon–Kuskokwim Delta, including Nunivak Island, and populations probably peaked during the 1860s (Skoog 1968). By the early 1900s few caribou were in the lowlands of the Delta. Before 1994 only 1 small herd, the Kilbuck Mountain (KCH) or Qavilnguut Herd, resided in Unit 18. This herd was located in the Kilbuck and Kuskokwim mountains southeast of Bethel. Radiotelemetry data indicate Kilbuck caribou calved on high ridges in the western portion of the Kuskokwim Mountains, summered in alpine meadows, and wintered in valleys and on wind-blown slopes further west and south. Their range included the eastern portion of Unit 18, encompassing the edge of the lowlands of the Delta and the montane western border of Units 19B and 17B. Until 1994 conservative management techniques were used to protect this small, discrete, resident herd in the Kilbuck Mountains. Since 1994 very large numbers of caribou from the rapidly expanding Mulchatna Herd (MCH) in eastern Unit 18 have seasonally invaded the entire range of the Kilbuck Herd. The mixing of Kilbuck and Mulchatna caribou in Unit 18 since 1994 has severely restricted data collection for the KCH and has caused a reevaluation of caribou management strategy and plans for the KCH.

Since closure of the caribou season in the Kilbuck Mountains in June 1985, the department and the US Fish and Wildlife Service (FWS) have conducted a cooperative study of the KCH, and more recently this has included the Mulchatna caribou in Unit 18. Numerous aerial surveys and radiotelemetry flights have been completed during this cooperative study.

Cooperative management planning for the KCH was initiated in 1990 when the department realized a management problem existed with the KCH because harvest exceeded annual sustained yield. Subsequent action by the Board of Game closed the caribou season in Unit 18 in June 1985. On 5 April 1990 a Federal court ordered the department to allow residents of Kwethluk to harvest 50 antlerless male caribou. The hunt was monitored by the Department and the Kwethluk I.R.A. Council. Hunters harvested 39 animals during a 10-day season (5 April to 15 April).

The Department felt that closed seasons and conservative management measures would not succeed without support from the users of Kilbuck caribou. During spring 1990 the department made a commitment to the Board of Game and the user groups that they would take the lead role in cooperative management planning for the KCH. The department joined the local residents and user groups to begin the process to develop the Kilbuck Caribou Herd Cooperative Management Plan (KCHCMP).

Management planning meetings took place from December 1990 through November 1995 and included users of the caribou resource and management agencies. Eighteen villages from the Yukon–Kuskokwim region, AVCP, FWS, and the Department met ten times to discuss working cooperatively and to draft the KCHCMP.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

General management objectives for Unit 18 were to increase caribou numbers and to better identify the status and size of the KCH. Specific management objectives include:

1 Changing harvest in response to population size of the KCH as follows:

   a No harvest allowed when the population size is <1000 animals.

   b Allow a 5% harvest rate when the population size ranges between 1000–3000 animals.

   c Allow a 7.5% harvest rate when the population size ranges between 3000–5000 animals.

   d Reevaluate the harvest rate and strategy when the population size exceeds 5000 animals;

2 Gathering accurate harvest information for the KCH; and

3 Increasing compliance with caribou hunting regulations.

The presence of overwhelming numbers of Mulchatna caribou within the range of the KCH in Unit 18 since October 1994 has changed the management direction of the KCH. Since the mixing of the two herds makes it impossible to collect data on the status and distribution of Kilbuck caribou, we are reconsidering harvest and management strategies for the KCH.

METHODS

The cooperative study of the KCH was continued during the reporting period. Department and FWS staff completed 66 radiotracking flights, using fixed-wing aircraft to monitor radiocollars in both the Kilbuck and Mulchatna herds during 1994–1996. We monitored 22 radiocollars deployed within the "traditional" range of the Kilbuck Herd and 53 radiocollars deployed elsewhere on Mulchatna caribou. Caribou locations were mapped using LORAN C and Global Positioning System (GPS) equipment. Detailed methodology for Kilbuck caribou radiotelemetry study is available in Hinkes (1989) and Ernst (1993).

We used a helicopter to complete fall composition counts of Kilbuck caribou in a discrete portion of the population north and east of Eek Lake, including the Kisaralik and Kwethluk drainages. We discontinued fall composition counts when large numbers of Mulchatna caribou began migrating into the area in the fall of 1994.

During May 1995 and May 1996, FWS conducted calving grounds surveys using fixed-wing aircraft in eastern Unit 18 and adjacent Units 19A and 17B. This included locating radiocollared

females and completing age/sex composition counts in a sample of animals near the instrumented caribou.

The cooperative management planning process was continued with user groups and management agencies. Annual meetings of the cooperators were held to finalize and revise the management plan.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The KCH remained low in density but was growing in size and extending its range when it was overrun with approximately 35,000 Mulchatna caribou in September/October 1994. A second influx of approximately 36,000 Mulchatna caribou occurred during the fall of 1995. The area had remained closed since June of 1985 because previous annual harvests probably had exceeded recruitment. On April 5, 1990 a Federal court ordered the department to allow residents of Kwethluk to harvest 50 antlerless male caribou. The department and the Kwethluk I.R.A. Council monitored the hunt.

Prior to the presence of Mulchatna animals, the minimum population estimate for the KCH caribou in eastern Unit 18 was 4220 caribou. This estimate was based on an aerial census completed during November and December 1991, a second census completed during November and December 1993, and a projected 15% recruitment rate from 1993 to 1994. Further extrapolation of growth rates for Kilbuck caribou projecting beyond fall 1994 are not justified because of the presence of Mulchatna caribou.

From previous censuses we know the KCH was increasing in population size during 1989–1993. The minimum annual rate of increase was approximately 23% between 1989 and 1991 and 15% between 1991 and 1993. Increased sightings of caribou between 1986 and early 1994 also provide evidence the population was increasing. This increase can be attributed to a succession of mild winters from 1989 through 1993, low predation rates, a limited annual harvest rate of less than 5% since 1991, possible early influx of individuals from the nearby Mulchatna Herd, and virgin range that caribou and reindeer have not extensively grazed for at least 50 years.

Until 1994 we considered the KCH a distinct resident population of caribou in Unit 18. The evidence supporting this conclusion included the presence of discrete calving areas and the fidelity of radiocollared animals to the study area. Since 1994 we have found very large range overlap between Mulchatna and Kilbuck caribou. This includes partial seasonal exodus of Kilbuck caribou from Unit 18 with the Mulchatna Herd and continued seasonal immigration and range expansion of Mulchatna caribou into Unit 18. At this time the KCH does not appear to be a distinct herd in Unit 18.

Population Composition

Because of the influx of Mulchatna caribou, we do not have reliable composition count data for the KCH during the reporting period. Previous composition counts show the bull:cow ratio

ranged between 115–120 bulls:100 cows during 1992–1994. During the 1993 calving ground survey, a count of 440 Kilbuck females resulted in a calf:cow ratio of 50:100.

During the 1994 calving ground survey, many radiocollared females thought to be from the Kilbuck Herd were found near a large calving aggregation of Mulchatna caribou east of the Tikchik Lakes in Unit 19B. The calving aggregation east of the Tikchik Lakes was the main calving group of the Mulchatna Herd in 1994. Ten of the 18 active radiocollared females from the Kilbuck Herd were present in this calving aggregation, far east of the calving grounds previously used by Kilbuck caribou. The cow:calf ratio in the calving aggregation near the Tikchik Lakes in 1994 was 66 calves:100 cows. This may have reflected the cow-calf ratio of the Mulchatna Herd, rather than the Kilbuck Herd.

Most of the MCH and several radiocollared females from the Kilbuck Herd calved in the Tikchik River basin in 1995. Productivity within this calving area in 1995 was lower and later than observed in previous years. From 18–22 May 1995 productivity was approximately 30 calves:100 cows, but by 31 May 1995 the productivity rate increased to approximately 48 calves:100 cows.

During 3–7 June 1996, we completed caribou calving surveys in the eastern portion of Unit 18 and adjacent portions of Units 17B and 19B where we believed most of the Kilbuck caribou would be located. We found that most of the MCH and radiocollared Kilbuck caribou calved east of the Tikchik River basin at the head of the King Salmon and Klutuspak Rivers. Many thousands of caribou were observed calving on 31 May and 4 June. Approximately 75 calves:100 cows were observed, with some areas having close to 100 calves:100 cows and other areas with about 47 calves:100 cows. Calving rates seemed exceptional in spring 1996 and may be explained by a mild winter with virtually no snow, a warm dry spring, and lower than usual insect numbers. The earliest calving recorded was on 10 May (2 caribou with calves observed) and by 23 May approximately half the cows observed had calves. Several cows with twins were observed in the core area. Approximately 100,000 caribou, including most of the radiocollared cows from the Kilbuck Herd, were near this very large group. It was very difficult to pick out individual collared animals from the larger groups.

Distribution and Movements

Cooperative efforts between the department and FWS to document the distribution of the KCH, and more recently, the Mulchatna Herd in Unit 18, continued through the reporting period. As of November 1992, 20 KCH caribou (1 male and 19 females), representing approximately 0.5% of the herd, were instrumented with radiocollars. These collars were deployed during 1987, 1988, 1989, and 1992. During October 1994, an additional 28 collars were deployed on short-yearling females during an influx of over 30,000 Mulchatna animals. We did not know initially what percentage of these radiocollared caribou were Mulchatna animals, but it now appears likely all 28 collars were deployed on individuals from the Mulchatna Herd.

All radiocollared Kilbuck caribou remained in the western and central Kuskokwim and southern Kilbuck mountains until late 1994. The KCH extended its winter range south and west near Three Step Mountain, the Eek River, the Great Ridge, and the flats between Akiak and Bethel. A single radiocollared male moved north and east of Aniak Lake in July 1990, and 1 female moved

near Nishlik Lake during July of 1991. During the 1994 calving ground survey, 10 radiocollared females believed to be Kilbuck caribou were in the northern Tikchik basin, calving with approximately 50,000 Mulchatna Herd animals. All these radiocollared animals eventually returned to traditional KCH winter range, mixing with large numbers of Mulchatna caribou.

Approximately 30–40,000 caribou from the Mulchatna Herd moved into lower Kuskokwim River drainages during the late fall of 1994 and 1995 and remained there until spring. Mulchatna caribou shared ranges with the Kilbuck Herd and expanded into areas that had not been occupied by caribou for at least 100 years. The primary concentration area for these caribou was between the villages of Quinhagak and Goodnews Bay. The caribou remained within Unit 18 until late March 1995, and began moving into Units 17B, 17A, and 19B. As this large group of Mulchatna caribou moved to new range, they took many of Kilbuck caribou (including many radiocollared animals) with them. This was the first known migration of Kilbuck caribou from their traditional range (*e.g.*, west of the Tikchik Lakes) into areas that were traditionally used by the much larger MCH. Many Kilbuck caribou remained far east of their traditional calving areas until August–September 1995 when they began to return to their 'traditional' range. During September/October 1995, approximately 36,000 Mulchatna caribou moved into Unit 18, bringing many radiocollared "Kilbuck" caribou back to their 'traditional' range.

Our observations indicate extensive range overlap among Mulchatna and Kilbuck caribou during 1994–1996 in the southern Kuskokwim and Kilbuck mountains, especially for the Tuluksak River, Marvel Creek, and the Heart Lake area to the Goodnews River drainage. Much of this overlap first occurred in 1994 in the mountain passes between Units 19B, 17B, and 18, but by winter 1995–1996 the range overlap encompassed all of the known range of the KCH. Since 1994 Mulchatna caribou have seasonally occupied large portions of the Kuskokwim Mountains and lowlands south and east of the Kuskokwim River, extending from the Whitefish Lake area near Aniak at least as far south as the Goodnews River drainage.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Season Subsistence and General Hunts	Nonresident Open Season
Regulatory year 1994–1995		
Unit 18, north of the Yukon River; 1 caribou.	1 Feb–31 Mar	1 Feb–31 Mar
Unit 18, south of the Kuskokwim		

River.		
Resident Hunters: 1 bull; by permit only.	1 Sep–30 Sep	
Nonresident Hunters		No open season
Remainder of Unit 18	No open season	No open season
Regulatory year 1995–1996		
Unit 18, north of the Yukon River.		
Resident and Nonresident Hunters: 1 caribou per day.		
Bulls	16 May–30 Jun	16 May–30 Jun
Any caribou	1 Jul–15 May	1 Jul–15 May
Unit 18, south of the Yukon River.		
Resident Hunters: Two caribou total; 1 bull by permit only	1 Sep–30 Sep	
Or		
2 caribou (only up to 2 caribou)	Season sometime between 1 Oct–31 Mar may be opened by emergency order.	
Nonresident Hunters		No open season

Human-Induced Mortality. During the 1994 State fall hunting season (1-30 Sep), 121 registration permits were issued. A harvest of 19 bull caribou was reported. During the 2 Federal seasons (31 Dec 1993–9 Jan 1994 and 22 Feb–15 Mar 1994), 257 permits were issued. The Federal permits

were based on an annual harvest quota less the number of animals taken during the State season (276 - 19 = 257). Federal "closed" registration permits were issued to 16 villages. The total combined reported harvest for the 1994–1995 season was 99 caribou as a minimum. However, during the 1994–1995 season, unreported harvest may have been substantially higher, especially during the winter months. Anecdotal information from local hunters suggests that up to several hundred caribou may have been taken illegally between 1 November 1994 and 30 March 1995.

Only 41 Kilbuck–Mulchatna caribou were reported taken during the 1995–1996 regulatory year in Unit 18. The reporting rate for the registration hunt from 1–30 September 1995 was 96% for a total fall harvest of 21 caribou. Based on a reporting rate of <15%, the reported harvest for the emergency-ordered season, extending from 1 October through 31 March, was 20 caribou taken by 18 hunters. Actual harvest was believed to be considerably higher, estimated at 120 hunters, taking 240 caribou. This estimate was influenced by our experience during the 1994–1995 regulatory year when we estimated a harvest of 1200 caribou by 300 hunters. Snowfall during the 1995–1996 winter was minimal, and poor winter traveling conditions reduced the hunting pressure to 20% of the effort in 1994–1995.

Board of Game Actions and Emergency Orders. Caribou seasons in Unit 18 south of the Yukon River have been restrictive or closed since June 1985 when the Board of Game closed the season because we believed harvest was exceeding sustained yield limits. The subsequent rapid growth and recovery of the small Kilbuck Herd after season closure confirmed our belief that human harvest was a major factor limiting herd growth.

During the reporting period, the board adopted an emergency regulation allowing emergency-ordered openings of increased seasons and bag limits in Unit 18 south of the Yukon River. The first emergency order was issued in October 1994 for the take of 2 caribou of either sex during the period 29 October–15 March of the 1994–1995 regulatory year. The emergency order was issued in response to the immigration of approximately 35,000 Mulchatna Herd caribou into Unit 18 beginning 27 October 1994. An additional harvest of 80 caribou was reported during the emergency order season. During the 1995–1996 regulatory year, a second emergency order was issued for the period 1 October–31 March after approximately 36,000 Mulchatna caribou moved into Unit 18. The bag limit for the second emergency opening remained at 2 caribou. Actual harvest in 1995–1996 was relatively low because the lack of snow throughout the winter in Unit 18 hindered access by hunters.

Natural Mortality

Little information is available regarding natural mortality of Kilbuck caribou. Previously we reported predation by wolves, including a female caribou killed by a pack of 7 wolves in the southern Kilbuck Mountains during February 1988 and another caribou killed during November 1988. We documented several additional caribou killed by wolves during the 1994–1996 reporting period. Resident wolf packs have been observed near Nyak on the upper Tuluksak and Fog River drainages, in the upper Kwethluk and Kisaralik drainages, and in the Goodnews and Arolik River drainages. Caribou are probably an important prey species for these three wolf packs. Wolves and wolverines are becoming more numerous in the Kilbuck Mountains in response to increasing populations of large ungulates. Increased numbers of caribou in Unit 18

will probably attract additional wolves and allow year-round occupancy of more wolves within the unit.

Another source of mortality may be predation by brown bears, although we have little direct evidence from Unit 18. Brown bears are numerous in the Kilbuck and Andreafsky Mountains, and we observed approximately 70 different bears within or near the core range of the KCH during brown bear capture operations in the southern Kilbuck Mountains in 1993. Despite the large numbers of brown bears in the Kilbuck range, we do not have any estimate of predation rates on Kilbuck caribou. Bear and wolf predation rates on caribou in eastern Unit 18 may have become temporarily insignificant since the recent expansion of the Mulchatna Herd into the area.

HABITAT

Assessment

The lichen range in the Kilbuck and southern Kuskokwim Mountains is in excellent condition and could support more caribou than the low density (0.4 caribou/km^2) on the KCH range before September–October 1994. Before the influx of Mulchatna caribou into the KCH range, neither the Andreafsky nor the Kilbuck Mountains had been substantially grazed by caribou or reindeer for over 50 years (Calista Professional Services and Orutsararmuit Native Council, 1984). The tundra areas between the Yukon and Kuskokwim Rivers also have not been grazed by caribou for the last 100 years, and not by reindeer for the last 60 years. We believe all upland areas of Unit 18 could support much higher densities of caribou.

COOPERATIVE MANAGEMENT

The KCHCMP was developed and finalized on 6 October 1994 after extensive agency and public input over a 5-year period. The plan provides guidelines for management of the KCH. The plan was revised at the annual meeting of the cooperators on 15 November 1995 to allow new regulations with different seasons and bag limits while Mulchatna caribou are present in Unit 18. Even though the status of the KCH has become questionable since the arrival of Mulchatna caribou in Unit 18, the Cooperative Planning Group has agreed to remain the forum for discussion of caribou management within the unit.

CONCLUSIONS AND RECOMMENDATIONS

The KCH was studied cooperatively by the FWS and the department beginning in 1986 and continuing through the 1994–1996 reporting period. Estimated at a minimum of 4220 animals in 1994, the KCH comprised a distinct herd resident in the Kilbuck and southern Kuskokwim Mountains. We observed these caribou calving for 8 consecutive years on high ridges near Kisaralik Lake, east and north of Greenstone Ridge, ridge tops on the southern edge of the Kilbuck Mountains, and the southwest edge of the Kuskokwim Mountains. The herd continued to grow and extend its range until becoming inundated by very large numbers of Mulchatna caribou in late October 1994. Since the appearance of Mulchatna caribou, it has been impossible to distinguish the KCH, and the integrity of a discrete population of Kilbuck caribou is unlikely. Radio collar locations of Kilbuck caribou show that Kilbuck caribou have been mixing with Mulchatna animals and leaving their 'traditional' range.

The decline of the KCH in the early 1980s was attributed to inadequate population monitoring and heavy harvests. In the future we should place a high priority on continuing annual aerial censuses to determine the size of the caribou population in eastern Unit 18, regardless of whether Kilbuck or Mulchatna origin. We should also complete composition counts during the spring or fall to determine the sex and age structure of these caribou herds. We should continue radiotracking flights to locate groups for census, composition counts, and calving ground surveys. Radio collars should be retrieved periodically and replaced with refurbished collars when collars are dropped, lost to mortality, or battery life is exhausted.

The range overlap between the Kilbuck Herd and the growing Mulchatna Herd needs much further investigation. Additional animals from both herds should be radiocollared, if possible, to better establish the overall range and movements of the 2 herds. Since the 28 collars deployed in October 1994 now appear to have been placed on Mulchatna animals, an additional number of collars will have to be placed on Kilbuck caribou when the 2 herds are separate.

The Mulchatna Herd has continued to increase dramatically in numbers and extend its range into Unit 18. The Mulchatna Herd now seasonally occupies much of Unit 18 south and east of the Kuskokwim River. A few caribou have crossed the lower Kuskokwim River and occupied ranges where caribou have been absent for 100 years.

The KCH may have become indistinguishable from the Mulchatna Herd and may remain so until that herd eventually declines and retreats, leaving a small remnant herd of caribou calving in the Kilbuck Mountains.

We should attempt to recognize the effects of the growth of the Mulchatna Herd on potentially unique demographic components such as the Kilbuck Herd when setting management objectives and proposing regulatory formulas. We should continue to support a cooperative management planning process for any caribou in Unit 18 involving local hunters, AVCP, the FWS and other interested groups.

Recommended management actions for the next several years include:

1 Complete an annual census after the rut between the end of October and early December, depending on snowfall. This census timing may have to be changed to the summer when the 2 herds (Mulchatna and Kilbuck) are most likely to be separated.

2 Complete composition surveys annually during October.

3 Complete calving surveys in late May or early June of each year.

4 Maintain a minimum of 1 radiocollared animal per 500 animals in the KCH. This may prove impossible if range overlap remains extensive from the Mulchatna Herd.

5 Develop an improved method of collecting harvest information.

ACKNOWLEDGMENTS

The Alaska Department of Fish and Game acknowledges Randy Kacyon as the Unit 18 Area Biologist who completed all the design, planning, logistics, aerial surveys, data collection, preliminary analysis, and community meetings summarized in this report. Tragically, Randy was killed in an aircraft accident on 30 November 1996 while conducting a moose survey along the lower Yukon River. Randy achieved high standards as a wildlife management biologist and worked closely with other agencies and local residents to develop a high level of trust and respect. Successful completion of the Kilbuck Caribou Herd Cooperative Management Plan was largely the result of his fine efforts and close working relationships with the residents of Unit 18.

Also, the department thanks Sam Patten for his willingness and thoroughness to help prepare and finalize this report detailing the data collected by Kacyon. His knowledge and previous work experience in Unit 18 helped prepare an accurate summarization of departmental activities in Unit 18.

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LOCATION

GAME MANAGEMENT UNIT: 19 (A, B, C, and D) and 21 (A and E) (60,523 mi^2)

Herd: Beaver Mountains, Big River-Farewell, Kilbuck Mountains, Kuskokwim Mountains, Rainy Pass, Sunshine Mountain, and Tonzona

GEOGRAPHIC DESCRIPTION: Drainages of the Kuskokwim River upstream from the village of Lower Kalskag; Yukon River drainage from Paimiut upstream to, but not including, the Blackburn Creek drainage; the entire Innoko River drainage; and the Nowitna River drainage upstream from the confluence of the Little Mud and Nowitna Rivers

BACKGROUND

Caribou have undoubtedly played an important historic role in this area. Moose are a relatively recent large ungulate, arriving less than 100 years ago in the area. Although documentation is poor, discussions with village elders and reports of early explorers (Hemming 1970) support the idea that caribou existed in far greater numbers and over a greater range during the 1800s than they do today. The Mulchatna Caribou Herd probably once roamed throughout the Kuskokwim Basin, but as numbers dwindled, they retreated to the better range to the south. As the Mulchatna Herd increases (the 1996 summer estimate was over 200,000 animals), it is extending its winter range northward and using portions of Unit 19.

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

Caribou herds in the Kuskokwim Mountains north of the Kuskokwim River have variously been referred to in previous reports as the Kuskokwim Mountains Herd/Herds or the Beaver Mountains Herd and Sunshine (Sunshine/Nixon) Mountain Herd (Shepherd 1981, Pegau 1986). In the early 1980s, Pegau (1986) radiocollared caribou in the Beaver Mountains and on Sunshine Mountain. During the course of his 4-year study, no range overlap was documented. Radiocollared caribou from the Beaver Mountains ranged south almost to Horn Mountain. Caribou in that portion of the Kuskokwim Mountains (near Horn Mountain) had been referred to as the Kuskokwim Mountains Herd.

Based on Pegau's work, there seem to be only 2 groups of caribou in the Kuskokwim Mountains that warrant herd status, Beaver Mountains and Sunshine Mountain. It is possible that even these may frequently interbreed resulting in considerable interchange.

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

Resident caribou inhabit the Rainy Pass area and the drainages at the head of the South Fork Kuskokwim River and surrounding area. These caribou are the Rainy Pass Herd. This herd is perhaps the least studied and least understood in the state. Major questions remain about herd size, discreteness, and interactions/relationship to Mulchatna Herd caribou.

Caribou occupying ranges south of the Kuskokwim River have been little used by Native hunters in recent times, except that residents of Nikolai and Telida have occasionally had opportunities to hunt Tonzona and Big River-Farewell caribou. Mulchatna caribou have increasingly been hunted along the Holitna and Hoholitna rivers. Recent movement into more northerly areas by members of the Mulchatna Caribou Herd has increased their availability to village hunters in all Kuskokwim River villages downstream from Nikolai, including those from major population centers of McGrath and Aniak. Hunters who fly into the area primarily for sheep, moose, and bison hunting have generally harvested the Big River-Farewell Herd, Tonzona Herd, and Rainy Pass Herd. Harvest from the Kuskokwim Mountains Herds has totaled less than 15 caribou per year since winter seasons were suspended.

MANAGEMENT DIRECTION

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

South of the Kuskokwim River in the Alaska Range, hunting pressure has been increasing. Management goals have been to determine the size, identity, and ability of those herds to withstand harvest. Present goals and objectives were proposed in 1990 at the Division of Wildlife Conservation's caribou workshop.

MANAGEMENT GOALS/OBJECTIVES

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

- Estimate herd size and trend of the herds south of the Kuskokwim River by fall 1996.

- Determine the seasonal ranges and discreteness of the southern Kuskokwim herds, specifically the Big River-Farewell and Rainy Pass herds, by 1996.

Provide for continued consumptive use of caribou.

- Determine the dynamic consumptive demands for caribou in consultation with the Division of Subsistence by 1996.

Provide increased opportunity for people to participate in caribou hunting.

- Determine minimum population size objectives for various herds and develop seasons and bag limits to attain those objectives by fall 1996.

METHODS

We reviewed hunter harvest reports and tabulated data annually, also making incidental observations of caribou numbers and calving areas. Personnel from Dillingham, McGrath, and Fairbanks completed a photocensus of the Mulchatna Caribou Herd during summer 1996. We also completed surveys of the Beaver Mountains and Sunshine Mountain during May and June 1994 and 1995. We surveyed all alpine areas from Flat to Von Frank Mountain, using a Piper Super Cub. Caribou were concentrated near snowfields, and all caribou were counted and classified as adults or calves.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Periodic population estimates of the Beaver Mountains Caribou Herd have been made since the early 1960s. At that time, Skoog (1963) estimated a total of 3000 animals. In 1986 Pegau (1986) estimated the population at 1600. In 1992 I estimated 865 caribou were present, and in 1994 only 536 remained. During aerial surveys in early summer 1995, when caribou were concentrated on calving ranges, I counted only about 400 animals. It seems the population continues to decline. Hunter harvest has been extremely low, and I assume the population decline is due to heavy bear and wolf predation. Calf production seems adequate, but neonatal mortality is heavy.

Based on cursory aerial surveys in the range of the Sunshine Mountain Caribou Herd, populations there seem to have declined. I estimated the population at close to 700 animals in 1994, but 1995 estimates were only about 500 animals. Dynamics of this herd seem to mirror those of the Beaver Mountains Herd, with predators probably having a major impact on calf survival.

Extraterritorial movements of a segment of the Mulchatna Caribou Herd in early winter 1996 resulted in up to 20,000 Mulchatna animals moving north. As many as 300 of those animals seem

to have remained in the traditional wintering range of the Sunshine Mountain Herd during winter 1996–1997. About 500 to 600 Mulchatna caribou also wintered immediately south of the Beaver Mountains. Early summer surveys planned for 1997 will hopefully reveal whether those Mulchatna caribou will remain in these northern areas, supplementing the Kuskokwim Mountains remnant herds.

A summer 1996 photocensus of the Mulchatna Caribou Herd resulted in a population estimate of over 200,000 animals. For details of this herd's status, see the Unit 17 caribou management section of this report.

Population Composition

No late summer/fall composition surveys were conducted during this reporting period on the Units 19 and 21 caribou herds.

Distribution and Movements

As mentioned above, a segment of the Mulchatna Caribou Herd moved nearly 100 miles north of their traditional range. As many as 20,000 animals moved from the Stoney and Swift rivers in a northerly direction, and they arrived in the upper Kuskokwim River basin in early November. Some of these caribou remained in the Big River flats near McGrath (about 5000 animals), the Nixon Fork flats (about 250 animals), and the upper Takotna River/Fourth of July Creek (about 2000 animals). The remainder of Mulchatna caribou that moved north apparently retreated back to the south, following the uplands of the George River drainage, rejoining other Mulchatna animals wintering near the Holokuk and Aniak rivers.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident/Subsistence Open Seasons	Nonresident Open Seasons
Unit 19A, within the Lime Village Management Area		
Resident Hunters: 4 caribou total.	10 Aug–31 Mar 1 Apr–9 Aug	
4 caribou. OR 4 bull caribou OR 4 cows without calves	1 Apr–9 Aug	
Nonresident Hunters: 1 caribou.		10 Aug–31 Mar
Unit 19B and remainder of 19A		
Resident Hunters: 5	1 Aug–15 Apr	

caribou, however, no more than 2 may be bulls.		
Nonresidents: 2 caribou.		1 Aug–15 Apr
Unit 19C		
Resident Hunters: 1 bull.	10 Aug–10 Oct	
Nonresident Hunters: 1 bull.		10 Aug–10 Oct
Unit 19D, south and east of the Kuskokwim and North Fork of the Kuskokwim River		
Resident Hunters: 1 caribou.	10 Aug–30 Sep OR 1 Nov–31 Jan	
Nonresident Hunters: 1 caribou.		10 Aug–30 Sep
Remainder of 19D		
Resident Hunters: 1 caribou.	10 Aug–30 Sep	
Nonresident Hunters: 1 caribou.		10 Aug–30 Sep
Unit 21A		
Resident Hunters: 1 caribou.	10 Aug–30 Sep OR 10 Dec–20 Dec	
Nonresident Hunters: 1 caribou		10 Aug–30 Sep OR 10 Dec–20 Dec
Unit 21E		
Resident Hunters: 1 caribou.	10 Aug–30 Sep	
Nonresident Hunters: 1 caribou.		10 Aug–30 Sep

Board of Game Actions and Emergency Orders. Because of an influx of Mulchatna Caribou Herd animals into Unit 19D, along with the lack of moose available to meet subsistence needs, the Board of Game enacted an emergency regulation, opening the caribou season in Unit 19D (except the drainages of the Nixon Fork River) for harvest of up to 5 caribou per resident hunter during the period 10 November 1996 through 31 March 1977.

Hunter Harvest. The use of caribou by subsistence and sport hunters is increasing in Unit 19. However, this increase can be attributed to the increase in range and numbers of the Mulchatna Caribou Herd. Thus, the figures reported below (Tables 1–5) do not accurately reflect the majority of the hunter harvest in Unit 19. Additionally, local subsistence-based users probably

report through harvest tickets less than half of the actual harvest. I suspect the actual harvest of caribou in Units 19, 21A, and 21E during the 1995–1996 regulatory year was probably near 2000 animals.

Permit Hunts. All hunts within Units 19, 21A, and 21E were conducted with harvest tickets or, in the case of Lime Village, with the use of a village recording system.

Hunter Residency and Success. During recent years, migration patterns of Mulchatna Herd animals enabled local (Unit 19 residents) hunters to increase their harvest of caribou. The Mulchatna Herd is the only herd readily accessible by boat, and harvest by local hunters from other herds is low (Table 3). In all, less than 10% of the reported harvest is by local hunters. It should be stressed again, however, that local users are less inclined to report their hunting activities than are nonlocal and nonresident hunters. Nonlocal residents of Alaska and nonresidents of the state are about equally represented in the harvest statistics concerning Unit 19, 21A, and 21E caribou (Table 3). Most harvest data come from guided and nonlocal hunters hunting the Big River-Farewell, Rainy Pass, and Tonzona herds.

Reported hunter success has averaged about 80% during the past 5 years. Because of disproportionate returns (many unsuccessful hunters do not report), I believe actual success rates are slightly lower, averaging 50–60%. Reported success rates on all Unit 19, 21A, and 21E herds during the 1995–1996 season averaged 81%.

Hunter effort, as measured by the number of days both successful and unsuccessful hunters reported they remained afield, has not changed significantly in the past decade. For all Unit 19, 21A, and 21E caribou hunters, the 1995–1996 reported length of the hunting trip averaged 5.9 days for successful hunters and 7.4 days afield for unsuccessful hunters. Combining the 2 groups, the average was 6.2 days afield.

During the period 1991–1992 through 1995–1996, about 12% of the Unit 19 caribou harvest was female. Most of the harvested females are taken from the Mulchatna Herd. When Mulchatna harvest is discounted, the reported harvest of females is reduced to less than 3% of the total take (Table 5).

Harvest Chronology. Discounting the harvest of Mulchatna caribou, open seasons for caribou hunting are largely only during fall months (with the exception of short winter periods); thus, the reported harvest is largely during August and September. During the most recent regulatory year for which data have been analyzed (1995–1996), 31% of the harvest of non-Mulchatna animals was during August, 68% during September, and 1% during October. This harvest chronology has not changed significantly in the past 8 regulatory years (Table 1).

Transport Methods. For access to the herds in Units 19, 21A, and 21E (again, discounting Mulchatna), aircraft were generally used with all other access means subordinate. During the previous 5-year period (1991–1992 through 1995–1996), aircraft were used by 78% of caribou hunters, 3- or 4-wheelers by 8%, horses 6%, boats 3%, ORVs and highway vehicles 2% each, and snowmachines less than 1% (Table 4).

Other Mortality

Although no specific data have been collected concerning natural mortality rates or factors during this reporting period, I suspect wolf predation is relatively high within most of the Unit 19 and 21 caribou herds. The low proportion of Beaver Mountains Herd calves (<1%) and the early calving dates indicate the Beaver Mountains Herd is highly productive but suffers from high neonatal mortality. The Sunshine Mountain Herd probably also suffers high predation mortality. Throughout the early 1990s, winters were severe and probably contributed substantially to high rates of natural adult and calf mortality.

HABITAT

No investigations concerning caribou range conditions have been conducted in the area in recent years. Because of dwindling caribou populations due largely to effects of predation, I think that caribou range conditions are good and capable of allowing herd increases.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Because of declining moose numbers in the lowlands of the upper Kuskokwim River basin (Unit 19D), increases in caribou bag limits and season lengths were enacted during 1996–1997 to allow local subsistence-based users the opportunity to harvest caribou. It seems the needs of local users were largely met because of the influx of Mulchatna caribou into the area. Whether or not this extraterritorial movement will be repeated in subsequent years remains to be seen.

CONCLUSIONS AND RECOMMENDATIONS

The objectives stated previously in this report were not met. Additional effort must be focused on basic understanding of the dynamics of all Unit 19 and 21 caribou herds. The regulatory change in Unit 19C allowing harvest of bulls only has apparently decreased the harvest pressure on cows from the Rainy Pass and other Unit 19C caribou herds. More money and effort should be expended in the area to document herd sizes, composition, and range boundaries. With continued growth of the Mulchatna Caribou Herd, harvest should be directed toward the area they inhabit, diminishing harvest on the other, smaller herds in the area.

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Table 1 McGrath[a] area caribou annual reported harvest by month, 1989–1995

Regulatory year	Month									
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Unk	*n*
1989-1990	0	47	104	14	0	0	2	1	1	168
1990-1991	0	47	150	8	0	2	0	0	4	211
1991-1992	0	80	122	11	2	0	0	0	2	217
1992-1993	0	41	80	4	0	1	0	0	0	126
1993-1994	0	53	73	0	2	3	1	0	2	134
1994-1995	0	60	103	9	0	0	0	0	2	174
1995-1996	0	32	69	1	0	0	0	0	0	102

[a] Excludes Mulchatna Caribou Herd animals taken in Unit 19.

Table 2 McGrath[a] area caribou annual reported harvest by herd, 1989–1995

Regulatory year	Successful Hunters						
	Beaver Mtns	Sunshine Mtn	Farewell/ Big River	Rainy Pass	Tonzona	Unspecified	Total
1989-1990	12	2	49	84	12	8	167
1990-1991	5	2	72	115	15	2	211
1991-1992	13	0	65	101	37	1	217
1992-1993	4	2	51	62	5	2	126
1993-1994	3	1	61	35	15	19	134
1994-1995	2	0	82	57	25	6	172
1995-1996	1	0	55	30	13	3	102

[a] Excludes Mulchatna Caribou Herd animals taken in Unit 19.

Table 3 McGrath[a] area caribou annual reported harvest by location of residence, 1989–1995

Regulatory year	Local resident[b]	Nonlocal resident	Alien and nonresident	Total	Percent nonresident
1989-1990	9	129	120	261	47
1990-1991	6	125	160	297	55
1991-1992	12	177	140	332	43
1992-1993	5	86	80	172	47
1993-1994	10	104	98	214	46
1994-1995	3	115	146	264	55
1995-1996	10	72	90	174	52

[a] Excludes Mulchatna Caribou Herd animals taken in Unit 19.
[b] Local resident is any resident of Unit 19.

Table 4 McGrath[a] area caribou annual reported harvest by transport method, 1989–1995

Regulatory year	Method of transportation								
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk	*n*
1989-1990	213	9	14	7	4	3	10	3	263
1990-1991	268	10	5	6	0	2	4	2	297
1991-1992	253	21	7	22	2	7	18	2	332
1992-1993	143	11	5	10	1	2	0	0	172
1993-1994	160	20	9	10	5	7	3	0	214
1994-1995	219	10	5	33	0	5	0	2	274
1995-1996	132	5	6	23	0	4	0	4	174

[a] Excludes Mulchatna Caribou Herd animals taken in Unit 19.

Table 5 McGrath[a] area caribou annual reported harvest by sex, 1989–1995

Regulatory year	Males	(%)	Females	(%)	Unspecified	Total
1989-1990	153	(92)	13	(8)	2	168
1990-1991	188	(90)	22	(10)	1	211
1991-1992	186	(86)	30	(14)	1	217
1992-1993	109	(87)	16	(13)	1	126
1993-1994	131	(98)	3	(2)	0	134
1994-1995	172	(100)	0	(0)	0	172
1995-1996	99	(97)	3	(3)	0	102

[a] Excludes Mulchatna Caribou Herd animals taken in Unit 19.

LOCATION

GAME MANAGEMENT UNIT: 20A (6796 mi^2)

HERD: Delta (including former Yanert Herd)

GEOGRAPHIC DESCRIPTION: Central Alaska Range and Tanana Flats

BACKGROUND

The Delta Caribou Herd primarily inhabits the foothills of the central Alaska Range between the Parks and Richardson highways and north of the divide separating the Tanana and Susitna drainages. Like other small bands of Alaska Range caribou, the herd drew little attention until population identity studies began in the late 1960s. For a time, the department recognized a small group of caribou in the Yanert drainage as a separate herd. The Delta Herd grew, eventually mixing with and outnumbering the Yanert Herd (Valkenburg et al. 1988).

By the mid-1970s, the herd rose from anonymity to a herd of local and scientific importance. At times good-sized for an Interior herd, its nearness to Fairbanks and fairly good access made it a popular pursuit for hunters. For the same reasons, it has been the subject of intensive management and research. Long-term studies of caribou population dynamics, ecology, and predator/prey relationships resulted in numerous publications and reports. Boertje et al. (1996) and Valkenburg et al. (1996) provide summaries and citations.

Since the mid-1970s, the size of the herd has fluctuated, inducing new actions by the state. Estimated at 1500 to 2500 in 1975, it grew to a peak of nearly 11,000 in 1989. It declined in the early 1990s, as did other central Alaska Range herds, to less than 4000. Valkenburg et al. (1996) presents a detailed analysis of the decline. Since prestatehood federal programs, the state authorized and conducted 2 wolf control programs in the unit. State biologists killed wolves from 1976–1982 to increase moose and caribou populations and from October 1993 to December 1994 to halt the decline of the caribou herd. Boertje et al. (1996) summarized the influence of these programs on the Delta Herd. Harvest and harvest regulations also varied widely due to population fluctuations and strong hunter interest. The Board of Game suspended hunting in 1992 in response to declining numbers, and the herd remained closed to hunting through the 1995–1996 regulatory year.

Research and enhancement of Delta caribou remains a regional priority. The department initiated an experimental diversionary feeding program in 1996 to determine whether wolves can be diverted from calving areas during the peak of calving. The project is intended to evaluate the feasibility of this technique for increasing neonate survival.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Historically, goals for the herd varied from providing high quality hunts to maximum sustained yields. The recent decline of the herd shaped the current management goals to restore the herd

and resume consumptive use. Likewise, the current management objectives reflect regulations (5 AAC 92.125) enacting the 1993–1994 wolf control effort to reverse the decline. Although the wolf control program was suspended prematurely, the regulations remain in place.

Management Objectives

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

- Conduct annual fall composition counts.

Reverse the decline of the herd and increase the midsummer population to 6000 to 8000 caribou.

- Conduct annual photocensus of the herd.
- Cooperate with Research Study 3.37 to "evaluate the influence of weather, density, food limitation, hunting, and predation on the population dynamics of the Delta Caribou Herd."
- Reduce wolf predation on caribou by decreasing the wolf population.
- Implement a wolf control program.

Sustain an annual harvest of 300 to 500 caribou by 1996.

- Gather information on predator:prey ratios and on the significance of predation and weather as natural mortality factors.
- Cooperate with Research Project 3.37.

METHODS

Population Size

We estimated population size using the radiosearch technique (Valkenburg et al. 1985). We photographed large groups from a Dehavilland Beaver aircraft with a belly-mounted Zeiss RMK-A 9x9 camera and from Piper Cubs and Bellanca Scouts with 35-mm cameras loaded with 100 ASA Kodak Ektar film.

The herd was counted on 20 June 1995 using 5 radiotelemetry-equipped aircraft, including the Beaver. All 81 active radiocollared animals were accounted for except 1 that was inadvertently deleted and another that was known to be well south in the Chulitna Mountains. Most collared caribou were in the Wood River drainage near Mystic Creek.

The 1996 survey was completed on 22 June using 5 aircraft. All 86 active radiocollared caribou were located. The herd was in smaller than optimum groups, and there was evidence that some caribou were missed, including a group of 200 bulls. Most of the herd was found on Wood River drainage snowfields upstream from Sheep Creek.

POPULATION COMPOSITION

We conducted composition surveys using 2 R-22 helicopters and a Bellanca Scout. A biologist in the Scout located the radiocollared caribou. Observers in the R-22s classified caribou in groups with radiocollars and caribou found in a search of the surrounding area. We broadly searched areas containing numerous radiocollared caribou for additional groups. We also classified any caribou encountered while in transit between areas. Classification categories consisted of cows, calves, and large, medium, and small bulls. Observers identified bulls by the absence of vulva and classified bulls by antler characteristics (Eagan 1993). We tallied the composition of each group on a 5-position counter and recorded the tallies on a data sheet.

We classified 1567 caribou on 3 October 1995 under moderate to low overcast, calm winds, and occasional snow showers. Most of the herd were in the West Fork and Wood rivers and Dick and Dean creeks.

The 1996 survey was again completed on 3 October under clear skies and light winds. However, the caribou were rather spread out, often in brush or old burns. With the bright light, sighting was less than optimum. We classified 1532 caribou.

PARTURITION SURVEYS

In conjunction with the caribou calf mortality study, we conducted parturition surveys to estimate pregnancy rates (Valkenburg 1997). We classified caribou on the calving grounds a few days after the peak of calving as indicated from radiocollared cows. Parturient cows had distended udders, antlers, or a calf at heel. An observer in an R-22 helicopter classified each caribou as parturient cow, nonparturient cow, calf, or bull.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The Delta Herd declined from over 10,000 in 1989 to less than 4000 in 1993. The decline resulted from interrelated effects of adverse weather and predation and also occurred in neighboring herds (Valkenburg et al. 1996). However, the Delta Herd declined more than the neighboring Denali and Macomb herds. The Delta Herd existed at a much higher crude density than Denali and Macomb herds, indicating that density-dependent food limitation might have influenced the magnitude of the decline (Valkenburg et al. 1996). Since the decline, estimates of the size of the herd vary (Table 1). Survey data indicate the herd increased slightly in 1994 and 1995, but 1996 data did not continue the trend.

As noted for the 1996 survey, we found caribou distributed in numerous groups. This increased the chances of missing entire groups. During the survey, we did not locate a group of about 200 bulls observed the day before. Inclusion of that group of bulls increases the estimate to about 4100 caribou. This illustrates that these estimates are either minimum counts or based on minimum counts and subject to sighting and distribution errors.

Population Composition

Dismal recruitment rates characterize the decline phase of the herd (Table 1). However, since 1994 calf:cow ratios improved and are sufficient for slight growth.

Bull:cow ratios have varied considerably since 1990 and range from 25 to 38. The ratio of large bulls:cows improved once the decline ended (Table 1). Most of the short-term variance in bull:cow ratios since 1992 is primarily a result of variable behavior and distribution of bulls during counts. Weather can effect herd distribution and movements and behavior during rut counts.

Distribution and Movements

Through the mid-1980s, the Delta Herd showed strong fidelity to calving areas between the Delta River and the Little Delta River in southeastern Unit 20A (Davis et al. 1991). However, as the Delta Herd increased, it extended the area used for calving to the foothills between Dry Creek and the Delta River (Valkenburg et al. 1988). Subsequently, the herd also used the upper Wood River, Dick Creek, and upper Wells Creek with this area becoming the primary calving area by 1993. During the rest of the year, the herd is distributed among the northern foothills from the Delta River to the Nenana River.

MORTALITY

Harvest

Season and Bag Limit. There was no open hunting season for the Delta Herd during this reporting period. Caribou hunting regulations for Unit 20A are summarized in Davis et al. (1991) and Eagan (1993).

Board of Game Actions and Emergency Orders. In response to a proposal at the March 1996 meeting, the Board of Game authorized a drawing permit hunt beginning the 1996–1997 regulatory year. Based on improvement in herd recruitment and large bull:cow ratios, the division recommended issuing 75 permits.

Other Mortality

Research staff conducted calf mortality studies in 1995 and 1996. Wolves, bears, and eagles were the primary agents. Details of causes and trends in calf and adult mortality are in research progress reports and publications (Davis et al. 1991, Boertje et al. 1996, Valkenburg et al. 1996, Valkenburg 1997). Calf and adult survival were poor during the decline phase. After 1993 adult and calf survival rates improved but remained below pre-decline levels.

HABITAT

Research and management staffs periodically collect fecal samples on winter range to monitor the status and use of lichen ranges. We also weigh female caribou calves to determine body condition and relate body condition to natality rates. Analysis of fecal samples collected in late winter 1989 and 1993 indicated depletion of the foothill lichen range in Unit 20A. The proportion of lichens in the diet was relatively low and the proportion of mosses high, compared

to samples from other Interior herds. After 1993 body weights of 5-month-old caribou calves improved but remained below pre-decline levels.

CONCLUSIONS AND RECOMMENDATIONS

The primary concern at this point is whether the herd will be able to grow or support improved harvests with increasing wolf densities. Wolf numbers are currently high and increasing due to the abundant moose population. The degree to which high wolf:caribou ratios will influence predation rates on caribou is unknown. While high wolf:caribou ratios seem bound to increase caribou mortality to some degree, a variety of mechanisms may have mitigating effects. Wolf behavioral patterns, such as selectivity in prey or search habitat types, may result in wolves largely killing moose. Low vulnerability of caribou due to improved nutritional status could produce similar results. Adams et al. (1995) presented data indicating that caribou spatial distribution, too, may reduce wolf predation risk for caribou calves.

Any or all scenarios seem plausible at this point, although very slow growth of the herd seems most likely and consistent with current recruitment and survival data. Even with favorable weather, meeting management objectives of 6000 to 8000 and harvest of 300 to 500 caribou soon is unlikely under current management options.

The management objective to provide harvests of 300 to 500 by 1996 is now obsolete. I recommend that "by 1996" be deleted from the objective. Limited harvest by drawing permit, as currently authorized, should be appropriate for at least the next few years.

I also recommend we fully evaluate diversionary feeding of wolves as a tool for enhancing caribou recruitment. Concerns regarding the nutritional status of the herd relative to range capability should be addressed through careful monitoring. We should also consider ongoing studies of wolf, moose, and caribou to provide information for maintaining enhanced systems and optimizing harvests.

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Table 1 Delta Caribou Herd fall composition counts and estimated population size, 1983–1996

Survey date	Bulls: 100 Cows	Large bulls: 100 Cows	Calves: 100 Cows	Calves %	Cows %	Small bulls % of bulls	Medium bulls % of bulls	Large bulls % of bulls	% Total bulls	Composition sample size	Minimum herd size	% Herd sampled
10/4/83	35	12	46	25	55	59	6	36	20	1208	5055	24
10/17/84	42	17	36	20	56	28	32	40	24	1093	6227	18
10/9-12/85	49	9	36	20	54	57	24	19	26	1164	8083	14
10/22/86	41	9	29	17	59	49	30	21	24	1934	7204[b]	27
10/05/87	32	8	31	19	61	53	23	24	20	1682	7780[b]	22
10/14/88	33	4	35	21	60	50	38	12	20	3003	8338[c]	36
10/10/89	27	2	36	22	62	64	28	7	16	1965	10,690	18
10/4/90	38	6	17	11	65	45	39	16	24	2411	7886[c]	31
10/1/91	29	5	8	6	73	55	29	16	21	1705	5755	30
9/28/92	25	3	11	8	74	46	43	11	19	1240	5870	21
9/25/93[d]	36	7	5	3	72	45	33	22	25	1525	3661	42
10/3-6/94[d]	25	10	23	16	68	33	29	39	7	2131	4341	49
10/3/95	24	10	20	14	69	41	19	40	17	1567	4646	34
10/3/96	30	9	21	14	66	51	20	29	20	1537	4100	37

[a] Numbers of caribou counted during photocensus.
[b] Census results probably considerably lower than true herd size.
[c] Excludes Yanert Herd, which included approximately 600 caribou.
[d] Composition data was weighted according to the distribution of radiocollars.

LOCATION

GAME MANAGEMENT UNIT: 20B, 20C, 20D, 20E, 25C, and adjacent Yukon Territory (20,000 mi^2)

HERD: Fortymile

GEOGRAPHIC DESCRIPTION: Charley, Fortymile, Salcha, Goodpaster, and Ladue rivers, and Birch and Shaw Creek drainages between the Tanana River and the south bank of the Yukon River; the Fortymile Caribou Herd presently ranges up to 50 miles into the Yukon Territory

BACKGROUND

The Fortymile Caribou Herd (FCH) is 1 of 5 international herds shared between Alaska and the Yukon Territory. It has the greatest potential to be the most economically important herd in Interior Alaska and southern Yukon for consumptive and nonconsumptive uses. Like other caribou herds in Alaska, the FCH has displayed major changes in abundance and distribution. During the 1920s it was the largest herd in Alaska, and one of the largest in the world, estimated at 568,000 caribou (Murie 1935). For unknown reasons, the FCH declined during the 1930s to possibly as low as 10,000 to 20,000 caribou (Skoog 1956). Timing of the subsequent recovery phase is unclear but by the 1950s the FCH reached at least 50,000 caribou (Valkenburg et al. 1994). It seems herd recovery was aided by a federal predator control program that began in 1947. Until 1963 the herd fluctuated slightly, but most population estimates were about 50,000 animals (Valkenburg et al. 1994).

Between the mid-1960s and 1975, the herd again declined, probably because of a combination of high harvests, severe winters, and a high wolf population (Davis et al. 1978; Valkenburg and Davis 1989). The population low occurred between 1973 and 1976 when the herd was estimated between 5740 and 8610 caribou. The FCH began increasing in 1976 in response to favorable weather conditions, reduced harvests, and a natural decline in wolf numbers. In 1990 the FCH was estimated at 22,766 caribou (the annual rate of increase from 1976 to 1990 ranged from 5% to 10%). Herd numbers remained relatively stable during 1990–1995, ranging between 21,884 and 22,558.

Within its range, the FCH historically provided much of the food needed by Athabaskans, Alaskan and Yukon miners, and other early residents. From the late 1800s to World War I, the herd was subject to market hunting in both Alaska and the Yukon Territory. Most hunting was concentrated along the Steese Highway and along the Yukon River above Dawson before the Taylor Highway was constructed in the mid-1950s. During the 1960s hunting was concentrated along the Steese and Taylor highways in Alaska and along the Top of the World Highway in the Yukon Territory.

Between 1966 and 1975 the FCH reduced its range use and changed its seasonal migration patterns. After 1967 the herd no longer crossed the Steese Highway and, by 1973, few animals moved into the Yukon each year. Since the early 1970s the herd's range size has been about 19,300 mi^2 (50,000 km^2), less than 25% of the historical size. Consequently, hunter

concentration and harvest distribution has shifted and primarily occurs along the Taylor Highway and from small airstrips within the Fortymile and Charley River drainages. As herd distribution and movement patterns changed, hunting seasons were deliberately set to avoid the time that road crossings were likely. Also, since 1990 regulations have been enacted to ensure harvest does not limit herd growth (i.e., bull-only bag limit and conservative harvest quotas). Some road-crossing hunts have been deliberately provided since 1990 to accommodate the subsistence hunting priority.

MANAGEMENT DIRECTION

In 1990 representatives of the Yukon Department of Renewable Resources, Canadian Wildlife Service, and ADF&G met in Whitehorse, Yukon Territory to decide on management direction for the FCH. All parties were in agreement that reestablishing the herd in its historic range should be the primary goal. The primary management tools were reduced harvest and, if necessary, predator management. This goal was presented to the residents of the Upper Tanana/Fortymile rivers region and was strongly supported.

During development of the Fortymile caribou management and harvest goals and objectives, we failed to foresee the effects of federal subsistence management and the political repercussions public interest groups would have on our programs. Our oversight concerning dual management was realized when we asked the Federal Subsistence Board to close their hunting seasons during 1991 and 1992 because the annual harvest quota was reached. They refused to do so because the quota did not include a cooperatively agreed upon allocation for federal subsistence users.

The conflict between ADF&G and federal agencies was caused by differing interpretations of the Alaska National Interest Lands Conservation Act (ANILCA). The federal agencies decided that managing the Fortymile caribou hunt by a harvest quota without a guaranteed allocation for federally eligible subsistence users violated ANILCA and prohibited the federal agencies from following ADF&G's harvest management direction by stopping their hunts prior to the scheduled closure. Between 1991 and 1995, because of the inability of the agencies to agree on a harvest management direction, the public had to contend with more complex regulations, while the possibility of overharvest increased.

The second oversight in the original plan dealt with predator management and public response. In 1992 the Alaska Board of Game adopted a wolf control program designed to benefit the Fortymile Herd. However, prior to implementation, Governor Walter Hickel rescinded the program due to public pressures. Because we had a great deal of support within the herd's range for our management programs, we were surprised by the amount of interest and effort exerted by outside public interest groups to stop us from implementing them. It was obvious to all involved in Fortymile caribou management that a new management direction that at least included input from the federal agencies was necessary if we were even to meet our harvest objectives.

Many local people were unhappy with Fortymile caribou management direction following the 1992 events. In response, the Upper Tanana/Fortymile Advisory Committee, the Tr'on dek Hwech'in First Nation, and other public groups requested ADF&G and the federal agencies to work with the public in developing a Fortymile Caribou Management Plan. In July 1994 a

Fortymile Caribou Management Team was established. Members of the team represented the agencies of ADF&G, Bureau of Land Management, US Fish and Wildlife Service, National Park Service, Yukon Department of Renewable Resources, and 14 public representatives. The team's goals were to develop management recommendations for herd population, harvest, and ecosystem management to be used by the Board of Game and the Federal Subsistence Board during their regulatory decision process.

The following are the current management goals and objectives, developed with the Fortymile Caribou Management Team. These goals and objectives are contingent to the Board of Game's deciding to implement nonlethal predator control during the spring 1997 meeting.

Management Goals and Objectives

- Help recover the FCH to its traditional range in Alaska and the Yukon.
    - Provide conditions for the Fortymile Herd to grow at a moderate annual rate of 5% to 10% between June 1996 and June 2001.
    - Maintain an October bull:cow ratio of at least 35:100.
- Minimize the impact of human activities on caribou habitat.
    - Discourage or modify developments incompatible with caribou.
    - Maintain a near-natural fire regime.
- Provide increased caribou hunting, viewing, and other wildlife-related recreation in Alaska and the Yukon.

METHODS

Population Census

We censused the FCH between late June and mid July 1988 to 1996, excluding 1993, using 3 to 4 spotter planes (Supercub PA-18 or Bellanca Scout), 1 radiotracking plane (Cessna 206), and a DeHavilland Beaver equipped with a belly-mounted 9-inch format aerial camera. We located most postcalving aggregations by tracking the herd's radiocollared caribou. We photographed all groups that could not be counted accurately by the spotter planes (>50 caribou). The total population estimate was derived by counting the individual caribou on the photographs and adding those caribou in small groups that we counted visually from the spotter planes. We counted all photographs twice, each time by a different person. If counts were within 5% of each other, the initial count was used; otherwise, photographs were counted a third time. No correction factors were used to account for caribou missed during the search.

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

Fall Composition Surveys

Between 1989 and 1996 we estimated herd sex and age composition annually between late September and mid October, using either a Hughes 500D, Robinson-22, or a Bell Jet Ranger helicopter. We initially found most caribou by radiotracking. A pilot/observer team classified each caribou as either a cow, calf, or bull. Bulls were further classified as either small, medium, or large based on antler size. The Yukon government contributed staff and finances to the 1992 and 1993 surveys.

Spring Composition Surveys

During 1988, 1991, 1992, and 1993, we conducted herd sex and age composition surveys in mid to late June. Techniques followed were the same as those used during fall surveys, except bulls were not classified by size, and large groups (i.e., >1000) were sometimes classified from the ground with spotting scopes. The Yukon government contributed money and personnel to the 1992 survey.

Herd Condition

During the report period, we used 4 indices to evaluate herd condition: 1) fall calf weights, 2) percentage of calves of radiocollared cows dying during the first 48 hours of life, 3) percent natality of radiocollared cows, and 4) median calving date. Fall calf weights were obtained during fall capture activities during 1991 through 1994. We evaluated the other 3 indices by daily radiolocating at least 30 adult cows (3 years and older) during calving until 2 days following birth. Median calving date was the day by which 50% of the adult collared cows had given birth. We assessed range condition by evaluating the relative proportion of lichen and moss in the herd's winter diet.

Radiotelemetry Data

We obtained herd distribution, movements, and estimates of annual mortality by radiotracking 30 to 90 radiocollared adults. From 1994 to 1996, an additional 50 to 60 newborn calves were also collared. Calves were located daily during May and June, and at least once every month thereafter. Adults were located approximately once every month throughout the year. We retrieved collars of dead caribou as soon as possible after detection to determine cause of death.

Harvest

I estimated harvest using registration hunt reports and harvest report cards (prior to 1994); the latter were corrected (multiplied by 1.59) for nonreporting by successful hunters (Kelleyhouse 1986, McNay 1990). We used this information to determine total harvest, hunter residency and success, harvest chronology, and transportation modes. During 1991, 1992, 1993, and 1996, we used checkstations to monitor the harvest to ensure the harvest quota was not exceeded.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The herd increased slightly (4%) in 1996 in part due to reduced wolf predation and favorable weather. The wolf population was reduced on the herd's wintering grounds by elevated wolf harvest rates. Low snow levels prevailed throughout winter 1995–1996; caribou were in better condition and more successfully evaded predation.

Population Composition

Estimated fall bull:cow and calf:cow ratios remained relatively stable in the FCH since at least 1986, except that calf numbers were low in 1991 and relatively high in 1987 and 1996. Estimated ratios in late June counts have been more variable, probably because June counts are more difficult to do accurately (Table 2). Population modeling predicts the bull:cow ratio will slowly increase if recruitment remains above 30:100 cows and harvest is maintained at the current level of 150 bulls.

Distribution and Movements

In 1995 the FCH summered between the upper Salcha River, Mount Harper, and Glacier Mountain. During August and September most of the herd stayed in the Charley River, Copper Creek, upper Salcha and Goodpaster Rivers drainages. The remaining caribou either were in the Birch Creek drainage or near Mount Warbelow and upper Bullion and Hutchinson creeks. During the rut, the herd was widely distributed and ranged between Crescent Creek and Glacier Mountain, with the largest concentrations in the Seventymile River, and Granite, Copper, and Essie creeks.

Similar to the past 4 years, the herd wintered west of the Dennison Fork of the Fortymile River. Throughout the winter the herd remained widely scattered primarily in small groups in the West, Mosquito, Middle, and North forks of the Fortymile River and in the Upper Eisenmenger, Goodpaster, and Salcha rivers.

Peak of calving was 18 May 1996. The primary calving grounds were between the upper Middle Fork of the Fortymile River, 3-Finger Fork of the Charley River, and in Ruby, Slate, and Granite creeks. By early June most of the herd moved north into the Charley River drainage. In mid June most of the herd was loosely aggregated between Independence Creek and the Charley River. We conducted the census on 21 June, and over 90% of the herd (based on radiotelemetry) were in upper Charley River, upper Goodpaster River, and upper Joseph Creek. The herd ranged primarily between the Goodpaster and Salcha rivers to upper Birch Creek during August to mid-September.

Beginning in mid-September, most of the herd traveled east as far as Glacier Mountain and then turned south and moved through Bullion and Hutchinson creeks, over Mount Warbelow to Mosquito Fork. Most of the 1996 rut took place in the Mosquito Flats to upper Cedar Creek. After the rut the herd moved northwest to the Goodpaster River, but by 1 December over half the herd was once again to the west along the Taylor Highway and as far east as Prindle Volcano,

mixed with the Nelchina and Mentasta herds. From December through January, the herd spread out from the Yukon border to the Middle Fork of the Fortymile River.

The primary difference in the herds' movements the past 2 years compared with the previous 3 years is reduced use of the Middle Fork for calving and different fall movement patterns. During the past 2 years the herd remained in the central portion of its range throughout the fall hunting season and, as a result, has been inaccessible to most hunters. Between 1991 and 1993, 7000 to 17,000 caribou were near Chicken Ridge on 10 August, the start of the fall hunting season.

MORTALITY

Harvest

Season and Bag Limit. See Table 3.

Board of Game Actions and Emergency Orders. All Board of Game actions in 1991 through 1995 were described in detail in Gardner (1993) and Gardner (1995). In 1996 there were significant policy changes that affected the state and federal hunting seasons and quotas for Fortymile caribou. In spring 1996 the board adopted a policy recommended by the Fortymile Caribou Management Team to reduce harvest to 150 bull caribou during the life of the Fortymile Caribou Plan. To ensure against overharvest, the board gave ADF&G authority to close the Chicken Trail to caribou hunters using motorized vehicles, limit locales and times registration permits were issued, require a short report period by successful hunters, and to enact area, road, and temporary season closures if the herd became too vulnerable to harvest.

In spring 1996 the Federal Subsistence Board made the following 2 important decisions in support of the Fortymile Caribou Plan: 1) they adopted the herd quota of 150 bull caribou which meant that both the state and federal seasons would close once the quota was reached, and 2) they agreed that both the state and federal hunts would be managed using a joint state/federal registration permit that the state would administer and collect. Those 2 decisions were instrumental in limiting harvest to the plan's recommended level. For the first time since dual management started, Fortymile caribou seasons and bag limits are consistent under state and federal regulations and, compared with past years, are much easier for the hunter to understand (Table 3).

The Board of Game and the Federal Subsistence Board decisions during 1996 were the first steps in implementing the Fortymile Caribou Plan. During the 1997 meeting, the Board of Game will be deciding if nonlethal predator control should be implemented. If the board decides against this program, the harvest quota will increase to 450 bulls. The Federal Subsistence Board will not have to act on any Fortymile caribou proposals during spring 1997 but will need to show support for the nonlethal program.

Hunter Harvest. During 1995 the total reported harvest was 200 caribou (Table 4). The estimated illegal cow harvest of 20 resulted in an estimated total harvest of 220 caribou (Table 5). The harvest was 0.9% of the estimated population and was below the harvest quota of 450. Currently, all but 65 of the 906 registration permits given out in 1996–1997 have been returned, and the

total reported harvest was 135 caribou. An estimated additional 10 were taken illegally resulting in a total harvest of 145 caribou. The 1996 harvest quota was 150 caribou.

Illegal Harvest. The number of illegally harvested caribou declined in 1991 and 1992 and then stabilized between 20 and 30 cows annually. Determining the sex of caribou can be difficult, especially if the hunter does not know all of the distinguishing characteristics or does not take the time to look for them. The illegal kill declined in 1996 due more to reduced hunting pressure than to hunters becoming better at identifying caribou. I believe the 2 primary reasons that the illegal kill has not continued to decline are: 1) annual influx of hunters with no or little caribou hunting experience and 2) some hunters are willing to take a chance on questionable animals because they do not want to go home empty-handed.

Hunter Residency and Success. Only Alaskan residents were eligible to hunt Fortymile caribou in Units 20E and 25C (permit hunt RC865). Hunt RC865 was divided into a fall and winter season. Alaskan residents and nonresidents could hunt Fortymile caribou during a fall season in Units 20B and 20D (RC863). In 1995 the total number of hunters who hunted Fortymile caribou (RC863, 175 hunters; RC865, 1301 hunters) was 1476, and of these, 352 (23.9%) were local residents, 1088 (73.7%) were nonlocal Alaskan residents, and 36 (2.4%) were nonresidents (Table 6). The overall success rate was 14% (Table 4). In comparison, hunters experienced an 8% success rate during the fall RC865 hunt, 23% during the winter hunt, and 23% during the fall RC863 hunt.

Harvest success during the fall and winter RC865 hunts declined during the past 3 years (Table 4). The difference has been due to the herd being inaccessible throughout most of the fall season in 1993 through 1996. The winter hunt offers relatively high success (23% to 55%), but due to weather severity and difficult traveling conditions, fewer hunters participate (300 to 550 annually).

Under permit hunt RC863, nonresidents can participate. In 1995 7 (4%) of the hunt participants were local residents, 132 (75%) were nonlocals, and 36 (21%) were nonresidents. Nonresidents accounted for 55% of the harvest under permit RC863 but were responsible for only 3% of the Fortymile caribou annual harvest. Nonresident participation in RC863 is increasing and is only limited by the restrictive harvest quota. Currently, RC863 is the only caribou hunt air taxi operators and guides can take nonresidents to in the eastern Interior.

Harvest Chronology. Between 1991 and 1993 about ¼ to ¾ of the Fortymile Herd was near Mount Warbelow and Taylor Mountain at the onset of the hunting season and remained in that area for 10 days to 2 weeks. During those years 59–84% of the total fall harvest was taken during the first week of the season (Table 7). During 1994 to 1996 the herd was inaccessible to most hunters nearly all of the fall season. The greatest percentage of the harvest still occurred during the first week (32– 45%), when the greatest number of hunters were in the field. The herd was accessible from 1994 to 1996 to hunters along the Taylor Highway during the last few days of the fall season, but few hunters were in the field.

During the winter seasons from 1991 to 1996, there were caribou available throughout the season. The greatest hunter effort and harvest occurred during the first week. Temperature, holidays, and available daylight affect harvest timing during the winter season.

Transport Methods. In 1995 most successful hunters reported using airplanes (33%) or snowmachines (19%; Table 8). The trend for most successful hunters to use airplanes continued in 1996. Between 1990 an 1993, most successful hunters used 3- or 4-wheelers. The change in the most effective transportation type reflects the different movement patterns by the herd since 1994. During the past 3 years, the herd was inaccessible to hunters accessing by 3- or 4-wheelers from the Taylor Highway. The increased use of snowmachines reflects the herd's accessibility during the winter season and increasing hunter participation. The high incidence of highway vehicle use by successful hunters occurs during the winter season along the Taylor Highway (50–77% of successful hunters).

In the RC863 permit area, most successful hunters used airplanes in 1995 (93%) and in 1996 (87%). Access into this area is difficult due to the lack of trails and suitable river systems.

Other Mortality

Since October 1991 we have determined the cause of mortality of 47 radiocollared caribou >4 months old. Wolves killed 40 (85.1%), grizzly bears killed 2 (4.3%), lynx killed 2 (4.3%), and 3 (6.4%) died from nonpredation. Both animals killed by lynx were <1 year old. All but 2 of the 47 deaths occurred from November through April.

We deployed 50, 52, and 60 radio collars on newborn Fortymile caribou calves in May and June 1994 through 1996. By 30 June each year, 40% to 50% of the calves were dead. Another 20% died before reaching the age of 1 year (Boertje and Gardner 1996). This pattern of births and deaths is similar to that in other Interior Alaskan herds (Adams et al. 1996; Valkenburg, unpubl data). For the 1994 and 1995 calf cohorts, the annual mortality rate totaled 71% and 59%, respectively. The major cause of mortality was predation (85–96%), primarily wolves (38–43%) and grizzly bears (27–32%). As of 31 January 1997, 34/60 (57%) radiocollared calves died; wolves (44%) and grizzly bears (33%) were the primary predators. Most grizzly bear predation (73%) occurred within the first 4 weeks of life. Most wolf predation also occurred during the first month of life but continued throughout the winter. Accidents and calf abandonment accounted for the nonpredation calf mortality (3–13%) between May and January.

Recent research identified calf predation by wolves and grizzly bears as the most significant factor now limiting Fortymile Herd growth. Natural adult mortality and harvest have been low, natality rates have been average to high, and body and range condition have been good to excellent. We tested Fortymile caribou for exposure to 6 infectious diseases. We found no evidence of disease based on blood samples collected in 1992 and 1995.

We also estimated impacts of predation, other sources of mortality (drowning, abandonment, disease, etc.), and harvest by humans on the growth of the FCH, using a population model developed by M McNay (ADF&G). The primary working components of the model are: 1) current composition, recruitment, and population data for the FCH; 2) the area's wolf and bear population size estimates; and 3) bear and wolf predation rates on Fortymile caribou since 1991.

The model indicates that wolves and bears combined are removing 20–21% of the postcalving population, while people are removing <2%. The model predicted that the FCH would increase significantly if predators were reduced. Further reduction of harvest will have little effect on population growth.

HABITAT

Assessment

Range condition was evaluated by determining the percent lichen fragments in relation to the percent moss in Fortymile caribou fecal samples. During 1991 and 1992 range conditions were excellent, as evidenced by high proportions of lichen fragments (72–81%) and a low proportion of mosses (8%). Fecal samples from overgrazed winter ranges contain a relatively high proportion of mosses (Boertje 1984).

The current density of Fortymile caribou (0.44/km^2) is low. More than 75% of the historic Fortymile range has not been used for over 30 years; the far eastern portion has not been used for over 50 years. The historic range supported hundreds of thousands of caribou.

Except in 1993, nutritional stress has not been detected (Boertje and Gardner 1996). In 1993 low pregnancy rates (66%, n = 47) probably resulted from many adult cows being unable to gain sufficient fat to breed in 1992 due to the short growing season or severe weather and deep snow before the rut. Also, high adult mortality during 1989–1992 may have been related in part to stress from adverse weather.

Enhancement

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

CONCLUSIONS AND RECOMMENDATIONS

The FCH increased through the 1980s at an annual rate of 5–10%. Between 1990 and 1995 the herd was essentially stable. The herd increased by 4% from 1995 to 1996 and is expected to increase slightly (4–6%) after 1996. We continued the study to evaluate harvest by humans, range quality, predation, disease, and weather as possible factors limiting herd growth. We found that predation by wolves was the primary limiting factor. Wolves were the primary cause of death for Fortymile caribou >4 months old (85.1%) and a major cause of calf mortality. Predators, primarily wolves, were estimated to kill 20–21% of the postcalving population annually, while annual harvest removed less than 2%. However, between 1989 and 1993 unfavorable weather conditions and associated nutritional stress also contributed to reduced herd growth.

Hunters harvested <2% of the Fortymile caribou population for 20 of the past 23 years, and in 1996 harvest was <1%. During this period of reduced caribou harvest, the herd remained stable in some years and grew slowly (<10%) in others. Weather and predation have driven these minor fluctuations.

State and federal harvest regulations are now consistent which makes them easier to understand and greatly reduces the chance of overharvest.

The Fortymile Caribou Management Team recommended a series of management steps designed to reduce predation on calves by incorporating trapper harvest with nonlethal wolf control. In addition, the Team recommended steps to reduce caribou harvest and protect critical habitat by forming partnerships with the principal landowners. To date, policies have been enacted to reduce harvest, and the principal landowners have been contacted to begin negotiations on how best to protect critical habitat yet allow some development. Trappers have volunteered their services by initiating their own program designed to remove more wolves from the herd's summer range. The board will consider the sterilization of wolves during their spring 1997 meeting.

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Table 1 Fortymile caribou fall composition counts and population size, 1986-1996

Date	Bulls:100 Cows	Calves :100 Cows	% Calves	% Cows	% Small bulls (% of bulls)	% Medium bulls (% of bulls)	% Large bulls (% of bulls)	% Bulls	Composition sample size	Total count of herd size
10/13/86	36	28	17	61	35	24	41	22	1381	15,307
9/28/87	40	37	21	57	13	43	44	22	2253	
10/2-3/88	38	30	18	59	29	41	30	23	1295	19,975
10/13/89	27	24	16	66	34	41	25	18	1781	
9/27-28/90	44	29	17	58	42	39	19	26	1742	22,766
10/10/91	39	16	10	64	41	34	25	25	1445	
9/26/92	49	30	17	56	37	36	27	27	2530	21,884
10/3/93	45	27	16	58	47	36	17	26	3665	
9/30/94	42	33	19	57	45	33	22	24	2989	22,104
10/3/95	43	32	18	57	43	31	27	25	3303	22,558
9/30/96	41	36	20	57	46	31	23	23	4582	23,458

Table 2 Fortymile caribou mid to late June composition counts[a], 1985-1996

Date	Bulls:100 Cows	Calves:100 Cows	% Calves	% Cows	% Bulls	Composition sample size
6/19/85	18	48	29	60	11	3803
6/26/87	46	47	25	52	24	3596
6/30/88	54	36	19	53	29	1799
6/14/91	35	25	16	62	22	2998
6/22/92	41	46	25	54	22	3313
6/16/93	40	23	14	61	24	3143

[a] No counts were done in 1986, 1989, 1990, and 1994-1996

Table 3 Seasons and bag limits for the Fortymile Caribou Herd, 1987-1996

Regulatory year	Unit 20B SE of Steese		Unit 20D N of Tanana River		Unit 20E		Unit 25C SE of Steese	
	State	Federal	State	Federal	State	Federal	State	Federal
	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit
1987-1988	8/10-9/20 1 bull	-[a]	8/10-9/20 8/10-9/30[b] 12/1-2/28[b] 1 bull	-[a]	8/10-9/20 8/10-9/30[b] 12/1-2/28[b] 1 bull	-[a]	8/10-9/20 1 bull	-[a]
1988-1989	8/10-9/20 1 bull	-[a]	8/10-9/20 8/10-9/30[b] 12/1-2/28[b] 1 bull		8/10-9/20 8/10-9/30[b] 12/1-2/28[b] 1 bull		8/10-9/20 1 bull	-[a]
1989-1990	8/10-9/20 1 bull	-[a]	8/10-9/20 1 bull 8/10-9/30[b] 12/1-2/28[b] 1 caribou	-[a]	EAST: 8/10-9/20[d] 1 bull 8/10-9/30[bc] 12/1-2/28[bc] 1 caribou WEST: 8/10-9/20 1 bull 8/10-9/30[b] 12/1-2/28[b] 1 caribou	-[a]	8/10-9/20 1 bull	-[a]
1990-1991	8/10-9/20 1 bull 2/15-3/15 1 caribou	-[a]	8/10-9/20 1 bull	-[a]	EAST: 8/10-9/30[ce] 1 bull 12/1-2/28[ce] 1 caribou WEST: 8/10-9/20 1 bull 8/10-9/30[c]	-[a]	8/10-9/20 1 bull	-[a]

Table 3 Continued

Regulatory year	Unit 20B SE of Steese		Unit 20D N of Tanana River		Unit 20E		Unit 25C SE of Steese	
	State	Federal	State	Federal	State	Federal	State	Federal
	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit
					12/1-2/28[e] 1 caribou			
1991-1992	8/10-9/20 1 bull	No open season	8/10-9/20 1 bull	No open season	EAST: 8/10-9/30[ce] 1 bull 12/1-2/28[ce] 1 caribou WEST: 8/10-9/20 1 bull 8/10-9/30[e] 12/1-2/28[e] 1 caribou	Same as state	8/10-9/20 1 bull	8/10-9/20 2/15-3/15 1 bull
1992-1993	8/10-9/20 1 bull	No open season	8/10-9/20 1 bull	No open season	EAST: 8/10-9/30[ce] 1 bull 12/1-2/28[ce] 1 caribou WEST: 8/10-9/20 1 bull 8/10-9/30[e] 12/1-2/28[e] 1 caribou	Same as state	8/10-9/20 1 bull	8/10-9/20 2/15-3/15 1 bull
1993-1994	8/10-9/20[c] 1 bull	No open season	8/10-9/20 1 bull	No open season	8/10-9/30[ce] 1 bull 12/1-2/28[ce] 1 bull	8/10-9/30[f] 1 bull 12/1-2/28 1 bull[f]	8/10-9/30[ce] 1 bull 12/1-2/28[ce] 1 bull	8/10-9/30[f] 1 bull 12/1-2/28[f] 1 bull
1994-1995	8/10-9/20[c]	No open	8/10-9/20[c]	No open	8/10-9/30[ce]	8/10-9/30[f]	8/10-9/30[ce]	8/10-9/30[f]

Table 3 Continued

Regulatory year	Unit 20B SE of Steese		Unit 20D N of Tanana River		Unit 20E		Unit 25C SE of Steese	
	State	Federal	State	Federal	State	Federal	State	Federal
	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit
	1 bull	season	1 bull	season	1 bull	1 bull	1 bull	1 bull
					12/1-2/28[ce]	12/1-2/28	12/1-2/28[ce]	12/1-2/28[f]
					1 bull	1 bull[f]	1 bull	1 bull
1995-1996	8/10-9/20[c]	No open	8/10-9/20[c]	No open	8/10-9/30[ce]	8/10-9/30[f]	8/10-9/30[ce]	8/10-9/30[f]
	1 bull	season	1 bull	season	1 bull	1 bull	1 bull	1 bull
					12/1-2/28[ce]	11/15-2/28	12/1-2/28[ce]	12/1-2/28[f]
					1 bull	1 bull[f]	1 bull	1 bull
1996-1997	8/10-9/20[c]	No open	8/10-9/20[c]	No open	8/10-9/30[ce]	8/10-9/30[fg]	8/10-9/30[ce]	8/10-9/30[fg]
	1 bull	season	1 bull	season	1 bull	1 bull	1 bull	1 bull
					12/1-2/28[ce]	11/15-2/28	12/1-2/28[ce]	12/1-2/28[f]
					1 bull	1 bull[f]	1 bull	1 bull

[a] No separate season.
[b] Subsistence hunters or residents domiciled in communities or units in rural areas as defined by joint game boards.
[c] Registration hunt.
[d] Drawing permit for resident hunters only.
[e] Definition of subsistence hunter changed to include any resident of the state, December 1989.
[f] Registration hunt for federal subsistence users only. Who qualifies as an Fortymile caribou federal subsistence user differs between subunits i.e., in Unit 20E it is rural residents of Unit 12 north of Wrangell-St Elias National Park and Preserve, Unit 20D and Unit 20E; in Unit 25C eligible federal subsistence are all rural residents in the state.
[g] Federal hunt managed under a joint state/federal permit issued by the state.

Table 4 Reported Alaskan Fortymile caribou harvest by type of hunt, 1989-1996

Hunt number	Regulatory year	Permits issued	% Did not hunt	% Successful hunters	% Unsuccessful hunters	Harvest			Total harvest[a]	Notes
						Bulls	Cows	Unk		
572 Drawing permit	1989-1990	750	31	11	89	57	0	0	57	
575[b]	1989-1990	681	28			148	98	0	246[c]	
Registration permit	1990-1991	1478	29	25	75	238	18	8	265	
	1991-1992	1864	21	23	77	335	1	1	337	
	1992-1993[d]	973	17	34	66	262	10	0	272	
	1993-1994	2809	22	15	85	325	10	0	335	
	1994-1995	2472	19	15	85	294	12	0	306	
	1995-1996	1860	26	12	88	160	15	0	175	
	1996-1997[e]	807	26	23	77	112	5	0	117	
General[f] hunt	1987-1988			25	75	142	0	0	142	561 hunter reports
	1988-1989			42	58	399	2	0	401	964 hunter reports
	1989-1990			47	53	121	0	0	121	255 hunter reports
	1990-1991			10	90	47	2	0	49	467 hunter reports
	1991-1992			27	73	95	4	1	100	424 hunter reports
	1992-1993					60	0	0	60	102 hunter reports
	1994-1995	308	44	9	91	15	0	0	15	
	1995-1996	306	37	23	77	40	0	0	40	
	1996-1997	99	35	36	64	23	0	0	23	
575 Federal hunt	1991-1992	20				4	0	0	4	
	1992-1993	244	18	39	61	59	12	11	82	
	1993-1994	77	58	3	97	1	0	0	1	
	1994-1996[g]	< 30	100	0	0	0	0	0	0	
	1996-1997[h]	0	0	0	0	0	0	0	0	

Table 4 Continued

Hunt number	Regulatory year	Permits issued	% Did not hunt	% Successful hunters	% Unsuccessful hunters	Harvest			Total harvest[a]	Notes
						Bulls	Cows	Unk		
Total for all hunts	1987-1988			25	75	142	0	0	142	561 hunter reports
	1988-1989			42	58	399	2	0	410	965 hunter reports
	1989-1990			37	63	32	98	0	424	1264 hunter reports
	1990-1991			21	79	295	20	8	313	1520 hunter reports
	1991-1992			23	77	434	5	2	441	1919 hunter reports
	1992-1993			34	66	382	24	11	417[d]	1086 hunter reports
	1993-1994	2886	23	15	85	326	10	0	337	
	1994-1995	2780	22	15	85	309	12	0	321	
	1995-1996	2166	28	14	86	200	20	0	220	
	1996-1997[e]	906	27	25	75	135	5	0	140	

[a] Total harvest does not include harvest occurring in Canada. Canadian harvest since 1973 has been less than 20 caribou per year.
[b] Hunt 575 renamed RC865 in 1993.
[c] Harvest may include 44 Nelchina/Mentasta caribou taken from southern portion of Unit 20E and 1 Macomb caribou from northern Unit 12.
[d] Canadian harvest was estimated to be 50 additional caribou.
[e] Preliminary harvest results.
[f] During 1994 permit hunt RC863 was set up in Units 20B and 20D. Alaskan residents, nonresidents, and aliens could participate.
[g] Federal Subsistence office never sent data; Estimates generated through discussions with local federal biologists.
[h] State and federal hunts were managed under a joint permit. State and federal quota was 150 bulls.

Table 5 Fortymile caribou harvest and accidental death, 1985-1996

Regulatory	Reported[a]				Estimated			Yukon	
year	M	F	Unk	Total	Unreported[b]	Illegal	Total	harvest	Total
1985-1986	261	0	0	261	160	20	180	0	441
1986-1987	223	0	0	223	137	20	157	0	380
1987-1988	142	0	0	142	87	20	107	0	249
1988-1989	399	2	0	401	244	150[c]	394	0	795
1989-1990	326	98	0	424	74	0	74	3	501
1990-1991	285	20	8	313	28	2	30	0	343
1991-1992	434	5	2	441	59	5	64	0	505
1992-1993	382	14	0	396	0	21	417	50	467
1993-1994	326	0	0	326	0	10	336	10	346
1994-1995	309	0	0	309	0	12	321	7	328
1995-1996	200	0	0	200	0	20	220	5	225
1996-1997[d]	135	0	0	135	0	5	140	1	141

[a] Includes all Alaskan harvest reporting systems.
[b] Unreported harvest calculated by multiplying reported general hunt harvest by 1.59 to compensate for nonreporting by successful hunters.
[c] Forty cows found abandoned within 50 yards of trails; 150 assumed taken.
[d] Preliminary harvest results; winter season ongoing.

Table 6 Fortymile caribou hunter residency and success of hunters reporting residency, 1989-1996

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	
1989-1990	291			347 (35)	182	453		635 (65)	982
1990-1991	105	157		262 (25)	273	517		790 (75)	1052
1991-1992	91	260	23	374 (21)	339	1052	34	1425 (79)	1799
1992-1993	116	219		335 (35)	261	373		634 (65)	969
1993-1994	45	270	9	324 (16)	431	1278	15	1724 (84)	2048
1994-1995	87	211	11	309 (15)	296	1477	8	1781 (85)	2090
1995-1996	40	138	22	200 (14)	312	950	14	1276 (86)	1476
1996-1997[b]	20	63	17	100 (19)	155	269	1	425 (81)	525

[a] Residents of Unit 12 north of Wrangell/St Elias, Unit 20E, or Unit 20D and residents of Circle and Central.

[b] Results from fall hunt only.

Table 7 Fortymile caribou fall harvest by time period, 1987-1995

Regulatory year	Harvest periods								
	8/10-8/16	8/17-8/23	8/24-8/30	8/31-9/6	9/7-9/13	9/14-9/20	9/21-9/27	9/28-9/30	*n*
1988-1989				189[a]					
1989-1990[bc]	5	8	5	8	0	1	1	1	29
1990-1991	48	61	35	50	19	14	7	10	244
1991-1992	187	67	17	9	17	22	-[d]	-[d]	319
1992-1993[e]	289	0	1	0	1	0	47	7	345
1993-1994	167	16	12	15	10	4	1	0	225
1994-1995	51	16	21	21	17	9	4	19	158
1995-1996	33	10	6	5	12	2	3	1	72

[a] Between 1 September and 10 September 189 caribou were harvested

[b] Data from registration permit only.

[c] An additional 231 caribou were harvested between 1 October and 31 December.

[d] Closed by Emergency Order.

[e] State season was closed by Emergency Order 14 August 1992.

Table 8 Fortymile caribou harvest percentage by transport method, 1987-1996

Regulatory year	Percent of harvest									*n*
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Walking	Unk	
1987-1988[a]	58	1	3	19	3	3	13	0	0	142
1988-1989[a]	29	1	2	36	1	4	27	0	0	401
1989-1990[b]	27	0	0	10	6	5	52	0	0	424
1990-1991[c]	1	1	0	43	10	1	43	1	0	313
1991-1992[d]	16	1	2	53	5	4	23	5	0	441
1992-1993	5	0	1	58	5	7	21	0	3	378
1993-1994	16	0	2	38	16	8	17	0	2	326
1994-1995	11	0	1	23	28	7	28	0	2	298
1995-1996	33	0	2	14	19	6	26	0	2	326
1996-1997[e]	42	0	6	26	6	7	12	0	1	100

[a] General hunt numbers only.

[b] Drawing and registration permit hunt results.

[c] Registration permit hunt results only.

[d] Registration permit and general hunt results.

[e] Fall hunt only.

LOCATION

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

HERD: Galena Mountain, Ray Mountains, Wolf Mountain

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

BACKGROUND

Caribou are distributed throughout the Kokrines Hills and Ray Mountains north of the Yukon River from the upper Hodzana River, across the Dalton Highway, to the lowlands northwest of Galena Mountain. Galena Mountain is a local name for the 3274 ft unnamed mountain northeast of Galena.

The origin of these herds is unknown, but some residents believe these animals are feral reindeer from a commercial reindeer operation in the Kokrines Hills. The reindeer venture in that area ended around 1935, but there is no evidence of reindeer physical characteristics or reindeer genes in the population to date. The mid-May calving dates of all 3 herds indicate the animals are caribou. Local residents have been aware of these *Rangifer* herds for many years, but the Alaska Department of Fish and Game (ADF&G) did not survey the herds until 1977.

There are 3 distinct calving areas and 3 recognized herds. Each herd is associated with and named for a mountain peak or mountains where the animals calve. The western group of approximately 250 to 500 animals typically calves east of Galena Mountain and winters west of the mountain. The middle group calves on Wolf Mountain and winters to the north and east in the Melozitna and Little Melozitna River drainages, overlapping with the Galena Mountain Herd. The Wolf Mountain Herd contains approximately 250 to 500 animals. The eastern group calves primarily on the south side of the Ray Mountains and winters on the north side of the Ray Mountains, primarily in the Kanuti–Kilolitna drainage. The 1995 population estimate for the Ray Mountains Herd was 1734 caribou.

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

These caribou herds have been lightly hunted because the areas are relatively inaccessible during open hunting season and few people outside the local area are aware of them. Since the early 1970s hunting seasons have been from 10 August to 30 September on the Galena and Wolf Mountain herds to keep harvest low but also to discourage harvest of cows. In 1984–1985, additional protection was given to the Ray Mountains Herd in southern Unit 24 to prevent overharvest near the Dalton Highway. That area had previously been under Western Arctic Herd regulations. Total reported and known unreported harvest from all 3 herds, combined, averaged less than 10 caribou per year over the last 10 years.

The mean body weights of Galena Mountain Herd female calf caribou measured in October are among the heaviest calves measured in Alaska (Valkenburg et al. 1993). The mean weight of 9 female calves in 1994 was 143.4 lb.

MANAGEMENT DIRECTION

The management objective established in 1988 was to determine population size, trend, and identity of caribou in the Ray Mountains and Kokrines Hills. The goals listed below were established in 1990. The management objectives were redefined in 1994.

MANAGEMENT GOALS

- Ensure harvest does not greatly restrict growth or cause a decline in population size.
- Provide increased opportunity for people to participate in caribou hunting.

MANAGEMENT OBJECTIVES

Ray Mountains Herd

- Determine the population size, calving locations, rutting areas, and winter distribution by 1996.
- Determine major mortality factors by 1997.

Wolf Mountain Herd

- Determine population size, calving locations, rutting areas, and winter distribution by 1996.

Galena Mountain Herd

- Promote expansion for the herd until it is large enough to allow an increase in the length of the hunting season.
- Prevent overharvest of the herd while allowing maximum harvest opportunities of the WACH, when both occur in the same wintering grounds.

METHODS

Caribou from these herds were monitored through cooperative radiotelemetry studies involving ADF&G, US Fish and Wildlife Service (FWS), and US Bureau of Land Management (BLM). In April 1992, 8 adult females, 2 female calves, and 10 adult male caribou were radiocollared on the winter range of the Galena Mountain Herd north of Galena. In October 1993, 4 female calves were radiocollared in the Galena Mountain Herd. In October 1994, 8 female calves were radiocollared in the Galena Mountain Herd, 20 female calves were radiocollared in the Ray Mountain Herd, and 3 female calves were radiocollared in the Wolf Mountain Herd. In October

1995, 8 female calves were radiocollared in the Wolf Mountain Herd. In October 1996, 3 female calves were radiocollared in the Wolf Mountain Herd.

We conducted annual composition counts with a fixed-wing aircraft (Super Cub or Scout) and a Robinson (R-22 or R-44) helicopter in October. Surveys in the Ray Mountains included taking 35-mm aerial photographs from fixed-wing aircraft during postcalving aggregations. We monitored hunting mortality from caribou harvest reports and interviews with local residents.

Standard morphometric measurements were taken on all caribou captured, and blood was withdrawn for antibody testing and mitochondrial DNA (mtDNA) analysis (Wolf Mountain and Galena Mountain herds). M Cronin, LGL Research Associates, Anchorage conducted the mtDNA analysis.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The Galena Mountain Herd has never been censused, but it probably contains from 300 to 500 caribou. The highest number of caribou seen was 310 in October 1995 (Table 1). Its population trend seems to be stable. Although radiocollaring caribou in this herd was expected to help locate caribou for census purposes during the October rut aggregation, use of the collars has not increased the number of caribou found. However, the use of radio collars has revealed that during the rut, the herd uses habitat comprising fairly dense black spruce in which sighting caribou is difficult. Continuation of surveys or censuses during summer or postcalving aggregations may provide the best estimates of population size for this herd.

The first fall composition survey in the Wolf Mountain Herd was conducted in October 1996 (Table 2). The highest count during June surveys was 595 caribou in 1992. Based on these counts, Osborne (1995) estimated the population of the Wolf Mountain Herd to be 600 to 850 caribou, which was higher than previous estimates. Better surveys caused the increase in estimated population; the population is stable.

In the Ray Mountains the previous population estimate of 500 (Robinson 1988) was based on a survey of all known upland ranges but did not include the Caribou Mountain area. Counts from photographs taken of aggregated caribou during a radiotracking flight on 21 June 1995 indicated a new minimum herd size of 1737 caribou in the Ray Mountain Herd. The population trend of the herd is unknown. Harvest is low and predation is probably the main limiting factor.

Population Composition

The counts of the 3 herds were a mixture of fixed-wing and helicopter aircraft, and not all yielded composition data (Tables 1–4). The fall surveys that began in 1992 were conducted by helicopter and provided the first accurate composition data on these herds (Tables 1–4).

Distribution and Movements

Galena Mountain Herd. These caribou usually migrate toward alpine areas east of Galena Mountain in April. All radiocollared caribou were in alpine areas from June to September in all years. However, a few bulls have been seen along the Yukon River and north of Galena in September. During October caribou usually migrate from alpine areas across Galena Mountain toward the Holtnakatna Hills and around Hozatka Lakes where they winter. In October 1995 radiocollared caribou from the Galena Mountain Herd were in the Holtnakatna Hills, and we conducted composition counts. But in 1996 they were scattered from these hills eastward to the Melozitna River where some were mixed with Wolf Mountain caribou.

In late September through early October 1996, 10,000 to 15,000 caribou from the Western Arctic Caribou Herd crossed the Koyukuk River from the west about 50 miles upstream of the mouth. This group did not remain long in Unit 21D, and it is not known if there was any mixing with the Galena Mountain Herd.

Wolf Mountain Herd. Based upon tracks encountered during surveys in the early 1980s, a general migration pattern for the Wolf Mountain Herd was hypothesized. The herd calved on the slopes of Wolf Mountain, spent most of the summer in the surrounding alpine habitat, then in October moved northward toward Lost Lakes on the Melozitna River. In May 1995 the radiocollared caribou were located in the headwaters of Hot Springs Creek. In May 1996 the radiocollared caribou were located on the north side of Wolf Mountain. In October 1994 approximately 500 caribou were seen in the Hot Springs Creek area during collaring activities. In October 1995 the herd was on the north side of Wolf Mountain in the West Fork of Wolf Creek. In October 1996 the herd was on the lower part of the Melozitna River, approximately 10 to 35 miles southwest of Wolf Mountain.

Ray Mountains Herd. Prior to October 1994 there were no radiocollared caribou in the Ray Mountains, and the movements of the Ray Mountains Herd were not well known. Robinson (1988) found them north of the Ray Mountains and in the upper Tozitna River drainage. Based on the trails he found, he suspected this herd made seasonal migrations between the 2 areas. During late October 1991, several hundred caribou were seen along the Dalton Highway near Old Man. Small groups of 10 to 20 male caribou are regularly seen in March near Sithylemenkat Lake. In March 1991, 200 caribou were seen in the Kanuti Lake area, but it was unknown if they were from the Ray Mountains Herd or Western Arctic Herd.

Since radiocollaring began in October 1994, we have found that relocations during the winter have been primarily on the northern slopes of the Ray Mountains. Radiolocations during the calving season have been on the southern slopes of the Ray Mountains in the upper Tozitna River drainages. Summer range has been in the alpine areas of the Ray Mountains, frequently in the Spooky Valley area, around Mt Henry Eakins and occasionally in the alpine areas south of the upper Tozitna River.

Analysis of mitochondrial DNA by Cronin et al. (1995) indicated that none of the samples from Galena Mountain Herd, Wolf Mountain Herd, or Ray Mountain Herd caribou contained any unique reindeer genes.

MORTALITY

Harvest

During the 1994–1996 hunting seasons, caribou were reported taken (Table 5) from each of the herds. Hunter access to the Ray Mountains Herd during the open season in early March is limited to lengthy snowmachine trips. The Galena Mountain Herd is most accessible for hunting when it crosses the Galena–Huslia trail in winter. The season there has been closed during this time to limit the potential for a serious overharvest. The Wolf Mountain Herd is almost never accessible for hunting because of the scarcity of aircraft landing areas. A guide using horses has been able to access a limited part of the Wolf Mountain Herd's range and occasionally takes caribou from this herd, and moose hunters on the Melozitna River also occasionally take Wolf Mountain caribou. Success of hunters in all 3 herds is limited (Table 6).

The total reported harvest averages less than 10 caribou per year. Each year 1 or 2 caribou are taken but not reported along the Yukon River near Ruby, and 3 to 5 caribou are taken along the Yukon River in the Rampart–Tanana section (Osborne 1995). These caribou are usually bulls that occasionally wander to the river during September. In addition, hunters using snowmachines took 5 to 7 caribou from Tanana (Osborne 1995).

Season and Bag Limit.

Units and Bag Limits	Resident/Subsistence Open Seasons	Nonresident Open Seasons
Unit 20F Tozitna River drainage.		
Subsistence and Resident Hunters: One caribou; however, only bull caribou may be taken during the 10 Aug-30 Sep season.	10 Aug–30 Sep 1 Dec–30 Dec 1 Mar–15 Mar	
Nonresident Hunters: One bull.	10 Aug–30 Sep	10 Aug–30 Sep 1 Mar–15 Mar
Unit 21B, 21C, and that portion of Unit 21D north of the Yukon River and east of the Koyukuk River. One caribou, however, 2 additional caribou may be taken during a winter season to be announced.	10 Aug–30 Sep Winter season to be announced.	10 Aug–30 Sep
Unit 24, the Kanuti River drainage upstream from Kanuti River, Chalatna Creek	10 Aug–30 Sep	10 Aug–30 Sep

confluence, and the Fish Creek drainage, including Bonanza Creek. One bull.		
Unit 25D, drained by the west fork of the Dall River, west of the 150°W Long. One bull.	10 Aug–30 Sep	10 Aug–30 Sep

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

Board of Game Actions and Emergency Orders. In March 1991 the Alaska Board of Game issued emergency order authority to the Department of Fish and Game to open a portion of Unit 21D when WACH are present. A bag limit of 2 caribou was established. This action allows hunters the opportunity to take caribou while protecting the smaller Galena Mountain Herd that may be intermixed with the WACH. During the report period, this authorization has not been used. No Board of Game actions concerning caribou in these 3 herds occurred during this reporting period.

Other Mortality

Judging from fall calf percentages (Tables 1–4), natural mortality of caribou calves is high in all 3 herds. Black bears may be primary calving ground predators and are often seen during calving surveys in the Galena Mountain area. Grizzly bears are throughout the calving ranges of all 3 herds.

CONCLUSIONS AND RECOMMENDATIONS

The mountains between Galena and the upper Hodzana River on the north side of the Yukon River contain from 2700 to 3150 caribou in 3 herds centered around 3 main calving areas. Although open caribou hunting seasons exist, due to limited access the hunters take few caribou. Management objectives for these caribou herds include expansion of the herds until they are large enough that their movements make them more accessible to hunters during fall. Predation is probably restricting herd growth. Lush lichen ranges, early calving, and large body size and weight of calves and adults in the Ray Mountains Herd indicate good nutrition. The large body size and heavy weight of calves and adults in the Galena Mountain Herd also indicate they are not limited by nutrition.

To allow harvest from the WACH in Unit 21D east of the Koyukuk River and protect the Galena Mountain and Wolf Mountain caribou herds, we need to maintain a restricted season when the WACH is not present. Maintaining radio collars in the Galena and Wolf Mountain herds should help facilitate separation from the WACH. In addition, radio collars should help obtain better population estimates. Because of insignificant harvest and the small number of caribou in the Galena, Wolf Mountain, and Ray Mountains herds, other management work on these herds will remain a low priority.

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Table 1 Galena Mountain Herd caribou fall composition counts, 1991–1996

Date	Bulls:100 cows	Calves:100 cows	Calves	Cows	Bulls	Total
12/91						260
10/92	40	7	9	123	49	181
10/93	32	25	41	165	53	259
10/94	22	40	46	115	25	211
10/95	28	19	40	211	59	310
10/96	37	13	19	151	56	232

Table 2 Galena Mountain Herd caribou summer calving counts, 1991–1994

Date	Cows	Calves (%)	Bulls	Total
6/91	97	11 (8)	27	135
6/92	227	12 (5)		239
5/93	65	12 (13)	16	93
6/93	130	24 (13)	40	194
5/94	56	13 (12)	40	109
6/94	104	34 (18)	53	191

Table 3 Aerial counts of caribou from Wolf Mountain Herd, 1991–1996

Date	Cows	Calves (%)	Bulls	Total
6/91	117	18 (12)	11	146
6/92				595
1993[a]				
5/94	337	121	16	474
1/95				194
10/95	192	51 (15)	103	346
10/96	167	37 (14)	62	266

[a] No surveys.

Table 4 Ray Mountains Herd caribou compositions counts, 1991–1996

Date	Bull:100 cows	Calves:100 cows	Calves (%)	Cows	Bulls	Total
6/91		31	93	296	57[a]	446
6/91			58		245[b]	303
10/91						140[c]
10/94						652
10/94	37	19	78 (12)	403	148	629
1/95						684
10/95	34	12	83 (8)	681	230	994
10/96	28	15	145 (10)	971	271	1387

[a] Includes 50 unclassified adults
[b] Included 245 unclassified adults
[c] Caribou Mountain portion only

Table 5 Reported harvest of caribou by herd in Units 20F, 21C, and 24, 1990–1996

Year	Ray Mountains	Galena Mountain	Wolf Mountain
1990	3	0	1
1991	2	0	1
1992	2	0	2
1993	9	1	0
1994	2	2	1
1995	0	0	0
1996	0	1	0

Table 6 Galena Mountain, Wolf Mountain and Ray Mountains caribou hunter residency and success, 1990–1996

Regulatory year	Successful				Unsuccessful				Total hunters
	Local resident	Nonlocal resident	Nonresident	Total	Local resident	Nonlocal resident	Nonresident	Total	
1990-1991	0	4	0	4	3	23	3	29	33
1991-1992	0	3	0	3	2	28	0	30	33
1992-1993	0	2	2	4	1	7	2	10	14
1993-1994	1	8	1	10	0	15	2	17	26
1994-1995	0	3	2	5	2	18	0	20	25
1995-1996	0	0	0	0	2	10	0	12	12
1996-1997	0	1	0	1	1	11	1	13	14

LOCATION

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

HERD: Western Arctic

GEOGRAPHIC DESCRIPTION: Northwest Alaska

BACKGROUND

The Western Arctic Caribou Herd (WAH) ranges over approximately 140,000 mi^2 (363,000 km^2) of northwestern Alaska. Summer range includes the North Slope and Brooks Range west of the trans-Alaska Pipeline. Most calving occurs in the northern foothills of the Brooks Range. Typical winter range includes the eastern third of the Seward Peninsula to the Tagagawik drainage and Nulato Hills south to the Unalakleet drainage.

In the early 1970s, the WAH numbered about 243,000 caribou. Then, during the mid-1970s, it declined dramatically in a period of 4–6 years to an estimated 75,000 animals. From 1976 to 1993, the WAH grew rapidly. Now, it appears this long period of rapid growth is slowing.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

1 To protect and maintain the WAH and other components of the natural ecosystem upon which caribou depend.

2 To provide for subsistence and recreational hunting on a sustained yield basis.

3 To provide for viewing and scientific study of caribou.

4 To perpetuate associated wild carnivore populations.

MANAGEMENT OBJECTIVES

1 To maintain a postcalving population of ≥ 200,000 caribou.

2 To minimize conflicts with the reindeer industry.

3 To monitor the size and composition of this population.

4 To improve public understanding of WAH management, improve harvest, and encourage involvement in the regulatory process.

5 To minimize impacts of industrial development on caribou and their habitat.

6 To explore cooperative management of this herd involving the department, federal land managers, and private organizations.

METHODS

POPULATION STATUS AND TREND

We used conventional VHF radiotelemetry techniques to estimate population size, adult mortality, calf production and recruitment, sex and age composition, movement patterns and distribution. Most conventional radio collars consisted of Model 600 transmitters equipped with 5-hr delay mortality mode sensors and long-range dipole antennas (heavy gauge, flexible whip) produced by Telonics, Inc. (Mesa, AZ). Transmitters were cold temperature-tested and configured for standard power output.

We categorized observations of radiocollared caribou by accuracy of location. "General" locations indicated that neither the collared caribou nor its group were observed; these locations were probably accurate within 30 miles of the actual location of collared caribou. "Specific" locations indicated the group containing the collared caribou was observed and were probably accurate within 5.0 mi on most occasions (variation was attributable to mapping errors). "Visual" locations indicated the collared caribou were observed; accuracy was probably comparable to that for specific locations. For both specific and visual locations, accuracy was within 0.25 mi when global positioning system (GPS) coordinates were recorded.

We attempted to complete each "collar year" (1 Oct–30 Sep) with ≥ 100 functional transmitters on living caribou. "Collar years" begin 1 October to correspond with deployment of WAH radio collars during September. We began the 1994–1995 collar year with 127 conventional collars on living caribou (118 cows and 9 bulls); of these, 10 collars on cows were also equipped with platform terminal transmitters (PTTs or satellite collars). We began the 1995–1996 collar year with 130 conventional collars (119 cows and 11 bulls); of these, 8 collars were also equipped with PTTs (7 cows and 1 bull).

We began deploying PTTs in the WAH during the 1987–1988 collar year. Since that time the maximum number of PTTs active in this herd during any individual year was 14 (1993–1994). Ten PTTs were active during the 1994–1995 collar year, and 8 in 1995–1996. The primary objective for deploying PTTs in the WAH has been to efficiently search for conventional collars. In addition, PTTs aided educational programs in Barrow and Kotzebue and provided movement and distribution information during periods when conventional collars could not be located. The duty cycle of all PTTs in this herd is to be active daily during June to document the distribution of caribou during calving and once every 3 days during the rest of the year.

Virtually all WAH radio collars are deployed during September at Onion Portage on the Kobuk River. Using boats, we captured caribou and physically restrained them as they swam the Kobuk River. Net gun and chemical immobilization techniques are not used because 1) local residents object to drugs, darts, and aircraft for capturing wildlife; 2) the hunting season for bulls and cows is open most of the year, and there is no way to ensure recently immobilized caribou will not be shot for human consumption; and 3) this technique is less expensive and easier on caribou than other capture techniques. We do not recollar or remove radio collars from WAH caribou. The only exceptions to this method of collaring WAH caribou have been 1–2 satellite collars that the North Slope Borough Department of Wildlife Management purchased annually and deployed using net gun capture techniques near Anaktuvuk Pass.

Before 1995 we attempted to have 15 bulls collared for each census. The purpose of this was to indicate whether a substantial number of bulls were missed during photography rather than to find every group of WAH bulls for the census. Disproportionate numbers of bulls shed their collars compared to cows, and collared cows are useful for conducting calving and short yearling surveys whereas collared bulls are not. Therefore, we collared bulls primarily during the fall preceding each census and allowed the proportion of collars on bulls to decline during noncensus years. Since 1995 we have attempted to annually maintain 10–15% of all collars on bulls (roughly 15 collars each year) for several reasons. First, few bulls are available to collar during some years. This occurred in 1995 and, as a result, the 1996 census was conducted with only 4–5 collared bulls in the population. Maintaining a consistent proportion of collared bulls among years minimizes the chance of repeating this situation. Also, because collared bulls are used to estimate fall sex/age composition and adult mortality, maintaining a consistent proportion of collared bulls through time will minimize obscuring biological trends with sampling variability.

There have been several modifications of the radiocollaring technique for swimming caribou since it was first used in 1987. We now avoid fragmenting groups of cows with calves while capturing caribou, and attempt to herd all caribou not captured to the south bank of the Kobuk River. When few caribou are crossing the river and it becomes necessary to capture every possible individual, additional bulls and cows without calves are kept swimming in the river while the capture boats process caribou. Cows with calves are never kept in the river longer than absolutely necessary.

Bulls are collared using 2 boats and 5–6 staff. We capture each bull by grabbing its antlers, moving the animal to the right front quarter of the boat, and rotating the antler tops to the floor of the boat. In this position, the bull's nose points up, and the base of both antlers rests on the right front gunnel of the collaring boat. As soon as the bull is caught, we stop the motor and anchor the boat. The second boat then pulls alongside the first boat, sandwiching the bull between the boats. One person in the bow and one in the stern of the second boat ensure the two boats do not squeeze the bull's neck and do not drift apart. Once both boats are in position, the bull's head is brought upright while the right antler is passed to an individual in the second boat. One person in each boat holds the bull's head upright. This naturally upright position enables a blood sample to be drawn and allows correct sizing of the collar.

Population Size

The WAH is censused every 3 years using the direct count photo extrapolation technique (Davis and others 1979). No census was conducted during this reporting period.

Population Composition

Calving. Calving surveys are conducted annually to estimate initial calf production and delineate calving areas. During photocensus years, calving surveys also provide a final opportunity to determine which radiocollars are functional for the census. In 1995 and 1996 calving surveys were flown in a C-185 with 2–3 observers. In 1995 flights were conducted 9–11 and 19–20 June. In 1996 they were flown 5–6 and 13–14 June. In both years, breaks in the surveys were due to inclement weather.

In 1995, 2 methods were used to estimate calf production: 1) visual observation of radiocollared cows and 2) tallywhacker counts of approximately 200 neonates and adults (adult defined as any caribou ≥ 12 months old) within 3 miles of radiocollared cows. In 1996 calf production was estimated only from visual observation of collared cows.

Before 1995 we determined maternal status of collared cows solely by the presence of a neonate at heel; antler status was recorded but not used to indicate maternal status. Antlers and udders are good indicators of parturition for caribou (Whitten 1995). In 1995 we attempted to use udders as an additional indicator of maternal status but this proved unfeasible. Therefore, calf production for collared cows was recomputed for all years using antlers and presence/absence of a neonate to determine maternal status.

In both 1995 and 1996, the northern foothills of the Brooks Range between the Lisburne Hills and Liberator Lake were searched intensively during calving surveys. Additionally, the DeLong Mountains, Noatak drainage west of Howard Pass, Kobuk drainage west of Ambler, and Selawik drainage were searched less intensively in both years.

Prior to 1990 we made little effort to locate radiocollared WAH cows outside of recognized calving areas. Most cows migrating to traditional calving areas in May and June are parturient, and those migrating to other locations are often nonparturient. Recording calf production on the calving grounds is certainly necessary for estimating caribou primary production; however, evaluating the proportion of all cows on the calving grounds is equally important. Therefore, calving surveys conducted before 1990 may overestimate initial calf production because most nonparturient cows were probably not counted. Even since 1990 the effort invested in searching areas outside regularly used calving grounds has varied due to weather and mechanical constraints.

Fall composition. Fall composition surveys are conducted in October to estimate numbers of bulls, cows, and calves in the WAH. They are timed to coincide with rut when segregation by sex and age is minimal. Fall composition surveys provide an estimate of oversummer calf survival and help show herd status when compared with spring short yearling counts. Fall WAH composition surveys were conducted sporadically from 1961–1982. During these years we classified caribou from ground and aerial surveys using various sex/age categories. Since 1992, fall aerial composition surveys have been conducted annually with a Robertson R-22 helicopter; however, sampling techniques were not standardized until 1995.

In 1994 department staff conducted fall composition surveys 8–10 October near Granite Mountain, the Tagagawik drainage, Purcell Mountains, and Kobuk drainage. As in 1992 and 1993, a Bellanca Scout radiotracked collared caribou and carried extra gear and fuel (30–40 gallons) for the R-22 helicopter. The observer in the Scout directed the R-22 to general areas containing collared caribou, and the observer in the R-22 classified a "grab sample" of caribou. Caribou were classified as small bulls, medium bulls, large bulls, cows, or calves, based on the following criteria: body size, antler size and configuration, and external genitalia. During summarization, standardized sampling effort among count areas was achieved by weighting raw composition count data by the relative number of radiocollared caribou in each count area. We also adjusted the raw count data because it became evident that caribou were being misclassified.

We calculated a correction factor by having an experienced observer make a second classification of a small number of caribou in one area and comparing the 2 sets of count data. Neither the weighting nor adjusting factors substantially altered the raw data. Therefore, for this report, only raw data (*i.e.*, unadjusted and unweighted data) are reported.

In 1995 fall we conducted composition counts 23, 24, and 26 October near the Ambler River drainage, upper and middle Noatak drainage, Death Valley, Koyuk drainage, Buckland drainage and Nulato Hills. In the week preceding the composition counts, several radiotracking flights were flown to locate collared caribou to minimize search time for collared animals during the composition counts. During the composition surveys, we radiotracked collared caribou using a Cessna C-206 fixed-wing aircraft and relayed accurate GPS latitude/longitude coordinates of collared animals to the R-22 for classification. The R-22 moved to each successive collar location where up to 200 caribou were classified as bulls, cows, or calves within a 3-mile radius of these coordinates, usually within 0.5 hr of receiving them. In 1995 we also used the R-22 to retrieve moose and caribou radiocollars on mortality mode.

Fall composition counts were also used to collect additional information for the WAH. The low altitude and slow speed of the R-22 survey provided a good opportunity to qualitatively evaluate fall body condition of large numbers of caribou. The surveys also provided detailed information showing the distribution and number of caribou near reindeer ranges on the eastern Seward Peninsula and northern Nulato Hills.

Spring composition. Short yearling surveys during the spring season are used to estimate recruitment of calves into the adult population. Because WAH cows do not begin reproducing until 2–3 years old, we probably overestimate recruitment. Before 1988 short yearlings were classified using a variety of techniques, including ground, helicopter, and fixed-wing aircraft observations. Radio collars were not used to allocate sampling effort among areas.

In 1988 we began basing short yearling surveys out of Kotzebue, using standardized techniques and a Piper Super Cub (PA-18) fixed-wing aircraft. Collared cows are radiotracked during March through May in areas close to Kotzebue with relatively flat terrain, especially the middle and lower Kobuk, Selawik, and Buckland River drainages. Searching areas of flat terrain facilitates locating and classifying collared cows. Flights to relocate collared caribou are repeated every 5–14 days. Occasionally, other areas are searched for collared caribou as time permits. During the composition surveys, the PA-18 aircraft moves to each collar location where up to 200 caribou are classified as short yearlings (caribou <1 year old) or adults (caribou >1 year old) within a 3-mile radius of each radiocollared cow. The criteria used to distinguish short yearlings from adults are body size, antler size and configuration, behavior (*e g.*, an obvious cow/calf bond), and facial proportions (short yearlings have disproportionately shorter faces than adults).

In 1995 short yearling surveys were completed in the Squirrel, middle Kobuk, Selawik and Buckland drainages on 1–3, 9 and 11 May. In 1996 we completed short yearling surveys in the Squirrel, middle and upper Kobuk, Selawik and Buckland drainages on 4, 15, 16, 19 April and 13–15 May.

Distribution and Movements

In 1995 and 1996 we completed spring range-wide telemetry surveys in conjunction with short yearling surveys, and we completed fall range-wide telemetry surveys with fall composition counts. The purposes of range-wide surveys are: 1) to identify and locate collared caribou that died or shed their collar; 2) to record gross distribution and movements of the herd; and 3) to minimize conflicts between caribou and the reindeer industry.

Range-wide telemetry surveys, by definition, include searching the entire known range of the WAH at least once during the survey period. We conducted spring range-wide surveys between February and May of 1995 and 1996. A fall range-wide survey was not completed during 1994, but it was completed between August and November of 1995. Flights were based out of Barrow, Kotzebue, Nome and Fairbanks. Gates of the Arctic National Park chartered a Piper PA-18 aircraft (Caribou Air Service) to conduct several telemetry flights in the central Brooks Range during fall 1995. The department covered all other areas. Most radiotracking flights not associated with composition surveys recorded only general locations of collared caribou; however, specific locations with GPS latitude/longitude coordinates were recorded for collars on mortality mode. Accurate locations of mortality collars facilitate retrieval of collars during helicopter operations.

MORTALITY

The WAH annual mortality rate is determined solely from the mortality of radiocollared caribou and is based on a 'collar year' from 1 October to 30 September. Therefore, the 1994–1995 mortality estimate corresponds with the 1995 short yearling estimate of recruitment. Estimated mortality rate includes all sources of mortality, *e.g.*, predation, starvation, disease, accidents, and hunting.

Before annual range-wide radio relocation surveys were initiated, it was often difficult to determine the specific collar year in which a caribou died. In cases where a caribou collar was located on mortality mode and it was >1 year since last found alive, the year of death was assigned to the last year the caribou was known to be alive. Range-wide spring and fall relocation surveys have minimized this problem because all radiocollars are located twice each collar year.

Like all wildlife telemetry programs, some WAH transmitters fail from defective components or expired batteries while the caribou is alive. The varying lifespan of conventional transmitters makes it difficult to determine the sample size of radiocollared caribou at the beginning of each collar year (from which we determine mortality rates). For collars not heard during radiotracking flights, we consider transmitters functional for 2 years after their last known location. After 2 years, the transmitter is assumed to have failed and a "missing" status is assigned to the last year the caribou was located. Since "missing" status collars are not included in the beginning sample size for a collar year, mortality rates for any particular collar year may change for up to 2 years thereafter as missing collars are retroactively dropped from the initial sample of collared caribou. For transmitters known to be functional >6 months (i.e., located after February), the year "missing" status is included in the initial sample of collared caribou. If a collared caribou was not located after February, the collar is excluded from the initial sample for that collar year.

Range-wide telemetry surveys provide the additional benefit that few caribou are assigned "missing" status. Many transmitters near the end of their battery life probably function <1 year once the caribou dies and the mortality mode (increased pulse rate) is actuated. Prior to the initiation of range-wide surveys in 1993, many caribou that died with old collars were not found before their transmitter failed.

Slipped collars also affect our estimate of adult mortality. Most collared cows on mortality mode are probably dead because their antlers retain the collar for almost the entire year. In contrast, bulls often slip their collar because the collars must be attached loosely to accommodate swelling of the neck during rut and because they lack antlers during most of the winter when neck girth is minimal and collars are loose. It is unfeasible to observe carcasses of collared caribou on mortality mode because relocation flights are flown so infrequently (carcasses are usually completely devoured and covered by snow or brush). Also, time required to descend from tracking altitude, search for a carcass, and return to tracking altitude reduces the likelihood of completing range-wide relocation surveys. When deciding whether a bull died or simply slipped his collar, we consider the presence of tooth marks on the collar, bones or hair nearby, and the date when the collar went on mortality mode. Unless there is evidence that a bull slipped his collar, we assume all bulls on mortality mode died. Since 1995 we have increased our efforts to retrieve WAH collars on mortality mode. This has allowed us to identify a larger proportion of slipped bull collars than in the past.

Harvest

Harvest of WAH caribou was determined from registration permits, statewide harvest tickets, and community-based harvest assessments.

Other Mortality

Disease Assessment. Before 1992 blood samples were collected opportunistically from hunter-killed caribou during the Onion Portage collaring project. Sample sizes were typically small (n = <10), the samples were frequently hemolyzed, and local hunters were often uneasy when several biologists approached them immediately after shooting caribou. In 1992 we began capturing 50–75 caribou annually to collect blood samples in conjunction with the Onion Portage collaring project.

As with radiocollaring, we collect blood samples, using boats and physical restraint. Cows are quickly and easily sampled along side of 1 boat with 3 staff, 1 person each to hold the head and tail and 1 person to draw blood. Most radiocollared cows are also bled; all radiocollared bulls are first bled. When collecting blood from bulls, the head must be raised to expose the jugular veins. Because little of the neck is exposed, this usually requires the blood sample to be drawn "upside down"; i.e., the needle penetrates the jugular vein pointing down toward the thoracic inlet rather than up toward the ear. Twenty cubic centimeters (cc) of whole blood are collected from each caribou sampled. The samples are allowed to stand overnight at room temperature, and the serum is collected and chilled or frozen. Hemoglobin and packed cell volume are not measured because these parameters are poor indicators of body condition.

Caribou sampled for disease analyses are selected opportunistically rather than randomly. Because we collect blood from most caribou that we radiocollar and because we do not collar young animals, our samples are biased toward older individuals. Also, the availability of bulls sometimes affects relative numbers of bulls and cows sampled. These factors combined with small sample sizes in relation to the size of this herd may compromise our understanding of disease. Therefore, we view serology results as a "red flag" to indicate whether disease may be affecting the population dynamics of the WAH. In addition to sampling caribou opportunistically, we sample lame caribou whenever possible. These caribou are excluded from samples estimating incidence of various pathogens.

During 1992–1994 sera were analyzed for 6 viruses (infectious bovine rhinotracheitis, bovine viral diarrhea, parainfluenza-3, respiratory synctial virus, epizootic hemorrhagic disease, and bluetongue) and 2 bacteria (*Leptospira* spp. and *Brucella suis* biotype 4). Sera were not tested for *Leptospira* spp. in 1995. As with all serology analyses, a positive test result only indicates exposure to a pathogen and does not necessarily indicate a current or previous infection.

Three tests have been used to assess exposure to *B. suis*: buffered *Brucella* antigen test (BBA; all years), plate test (SPT; all years) and card test (1994). Test results for the BBA test were considered positive at dilutions >100; the SPT and card test yield only positive or negative results. A caribou is considered positive for brucellosis only if both the BBA and SPT tests both indicate positive. Additionally, caribou that test positive for *Brucella* are retested to confirm these results (D. Hartbauer, pers. commun.). The serum neutralization test was used for bovine rhinotracheitis, bovine viral diarrhea, parainfluenza-3, and respiratory synctial virus; caribou were considered positive at dilutions $\geq$32. The immunodiffusion test was used for epizootic hemorrhagic disease (positive or negative). The microscopic agglutination test was used for *Leptospira* spp.; caribou were considered positive at dilutions $\geq$100.

HABITAT

Assessment

The department does not monitor range condition for the WAH.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Census results indicate the WAH numbered about 243,000 caribou in the early 1970s and then declined to approximately 75,000 caribou by 1976 (Fig 1). Biologists and local users disagreed about the causes and magnitude of this decline; however, everyone agreed the herd substantially declined during this time. From 1976 to 1993 the WAH grew at an average annual rate of 11% (Table 1). However, 1976 to 1990 may better reflect the growth phase for this herd with a 13% average annual rate of increase. From 1990 to 1993 the WAH probably grew little if at all (Machida and Dau, unpubl. data). This may represent the beginning of a period of relative stability or possible decline. The last WAH photocensus was conducted in July 1993. At that

time, the minimum estimate for this herd was 450,000 caribou (adults and calves combined; Machida and Dau, unpubl. data).

Population Composition

Calving. We observed 58 calves:100 radiocollared cows during June 1995; in 1996 this ratio was 61 calves:100 cows (Table 2). These ratios are lower than all but 1 previous year (1993, 54 calves:100 cows) since 1987. In 1993, 1995, and 1996 when calf production was lowest, we observed the highest incidence of cows with new velvet antlers (28:100, 20:100 and 17 cows with soft antlers:100 other cows, respectively). In all other years, this ratio has ranged from 0 to 6:100 (mean = 3.0, SD= 2.0, n = 6). This indicates the relatively low calf:cow ratios observed during June 1993, 1995, and 1996 are real and not artifacts of sampling or misclassification errors.

Although there is no clear trend in calf production through time, the mean calf:cow ratio during 1987–1992 was significantly higher than in 1993–1996 (P = 0.01; Student's t-test, variances not pooled). Fall body condition is considered a good indicator of calf production in the subsequent summer in the Central Arctic Herd (R. D. Cameron pers. commun.). Our observations and those of many local hunters indicate caribou body condition was generally poor during the fall of 1993 and 1994. The low calf production in 1995, despite following an easy winter of little snow, few major storms, and mild temperatures, is consistent with this explanation. In contrast, this explanation is equivocal when applied to the relatively high calf production in June 1994 (71 calves:100 cows).

Our estimates of calf production are conservative because we do not use udders to indicate maternal status of radiocollared cows. Visual collars are not used in conjunction with radiocollars in the WAH because local residents find them objectionable and believe they predispose caribou to mortality. Given the large group sizes we encounter during calving surveys, it is difficult to identify a collared cow until we are beside her and it is too late to see an udder. Some cows undoubtedly lose their calf and antlers before we locate them, and we erroneously classify them as nonmaternal because we fail to observe their udder.

Since 1990 variation in size and mobility of neonates and in the proportion of cows with hard antlers and distended abdomens indicates temporal variation in peak calving has occurred among years. Because each radiocollared cow is located only once during calving surveys and because it requires 1–2 weeks to locate most collared cows, this assessment is gross and subjective. Nevertheless, using antler status in addition to presence/absence of a neonate to indicate maternal status of collared cows and conducting calving surveys during early June (i.e., slightly before peak calving) reduce the effects of temporal variations in calving on estimates of primary production.

During June 1995 and 1996, 80–85% of all radiocollared cows were dispersed throughout the northern foothills of the Brooks Range between roughly Eagle Creek and Liberator Lake. In contrast, during many years between 1975 and 1990, calving was concentrated near Carbon and Disappointment Creeks (J. Coady, pers. commun.). Of 3 collared cows located south of the calving grounds during 1995, none had calves and all had soft antlers. Of 4 collared cows located

south of the calving grounds during 1996, none had calves and 2 had soft antlers. In both years all radiocollared bulls were south of the Brooks Range during June.

In 1990 and during 1992–1995, we classified about 200 adults and neonates within 3 miles of each collared cow. We tried this because: 1) it was an independent estimate of calf production consistent with the technique used to estimate calf recruitment during spring short yearling surveys and 2) we could do so with little additional time and expense. The same reasons that make antlers and udders useful to indicate maternal status of cows also render this neonate:adult ratio useless for estimating calf production. The low correlation between "neonate:adult" and "calf:collared cow" ratios observed during the 5 years we employed both techniques ($r = 0.54$) confirms this. In 1996 we discontinued neonate/adult counts to invest more time searching for radiocollared cows.

Fall composition. The fall calf:cow ratio was substantially higher in 1995 than 1994 (Table 3). This may have been partially due to misclassification of small bulls as cows during 1994 (P. Valkenburg, pers. commun.). Additionally, calf survival during summer 1994 may have been poor, considering the poor body condition of adults and calves observed that fall.

Variability in bull:cow ratios among years is probably more attributable to sampling than actual changes in numbers of bulls and cows in the WAH. Alternatively, annual variability in this ratio may reflect differences among observers in their ability to accurately classify caribou. It is hard to believe that relative numbers of bulls and cows are as flexible as our data indicate.

Misclassification of small bulls affects calf:cow and bull:cow ratios. This is reportedly a common problem even among experienced field personnel who have not worked extensively with caribou (P. Valkenburg, pers. commun.). The presence or absence of a vulva easily distinguishes bulls and cows. Even so, inexperienced observers commonly focus on antlers to determine the sex of caribou. Criteria for classifying caribou are presence/absence of a vulva to determine sex, and body size/head characteristics (face length and antler size) to distinguish calves from adults. To minimize classification errors among observers, sex and age categories should be kept as simple as possible (i.e., bulls, cows, and calves). Maintaining adequate training and consistent staff to classify caribou will reduce misclassification.

The R-22 is well suited for caribou composition surveys. It burns 100 LL avgas, simplifying fuel logistics; it is quiet and minimally disrupts caribou; it provides excellent visibility and is inexpensive compared to turbine helicopters. Unfortunately, because it carries only 1 passenger, training personnel to classify caribou must be accomplished other ways.

In 1995 we retrieved 11 radio collars (10 conventional and 1 PTT) in conjunction with fall composition surveys. This defrayed some of the expense associated with collecting fall composition data.

Spring composition. We observed 17 short yearlings:100 adults in spring 1995 and 22:100 in spring 1996 (Table 4). This ratio has been relatively stable since 1991. However, the short yearling:adult ratio has generally declined since the early 1980s (Fig 2).

Conducting WAH spring recruitment surveys from a Super Cub undoubtedly compromises survey accuracy. Some vigorous 10-month-old bulls are probably misclassified as adults, and some small 2-year-old cows are probably misclassified as short yearlings. Even if these errors are not compensatory and the relationship in Figure 2 is shifted up or down, our data should still accurately reflect temporal trends in WAH recruitment as long as any bias is consistent through time. These errors probably are consistent through time because we have largely used the same pilots, observers, and techniques since 1988. Practical considerations of conducting short yearling surveys (e.g., variability in timing of the spring migration, inclement weather, and cost) warrant continuing spring recruitment surveys with PA-18 aircraft.

The 1995 spring migration was exceptionally compressed in time and space. We encountered the vanguard of the migration in the Squirrel River drainage 1 May and observed stragglers in the South Fork of the Buckland River headwaters 11 May. Virtually the entire WAH crossed the Kobuk River between Noorvik and the Greater Kobuk Sand Dunes. Caribou migrated north in typical linear fashion and formed exceptionally large groups. For example, we observed several continuous lines of caribou extending from the main stem of the Squirrel River to the headwaters of the North Fork, a distance of 12–15 miles. Likewise, we encountered roughly half of the WAH in a large aggregation near the lower Mangoak River. This is unusual for spring migrations. As a result, short yearling surveys were exceptionally thorough in spring 1995.

In contrast, the 1996 spring WAH migration was relatively dispersed in space and time. Most of the WAH migrated north through the upper Kobuk and Alatna River drainages. The long distance to migrating caribou from Kotzebue, steep terrain, and chronically poor weather reduced our effectiveness in 1996.

A potential weakness of WAH short yearling surveys is that the entire population is rarely sampled. Each year, portions of the herd are missed. A spatial component of this problem has probably not been a serious problem since at least 1988 because most of the WAH wintered south of Unit 23 and were sampled each year. Likewise, a temporal component of this problem does not appear to have been serious. Combining all short yearling surveys from 1987 through 1996 (25 March–30 May, n = 44), we found no correlation (r = -0.14) between the short yearling:adult ratio and date of survey (Fig 4). Likewise, adjusting for annual differences in the short yearling:adult ratio yields no correlation between this ratio and date of survey (r = -0.05).

Segregation of short yearlings vs. adults often appears more striking within large groups than among groups. The bond between many cows and calves appears to break by the time WAH caribou are 9–11 months old. Like mature bulls, short yearlings often consort together as relatively discrete factions within large mixed sex and age groups of caribou. Breakdown of the maternal bond renders visual observation of radiocollared cows a poor parameter for estimating recruitment. Segregation by sex and age during spring migrations necessitates sampling a broad spectrum of caribou among and within groups.

Because we do not classify exactly 200 caribou near each collared cow, individual collared cows do not contribute equally to the overall short yearling:adult ratio. We rarely count more than 250 caribou per collared cow; however, we frequently classify <200 caribou when few animals are in an area (occasionally, a collared cow is alone so only 1 caribou is classified). This doesn't appear

to be a serious shortcoming because the median number of caribou classified per collared cow has been 207 (n = 335) since 1990.

Distribution and Movements

We located 110 of 118 functional collars (93%) between February and May 1995 during spring range-wide telemetry surveys; 74 of 114 functional collars (65%) were found during the same months in 1996. A range-wide telemetry survey was not completed in fall 1994; 92 of 124 active collars (74%) were found during August–November 1995.

During the reporting period range-wide surveys improved our understanding of WAH movements and distribution. For example, during fall 1995 approximately 16 collared WAH caribou were found near Gunsight Mountain and Anaktuvuk Pass. Within 4 weeks many of these individuals were relocated in the Buckland and Kiwalik River drainages, a minimum straight-line distance of approximately 450–500 statute miles. During this time, ambient air temperatures were exceptionally warm with daily high ambient air temperatures reaching or exceeding 70 F. This illustrated 2 aspects of WAH movements not previously observed. First, WAH caribou are less dependent on cold temperature and snow to induce rapid fall migrations than previously thought. Second, WAH caribou in the northeastern portion of their range may still converge on the Buckland River drainage and northern Nulato Hills rather than move south through the upper Koyukuk and Alatna River drainages.

Between July 1994 and June 1996, we received 1785 locations from caribou with PTT radiocollars. During this period, the mean number of days on which a location was received was 178 per PTT (SD = 103; range = 48–295). The highest latitude reached by a PTT-collared caribou was 69.598° N/155.268° W (approximately where the Ikpikpuk River enters the North Slope coastal plain). The minimum latitude was 64.016° N/160.142° W (lower Unalakleet River). The maximum longitude was 68.281° N/165° W (base of the Tigara Peninsula near Point Hope). The minimum longitude was 68.622° N/150.080° W (upper Itkillik River/May Creek).

MORTALITY

The adult cow mortality rate (conventional collars only) ranged from 6–20% between 1981–1982 and 1995–1996 collar years (Table 5). Combining all years since 1981–1982 through 1995–1996, WAH cows collared with conventional collars experienced a 13% mortality rate (172 deaths out of 1315 collar years). The mean annual mortality rate during this time was 14% (SD = 5.8; n = 15). Because bulls typically experience a higher mortality rate than cows and disproportionately few bulls have been collared in this herd, the mortality rate for all adult WAH caribou during this period was probably higher than our estimate. However, because of sample size limitations for collared bulls (few years collaring bulls; number of collared bulls relative to population size), we cannot confidently estimate bull mortality at this time.

Perhaps more important than the long-term average adult cow mortality rate is the apparent slow increase in adult cow mortality since the early 1980s (Fig 3). Despite the gradual nature of this change, this trend may be more biologically significant than the unusually high mortality that occurred during the 1983–1984 collar year.

Range-wide telemetry relocation surveys improved the accuracy of annual adult mortality estimates. The fate of more collared caribou was determined after we initiated range-wide surveys than in previous years. For example, during the 1992–1993 "collar year," 12 collared caribou were "missing" and year of death could not be determined for 4 caribou found on mortality mode. In the 1993–1994 "collar year," these numbers were 7 and 5, respectively. In contrast, during 1994–1995 when range-wide relocation surveys were initiated, only 1 caribou was missing and only 1 caribou was located for which year of death was uncertain. In 1995–1996, these numbers were 0 and 1, respectively. Also, because range-wide surveys leave fewer collared caribou in "unknown" status, we have a better estimate than in the past of the initial sample size of collared caribou to determine annual mortality rates.

Adult caribou mortality is most meaningful in relation to recruitment. The significance of Figures 2 and 3 is that recruitment has slowly declined while adult cow mortality has slowly increased. If estimates of recruitment or adult mortality have been consistently biased through time, the relationships shown in Figures 2 and 3 would shift up or down. If present, such biases are probably inconsequential, and annual changes in the size of the WAH have probably been small since 1993.

Since we began collaring bulls in 1987–1988, their mortality rate has been significantly higher than for cows (conventional collars only; 24% for bulls vs. 13% for cows; Chi square = 6.48, df = 1, $P < 0.02$). Ungulate bulls typically experience higher mortality rates than cows. Even so, it is unlikely that the mortality rate for bulls was almost twice that for cows as our data indicate. Two possible explanations for this are that we overestimate bull mortality by collaring only large (i.e., old) bulls, or we misclassify some slipped bull collars as mortalities.

The heavier weight of PTTs may predispose WAH cows to mortality. Combining all years since 1987–1988 when PTTs were first deployed in this herd, cows with conventional collars experienced a 13% mortality rate (139 deaths out of 1046 collar years; 90% binomial confidence interval 12–16%). In contrast, cows collared with PTTs experienced a 20% mortality rate (13 deaths out of 65 PTT years; 90% binomial confidence interval 12–30%). However, this difference was not statistically significant (Chi square test = 1.80, df = 1, $P > 0.10$). Not all cows with a PTT necessarily die soon after being collared. For example, a cow collared in September 1991 lived 5 years before dying during the 1995–1996 collar year; also, of 8 cows collared with PTTs in September 1993, 4 are still alive as of April 1997 (4 collar years). The benefits of movement data provided by PTTs outweigh their cost of increased mortality. However, as with collared bulls, cows collared with PTTs should be excluded from the sample of individuals to monitor adult mortality.

The life span of radio collar transmitters can also affect our estimates of WAH mortality. Given our current practice of collaring only adult caribou, most individuals die before their transmitter fails. For example, during the 1994–1995 and 1995–1996 collar years when spring and fall range-wide relocation surveys were conducted, only 1 transmitter failed before the caribou died. Since 1979 2 collars have functioned >12 years, 4 collars >11 years, and 3 collars >10 years (as of January 1997, all of these transmitters are still functioning on living caribou). This indicates our present strategy for collaring WAH caribou is probably not seriously compromising our ability to estimate adult mortality rates. However, by not collaring calves (i.e., caribou of known

age), we are forgoing age-specific information on mortality and productivity. Calves in this herd are probably too small to support Model 600 transmitters. The annual average duration of functional collars on living caribou peaked in 1985 at 5–6 years. That is, on the average, we can expect to follow a collared caribou 5–6 years before the caribou dies or transmitter fails.

Harvest

Season and Bag Limit.

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Units 21D, 22A, 22B, 23, 24, and 26A		
Resident Hunters: 5 caribou per day.		
Nonresident Hunters: 5 caribou total per year.		
Bulls		
Cows	No closed season	No closed season
	1 July–15 May	1 July–15 May

On state-managed lands during 1994–1995 and 1995–1996, there was no closed season for bulls, the season for cows was 1 July–15 May, and the bag limit was 5 caribou per day for resident hunters. Season dates for nonresident hunters were the same as for resident hunters, and the bag limit was 5 caribou per year.

Federal WAH caribou seasons and bag limits were identical to state regulations during 1994–1995. During 1995–1996, seasons remained the same but the bag limit was 15 caribou per day for federally recognized subsistence users.

Board of Game Actions and Emergency Orders. The Board of Game (BOG) proposed and passed a regulation allowing same-day-airborne (SDA) hunting of WAH caribou in Units 23 and 26A at their fall 1994 meeting. This regulation was in effect for the 1994–1995 and 1995–1996 regulatory years. The season for SDA caribou hunting was 1 January through 15 April; however, because of the 30-day waiting period after the Lieutenant Governor's signature, the regulation did not become effective until 15 January 1994. The BOG rescinded this regulation during its fall 1995 meeting as proposed by Maniilaq Association (Kotzebue). Few or no WAH caribou were taken under this regulation.

During their spring 1994 meeting, the Board of Game extended the Noatak Controlled Use Area (CUA). The Federal Subsistence Board passed an identical proposal during 1995. The original Noatak CUA was established by the Board of Game at their spring 1988 meeting. It extended 5 miles either side of the Noatak River between the mouths of Sapun Creek and the Kugururuk River, a distance of roughly 66 river miles and an area of approximately 430 mi^2. The expanded CUA extends from the mouth of Sapun Creek to the mouth of the Noatak River, a distance of roughly 225 river miles and an area of approximately 1440 mi^2. The Board of Game reconsidered this action at their spring 1995 meeting and retained the *status quo*. The purpose of the original CUA and its subsequent extension was to reduce conflicts between local and nonlocal hunters in this area. This action probably redistributed nonlocal hunters to other portions of Unit 23 but did not reduce harvest of WAH caribou.

The Federal Subsistence Board increased the bag limit for qualified subsistence users of the WAH on federal public lands in Unit 23 from 5 to 15 caribou per day beginning 1 July 1995.

Harvest Assessment. Hunting is administered through 2 systems for the WAH: 1) a registration permit hunt for local hunters (residents living west of the Dalton Highway and north of the Yukon River) and 2) a statewide hunt for nonlocal hunters (everyone else). The only difference between these 2 systems is the way harvest information is collected. Nonlocal hunters are required to fill out and return their statewide harvest ticket to the department within 15 days of the close of the season. However, no reminder letters are sent to hunters who receive a statewide caribou harvest ticket and fail to voluntarily report the results of their hunt, and the reporting requirement is not enforced.

Local hunters who register to hunt WAH caribou are sent a letter at the end of each regulatory year asking how many caribou they harvested the preceding fall and during the winter/spring. There is no limit to the number of registration permits available each year, and no special charge associated with registering to hunt. Even though the WAH registration permit system was established to simplify harvest reporting for local caribou hunters and improve accuracy of harvest data, only about 10% of the actual harvest taken by local residents is reported under this system (Georgette 1994, Dau and Pederson, unpubl. data). There are many reasons for poor compliance with registration permit requirements (Dau and Pederson, unpubl. data).

There is probably no single technique to adequately assess caribou harvests by all groups of hunters. The best approach will likely combine 2 or more techniques, *e.g.*, harvest tickets for nonlocal hunters and some form of community-based harvest assessment for local residents. Currently, department staff are considering a community-based harvest assessment program for communities within the range of the WAH.

Hunter Residency and Success. During the 1994–1995 regulatory year, 951 hunters registered to subsistence hunt WAH caribou. Of these hunters, 595 (63%) responded to the harvest questionnaire and reported taking 969 caribou during the regulatory year. These results include 39 nonlocal Alaskan residents and 13 nonresidents that erroneously participated in the registration hunt. During the 1995–1996 regulatory year, 579 hunters (50 of which were either nonlocal residents or nonresidents) registered for this hunt and reported taking 1177 caribou. Community-based harvest assessments indicate local subsistence hunters take approximately

20,000 WAH caribou annually. This indicates only approximately 5% of the actual subsistence harvest of WAH caribou was reported through the registration permit system during each year, lower than previously reported (Georgette, 1994).

During the 1994–1995 regulatory year, 137 nonlocal hunters reported taking 238 WAH caribou through the statewide caribou harvest ticket system. In 1995–1996, 308 nonlocal hunters reported taking 344 caribou. These are minimum estimates of both hunters and harvests because reminder letters are not sent to hunters who get a statewide caribou harvest ticket. The actual harvest by nonlocal hunters is probably between 1000 and 3000 WAH caribou annually.

Harvest Chronology. Subsistence harvest of WAH caribou occurs throughout the year. Harvest levels are usually low during late May through mid August. From mid August through early October, subsistence hunters primarily harvest large bulls because they provide the best meat. Once bulls enter rut and become unpalatable, typically around 7–12 October, subsistence harvest switches to cows until approximately March or April. During March–May, subsistence hunters take caribou of both sexes based on body condition.

Virtually all harvest by nonlocal hunters occurs between late August and late October with most of the harvest occurring throughout September. Nonlocal hunters harvest large bulls almost exclusively even after onset of the rut.

Transport Methods. Subsistence hunters use snow machines during October–May and boats or 4-wheelers the rest of the year. Nonlocal hunters depend almost entirely on aircraft to initially access hunting areas. Once in a hunting area, many sport hunters use rafts to float rivers. Since 1994-1995, guides have increased their use of 4-wheelers to transport clients out of base and spike camps. In Unit 23 increasing numbers of village residents have recently begun transporting nonlocal moose and caribou hunters in their personal boats.

Other Mortality

Disease. Serology results show no clear trends in prevalence of 8 selected pathogens in the WAH (Table 6). However, incidence of the respiratory viruses IBR, BVD, and PI3 appears to have substantially increased since 1992. The high proportion of caribou with positive titers for these viruses indicates that cross reactions with other antigens may be causing "false positives" (J. Blake and R.A. Dieterich, pers. commun.). In contrast, the incidence of brucellosis (*Brucella suis* biotype 4) appears to have decreased since 1992. However, these comparisons should be viewed with caution because laboratory techniques to detect exposure to brucellosis and other pathogens have substantially improved since 1962. The high variability in exposure to brucellosis between 1992 and 1996 when testing procedures were consistently reliable (J. Blake, pers. commun.) is perplexing. This variability may be an artifact of small sample sizes in relation to the size of this herd.

Reports of "sick" caribou from local subsistence hunters have increased since 1990, although again no clear trend has emerged. Most maladies described by hunters appear to be tapeworm larvae or abscesses. Even so, the disparity between local hunters' observations and serology results indicates serologic tests are missing some pathogens in this herd.

Local subsistence users expressed 2 concerns regarding environmental disease in WAH caribou during this reporting period. When 2000–3000 WAH caribou died within 10 miles of the coast between Cape Krusenstern and Cape Lisburne during the fall and winter of 1994–1995 (ADF&G unpubl. data), alarmed residents of Point Hope, Kivalina, Noatak, and Kotzebue strongly suspected radioactive contaminants from Project Chariot had killed the animals. Forty carcasses were necropsied by personnel from the department, the North Slope Borough (NSB) Department of Wildlife Management, and the University of Alaska. The distribution of carcasses as well as extreme emaciation, the presence of soil in the rumen, atrophied livers, and red jelly-like bone marrow all indicated the caribou had starved. Tissue samples examined for gross emission of alpha and beta particles as well as Strontium-90, Cesium-137 and Potassium-40 showed no evidence that radioactive isotopes contributed to these deaths (NSB, unpubl. data). Tissue samples were also submitted for heavy metal assessment; however, these tests were incomplete as of April 1997.

The other concern regarding environmental disease in WAH caribou comes from mineral development at the Red Dog Mine. In January 1995, residents of Noatak expressed concern that caribou feeding near the Red Dog haul road were ingesting vegetation contaminated with concentrated lead and zinc dust from ore being transported to the Port Site facilities. Fifteen caribou of both sexes and various ages were collected by a resident of Noatak and necropsied at the Red Dog Mine. Tissue samples were submitted for radioactive isotope and heavy metal assessment. Necropsies showed no gross evidence of poisoning by metals or radioactive isotopes; in fact, all caribou sampled were in good condition and all adult cows were pregnant. Therefore, the meat from these caribou was salvaged and donated to elders in Kotzebue and Barrow. Laboratory results indicate levels of radioactive isotopes are normal (NSB, unpubl. data). Results of the metal analyses were incomplete as of March 1997.

HABITAT

Assessment

In 1995 BLM began a project to reevaluate winter range in the Nulato Hills and Buckland River drainage (R. Meyers, pers. commun.). This project is still underway. Residents of Noatak and Kivalina requested that heavy metals on and within vegetation be monitored along the Red Dog Mine road; however, no work has been conducted to date.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Body Condition

Before 1993, it was unusual to see large WAH bulls in poor condition during September. In early September 1993 and 1994, when large bulls should have been in peak condition, department staff and local hunters observed many WAH bulls with little or no subcutaneous fat. Many cows were also thin and had small calves. During this time, some caribou of both sexes were in good condition; however, these individuals were the exception. In September 1995 and 1996, thin mature bulls were less common than in 1993 or 1994 but were still more prevalent than before 1993. The reasons for this deterioration in body condition are unknown. Poor body condition in early fall indicates caribou are not acquiring adequate fat reserves while on summer range.

Poor body condition of some WAH caribou may be more attributable to herd size rather than a general deterioration of seasonal ranges. The concept of density is difficult to apply to caribou because they are never distributed uniformly throughout their range. Since the mid 1980s, countless observations have shown WAH caribou tend to be in large numbers regardless of season. This tendency is most pronounced during June and July when WAH caribou form large postcalving and insect-induced aggregations numbering >200,000 individuals (ADF&G unpubl. data). Large groups of caribou reduce food availability by ingesting and, probably to a greater extent, trampling vegetation. The poor body condition during early autumn of recent years may have been a function of how much time WAH caribou spent in huge, insect-induced aggregations during the previous summer. Indeed, during the die-off that occurred between Cape Krusenstern and Cape Lisburne during fall and winter 1994–1995, severe storms were merely the *coup de grace* for caribou on the verge of starvation when they left their summer range.

WAH Co-management Initiative

During April 1995 a conference titled "Understanding Harvest Assessment in the North" was held in Girdwood, Alaska. A major theme that developed at this conference was co-management of natural resources. It was here that co-management of the WAH was first seriously discussed by department staff and representatives of local organizations, i.e., Maniilaq Association and the North Slope Borough Department of Wildlife Management.

Following the Harvest Symposium, the Department Division of Wildlife Conservation (DWC) and University of Alaska-Anchorage Institute of Social and Economic Research (ISER) organized a series of scoping meetings in Barrow, Kotzebue, Nome, and Huslia to assess rural interest in co-managing the WAH. Meetings were also held in Fairbanks and Anchorage to contact sport hunters, nonconsumptive users, environmental groups, and Federal land managers. Commercial operators within the range of this herd and the Alaska Professional Hunters Association were contacted through letters describing the initiative and soliciting their comments. Two representatives of the Alaska Outdoor Council were contacted by phone for their comments.

Response to the rural scoping meetings ranged from guarded interest (Barrow) to enthusiastic support (Kotzebue). Individuals from Fairbanks and Anchorage were generally interested in exploring co-management of the WAH but were also concerned their interests would become secondary to local subsistence users. Federal participants were generally supportive of co-management but were concerned about how their agencies would participate in the process. Commercial operators wanted to continue involvement in this initiative.

Maniilaq Association held a mini-symposium on WAH co-management in April 1996 attended by tribal representatives, an ISER researcher, staff from the department, BLM, NPS, FWS, and representatives of private organizations, i.e., NANA Corporation, Maniilaq Association, North Slope Borough and Kawerak. This symposium updated tribal representatives on results of the scoping meetings. Since then, the Maniilaq Association subsistence coordinator and the chairman of the Kotzebue Sound Fish and Game Advisory Committee have drafted a WAH co-management plan, met with tribal entities in the NANA Region, and contacted federal staff to discuss this issue.

WAH Population Advisory

The department (Region V staff) developed a 4-page pamphlet describing quantitative and qualitative information as a public information tool regarding the current status of the WAH. This pamphlet was widely reviewed within and outside the department before being distributed to all box-holders within the range of this herd. Copies were also given to local federal land management agencies and regional department offices in Fairbanks and Anchorage. A commercial vendor printed 20,000 copies of the pamphlet.

School Programs

Region V staff made numerous classroom presentations on WAH caribou in schools throughout the range of this herd. Locations from caribou collared with PTTs were used in 2 programs to allow students to track movements of this herd. From 1991–1995, >100 students from 6 communities helped radiocollar caribou at Onion Portage. In 1996 this program was temporarily suspended until the State Office of Risk Management and Northwest Arctic School District can establish liability for students. A graduate of Kotzebue High School employed as a college intern participated in all aspects of the 1996 WAH photocensus and the Onion Portage caribou-collaring project.

Local Participation in WAH Management Activities

In June 1995 volunteers from Point Hope, Kivalina, and Kotzebue assisted with aerial searches to assess the WAH die-off that occurred between Cape Krusenstern and Cape Lisburne during 1994–1995. Residents of Point Hope were hired to provide logistic support and assist with necropsies of these carcasses. A resident of Noatak was hired to collect caribou necropsied for tissue samples to assess metals and radio isotopes along the Red Dog Road during March 1996. Representatives of the reindeer industry accompanied department staff on several caribou telemetry relocation flights and low-level flights over reindeer ranges on the Seward Peninsula.

Local residents have generally not supported the department-sanctioned collections of caribou or other wildlife. When they have, it has been with the conditions that aircraft not be employed and local residents be hired to make the collections. This affects the feasibility of some types of research and management projects in northwest Alaska. For example, a WAH caribou calf collection project administered by Region III staff employed local residents to collect and process female calves to monitor body condition for several years. With 1 exception, this arrangement failed for a variety of reasons. There is growing awareness among agency staff that local residents need to endorse and participate in wildlife research and management activities. The feasibility of future projects should be evaluated with this in mind.

Conflicts between the WAH and Reindeer Industry

Since approximately 1990, the Sheldon (Candle), Hadley (Buckland), and Henry (Koyuk) reindeer herds have been essentially lost to the WAH. Other herds have also lost reindeer to the WAH: the Gray (White Mountain; 50% loss), Karmun (Deering; 75–90% loss), Menadelook (Teller; percentage unknown), and Sagoonick (Shaktoolik; percentage unknown).

The Sheldon, Hadley, Henry, and Sagoonick ranges are located directly in a major migration path and within winter range the WAH has used regularly and heavily since at least 1985. Caribou begin migrating south through these areas in September, often more than a month before freeze up and snow conditions enable herders to travel by snow machine. Likewise, during spring migrations, caribou often move through these areas after breakup precludes travel by snow machine. Inclement weather can preclude herding activities, even when snow conditions are ideal for traveling.

User-Group Conflicts

Conflicts among nonlocal hunters (who reside outside the range of the WAH), commercial operators (i.e., guides and transporters), and local hunters intensified during September 1994 and 1995. These conflicts were most pronounced in the middle and lower Noatak drainage, upper Kobuk drainage, and Anaktuvuk Pass. Opportunistic observations by department staff, Department of Public Safety officers, guides and transporters, and many local residents suggest these conflicts result from increasing numbers of nonlocal hunters and commercial activity in northwestern Alaska and annual and seasonal shifts in the movements and distribution of caribou.

This is a complex issue that involves all hunters—not merely caribou hunters. It is affected by 1) the heavy reliance on aircraft by nonlocal hunters and commercial operators in contrast to subsistence users' dependence on boats and snow machines; 2) deteriorating hunting conditions (i.e., shortened seasons, reduced bag limits, crowding, and few large bulls) in other portions of Alaska; and 3) fewer places to hunt multiple big game species, e.g., moose, caribou, brown and black bears. The limiting factor driving much of this conflict in northwest Alaska is not inadequate numbers of wildlife, certainly not with regard to WAH caribou. Rather, the limiting factor is inadequate space to accommodate everyone who wants to utilize the superabundant WAH. The essence of this issue is how many local subsistence users, nonlocal sport hunters, commercial operators, and nonconsumptive users can a finite area support.

CONCLUSIONS AND RECOMMENDATIONS

Census results indicate the WAH grew rapidly from approximately 1975 through 1993. Recruitment for this herd has slowly declined since the early 1980s. In contrast, adult mortality has slowly increased. Estimates of these 2 parameters support census results which indicate the WAH has probably stabilized or grown very slowly since 1993.

In 3 of the last 4 years (1993, 1995, and 1996), initial calf production was substantially lower than in previous years. Even so, good calf survival during these years must have compensated low production because recruitment remained roughly the same as during years of high calf production. Alternatively, we may have underestimated calf production during these years by not using udders to indicate maternal status.

Body condition of WAH caribou has generally declined since 1993; however, this has not been a clear trend through time, nor has it affected the entire herd in any individual year. The "bottleneck" for WAH body condition appears to be during summer based on observations of caribou during fall. The reasons for this change are unknown but may be related to range quality

or the amount of time individual caribou spend in huge insect-induced aggregations during summer.

There is no serologic evidence that disease is affecting the population dynamics of this herd. However, hunters' observations indicate the prevalence of sick caribou or caribou laden with parasites has increased since about 1990. Predation and hunting do not currently appear to be limiting the size of the WAH.

Conflicts between the WAH and the reindeer industry have intensified since about 1990. Three or 4 entire reindeer herds have been essentially lost to the WAH during this time, and at least 4 other herds have lost reindeer. The department should closely monitor the distribution of caribou near the Seward Peninsula during September through November when caribou are migrating to winter ranges. When caribou are near reindeer ranges, the department should continue to provide as much information to herders as possible within the constraints of staff, weather, aircraft, budgets, and other work. Additionally, the department should work with the Reindeer Herders Association to enable them to better monitor caribou movements on the Seward Peninsula.

Conflicts between local subsistence hunters, nonlocal sport hunters and commercial operators have also increased since 1992. The limiting factor driving these conflicts is not inadequate caribou to satisfy all demands. Instead, the limiting factor is space to accommodate all users.

Individuals from various groups and organizations who use or manage the WAH began exploring ways to cooperatively manage this herd in 1995. The department should continue to explore ways to implement co-management of this herd with all users.

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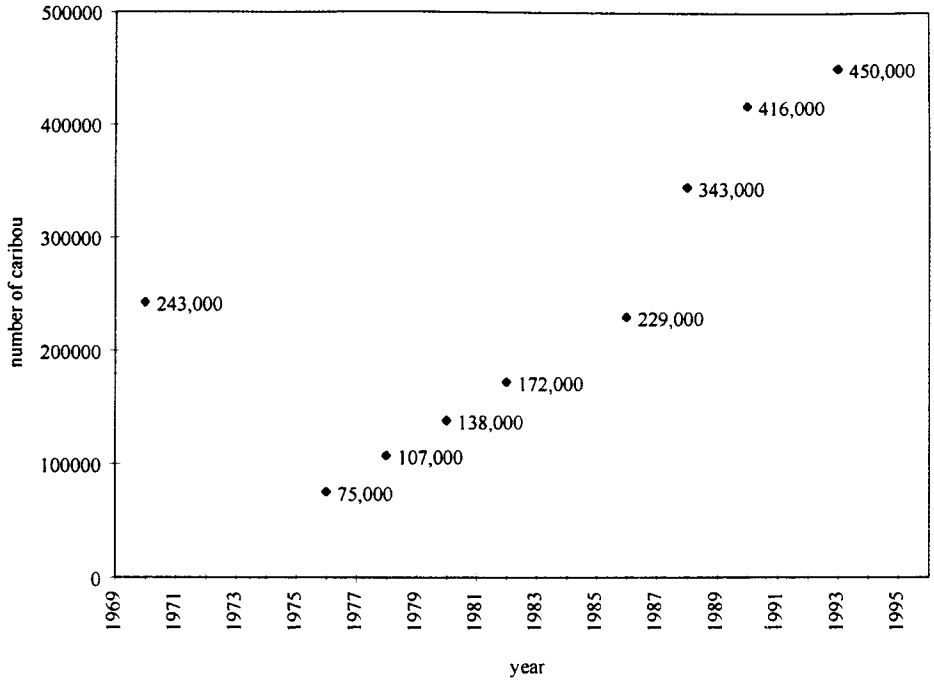

Figure 1 Photocensus population estimates of the Western Arctic Caribou Herd, 1970-1996

Figure 2 Annual calf recruitment in the Western Arctic Caribou Herd, 1982-1996

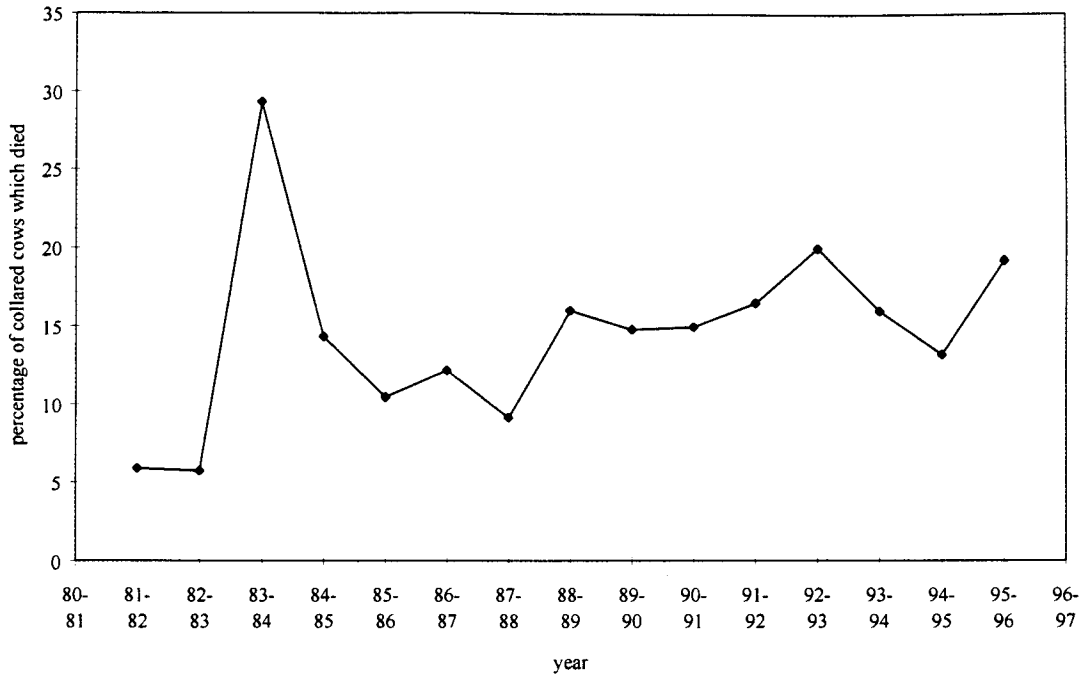

Figure 3 Annual adult cow mortality in the Western Arctic Caribou Herd, 1981-1996

Table 1 Photocensus population estimates of the Western Arctic Caribou Herd, 1970–1993

Census year	Minimum population size	Mean annual rate of change[a]	Estimated population size
1970	243,000		
1971		-18	200,000
1972		-18	164,000
1973		-18	135,000
1974		-18	111,000
1975		-18	91,000
1976	75,000		
1977		19	89,000
1978	107,000		
1979		14	121,000
1980	138,000		
1981		12	154,000
1982	172,000		
1983		7	185,000
1984		7	198,000
1985		7	213,000
1986	229,000		
1987		22	280,000
1988	343,000		
1989		10	378,000
1990	416,000		
1991		3	427,000
1992		3	438,000
1993	450,000		

[a] Mean annual rate of change = e^r

e = 2.7183; $r = [\ln(N_{t2}) - \ln(N_{t1})]/t$ where: t = number of years between censuses; N_{t1} = pop. estimate at $time_1$; and N_{t2} = pop. estimate at $time_2$

Table 2 Aerial calving surveys from observations of radiocollared cows in the Western Arctic Caribou Herd, 1987–1996

Year	June dates	With Calf	Nr calf > 1 hard antler	Nr calf soft antlers	Nr calf no antlers	Total	Maternal	Non-maternal	Calves: 100 Cows
1987	17-19	29	0	1	9	39	29	10	74
1988	3-5	27	17	1	9	54	44	10	81
1989	10-12	34	5	2	9	50	39	11	78
1990	11-13	51	0	5	15	71	51	20	72
1991									
1992	12-14	55	6	0	10	71	61	10	86
1993	11-17	38	4	17	19	78	42	36	54
1994	10-13	42	15	2	21	80	57	23	71
1995	9-13, 19-20	47	2	14	21	84	49	35	58
1996	5-6, 13-14	38	16	13	22	89	54	35	61

Table 3 Fall population composition of the Western Arctic Caribou Herd, 1961–1996

Year	Bulls	Cows	Calves	Total	Calves: 100 Cows	Calves: 100 Adults	Bulls: 100 Cows
1961	276	501	187	964	37	24	55
1970	1748	2732	1198	5678	44	27	64
1975	720	2330	1116	4166	48	37	31
1976	273	431	222	926	52	32	63
1980	715	1354	711	2780	53	34	53
1982	1896	3285	1923	7104	59	37	58
1992	1600	2498	1299	5397	52	32	64
1993	859	2321	859	4039	37	25	37
1994	1354	3284	1118	5756	34	24	41
1995	1176	2029	1057	4262	52	33	58
1996	2621	5119	2525	10265	49	33	51

Table 4 Short yearling[a] survey results of the Western Arctic Caribou Herd, 1980–1996

Year	Number of caribou			Number		SY[a]:100 adults	3-yr running average
	Adults	SY[a]	Total	Groups	Radio-collared cows		
1980	7823	2559	10382			33	
1981							
1982	3988	1164	5152			29	
1983	5079	1648	6727			32	31
1984	1646	503	2149			31	28
1985	2776	600	3376			22	25
1986	5372	1227	6599			23	23
1987	4272	1003	5275			23	23
1988	6047	1312	7359	31	45	22	26
1989	5321	1718	7039	29	37	32	26
1990	5231	1278	6509	25	36	24	25
1991	7111	1371	8482	47	48	19	22
1992	7660	1678	9338	49	52	22	20
1993	4396	814	5210	19	33	19	20
1994	8369	1587	9956	44	53	19	18
1995	13283	2196	15479	53	86	17	19
1996	5044	1111	6155	32	36	22	

[a] Short yearlings are 10–11 month old caribou.

Table 5 Annual mortality and binomial confidence intervals for Western Arctic Herd caribou cows collared with conventional radiocollars, 1984–1985 through 1995–1996 "collar years" (1 Oct–30 Sep)

Collar Year[a]	Sample Size[b]	Nr Died	Mortality Rate[c] (%)	Binomial Confidence Level 80%	90%	95%
1981-1982	34	2	6	2-15	1-17	1-20
1982-1983	35	2	6	2-14	1-17	1-19
1983-1984	41	12	29	20-40	18-43	16-46
1984-1985	28	4	14	6-27	5-30	4-33
1985-1986	48	5	10	5-18	4-21	3-23
1986-1987	66	8	12	7-19	6-21	5-22
1987-1988	88	8	9	5-14	5-16	4-17
1988-1989	88	14	16	11-22	10-24	9-25
1989-1990	102	15	15	10-20	9-22	8-23
1990-1991	101	15	15	10-20	9-22	9-23
1991-1992	104	17	16	12-22	11-24	10-25
1992-1993	106	21	20	15-26	14-27	13-29
1993-1994	101	16	16	11-22	10-23	9-24
1994-1995	107	14	13	9-18	8-20	7-21
1995-1996	110	21	19	14-25	13-26	12-28

[a] "Collar year" defined as 1 October–30 September

[b] Sample size = total number of conventional radiocollars active on adult cows at the beginning of the collar year

[c] Mortality rate = Number caribou died/Sample size

Table 6 Percent positive results for 8 selected pathogens from serology analyses of the Western Arctic Caribou Herd, 1962–1996

	IBR[a]		BVD[b]		PI3[c]		RSV[d]		EHD[e]		BT[f]		Leptospirosis[g]		Brucellosis[h]	
Year	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)
1962															30	(56)
1963															19	(74)
1964															14	(37)
1965															12	(149)
1975	18	(11)	18	(11)	0	(12)							0	(9)	14	(14)
1981	0	(20)	0	(19)	0	(20)			0	(20)	0	(20)	0	(19)	39	(23)
1986	5	(40)	3	(40)	24	(41)	0	(40)	2	(41)	0	(41)	0	(41)	19	(37)
1992	31	(59)	36	(59)	48	(58)	0	(55)	0	(59)	0	(59)	3	(59)	4	(52)
1993	8	(63)	30		49	(63)	0	(63)	5	(63)	0	(63)	5	(63)	12	(51)
1994	5	(61)	23	(61)	43	(61)	0	(60)	11	(61)	0	(61)	2	(61)	11	(47)
1995	9	(44)	43	(44)	18	(44)	0	(44)	0	(44)	0	(44)	0	(44)	12	(34)
1996															3	(76)

[a]IBR = Infectious Bovine Rhinotracheitis
[b]BVD = Bovine Viral Diarrhea
[c]PI3 = Parainfluenza type 3
[d]RSV = Respiratory Synctial Virus
[e]EHD = Epizootic Hemorrhagic Disease
[f]BT = Bluetongue
[g]Leptospirosis = *Leptospira* spp.
[h]Brucellosis = *Brucella suis* type 4

LOCATION

GAME MANAGEMENT UNIT: 25A, 25B, 25D, and 26C (59,400 mi^2)

HERD: Porcupine

GEOGRAPHIC DESCRIPTION: Eastern portions of the Arctic Slope, Brooks Range, and northeastern Interior Alaska

BACKGROUND

The Porcupine Caribou Herd (PCH) migrates between Alaska and the Yukon and Northwest Territories of northern Canada. Most of its range of approximately 130,000 mi^2 is remote, roadless wilderness. The most heavily utilized portion of the PCH calving ground lies on the coastal plain of the Arctic National Wildlife Refuge (ANWR), which is also the most promising onshore petroleum prospect in the United States (Clough et al. 1987). Both industry and government have an interest in developing potential oil resources on the coastal plain. Therefore, various state and federal agencies and their Canadian counterparts are cooperating on baseline ecological studies of the PCH. These studies are expected to provide the basis for mitigation of any adverse effects of petroleum development on caribou.

In 1987 the United States and Canada established the International Porcupine Caribou Board to coordinate management and research among governmental and user groups. Board recommendations, research studies, and actions of Congress regarding the opening of ANWR to petroleum development will influence how the herd is managed to provide for a variety of uses.

The PCH remained more stable than other Alaskan herds during the 1960s and 1970s at about 100,000 caribou (Table 1). In 1979 the population began a steady increase and reached 178,000 caribou by 1989. Annual rates of growth averaged about 5% from 1979 to 1989. The PCH then decreased to 160,000 caribou in 1992, probably in response to lower yearling recruitment after harsh winters.

MANAGEMENT DIRECTION

Until the early 1970s the PCH was a low priority for management and research because of its remote location and the small number of people who harvested it. Then increasing pressure for oil development in northeast Alaska and growing international interest in the herd resulted in a higher management priority and heightened attention from biologists (Garner and Reynolds 1986). The Alaska Department of Fish and Game's (ADF&G) management goals are to provide for optimal harvest and the greatest opportunity to participate in caribou hunting. These goals may be modified or extended if a joint Canada/Alaska management plan is adopted. The International Porcupine Caribou Board proposed the following goals.

- Conserve the PCH and its habitat through international cooperation and coordination so the risk of irreversible damage or long-term adverse effects as a result of the use of caribou or their habitat is minimized.

- Ensure opportunities for customary and traditional uses of the PCH.
- Enable users of the PCH to participate in the international coordination and conservation of the PCH and its habitat.
- Encourage cooperation and communication among governments, users of the PCH, and others to achieve these objectives.

METHODS

We estimated population size by an aerial photocensus conducted in July 1994, using counting methods described in previous reports (Whitten 1993). We monitored radiocollared caribou to determine movements, productivity, mortality, and seasonal distribution of the herd. We estimated overwinter survival of calves from composition counts conducted in March 1993 and 1994.

Harvest ticket report cards submitted by nonsubsistence hunters provided most data on harvest in Alaska. We gathered additional data on subsistence harvest from field interviews and reports by Subsistence staff. We also obtained Canadian harvest figures from the Yukon Department of Renewable Resources.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We counted 146,536 caribou (95% CI = 145,261–147,809) on aerial photographs taken in July 1994. We also counted 272 caribou directly during the census. We accounted for all but 1 of 137 radiocollared adult caribou known to be in the PCH, but we were unable to photograph several large groups along the Canning River, which contained 4 radiocollared cows from the PCH and numerous collared animals from the Central Arctic Herd. Therefore, we adjusted the photographic and direct count by the proportion of radiocollared caribou not photographed (i.e., 5/137) to come up with a round number estimate of 152,000 caribou in the Porcupine Herd.

The 1994 count was lower than the 160,000 caribou estimated from a similar census in 1992. However, local weather and terrain conditions forced the photo-plane to fly higher than usual in 1994, and calves were difficult to see on some photos. In 1992 the calf:cow ratio from ground composition counts during the census was 55 calves:100 cows, and we counted 19% calves on photos. In 1994 the calf:cow ratio among radiocollared cows was 70 calves:100 cows, yet we counted only 14% calves on photos. Therefore, we probably undercounted calves in 1994, and we actually counted more adult caribou than in 1992. The 1994 estimate of 152,000 should be considered a minimum number for the herd.

Population Composition

Calf:cow ratios in March 1995 and 1996 were 40:100 and 41:100, respectively (D Cooley, Yukon Dep Renewable Resour, pers. commun.). These ratios exceed the 22:100 classified in

March 1992 and 32–33/100 in 1993 and 1994 (Whitten 1995). Late winter recruitment is now similar to that estimated during the 1980s, when the herd was growing approximately 40 calves:100 cows (Fancy et al. 1994).

No other general population composition counts were conducted this reporting period. The calf:cow ratio among radiocollared cows was 59:100 at the end of June 1995 and 72:100 in mid June 1996. These figures are not directly comparable to the calf:cow ratios in Table 2 because younger cows, with generally lower parturition rates, are underrepresented in the radiocollared cow sample. Nevertheless, the radiocollared cow data indicate excellent productivity and survival.

Distribution and Movements

Previous movements and distribution of the PCH have been summarized by Garner and Reynolds (1986), Whitten (1987, 1993, 1995), Whitten and Regelin (1988), Fancy et al. (1989), Golden (1989, 1990), and Whitten and Fancy (1991).

In 1995 and 1996 the herd calved in the traditional calving area on the ANWR coastal plain. Ninety-two percent of the calving sites for radiocollared cows in 1995 and 55% in 1996 were within the area being considered for oil and gas leasing. Snowmelt and plant phenology were early in both years, and caribou left the coastal plain in Alaska much earlier than normal and moved into the foothills across the Yukon border in late June. In fall few Porcupine Herd caribou ventured into Alaska, where traditional subsistence harvests were consequently low. In the Yukon caribou remained accessible most of the winter from the Dempster Highway and harvests were relatively high. No aerial surveys were flown to document distribution of the herd.

MORTALITY

Harvest

Season and Bag Limit. The state of Alaska hunting season for all hunters during this report period was 1 July to 30 April; in addition, hunters could take only bull caribou during 23–30 June in Unit 26C. The bag limit for nonresidents was 5 caribou. The bag limit for all Alaska residents was 10 caribou.

Board of Game Actions and Emergency Orders. The board took no actions regarding the PCH during this reporting period.

Hunter Harvest. Total harvest for the PCH has ranged from about 1500 to 4800 over the past few years (Table 3), or about 1% to 3% of estimated population size (Table 1).

Harvests by local residents and nonlocal hunters in Alaska are reported differently. Nonlocals use statewide caribou harvest ticket report cards. Harvest by nonlocal hunters has typically been a minor part of the overall PCH harvest and has shown no definite trend over the past 5 years. Nonlocal hunters do not usually kill many PCH cows. Most nonlocal hunters are Alaska residents.

Standardized reporting of harvest by hunters living north of the Yukon River was not required after 1989, and in previous years local residents did not report even though it was required. Therefore, subsistence harvests have always been estimates. Caribou were available to Kaktovik residents primarily in early summer during this report period. Caribou were briefly available to most villages south of the Brooks Range during late summer and fall. Subsistence harvest in Alaska reflected the relative availability of caribou. Harvest in Canada was relatively high because caribou moved through the Old Crow area several times each year and also spent time in the Richardson Mountains or along the Dempster Highway, where residents of Aklavik, Fort McPherson, and many road-connected communities had easy access (Table 3).

Hunter Success. Nonlocal hunter effort and success varies by game management unit and depends on herd distribution (Table 4). Word travels quickly when the PCH is scarce in Alaska. When this happens, few hunters travel to the PCH range. Perhaps because of its uncertain distribution and the difficulty and expense of traveling to its range, the PCH has never become very popular with nonlocal hunters.

Local subsistence hunter success during this report period was probably low. Caribou left the Kaktovik area in both 1995 and 1996 before sea ice conditions allowed travel to traditional hunting areas by boat. Arctic Village had caribou available for only a few weeks in late summer each year, and some other Gwitchin villages took small numbers of caribou along the Porcupine River in fall. Caribou remained in Canada through the winter.

Harvest Chronology. Nearly all nonlocal harvest of the PCH in Alaska occurs during August and early September. This pattern reflects when hunters prefer to be afield. During this report period caribou were available both winters in very sparsely populated eastern Unit 25A, but nonlocal hunters made little or no use of them. Subsistence harvest chronology depends on availability of caribou near villages, and harvest occurs whenever caribou are present. The exception is during June at Kaktovik, where caribou may be present but inaccessible because travel conditions are poor.

Transport Methods. Traditionally, nonlocal hunters fly into the PCH range, with very few traveling by boat up the Porcupine River. Local residents use boats or ATVs in summer and snowmachines in winter.

Other Mortality

The pregnancy rate among 95 radiocollared adult PCH females in June 1995 was about 69%, with calf mortality during June about 15%. In 1996, 85% of 78 collared cows gave birth. We were unable to complete surveys to determine mortality in late June. Mortality through 7 June was about 20%.

HABITAT

Assessment

Carrying capacity of the PCH range is not known. Population density is approximately 1.3 caribou per mi^2 (0.5/km^2). Several studies are currently assessing habitat availability and quality, primarily on the calving grounds and summer ranges. Preliminary results of studies by the

National Biological Service (NBS) on calving ground habitat use indicate calving caribou select areas with rapid plant growth rather than specific sites or habitats. Rapid plant growth occurs in different areas annually, but those areas tend to be found most frequently in the same region designated by previous researchers as the primary calving area of the PCH. The implication of the NBS study is that, over time, all of the traditional calving area is important for caribou. Preserving or protecting only portions of the calving area may not adequately protect the herd.

Enhancement

No habitat enhancement programs are underway or planned on the PCH's range. Much of the herd's range within Alaska is designated wilderness, and the northern portion of the Yukon Territory is national park. Most of the area is classified as "limited" for fire suppression, and largely natural fire cycles prevail.

CONCLUSIONS AND RECOMMENDATIONS

Routine annual monitoring of natality, early calf survival, and adult female mortality gave little indication that the PCH stopped growing between 1989 and 1992. However, we failed to collect adequate data on overwinter calf survival and yearling recruitment during the period of decline. The PCH probably stabilized between 1992 and 1994. Recruitment data collected over the past 2 years, coupled with other routine monitoring data, indicate the herd is now recovering. Nevertheless, the fact remains that confidence intervals around estimates of most population parameters are large enough to mask subtle changes that can combine synergistically to cause unanticipated changes in population trajectory. Thus, we should still consider that routine composition surveys and radiocollar data may not be sufficient for detecting small or short-term changes in population size and trend. Periodic censuses are necessary to confirm population trajectory.

The PCH remains lightly hunted, and harvest has not influenced recent population changes. The current rise in calf productivity and survival and the generally good physiological condition of animals in the herd is probably a response to mild climate. If mild weather continues, the herd should increase again.

The ADF&G is cooperating with NBS and Canadian government agencies to assess the importance of the ANWR coastal plain to the PCH. The department previously identified a portion of the ANWR coastal plain between the Hulahula and Aichilik rivers as being of special value to calving and postcalving caribou and recommended that area should receive special consideration in any plans to develop ANWR. However, more recent data gathered by NBS indicate all of the ANWR coastal plain and adjacent areas in Canada may be important to the herd over longer periods. The department should continue to work with other agencies to identify potential risks associated with developing the coastal plain. We should seek methods to avoid or mitigate impacts to caribou and other wildlife wherever they are found, rather than applying special restrictions or even complete protection to smaller areas.

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Table 1 Population estimates of the Porcupine Caribou Herd, 1961-1995

Year	Population estimate[a]	Type of estimate
1961	110,000	Calving ground census[b]
1972	99,959	APDCE[c]
1977	105,000	APDCE
1979	105,683	Modified APDCE
1982	125,174	Radiocensus[d]
1983	135,284	Radiocensus
1987	165,000	Radiocensus
1989	178,000	Radiocensus
1992	160,000	Radiocensus
1994	152,000	Radiocensus
1995[e]		

[a] All estimates include calves except for the 1961 estimate.

[b] Data presented by RO Skoog at the 1962 Alaska Science Conference.

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

[d] Valkenburg et al. 1985.

[e] No census.

Table 2 Porcupine Caribou Herd postcalving composition counts[a], 1971-1995

Approximate survey date	Bulls:100 Cows	Calves:100 Cows	Percent calves	Percent cows	Percent yrlgs	Percent small bulls (% of bulls)	Percent large bulls (% of bulls)	Percent bulls	Composition sample size
7/71	24	38	21	56	10			13	29,197
7/72	23	49	26	53	9			12	11,721
7/73	16	47	27	58	6			9	19,101
7/74	9	67	37	55	3			5	14,127
7/75	23	52	27	52	9			12	18,814
7/76	5	58	32	55	10			3	13,762
7/77	7	39	24	61	11			4	25,520
7/78	30	68	32	47	7			14	18,669
7/79	15	55	30	55	7			8	19,154
7/80	59	66	26	39	11			23	9,046
7/82[b]	95	43	15	36	15		46	34	19,718
7/83	9	73	38	52	5	61	39	5	2,583
7/86[b]	57	52	22	42	12			24	19,499
7/87[b]	72	62	24	38	10	49	51	28	33,044
7/88	28	54	27	50	10	57	43	14	6,420
7/89	17	46	25	55	11	77	23	9	23,242
7/90[b]									
7/91	36	46	28	46	10			17	16,060
7/92	27	55	27	49	10	62	38	13	18,217

[a] No composition data have been obtained since 1992.

[b] Only these surveys sampled all portions of the herd, including bull groups.

Table 3 Porcupine Caribou Herd harvest, 1984-1995

Regulatory year	Hunter harvest							
	Reported				Estimated unreported			
	M	F	Unk	Total	Alaska	Canada	Total	Total
1984-1985	49	4	0	53	500-700	4000	4500-4700	4553-4753
1985-1986	52	12	1	65	500-700	4000	4500-4700	4565-4765
1986-1987	70	14	0	84	1000-2000	500-1000	1500-3000	1584-3084
1987-1988	106	22	1	129	<500	2000-4000	2500-4500	2629-4629
1988-1989	82	7	0	89	<500	2000-4000	2500-4500	2589-4589
1989-1990	104	8	0	112	500-700	2000	2500-2700	2612-2812
1990-1991	19	1	0	20	100-150	1680	1780-1830	1800-1850
1991-1992	101	3	0	104	100-150	2774	2874-2904	2978-3028
1992-1993	78	1	0	79	658	1657	2315	2394
1993-1994	77	5	0	82	250	2934	3184	3266
1994-1995	72	3	0	75	200	2040	2240	2312
1995-1996	61	7	0	68	200			

Table 4 Hunter success in the Porcupine Caribou Herd from 1991-1992 through 1995-1996

Hunters	Unit					Total 25 and 26C
	25A	25B	25D	25	26C	
1991-1992						
Total hunters	62	8	2	72	22	94
Successful	43	1	0	44	7	51
% Successful	69	13	0	61	32	54
1992-1993						
Total hunters	67	23	0	90	6	96
Successful	48	11	0	59	4	63
% Successful	72	48	0	66	67	66
1993-1994						
Total hunters	45	9	1	55	28	83
Successful	33	1	1	35	19	54
% Successful	73	11	100	64	68	65
1994-1995						
Total hunters	49	13	2	64	14	78
Successful	36	2	0	38	8	46
% Successful	73	15	0	59	57	58
1995-1996						
Total hunters	57	9	1	67	21	88
Successful	32	2	0	34	10	44
% Successful	56	18	0	51	48	50

LOCATION

GAME MANAGEMENT UNIT: Western half of Unit 25C and small portions of northern Unit 20B and eastern Unit 20F

HERD: White Mountains

GEOGRAPHIC DESCRIPTION: White Mountains Area north of Fairbanks

BACKGROUND

Historically the Fortymile Caribou Herd calved in the White Mountains and moved southeast across the Steese Highway to wintering areas (Davis et al. 1978). As recently as 1960, 30,000 Fortymile caribou crossed the Steese Highway to summer in the White Mountains (Jones 1961). As the Fortymile Herd declined throughout the 1960s, they abandoned the traditional White Mountains calving area and remained southeast of the Steese Highway. However, in the late 1970s, public reports and incidental observations by biologists confirmed the year-round presence of caribou in the White Mountains, implying a small resident herd had existed for many years (Valkenburg 1988). White Mountains Herd (WMH) caribou now maintain a distinct calving area mostly east of Beaver Creek and are considered a separate herd.

The White Mountains National Recreation Area is managed by the Bureau of Land Management (BLM) and was created by Alaska National Interest Lands Conservation Act in 1980. In 1982 BLM and ADF&G initiated a cooperative project to determine the identity and distribution of caribou in the White Mountains. Caribou radiocollared during that project provided information on movements and distribution of the herd. The herd also provides a low-density comparison population for the long-term Delta Herd research project.

From 1990 to 1995 reported harvests averaged 17 bull caribou annually. Public use of the White Mountains is increasing, especially during early and late winter. The BLM continues to improve access and increase recreational opportunities through development.

In 1990 2 drawing permit hunts (877 and 878) were established to give people an opportunity to hunt caribou during winter in the White Mountains. One hunt (877) is a motorized access hunt and the other hunt (878) is a nonmotorized access only hunt. Although 100 permits were issued for the first 3 seasons (50 per hunt), success was low (6 caribou total). Since 1993 we issued 75 permits per hunt, totaling 150 permits. The reported harvest was zero in 1993, 3 in 1994, and zero in 1995. We are formulating plans to increase hunter success in the winter hunt.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Allow continued growth and natural regulation of the White Mountains Caribou Herd.
- Ensure that increased recreational use and mining development do not adversely affect the White Mountains Herd.

- Provide the greatest sustained opportunity for hunting caribou.
- Develop a creative strategy to increase winter hunting opportunities, while minimizing potential for overharvest.
- Provide an opportunity to view and photograph caribou.

MANAGEMENT OBJECTIVES

- Maintain a fall bull:cow ratio of 30 bulls:100 cows.
- Maintain a reported harvest of <75 caribou, including 30 cows during the winter drawing hunts.
- Maintain at least 20 radiocollared caribou in the herd to adequately measure herd dynamics.
- Conduct aerial surveys of the White Mountains Herd to monitor distribution and population composition annually and estimate population size at least every 3 years.
- Monitor anticipated increases in recreational use and mining development and ensure such development does not adversely affect the White Mountains Herd.

METHODS

On 6 July 1992 J Herriges (BLM) estimated herd size using a radiocensus technique (Valkenburg et al. 1985) with extrapolation for missing radios. He recorded locations of caribou and counted smaller groups. Using a 35-mm camera, he photographed all groups of caribou too large to count precisely. He used direct counts combined with photo counts to develop a minimum population estimate. No population censuses were conducted during 1994 or 1995.

We flew fall sex and age composition surveys in 1995 and 1996, using a fixed-wing aircraft to locate radiocollared caribou. A Robinson R-22 helicopter was used to classify individuals by sex and age. We classified caribou into 6 categories: cow, male calf, female calf, small bull, medium bull, and large bull.

During 1995 and 1996 BLM monitored the pregnancy rate of radiocollared WMH calves with fixed-wing aircraft. A cow was considered to be pregnant if she was followed by a newborn calf or if she had a distended udder or hard antlers.

We estimated harvest using data from returns of harvest report cards and drawing permit report cards. Caribou harvested north of the Steese Highway were considered White Mountain Herd caribou; caribou harvested south of the Steese Highway were considered Fortymile caribou. To separate the White Mountain Herd from the Ray Mountains Herd harvest in Unit 20F, we considered animals killed south of the Yukon River White Mountain Herd caribou.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The White Mountain Herd seems to be stable or slowly increasing (Table 1). In 1992 BLM counted 832 caribou, including all the radiocollared caribou. No photocensuses were done in 1995 or 1996. We believe the herd contained between 1200 and 1400 animals in 1996, based on 1995 and 1996 composition data, harvest data, and the 1992 estimate. To meet our census objective, we plan to census the herd in summer 1997. We will census the herd every third year.

Population Composition

In fall 1995 we classified 418 caribou in 6 groups including 17 of 22 radiocollared individuals. In fall 1996 we classified 513 caribou in 11 groups containing 17 of 22 radiocollared caribou.

Fall calf:cow ratios in the WMH have been variable but did not sink to the lows seen in the Alaska Range herds during the early 1990s. Calf:cow ratios have been high enough to allow the herd to grow in most years. The fall bull:cow ratio is high in the WMH. Variation in counts probably reflects unrepresentative sampling because of segregation of bulls after the rut. Early surveys (i.e., 29 Sep–6 Oct) yielded higher bull:cow ratios than later surveys (Table 1).

Distribution and Movements

The WMH caribou calve primarily in the higher parts of the White Mountains east of Beaver Creek including the Nome, Fossil, Cache, and Preacher creek drainages. Some scattered calving occurs west of Beaver Creek (Durtsche and Hobgood 1990). Postcalving aggregations occur from mid June to late July as far east as Mt Prindle (Fig 1). In August or September most caribou cross Beaver Creek and winter in upper Hess and Victoria creeks and the upper Tolovana River drainages. However, some WMH caribou winter in the Preacher Creek drainage west of Circle.

MORTALITY

Harvest

Season and Bag Limit. The fall hunting season was 10 August–20 September throughout the herd's range (Units 20B, 20F south of the Yukon River, and 25C) with a bag limit of 1 bull.

The winter drawing permit hunts were open for caribou hunting north and east of the Elliott and Dalton highways and north and west of the Steese Highway. During the 1994–1995 season, Hunt 877 was open 15–28 February and Hunt 878 was open 1–15 March. For the 1995–1996 season, Hunt 877 was open 1–28 February and Hunt 878 was open 1–31 March. There were 75 permits available for each hunt (150 total) since 1995. Use of motorized vehicles for hunting is prohibited for Hunt 878. The bag limit for both winter hunts was 1 caribou.

Board of Game Actions and Emergency Orders. At the March 1995 meeting, the Board of Game supported a department proposal to extend the winter drawing hunt season to 1 month for each hunt: February for motorized vehicles and March for nonmotorized vehicles. This should increase participation by permittees but will probably have minimal effect on harvest. As part of

that proposal, the board also allowed the department the flexibility to increase the number of permits issued up to 250.

Hunter Residency and Success. Most hunting pressure on the WMH in fall is from Fairbanks area residents. In 1994 83% (15/18) of successful hunters were from the Fairbanks area, and 17% (3/18) were other Alaska residents. None was a nonresident. In 1995, 40% (4/10) of successful hunters were other Alaska residents, 30% (3/10) were Fairbanks area residents, and 30% (3/10) were nonresidents. In 1994 and 1995 overall general season success rates were 12% and 8%, respectively (Table 2).

Success during the winter drawing hunt has been low since it began (Table 3). Success is highly dependent on caribou location, distribution, weather conditions, and permittee eligibility. Increases in season length increased participation in 1995. Future increases in the number of permits issued should also increase participation and success.

Transport Methods. During the 1994 fall hunting season, 94% (17/18) of successful hunters used either highway vehicles, 3- or 4-wheelers, or ORVs to transport them afield. Only 6% (1/18) used a boat for transportation. During the 1995 fall hunting season, 60% (6/10) of successful hunters primarily used 3- or 4-wheelers or highway vehicles to transport them afield; 40% (4/10) used airplanes (Table 4).

In the 1994–1995 winter season, 2 of the successful permittees used snowmachines and 1 used a 3- or 4-wheeler. During the 1995 and 1996 season, no hunters were successful in either permit hunt. During the motorized hunt, 9 hunters used snowmachines, 3 used highway vehicles, and 1 was unspecified; during the nonmotorized hunt, 13 hunters used either dogsled, skis/snowshoes, or a highway vehicle.

Winter travel in the White Mountains can be difficult for hunters. Expansion of developed trails and cabins provided by BLM is making winter access easier. However, access trails have not been well developed in caribou wintering areas, and most caribou winter in dense spruce forest, making hunting difficult.

Human-induced Mortality. Fall harvest is increasing but remains relatively low. The reported fall harvest of WMH caribou has ranged from 10 to 21 over the last 5 years (Table 5).

Only 3 hunters reported taking caribou during winter permit hunts in 1995, and no caribou were reported taken during the 1996 hunts. The level of interest is decreasing based on the number of drawing permit applications (615 in 1994, 295 in 1995, and 354 in 1996) (Table 3). Bad weather and poor traveling conditions significantly influence winter hunt participation. The other factor that affects winter participation is the ineligibility of hunters who have already harvested a caribou earlier in the season. Participation did increase with the increase in season length during spring 1996 (Table 3).

To estimate a harvest quota for the winter hunt, we utilized a computer population model designed by P Valkenburg and D Reed. The model estimates the WMH could easily sustain a winter harvest of 25 cows, while still sustaining a fall and winter harvest of 40 bulls.

CONCLUSIONS AND RECOMMENDATIONS

The WMH is stable or slowly increasing. Harvests are below the sustainable yield. Remoteness and inaccessibility are the major contributors to low harvest. Increased hunter effort and harvest during fall may occur because of the decline of other Interior caribou hunting opportunities and completion of a road to Beaver Creek from the Steese Highway.

Permits should be increased to increase hunter participation and harvest for the winter drawing hunts. Each hunt (877 and 878) should have 125 permits issued for a total of 250 permits. This increase in permits would increase the opportunity and likelihood that hunters will participate in this hunt.

The protection of key seasonal ranges from mining and recreational development should be considered during any land-use planning, including known and historic calving areas, summer ranges, wintering areas, and movement corridors.

We are meeting our objective to maintain a fall bull:cow ratio of 30 bulls:100 cows.

We are currently meeting our objective to maintain a minimum of 20 active radio collars in the population. We will need to begin budgeting for FY99 to deploy at least 10 new collars to continue to meet our objective.

We are not meeting our objective to monitor herd distribution. We radiotracked the herd primarily during the fall composition survey. We need to emphasize and collect more information on distribution; funds should be allocated to attain this objective.

We are not meeting our objective to estimate population size every 3 years. Difficulties inherent in WMH postcalving caribou distribution and location, low hunter participation and success, and fiscal considerations have made this objective a low priority. Funding from the FY98 or FY99 budgets should be used to complete this task.

We are meeting our objective to monitor increases in recreational uses and development by working closely with BLM. We need to continue attending meetings on development of BLM lands.

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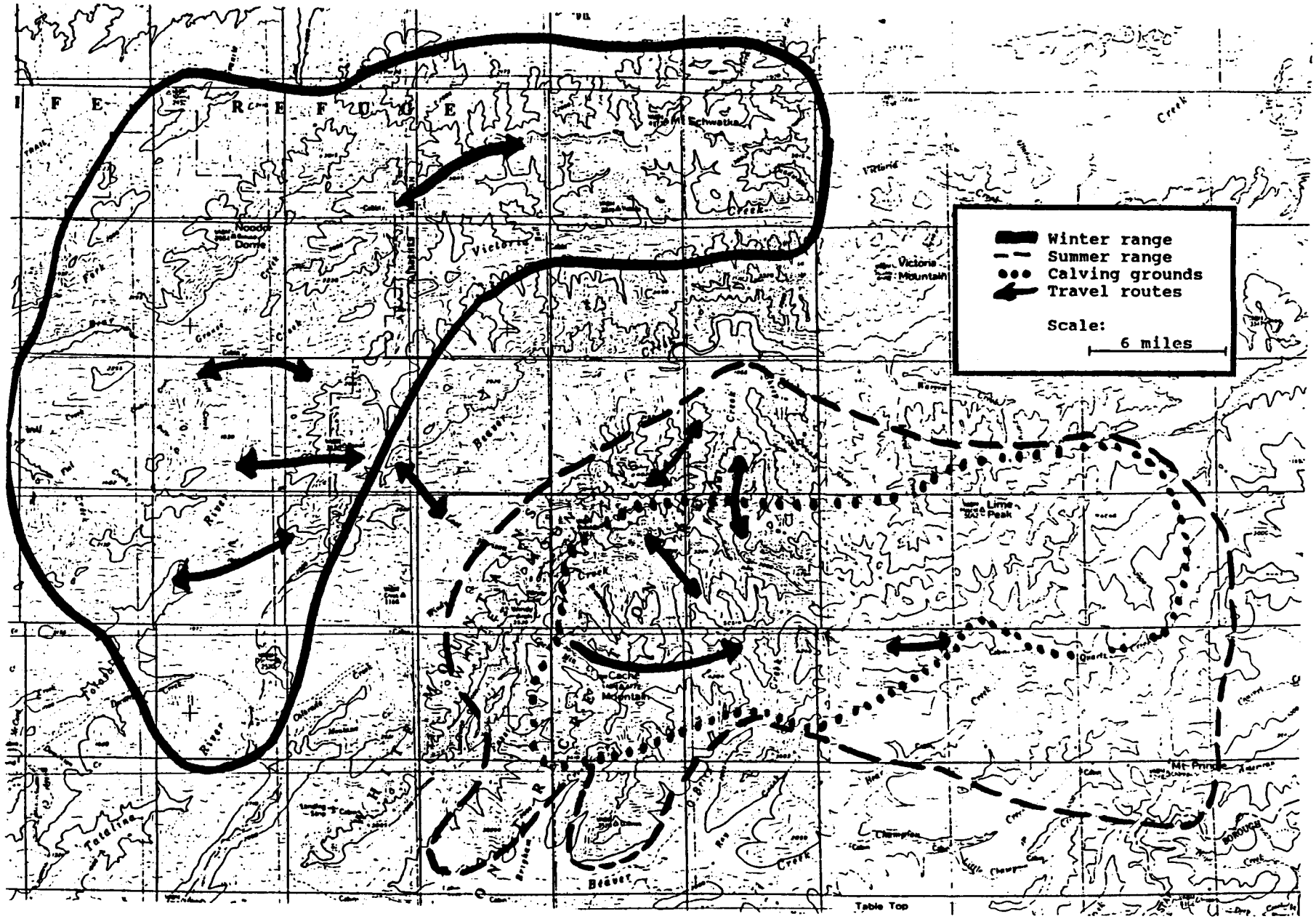

Figure 1 Approximate range of the White Mountains Caribou Herd (based on Durtsche and Hobgood 1990; Hobgood, pers commun).

Table 1 White Mountains caribou fall composition counts and estimated population size 1983–1996

Date	Bulls:100 Cows	Calves:10 0 Cows	Calves (%)	Cows (%)	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large (% of bulls)	Total bulls (%)	Composition sample size	Estimate of herd size
9/29/83	44	31	18	57	26	29	44	25	135	
10/85	36	31	18	60	0	0	0	22	65	
9/29/88	43	33	19	57	51	16	33	24	211	
10/06/89	50	36	19	54	46	33	22	27	744	750-1000
10/11/91	23	24	16	68	44	35	21	15	312	
10/29/91[a]			15						324	761[b]-1000
10/13/92	39	23	14	62	52	18	30	24	247	832[b]-1000
09/27/93	48	22	13	59	34	23	43	28	497	
10/04/94	39	25	15	61	34	24	42	24	418	
10/16-17/95	36	31	19	60	44	27	29	22	418	
10/2/96	44	54	27	50	60	20	20	22	513	

[a] Fixed-wing aircraft.
[b] Actual count of herd size.

Table 2 White Mountains Caribou Herd hunter residency and success during the fall hunting season, 1985–1995

Regulatory year	Successful				Unsuccessful		Total hunters
	Resident	Nonresident	Total	%	Total	%	
1985-1986			12	20	48	80	60
1986-1987			2	33	4	67	6
1987-1988			6	12	43	88	49
1988-1989			13	17	64	83	77
1989-1990	12	2	14	23	46	77	60
1990-1991	15	3	18	18	80	82	98
1991-1992	18	1	19	12	143	88	162
1992-1993	12	3	15	13	99	87	114
1993-1994	19	2	21	18	99	82	120
1994-1995	18	0	18	12	135	88	153
1995-1996	7	3	10	8	116	92	126

Table 3 Results of White Mountains Caribou Herd late winter (Feb/Mar) drawing hunts 877 and 878, regulatory year 1990–1995

Regulatory year	Number of permits available	Number of applicants	Number of permits issued	Harvest			Hunted unsuccessful	Did not hunt	Did not report
				Cow	Bull	Total			
1990-1991	100	229	89	1	2	3	18	66	2
1991-1992	100	409	100	0	0	0	12	88[a]	
1992-1993	100	537	100	2	1	3	19	76	2
1993-1994	150	615	150	0	0	0	26	120	4
1994-1995	150	295	149	2	1	3	26	116	5
1995-1996	150	354	137	0	0	0	37	98	1

[a] Includes those that did not report.

Table 4 Fall White Mountains caribou harvest by transport method 1988-1995[a]

Regulatory year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Other/unk	*n*
1988-1989	4	0	0	4	0	2	2	0	12
1989-1990	0	0	0	4	0	4	4	2	14
1990-1991	1	0	1	10	0	1	4	1	18
1991-1992	3	1	0	8	0	4	3	0	19
1992-1993	2	0	0	4	0	2	5	1	14
1993-1994	4	0	0	11	0	0	5	1	21
1994-1995	0		1	13	0	1	3	0	18
1995-1996	4	0	0	4	0	0	2	0	10

[a] Excludes winter permit hunts 577 and 578.

Table 5 White Mountains Herd caribou harvest 1987-1995

Regulatory	General season				Permit hunts 577 and 578				
year	M	F	Unk	Total	M	F	Unk	Total	Total
1987-1988	6	0	0	6					6
1988-1989	12	0	0	12					12
1989-1990	14	0	0	14					14
1990-1991	17	0	1	18	2	1	0	3	21
1991-1992	19	0	0	19	0	0	0	0	19
1992-1993	15	0	0	15	1	2	0	3	18
1993-1994	21	0	0	21	0	0	0	0	21
1994-1995	18	0	0	18	1	2	0	3	21
1995-1996	10	0	0	10	0	0	0	0	10

LOCATION

GAME MANAGEMENT UNIT: 26A (56,000 mi^2)

HERD: Lake Teshekpuk Lake

GEOGRAPHIC DESCRIPTION: Western North Slope

BACKGROUND

The presence of old drive sites near Teshekpuk Lake reflects the prehistory of caribou hunting in the area (Silva 1985). The area was used extensively for reindeer herding in the 1930s and 1940s, and local residents report observing caribou in the area throughout the year since the 1930s. The Teshekpuk Lake caribou herd (TLH) was documented in the mid-1970s as a separate herd from the Central Arctic (CAH) and the Western Arctic (WAH) caribou herds by Davis and Valkenburg (1978).

The Department and U. S. Bureau of Land Management (BLM) staff completed visual counts during 1978–1982 and estimated that 3000–4000 caribou inhabited the Teshekpuk Lake area (Davis and Valkenburg 1979, Reynolds 1981, and Silva 1985). In an effort to better assess the size and distribution of the TLH, 12 cows and 8 bulls were instrumented with radio collars in 1980 and monitored jointly by the department and BLM. The department and BLM conducted the first photocensus using a modified aerial photo-direct count-extrapolation (APDCE) technique during July 1984 and counted 11,822 animals. Trent and Toovak made a visual count in 1985 that included 13,406 caribou (ADFG files). As part of a joint project, the department, North Slope Borough Department of Wildlife Management (NSB), and BLM collared 17 cow caribou with VHF collars during 1986. We completed a photocensus in 1989 and counted 16,649 caribou (Carroll 1992); a photocensus in 1993 showed 27,686 caribou (Carroll 1995).

The TLH is an important subsistence resource to hunters from several North Slope villages. Collection of TLH harvest data has traditionally been incorporated into the WAH harvest reporting system because of range overlap between the two herds.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

The overall population management goal is to maintain stable or increasing numbers of caribou in the TLH and to provide continued hunting opportunity on a sustained yield basis.

MANAGEMENT OBJECTIVES

The operational management objectives defined in a draft cooperative management agreement between the ADF&G, NSB, and BLM are listed here.

1 Determine the herd population size every 2 to 3 years;

2 Determine the percentage of calves surviving their first winter;

3 Delineate the boundaries of the calving grounds annually;

4 Identify and map the movements and distribution of the herd throughout the year using aerial survey and radiotelemetry data;

5 Develop a system to capture caribou for radiocollaring without the use of drugs;

6 Encourage local participation in research and management decisions;

7 Determine harvest using methods acceptable to hunters and participating agencies;

8 Determine significant sources of nonhunter mortality.

METHODS

We completed a photocensus during 1995, using a modified APDCE technique (Davis et al. 1979). Photographs were taken from a DeHavilland Beaver (DHC-3) aircraft with a floor-mounted camera on 12 July 1995 while TLH caribou were in insect-relief aggregations. A Cessna 206 with telemetry equipment was used to detect how many radiocollared TLH animals were in the photographed groups and if there were instrumented WAH caribou in the area. Department and NSB staff counted images of caribou on the photographs the following winter.

Short yearling recruitment surveys were flown using a Cessna 185 on 24 April 1995 and a Piper PA-18 on 21 April 1996. We used telemetry equipment to locate radiocollared caribou and classified approximately 100 animals near each instrumented animal as adults or short yearlings. During 1–4 May 1996 I conducted a ground survey while traveling by dog team between Umiat and Barrow and classified caribou along the route.

We completed calving ground surveys on 8 and 12 June 1995 and on 7 and 14 June 1996, using a Piper PA-18 aircraft. We used telemetry equipment to locate as many collared cows as possible and observed them at close range to determine the success, timing, and location of calving. We used a Global Positioning System (GPS) receiver to record latitude and longitude of the calving locations. We worked with the North Slope Borough Geographic Information System to plot known calving locations since 1990.

Postcalving composition surveys were flown on 20 July 1995. We used a Hughes 500 helicopter to fly transects north of Teshekpuk Lake and categorized caribou as cows, calves, or bulls.

Using a Cessna 185, we completed a fall composition survey on 4 October 1994. We used radiotelemetry equipment to locate collared cows and classified up to 100 animals near the collared animals as calves or adults. The use of telemetry equipment allowed us to distribute our sampling effort throughout the range of the TLH.

Through a cooperative project with the NSB and BLM, 18 female caribou were captured using a Hughes 500 helicopter equipped with a skid-mounted net gun during July 1995. We attached Platform Transmitter Terminal collars (satellite radiocollar transmitters or "PTTs") on 8 animals and standard VHF collars on 10 animals to aid in population, productivity, and movement

studies. We collected blood samples and measured, weighed, and assessed the body condition of all captured caribou. Eight caribou were collected and necropsied to test for disease, parasites, trace elements, contaminants, and nutrient deficiencies. We involved 7 students from various North Slope villages in the capture, sampling, and necropsy work. During the last 4 school years, students from several different schools have been tracking movements of the satellite collars.

The PTTs were designed to transmit on a 6-hour per 48-hour duty cycle. We received satellite location data from the Argos Data Collection and Location System (ARGOS) using 2 methods. Current location information was retrieved from ARGOS using a computer and modem on an 'as-needed' basis. ARGOS also distributed monthly microcomputer diskettes summarizing all locations for the preceding month. In addition to receiving caribou locations from ARGOS, we completed periodic VHF radiotracking flights to collect information on caribou movements and distribution.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

From census photographs taken on 12 July 1995, department and NSB staff counted 25,076 caribou. This is a decrease of 4.8% per year since the last count of 27,686 in 1993. Previously, the population had increased at a rate of 13.5% per year between 1989 and 1993 (Table 1).

Population Composition

Short yearling recruitment increased during the report period. In April 1995 we counted 18 short yearlings:100 adults (n = 1637), and in April 1996 we counted 31 short yearlings:100 adults (n = 1486). In addition, on the ground survey of caribou in May 1996, I observed 1362 caribou including 336 calves, yielding 33 short yearlings:100 adults. The proportion of short yearlings observed in 1996 was much higher than in most previous years (Table 2).

The following summary of calving observations shows an increase in calving during the report period. In June 1995, 11 of 22 (50%) radiocollared cows were seen with these calves. Five calves were born before 8 June and 6 were born between 8 and 12 June. In June 1996 we located 26 cows with radio collars. Of the cows >3 years old, 22 of 24 (92%) calved successfully. Sixteen calves were born by 7 June and 6 were born between 7 and 14 June. One cow (Collar No.9515) may have had twin calves, as she was seen twice with 2 calves at heel. The 1996 calving rate was the highest we have witnessed from collared TLH caribou. Most calving took place east, northeast, and north of Teshekpuk Lake. During 1996 more calves were born north of the lake than usual. The known calving locations since 1990 are shown in Figure 1.

During postcalving composition surveys in July 1995, we classified 1987 caribou as 824 cows, 560 bulls, and 603 calves. We calculated the proportions to be 41% cows, 30% calves, 73 calves:100 cows, 29% bulls, and 68 bulls:100 cows (Table 3). Compared to 1993, the percent cows and percent bulls showed slight changes; however, the percent calves was twice the previous count.

Distribution and Movements

Radiocollars and direct observations have been used during the last decade to develop a generalized description of movement patterns of TLH caribou. The herd does not follow any consistent movement pattern during the fall and winter, but spring and summer movements are fairly predictable with most of the herd using critical areas to the east and north of Teshekpuk Lake (Philo et al. 1993).

Most TLH caribou move toward the southeastern side of Teshekpuk Lake during May. In early June most of the females move into the calving area northeast, east, and southeast of Teshekpuk Lake while most males are south and west of the lake. During late June through July, caribou of both sexes seek relief from insect harassment along the Beaufort Sea coast from Dease Inlet to the mouth of the Kogru River, around the edges and on islands of Teshekpuk Lake, and on sand dunes along the Ikpikpuk River and south of Teshekpuk Lake. Fall and winter movements are highly variable, with most of the herd wintering in a different area each year.

In previous years the TLC has wintered in varied locations from the Chukchi coast to the south side of the Brooks Range. In 1990–1991 about half of the herd wintered south of the Brooks Range and half on the Chukchi coast; in 1991–1992 most of the herd wintered within 30 miles of Teshekpuk Lake; in 1992–1993 the herd was split between the northern foothills of the Brooks Range and the coastal plain; and during 1993–1994 icing on the coastal plain caused most of the TLH to move into the area between Umiat and Anaktuvuk Pass with a portion of the herd moving to the south side of the mountains.

During 1994–1995, we monitored the movements of 3 satellite-collared caribou throughout the year. Two animals wintered on the Chukchi Sea coast and 1 wintered near Cape Lisburne. Two animals spent the spring of 1995 in the WAH calving grounds and 1 of the TLH collared animals calved near the Kokolik River among WAH caribou. The third TLH caribou returned to calve in the Teshekpuk Lake calving grounds. All satellite collared caribou survived the winter of 1994–1995.

During 1995–1996 we monitored the movements of 9 satellite collared caribou. The weather was mild, with no severe icing conditions, and all the satellite collared caribou wintered on the coastal plain, mostly between Dease Inlet and Wainwright. One animal, collared in 1993, calved with the WAH near the Utukok River. The other 8 caribou traveled to calve east of Teshekpuk Lake. All 9 satellite-collared caribou survived the winter of 1995–1996.

MORTALITY

Harvest

Season and Bag Limit. The hunting season and bag limit was the same for both regulatory years of the reporting period.

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 26A		
Resident Hunters: Five caribou per day; cow caribou may not be taken 16 May–30 June	1 July–30 June	
Nonresident Hunters: Five caribou total; cow caribou may not be taken16 May–30 June.		1 July–30 June

Hunter Harvest. At this time, it is impossible to determine the total TLH caribou harvest because 1) most hunters harvesting TLH caribou also harvest caribou from other herds, and there is no easy way to distinguish animals from different herds; 2) the TLH harvest is reported using the WAH harvest reporting system, and it is not possible to separate the TLH and WAH harvests reported in Unit 26A; and 3) only a small proportion of North Slope hunters actually report their harvest.

Local subsistence hunters are responsible for most of the TLH harvest because the area is remote and largely inaccessible to nonlocal hunters. Hunting pressure comes primarily from several North Slope villages.

Telemetry information shows a large proportion of the caribou harvest from 1994–1996 near Atqasuk, Wainwright, Nuiqsut, and Barrow were from groups of TLH caribou located near these villages. If current harvest patterns are similar to previous years, the total harvest of caribou from the TLH includes about 2500 animals per year. Harvest levels of TLH caribou are strongly influenced by the distribution of animals during the fall and winter, especially their proximity to villages or easy routes of travel.

Hunter Residency and Success. Most hunters were local residents of Unit 26A. Nonlocal residents and nonresident hunters took a small proportion of TLH caribou, primarily from the Colville River drainage. No quantitative data are available on hunter success, but we believe success rates were high.

Harvest Chronology. Most of the harvest occurred during July through October. Few caribou were taken during the early winter, but harvests increased during February and March. Braund and Associates (1989) have summarized harvest chronology for Barrow (Table 4), and the harvest pattern for other villages is believed to be similar. However, more spring caribou hunting

occurred in Nuiqsut and Atqasuk because hunters are not occupied with spring whaling, as they are in Barrow.

Transport Methods. Caribou hunters in Unit 26A used a wide variety of transport methods. Most people used boats to hunt TLH caribou during July, August, and September, and snowmobiles were used during the remainder of the year. Some use of aircraft and ATVs occurs throughout the year. Hunters occasionally used highway vehicles when caribou moved near the limited road systems, particularly the Gas Well Road near Barrow. Most nonlocal residents use aircraft.

Other Mortality

We have recorded sizable caribou die-offs in the past years within the range of the TLH. During the winter of 1989–1990, many dead and lethargic caribou were found in an area between Teshekpuk Lake, the Ikpikpuk River, and the Colville River. We estimate approximately 2000–3000 caribou died in this area, but it is impossible to determine how many were from the TLH because caribou from the WAH or the CAH may also have been present in the area (Carroll 1992).

During the winter of 1992–1993, at least several hundred, and probably over 1000, caribou died in the area to the east of Teshekpuk Lake and south of the Kogru River during a period of extremely cold, windy weather. Radio collars indicated that most of these animals were from the TLH. During that winter 36% of the collared TLH caribou died (Carroll, 1995).

We did not observe any unusual mortality events among TLH caribou during this reporting period. During 1994–1995 the mortality rate for caribou instrumented with VHF collars was 14%. During 1995–1996 the mortality rate was 4%, the lowest yearly mortality rate we have recorded. Mortality rates for caribou instrumented with VHF collars for most other years range between 11% and 16%.

HABITAT

Assessment

No efforts were made to quantitatively assess the quality of TLH range. As mentioned above, many caribou appeared to have died as a result of weather and poor nutrition east of Teshekpuk Lake during 1989–1990 and 1992–1993, indicating the area may have been overgrazed or that snow conditions impeded proper foraging.

Oil development is probably the main threat to habitat within the range of the TLH. Extensive development has taken place a short distance to the east, and portions of the TLH range may eventually be developed for drilling or transporting oil. Results of satellite telemetry studies (Philo et. al. 1993), VHF radiotracking flights, and composition surveys indicated that the area to the east and north of Teshekpuk Lake are critical for calving, migration, and insect relief.

CONCLUSIONS AND RECOMMENDATIONS

The number of caribou counted by photocensus declined at a rate of 4.8% per year from 27,686 in 1993 to 25,076 in 1995. This follows a period of growth when the herd increased at a rate of

13.5% each year since 1989, when the count was 16,649 animals. The herd may be in another growth phase as conditions were very favorable during the year of 1995–1996. We recorded the lowest mortality rate (4%), the highest short yearling survival rate (32 calves:100 adults), and the highest calving rate (92%) for all the years we have been collecting data on the TLH. We recommend continuation of census and composition work to adequately monitor the population.

Telemetry studies show there is range overlap and exchange of individuals between the TLH, CAH, and WAH. Since 2 of 3 satellite-collared TLH caribou (collared north of Teshekpuk Lake) spent the spring of 1995 in the WAH calving grounds, we know there is some exchange between the TLH and WAH. In addition, caribou that have been collared in the CAH area have permanently moved into the TLH home range. If considerable exchange is occurring among herds, changes in population size of the TLH may reflect immigration or emigration rather than actual productivity or mortality. Long-term telemetry studies of all 3 herds are needed to understand the extent of exchange.

Considering the difficulty to accurately assess harvest levels for the TLH, the NSB Department of Wildlife Management has implemented a harvest documentation program using local village residents hired as harvest monitors. This program will be a valuable source of information for harvest of TLH caribou.

Because federal laws prohibit the use of capture drugs during an open hunting season, and at the request of local people, we reached our goal of capturing caribou without the use of immobilizing drugs. During 1995 we used a helicopter with a skid-mounted net gun to capture caribou. After netting, we used hobbles and masks to control the caribou. No sedatives were used even when measuring, weighing, and collecting blood from the animals. We had 1 mortality when a caribou fell after becoming tangled in the net. The carcass was donated to the Senior Citizen's Center in Barrow.

Satellite radiotelemetry has been very useful in increasing our understanding of TLH movements. It has shown that TLH caribou move much more extensively than previously known. Some of these movements would have been impossible to track using standard VHF radiotelemetry. Satellite telemetry has clearly illustrated that while movements are fairly consistent during the spring and early summer, winter movements show great variability. VHF collars have been very useful in our conducting censuses, composition surveys, and productivity studies. We need to continue using both satellite and VHF collars to monitor herd status.

To provide educational opportunities, we allowed 7 students from various North Slope schools to assist in the caribou capture operation, collect samples from the captured caribou, and help with necropsy work. In addition, we have been working with several school classes and teaching them to plot caribou locations so they can track the movements of satellite-collared caribou for the last 4 school years.

Using satellite and VHF collars, we have learned that the area to the east, northeast, and southeast of Teshekpuk Lake is critical for calving. In addition, most of the herd travels to the area north of the Lake for insect relief each summer. Although movements are variable during

much of the year, most of the herd consistently travels through and uses these areas each year. Developing these areas or blocking caribou access to them could be very detrimental to the herd.

Because the TLH population remains high, we do not recommend any regulatory changes.

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Table 1 Population estimates and average annual rate of change of the Teshekpuk Lake caribou herd, 1978–1995

Year	Population estimate	Average annual rate of change
1978-1982	3000-4000[a]	N/A
1984	11,822[b]	N/A
1985	13,406[a]	N/A
1989	16,649[b]	7.1%[c]
1993	27,686[b]	13.5%[c]
1995	25,076[b]	-4.8%[c]

[a]Derived from visual estimate.
[b]Derived using aerial photocensus.
[c]Rate of change calculated using only numbers derived from photocensus.

Table 2 Spring composition data for the Teshekpuk Lake caribou herd, 1990–1996

Year	Adults	Short Yearlings	Total	Short Yearlings:100 Adults
1990	278	74	352	27
1991	532	168	700	24
1992	635	223	858	26
1993	1197	265	1462	22
1994	1281	205	1486	16
1995	1382	255	1637	18
1996	1787	575	2362	32

Table 3 Teshekpuk Lake caribou herd postcalving composition counts, June–July, 1991–1995

Date	Bulls: 100 Cows	Percent Bulls	Calves: 100 Cows	Percent Calves	Percent Cows	Composition Sample Size
1991	25	13	66	35	52	3673
1992	93	34	80	29	37	3047
1993	98	37	39	15	38	2959
1995	68	29	73	30	41	1987

Table 4 Percent and chronology of annual caribou harvest among Barrow residents 1987–1990[a]

Year	Mar–Apr	May–Jun	Jul–Aug	Sep–Oct	Nov–Dec	Jan–Feb	Annual Harvest
1987-1988	5%	5%	40%	44%	1%	5%	1595
1988-1989	5%	6%	38%	41%	4%	6%	1533
1989-1990	6%	2%	49%	29%	3%	11%	1656

[a]Data from Braund et al. 1991.

LOCATION

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

HERD: Central Arctic

GEOGRAPHIC DESCRIPTION: Central Arctic Slope and Brooks Range

BACKGROUND

Biologists first recognized the Central Arctic Caribou Herd (CACH) as a discrete herd in the mid-1970s (Cameron and Whitten 1979). Much of the herd's summer range lies within, or adjacent to, the industrial area near Prudhoe Bay. The CACH winters to the south and southeast of the oilfield, from the northern foothills to the southern slopes of the Brooks Range. Variable mixing frequently occurs with the Porcupine Caribou Herd on summer and winter range to the east and with the Western Arctic and Teshekpuk herds on winter range to the west. However, there is no documentation of permanent exchange of caribou between these herds.

The CACH grew from an estimated 5000 caribou in 1975 to over 23,000 in 1992 (Cameron and Whitten 1979; Whitten and Cameron 1983*a*; Whitten 1988; Valkenburg 1993; ADF&G files). Summer 1995 herd size was estimated at 18,100. The rate of herd growth decreased steadily between 1985 and 1993 (Valkenburg 1993), and herd size has probably stabilized in the last few years. Cameron (1993) suspected the herd may have reached or even exceeded carrying capacity.

Oil exploration and development on the North Slope in the late 1960s provided the impetus for long-term Alaska Department of Fish and Game (ADF&G) studies of the population dynamics, distribution, movements, and effects of development on the CACH. During the 1980s calving activity was rare in the Prudhoe Bay oilfield (Whitten and Cameron 1985) where it was known to occur before development. Additionally, cows and newborn calves were underrepresented along the Trans-Alaska Pipeline corridor and around oil production facilities in the early 1990s (Cameron et al. 1992, Cameron and Smith 1992). By the mid-1980s major movements of CACH caribou through the Prudhoe Bay oilfield described by Whitten and Cameron (1983*b*) in summer no longer occurred. Caribou distribution and movements within the Kuparuk oilfield were altered substantially (Smith and Cameron 1983, 1985*ab*; Whitten and Cameron 1983*b*, 1985; Curatolo and Murphy 1986). This report summarizes harvest data, population size, sex and age composition, and movement data from July 1994 through June 1996.

MANAGEMENT DIRECTION

Based on the hypothesis that displacement, if of sufficient magnitude, would be harmful to the CACH (Cameron 1983), ADF&G proceeded with 2 management approaches. We worked with the oil industry to minimize disturbance to caribou movement from barriers created by oil development. Acting on the assumption that stress is cumulative, ADF&G also reduced hunting activity in areas adjacent to the oilfield and the pipeline haul road. Current management objectives reflect these concerns.

MANAGEMENT GOALS AND OBJECTIVES

Minimize the adverse effects of development on caribou.

- Work with industry to prevent the construction of barriers to the free passage of caribou.
- Work with industry and other agencies to minimize disturbance to caribou near developments, except where caribou constitute a hazard.
- Maintain necessary restrictions on caribou hunting.

Provide for continued caribou hunting at a level that does not significantly affect population dynamics of the CACH, especially in areas away from developments.

- Determine the influence of current harvest levels on the CACH.
- Minimize harvest of cows from the CACH.
- Maintain a bull:cow ratio of at least 40:100.

Maintain opportunities for people to see caribou along the Dalton Highway and in the oilfields.

- Work with industry and other agencies to minimize disturbances to caribou near developments, except where caribou constitute a hazard.
- Regulate hunting along the Dalton Highway so conflicts between hunters and nonconsumptive users are minimized and hunting does not displace caribou from the vicinity of the road.

METHODS

POPULATION SIZE

Population size was estimated in July 1995 using the modified aerial photo-direct count-extrapolation technique described by Davis et al. (1979). Postcalving aggregations of caribou were located by radiotracking previously radiocollared caribou. Groups of caribou were photographed with a Ziess RMK-A 9x9-inch aerial photography camera mounted in a Dehavilland Beaver. Caribou were counted directly from the photographs.

POPULATION COMPOSITION

We estimated herd composition from counts conducted from a helicopter in mid October. Observed caribou were classified as cows, calves, and small, medium, or large bulls.

HARVEST

Harvest of caribou by nonlocal hunters was estimated from returns of harvest ticket report cards during 1994-1996. Alaska residents residing north of the Yukon River are not required to obtain

the standard caribou harvest tickets or harvest report cards. The Division of Subsistence estimated caribou harvest at Kaktovik and Nuiqsut, providing the best available information on caribou harvest from the CACH by local residents. We assumed all caribou that are reported on harvest ticket report cards from Unit 26B to be CACH caribou, although during fall and winter occasional mixing with the Porcupine Herd may occur in the southeast corner of the subunit.

MOVEMENTS AND DISTRIBUTION

We determined movements of the CACH from relocations of radiocollared females during June and July, early October, and late April.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The estimated size of the CACH was 18,100 in July 1995 based on the photocensus conducted during the postcalving aggregation. The photocensus scheduled for July 1994 did not occur because of mixing of the CACH with the Porcupine Caribou Herd. It is generally believed that herd growth of the CACH has leveled off.

Population Composition

Summer composition data through 1992 for the CACH indicated a general decline in recruitment beginning with the 1986 cohort (Table 1). Fecundity in radiocollared cows was relatively low in the late 1980s and early 1990s (e.g., 75% in 1992; Cameron 1993, 1994; ADF&G files). Survival of calves to 2 weeks was variable but particularly low in 1989. Cameron (1993) reported variability in calf numbers and fecundity was apparently related to nutrition. No summer composition counts were conducted in 1995 or 1996. The effects of wolf and grizzly bear predation on the CACH are unknown.

Fall composition data for the CACH indicate the bull:cow ratio continues to be high (Table 2). A few bulls from the Western Arctic Herd and the Porcupine Herd may mix with some parts of the CACH during fall. In any event, increased harvest of bulls within the range of the CACH would not be detrimental to the herd. A fall composition count conducted in October 1996 indicated a bull:cow ratio of 61:100 and calf:cow ratio of 67:100.

Distribution and Movements

Calving and summer distribution of CACH caribou occurs on the coastal plain. In early fall the herd gradually moves toward the northern foothills of the Brooks Range. The herd has occupied areas further south, often on the southern slopes of the Brooks Range, during the past several winters. Variable numbers of Western Arctic caribou have ranged as far east as the pipeline in fall, and it is not uncommon for caribou from the Western Arctic, Porcupine, and Teshekpuk herds to be mixed in with some caribou from the CACH at various times and places during the winter and with Porcupine Herd caribou during July. Since 1975 no radiocollared caribou have calved in 1 herd and subsequently moved to and calved in an adjacent herd.

MORTALITY

Harvest

Most of the harvest of the CACH occurs in Unit 26B. Occasionally portions of the herd winter in the northern part of Units 24 and 25A, mixing with the Western Arctic and Porcupine caribou herds.

Season and Bag Limit.

Units and Bag Limits	Resident/Subsistence Open Seasons	Nonresident Open Seasons
Unit 24 (other than Kanuti drainage)		
Resident Hunters: 5 caribou per day; however, cow caribou may not be taken 16 May–30 June.	1 Jul–30 Jun	
Nonresident Hunters: 5 caribou; however, cow caribou may not be taken 16 May–30 June.		1 Jul–30 Jun
Unit 25A		
Resident Hunters: 10 caribou.	1 Jul–30 Apr	
Nonresident Hunters: 5 caribou.		1 Jul–30 Apr
Unit 26B		
That portion north of 69°30′ and west of the east bank of the Kuparuk River to a point at 70°10′N lat 149°04′W long, then west approximately 22 miles to 70°10′ lat 149°56′W long, then following the east bank of the Kalubik River to the Arctic Ocean.		
Resident Hunters: 10 caribou.	1 Jul–30 Apr	
Nonresident Hunters: 5 caribou.		1 Jul–30 Apr

Units and Bag Limits	Resident/Subsistence Open Seasons	Nonresident Open Seasons
Unit 26B within the Dalton Highway Corridor Management Area		
Resident Hunters: 2 caribou; however, only 1 caribou may be taken from 1 Jul through 30 Sep, and cow caribou may be taken only from 1 Oct–30 Apr.	1 Jul–30 Apr	
Nonresident Hunters: 2 bulls; however, only 1 bull may be taken 1 Jul–30 Sep.		1 Jul–30 Apr
Remainder of Unit 26B		
Resident Hunters: 2 caribou; however, cow caribou may be taken only from 1 Oct through 30 Apr.	1 Jul–30 Apr	
Nonresident Hunters: 2 bulls.		1 Jul–30 Apr
Unit 26C		
Resident Hunters: 10 caribou; only bull caribou may be taken 23 Jun-30 Jun.	1 Jul–30 Apr	
Nonresident Hunters: 5 caribou.		1 Jul–30 Apr

Additional regulations affecting the taking of CACH caribou include special restrictions on hunting in the Dalton Highway Corridor Management Area (DHCMA) 5 miles either side of the Dalton Highway between the Yukon River and the Prudhoe Bay Closed Area. The DHCMA is closed to hunting except with bow and arrow. Hunters must possess a valid International Bowhunter Education Program card when hunting within the corridor. In addition, motorized vehicles, except aircraft, boats, and licensed highway vehicles may not be used to transport game or hunters within the DHCMA. Any hunter traveling on the Dalton Highway must stop at department checkstations within the Dalton Highway Management Area.

Federal subsistence hunting regulations also apply on federal lands within the DHCMA. During the 1992–1993 hunting season, federal regulations allowed rural subsistence hunters to use firearms for hunting on federal land within the DHCMA, including rural residents from south of

the Yukon River. Federal regulations since the 1993–1994 hunting season have allowed firearms for hunting on federal land within the corridor only by residents of the corridor and nearby villages.

Board of Game Actions and Emergency Orders. In 1993 a positive "Customarily and Traditional" use finding by the Federal Subsistence Board restricted the eligibility for subsistence hunting of the CACH on federal lands to only those residents of Anaktuvuk Pass, Kaktovik, Nuiqsut, and Wiseman. This finding qualified those residents to use firearms for caribou on federal lands in the DHCMA. Rural residents from other than those communities who had previously used firearms to hunt caribou on federal lands within the DHCMA were restricted to bow only. Effective with the 1996–1997 regulatory year, the bag limit for caribou in Unit 26B outside the DHCMA (not including that area southwest of the Kalubik and Kuparuk rivers) was changed to 2 caribou. The restriction on taking cows until 1 October remained. The restriction on taking only 1 bull caribou within the DHCMA prior to 1 October remained. No emergency orders were issued during this reporting period. A regulation closing caribou hunting on federal lands within the DHCMA in Unit 26B to all but federally qualified local subsistence hunters was adopted by the Federal Subsistence Board (FSB). A formal Request for Reconsideration submitted by ADF&G convinced the FSB that information provided to procedures followed by the FSB were in error, and the regulation was rescinded just prior to the start of the 1995 caribou hunting season.

Hunter Harvest. To curtail a rapidly increasing harvest of CACH caribou, more restrictive regulations were adopted in 1986. This resulted in a steadily declining harvest until the 1991–1992 season (Table 3). At that time, interest in hunting CACH caribou increased, especially within the DHCMA, largely because of reduced opportunities to hunt caribou in the Delta, Macomb, and Fortymile herds beginning in fall 1990. After the dramatic increase in hunting activity for CACH caribou in 1991–1992, a steady decline has occurred since the 1992–1993 season (Table 3). Checkstations were operated in 1991, 1992, 1993, and 1996. Checkstation reports are available.

Estimated harvest of caribou by residents of Kaktovik and Nuiqsut was similar to that in previous years and, as in the past; was highly dependent on herd distribution. Despite the lower recruitment in recent years before 1996, the bull:cow ratio in the CACH remains high. The herd could sustain a harvest of at least 1000 bulls or more.

Hunter Success. During the 1994–1995 regulatory year, 584 hunters reported hunting caribou within the range of the CACH. Of these, 318 hunters reported taking 340 caribou. During the 1995–1996 regulatory year, 571 hunters reported hunting caribou within the range of the CACH. Of these, 305 hunters reported harvesting 336 caribou (Table 3). In 1994–1995, 118 (32%) successful hunters reported using bows for taking caribou, and 79 (26%) successful hunters used bows in 1995–1996. Harvest from the returned harvest ticket report cards includes both hunters driving the Dalton Highway and those accessing Unit 26B by other methods. Caribou hunter success in Unit 26B can be high because visibility is good, caribou are numerous, and the Dalton Highway provides access to a large area. The cause for the decrease in hunter numbers in the past several years is unknown.

Harvest Chronology. Although caribou may be taken in Unit 26B during any month except May or June, the greatest proportion of the harvest occurs from August through October (Table 4).

Transport Methods. In 1994 the Dalton Highway was officially open to private vehicles. Before 1994 the Dalton Highway north of Dieterich Camp was officially closed to private vehicles, and after 31 August the corridor north of the Yukon River was also officially closed to private vehicles. Few people obeyed those closures, and the statute was not enforced. In fact, ADF&G no longer relied on those restrictions to limit the take of caribou, and management decisions presumed the Dalton Highway was open. There was great concern that the opening of the highway to private vehicles would greatly increase the number of caribou hunters and adversely impact the herd. Based on harvest card returns, numbers of caribou hunters using the highway to access the CACH decreased.

Because of restrictions on the use of off-road vehicles within the DHCMA and the remoteness of Unit 26B, hunters use either aircraft, highway vehicles, and boats for access (Table 5). Check-station and harvest report data may underestimate the use of aircraft because some Fairbanks-based hunters fly directly to the subunit. Rifle hunters were likely to use either aircraft or highway vehicles, while most bow hunters used only highway vehicles. Use of boats on the Ivashak and Sagavanirktok rivers continues to increase. Some hunters have started to trailer airboats up the Dalton Highway to use in the Sagavanirktok and tributaries.

Natural Mortality. Summer natural mortality of CACH caribou (especially calves) is low, primarily because calving takes place in relatively wolf-free and bear-free areas near the coast. Until 1990 most CACH caribou wintered in the northern foothills and arctic coastal plain. Wolves in this area have been hunted effectively by Nuiqsut residents for many years and by aircraft hunters before 1987. Wolf numbers have probably been periodically reduced below natural levels. Rabies may be a factor that occasionally decimates wolves north of the Brooks Range. Since 1990 many CACH caribou have wintered in the central Brooks Range, and winter mortality may now be higher. Radiocollared caribou are tracked infrequently during winter, making it difficult to estimate adult mortality or determine causes.

HABITAT

Assessment

Habitat of the CACH has been more intensively studied than any other habitat for an Alaskan arctic herd. Caribou/habitat/development relationships are the subject of ongoing long-term research by ADF&G and the US Fish and Wildlife Service (FWS). The FWS has ongoing habitat mapping and assessment projects, but no final reports are available.

CONCLUSIONS AND RECOMMENDATIONS

Although the growth rate of the CACH decreased in recent years, the low level of summer predation on calves and the high bull:cow ratio will make it possible to harvest at least 1000 caribou/year for several years. The presence of Western Arctic and other caribou in Unit 26B in some years in fall and winter may also relieve harvest pressure on the CACH. Harvest (particularly of bulls) has been liberalized seemingly without compromising management goals and objectives.

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Table 1 Central Arctic Herd caribou calving composition counts and estimated population size, regulatory years 1978–1996

Survey date	Yearling: 100 Cows	Bulls:100 Cows	Calves:100 Cows	Percent calves	Percent yearling	Percent cows	Percent bulls	Composition sample size	Population size
6/78		19	68	36		53	10	950	5000
6/79	24	6	80	38	12	47	3	1865	
6/80	48	4	69	31	22	45	2	787	
6/81	22	9	87	40	10	46	4	3337	8537
6/82		20	62	34		55	11	1101	
6/83		16	86	42		50	8	1879	12,905
6/12/84	25	9	89	40	11	45	4	2692	
6/13-14/85	35	16	88	37	14	42	7	2357	
6/12-13/86	33	7	56	29	16	51	4	891	
6/13/87	19	4	74	37	10	51	2	4839	
6/10-15/88	32	7	66	32	16	49	3	4892	
6/11-15/89	16	6	48	28	9	59	4	2520	
6/11-15/90	11	31	75	35	5	46	14	6543	
6/17-20/91[a]	29	73	45	18	12	40	30	2500	19,046[b]
6/11-14/92	12	6	73	38	6	53	3	5556	23,444[c]
1993[d]									
1994[d]									
6/29/95[e]		113	50	19		38	43	454	18,100[f]
1996[d]									

[a] Estimated from random stratified quadrat survey of entire caribou distribution. Results not directly comparable with other years.

[b] Ninety percent confidence interval was 14,677 to 23,414.

[c] 9 July 1992 photocensus.

[d] No survey.

[e] Only caribou east of Sagavanirktok River sampled in composition count.

[f] 13 Jul 1995 photocensus.

Table 2 Central Arctic Herd caribou fall composition counts, regulatory years 1976–1996

Survey date	Bulls:100 Cows	Calves:100 Cows	Percent calves	Percent cows	Percent small bulls (% of bulls)	Percent medium bulls (% of bulls)	Percent large bulls (% of bulls)	Percent bulls	Composition sample size
10/76	122	44	17	38				46	1223
10/77	118	55	20	37				43	628
10/78	96	58	23	39				38	816
10/80	132	49	18	35				47	1722
10/81	81	64	26	41	22	41	36	33	1712
10/16-18/92	96	47	19	41	37	27	40	40	2469
1993[a]									
1994[a]									
1995[a]									
10/22/96[b]	61	67	29	44	15	43	43	27	3062

[a] No survey.

[b] About half the distribution of radios were sampled.

Table 3 Harvest of caribou and hunter success in Unit 26B, 1984–1996

Regulatory year	Reported harvest[a]				No. of hunters	Percent successful hunters	Estimated unreported harvest[b]	Total harvest
	Male	Female	Unk	Total				
1984-1985	313	55	0	368			100-200	468-568
1985-1986	482	177	3	662			100-200	762-862
1986-1987	311	34	0	345	287	76	100-200	445-545
1987-1988	176	2	3	181	225	77	100-200	281-381
1988-1989	179	7	0	186	255	73	100-200	286-386
1989-1990	132	8	0	140	221	63	100-200	240-340
1990-1991	96	16	0	112	173	55	100-200	196-296
1991-1992	383	24	1	408	618	57	100-200	508-608
1992-1993	391	32	4	427	655	58	100-200	527-627
1993-1994	347	23	2	372	618	54	100-200	472-572
1994-1995	320	20	0	340	584	54	100-200	440-540
1995-1996	318	18	0	336	571	53	100-200	436-536

[a] Based on returned harvest reports. Does not include numbers from registration hunt or unreported harvest.

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

Table 4 Harvest chronology of caribou in Unit 26B, 1992–1995[a]

	Month													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unk	Total
1992-1993	1	0	6	6	1	0	7	197	122	73	10	1	3	427
1993-1994	2	4	3	8	0	0	34	152	73	78	14	1	3	372
1994-1995	0	0	12	6	0	0	28	154	109	27	1	0	3	340
1995-1996	4	1	9	8	0	0	9	150	64	65	21	1	4	336

[a] Includes only harvest from harvest reporting cards.

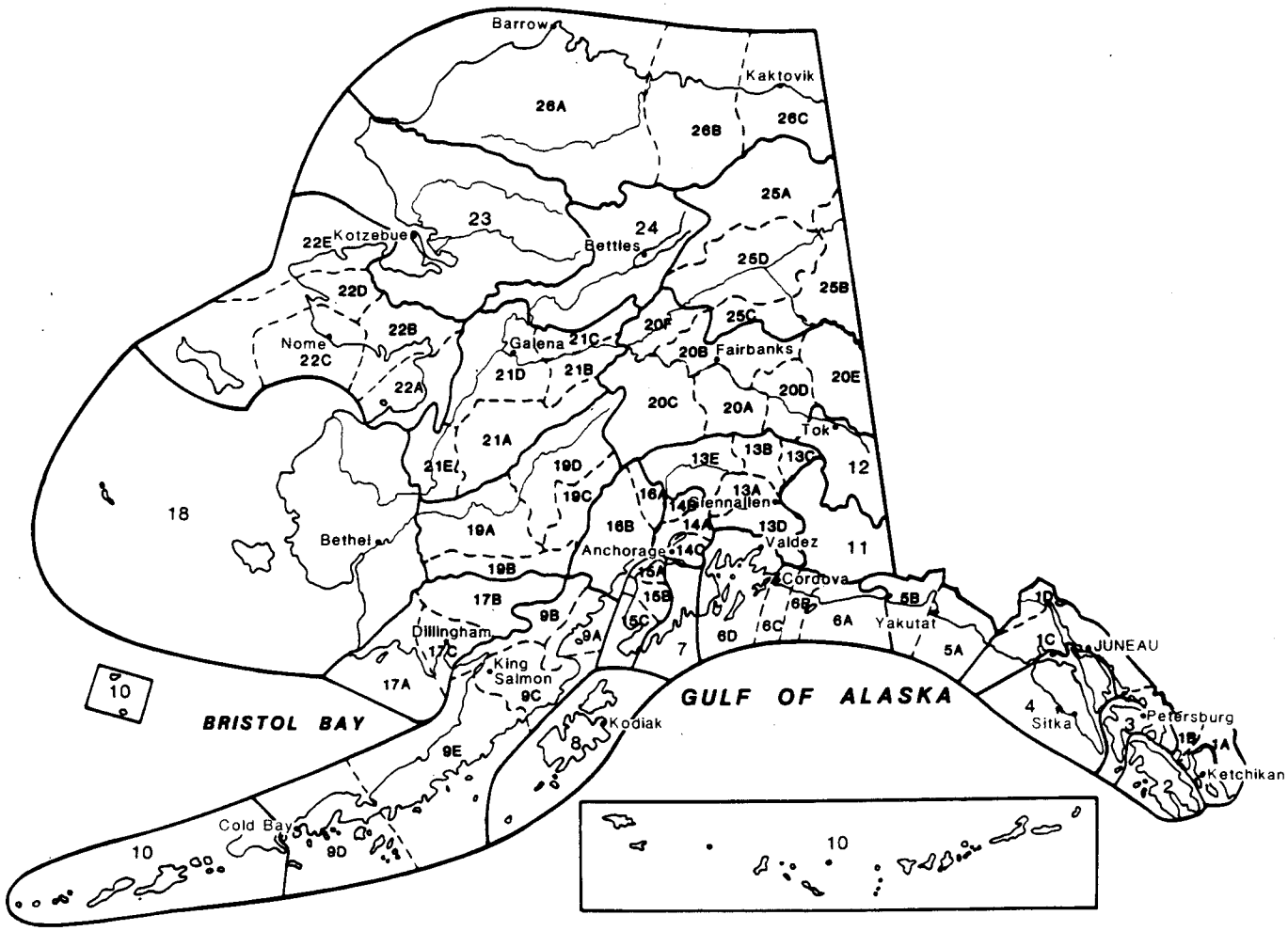
Table 5 Transport methods of successful caribou hunters reporting from Unit 26B, 1984–1995

Regulatory year	Airplane	Horse/Dog	Boat	3- or 4-Wheeler	Snowmachine	Off-road vehicle	Highway vehicle	Unk	Total[a]
1984-1985	40	0	0	0	0	0	140	0	180
1985-1986	61	0	0	0	0	0	22	0	283
1986-1987	85	0	0	0	0	0	133	0	218
1987-1988	83	1	11	0	2	1	71	0	169
1988-1989	69	1	17	0	0	1	88	0	176
1989-1990	0	0	0	0	0	0	0	0	0
1990-1991	0	0	0	0	0	0	0	0	0
1991[b]-1992	56	3	110	0	0	16	343	0	528
1992-1993	89	7	17	6	0	0	243	18	380
1993-1994	49	4	20	4	2	0	242	12	333
1994-1995	81	0	23	0	0	0	214	0	318
1995-1996	87	4	30	0	0	0	177	7	305

[a] Total hunters reporting.

[b] Check station data only.

Alaska's Game Management Units



The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.

Whitten